JOURNAL OF THE MALAYSIAN INSTITUTE OF PLANNERS

PLANNING MALAYSIA

This title is now indexed in Scopus
refine your research SCOPUS

MALAYSIA INSTITUTE OF PLANNERS
PLANNING MALAYSIA VOLUME 22 ISSUE 5 (2024)
[ISSN 1675-6215] e-ISSN 0128-0945]
www.planningmalaysia.org

PLANNING MALAYSIA

Journal of the Malaysian Institute of Planners

Editorial & Business Correspondence
PLANNING MALAYSIA
Journal of the Malaysian Institute of Planners
B-01-02, Jalan SS7/13B, Aman Seri, Kelana Jaya
47301, Petaling Jaya, Selangor Darul Ehsan, MALAYSIA
Tel: +603 78770637 Fax: +603 78779636 Email: mip@mip.org.my
www.planningmalaysia.org

Published By
Malaysian Institute of Planners

ISSN Number
1675-6215
e-ISSN
0128-0945

Date Published: 2nd October 2024

CONTENTS

MIP Council Members
2023 - 2025 Session

President
Datin TPr. Hjh Noraida Saludin (468/02)

Immediate Past President
TPr. Hj Ihsan Zainal Mokhtar (305/94)

Vice President
TPr. Hj. Abdul Hamid Akub (450/01)
TPr. Wan Andery Wan Mahmood (572/10)

Honorary Secretary
TPr. Juwairiyah Ho Abdullah (453/02)

Honorary Treasury
Datin TPr. Mazrina Dato' Abdul Khalid (559/09)

Council Members
TPr. Mohamad Fauzi Ahmad (418/99)
TPr. Abdul Halim Ali Hassan (407/98)
TPr. Saiful Azman Abdul Rashid (474/03)
Asst. Prof. TPr. Dr. Syafiee Shuid (813/21)
TPr. Hj Abdul Halim Abu (278/93)
TPr. Hj Nik Mohd Ruiz Ahmad Fakhrul Razy (570/10)
TPr. Rene Fu Swee Yun (553/99)
TPr. Dr. Marlyana Azyyati Marzukhi (582/11)
TPr. Annie Syazrin Ismail (670/17)
TPr. Diyanah Inani Azmi (839/22)
TPr. Young Elias Young Daud (815/21)

PLANNING MALAYSIA:
Journal of the Malaysian Institute of Planners
VOLUME 22 ISSUE 5 (2024), Page 1 – 11

SHORT TERM RENTAL ACCOMMODATION (STRA) AND HOME SHARING: DIFFERENT TERMINOLOGIES TO ADDRESS LEGAL REQUIREMENT OF PLANNING PERMISSION

Nuraisyah Chua Abdullah[1], Ramzyzan Ramly[2]

[1] *Faculty of Law,*
[2] *College of Engineering, School of Mechanical Engineering,*
UNIVERSITI TEKNOLOGI MARA, SHAH ALAM, MALAYSIA

Abstract

One of the debates on permissibility of short-term residential accommodation (STRA) is whether the nature of use of the building has significantly changed, with the operation of such business in the building. This led to the issue of whether planning permission is needed as this is a requirement in event of 'material change of use' of building. A home may be built as a one-family dwelling, but when it is converted to STRA use, it may be argued that it loses that character and contributes to unauthorized changes in neighbourhood character by intensifying the use both in terms of the number of people who typically use the property at any given time and by the negative impacts associated with frequent turnover. Basically, the main idea of planning permission is to ensure that there are no irregularities emerging from land use and development by individuals such as traffic jams, pollution, nuisance problems, loss of value or even amenities, floods or effects on the neighbourhood and ensures that the new development is suitable for occupation. This article suggests that one possible way to address the 'change of character' issue is by differentiating the types of short-term accommodation businesses based on the number of permitted bedrooms, guests, owner occupancy, number of bedrooms, location, and yearly maximum day-cap.

***Keywords**:* short-term residential accommodation, planning permission, change of use, zoning

[1] Corresponding author. Email: nuraisyah@uitm.edu.my

INTRODUCTION

Short-term residential accommodation (herein after referred to as the STRA) is a concept of home sharing where it is a welcome disruption to the traditional tourism economy as it allows a more diverse array of stakeholders to participate in the economy both as providers and consumers. It creates new and sometimes more accessible and affordable forms of tourist accommodation, brings extra income for residents who can rent out their units, creates the ability to absorb extraordinary demand for accommodation by visitors, and contributes to the regeneration of cities. One of the debates on permissibility of STRA is whether the nature of use of the building has significantly changed, with the operation of such business in the building. This led to the issue of whether planning permission is needed as this is a requirement in event of 'material change of use' of building.

Legality Of Using Residential Premise for STRAs

In Malaysia, under the Town and Country Planning Act 1976 (Act 172), the local authorities have the right to allow or prohibit owners of properties from carrying out commercial business such as STRA in their properties. Various local authorities use different approaches in addressing this issue, and this is influenced by the fact that every community's needs are different, changing, and the increasing demand of pursuit of quality life and influence of human rights (Meng Lee Lik et al., 2006) The pressing legal issue as regards to legality of operating STRA is whether landlords are allowed to use their properties to operate STRA. This generally arises from the general rule pertaining to property development set forward in Act 172.

Act 172 defines property development as "the carrying out of any building, engineering, mining, industrial or other similar operations in on, over or under land, or the making of any material change in the use of any buildings or other land, or the subdivision or amalgamation of lands" where planning permission needs to be obtained. Subsection 2 (1) of Act 172, planning permission is defined as 'given, with or without conditions, to carry out development. A planning permission is granted by the local planning authority for an area. For areas in a municipal / district councils / municipality, planning permission is issued by the relevant authority of the local planning authority area, under subsection 5 (1) of Act 172. For areas outside of a local authority, planning permission is given by the Town and Country Planning State under subsection 5 (2) of Act 172. The decision is usually made by local authorities by a full meeting of council or district.

This is according to Act 172 that determines among others, the land size, use, setback, building lines, other proposed use, proposed heights, proposed alignment, width and level of roads and back-lanes, provision of open space and

access to community facilities, provision of utilities, and other requirements for any proper kind of development. Basically, the main idea of planning permission is to ensure that there are no irregularities emerging from land use and development by individuals such as traffic jams, pollution, nuisance problems, loss of value or even amenities, floods or effects on the neighbourhood and ensures that the new development is suitable for occupation (Ahmad et al., 2013). Planning permission also aims to ensure that the environment and social economic welfare is not jeapordised due to the intended development and that the development complies with all the planning guidelines and standards. The new development must also be vetted to verify whether it has access and complies with all conditions and restrictions of the land title and all other legal requirements, among others, where consent from neighbours may be required before the licence to operate the business is granted. Neighbours of a landed property may also have legitimate grievances and claims against a property owner when a property is being used as a STRA. In broad terms, development can be divided into two categories;

i. the carrying out of physical operations such as building or engineering works, and
ii. the making of a material change of use

A change of use of land or buildings requires planning permission if it constitutes a material change of use. There is no statutory definition of 'material change of use'; however, it is linked to the significance of a change and the resulting impact on the use of land and buildings (Mohammad Yusup et al., 2018). Whether a 'material change of use' has taken place is a matter of fact and degree, and this will be determined on the individual merits of a case by the local authority. There is absence of express provision on the need for planning permission under Act 172, unlike big scale developments for example, new urban development for a population exceeding ten thousand (10,000) or covering an area of more than one hundred (100 hectares) hectares or both and the development for the construction of any infrastructure or key facilities.

All development shall obtain the approval of planning permission from the Local Planning Authority. If development is carried out without planning permission or development carried out contrary to planning permission, the owner may be convicted of an offence under Section 27 and Section 28 of Act 172. Penalties that may be imposed are in accordance with Subsection 26 (1), which is a fine not exceeding five hundred thousand ringgit or imprisonment for a term not exceeding two years or both.

Planning permission will not normally be required in operating a business from home, provided that a dwelling house remains a private residence

first and business second. In the United Kingdom, a local planning authority is responsible for deciding whether planning permission is required and will determine this based on individual facts. Issues which they may consider, whether home working or a business, leads to notable increases in traffic, disturbance to neighbours, abnormal noise or smells, or the need for any major structural changes or major renovations. This is in line with the idea that the happiness of residence is very much dependent on the neighbourhood (Oliver Ling Hoon Leh et al., 2015). A home may be built as a one-family dwelling, but when it is converted to STRA use, it may be argued that it loses that character and contributes to unauthorized changes in neighbourhood character by intensifying the use both in terms of the number of people who typically use the property at any given time and by the negative impacts associated with frequent turnover. The following discussion suggests some considerations which may be possible in determining whether the character of a premise has changed.

Classification of STRAs based on the Owner Occupancy in the Premise

One possible way to address the 'change of character' issue is by differentiating the types of short-term accommodation businesses based on the occupancy of the host in the premise. In Austin, Texas, STRAs can essentially be characterized by: (1) home-sharing, (2) home rental, or (3) transient rental.

Under the "Home sharing" model, the guest and the host are co-occupants of the premises during the guest's stay. According to this concept, "guests" use residences in ways that are almost identical to those of long-term inhabitants, neighbours, and their guests. This approach is frequently implemented without the typical permissions or licences needed for conventional tourist accommodations because it rarely calls for a physical alteration to the built environment. Home-sharing maximizes the accountability of the host because if the guest causes any nuisance to surrounding neighbours, the host is right there to deal with the problem. It would be reasonable if this type of STRA does not require planning permission.

Under the "Home rental" model, the host uses her primary residence for the STRA, but instead of restricting the guest to one room or STRA unit, the guest has rented the entire dwelling, and the host does not occupy the home during the guest's stay. In contrast to the house-sharing concept, the home rental model places less responsibility on the host. Living close to this kind of rental property might be anything from slightly unsettling to drastically changing one's life. Since guests often only stay for a few days, neighbours frequently witness newcomers moving in and out of their homes, particularly in areas with a high concentration of short-term holiday rentals. Local governments are nevertheless concerned about related complaints like noise disturbance, parking problems, and waste. This is demonstrated in a recent piece about Los Angeles (Joel Grover, Matthew

Glasser, and Cole Sullivan, 2017) with tales of short-term holiday rentals being converted into party houses with terrifying outcomes for nearby residents. In this arrangement, local authorities would most likely need planning authorization. While lawful home-sharing should be allowed, the legislation should also stop illicit STRA operators from forcing families out of their previously peaceful neighbourhood (Salleh Buang, 2017).

Under the "Transient rental" model, the host is essentially operating an income property that does not serve as the host's primary residence but is for the sole purpose of STRAs. Hosts utilizing the transient rental model are the least accountable of the three models. Since this model is mainly located in residential areas, by renting short-term vacation accommodation, tourists are using up space that otherwise might be used for living. In some places, this results in a decrease of long-term housing availability. Hence, while considering this model, cities in Malaysia could take example of large cities that are already facing problems with affordable housing like New York and San Francisco. It would be reasonable if this type of STRA requires planning permission.

Classification of STRAs based on Permitted Number of Bedrooms, Guests and Owner Occupancy

In some jurisdictions as per the following discussion, one possible way to address the 'change of character' issue is by differentiating the types of short-term accommodation businesses based on the number of permitted bedrooms and guests apart from owner occupancy. The neighbourhood as an element of the housing environment has a strong impact on residential satisfaction and influences the perception of residents' well-being.

In the City of New Orleans, U.S. state of Louisiana, three different categorizations are provided (City of New Orleans STR Office, 2022). Under the category of Accessory Short-Term Rentals, the portion of the dwelling licensed as an Accessory Short-Term Rental is limited to three (3) bedrooms, and occupancy is limited to six (6) guests (There must be at least one bedroom in the dwelling for the owner-occupant). The owner-occupant shall occupy the dwelling and be present during any STRA occupancy. Proof of owner-occupancy will be established by verification of a Homestead Exemption in the name of the applicant. However, Short-Term Accessory Rentals are prohibited in the French Quarter. Under the Temporary Short -Term Rentals category, an in-town property manager is always available. Temporary Short-Term Rental licenses allow a maximum of 90-rental nights per license year. Occupancy is limited to two (2) guests per bedroom or a total of ten (10) guests, whichever is less. The entire dwelling may be rented, and the owner/occupant of the dwelling does not need to be present. No signs advertising the presence of a Short-Term Rental are allowed. Temporary Short-Term Rentals are prohibited in the French Quarter.

Under the Commercial Short-Term Rentals category, rental of an entire dwelling is allowed, where occupancy is limited to five (5) bedrooms and ten (10) guests. The owner/occupant does not need to be present during the rental period, and there is no limitation on the number of rental nights per license year. This type of business must be in a non-residential zoning district. Commercial Short-Term Rentals are prohibited in non-VCE portions of the French Quarter.

Theoretically, neighbours should not have many issues with a bed, couch, or mattress that a resident "host" offers in a shared or even private room. A local "host" is available to assist in regulating visitor behaviour, and since both "guests" and "hosts" evaluate one another, there is a market incentive for both parties to behave politely. When whole houses are rented, there are more chances that the immediate neighbours will be negatively impacted (noise, disruptive behaviour), and the neighbourhood will become more "touristified" (Colomb & Novy, 2016). Hence, it would be reasonable if planning permission is required in event the STRA premise is operated with a large number of bedrooms and guests.

Residential Short-Term Rental Permit Categories based on Location with Speciation of Bedrooms and Guests in the USA

Limiting the character of use in the property can be an option to maintain the character of the STRA premise. When new projects first came into existence decades ago, the main purpose of zoning was to shield property owners from their negative effects. In the absence of zoning, residential property owners would have to deal with rapidly declining property values if a development had major negative effects. Regulations pertaining to zoning place limits on a landowner's general freedom to use and develop their property as they see fit, considering the pre-existing socioeconomic patterns of a particular community. This allows for the intentional use of land for the benefit of the community. It is a value system in that it serves as a tool to make the people's dreams come true. Its fundamental tenet is the sustainable management of land use and development for the benefit of an entire community (Akintunde Kabir Otubu, 2009). Thus, zoning can be used in addressing the evolution of technology in the case of STRA. In the City of Charleston, South Carolina, as of July 10, 2018, STRA regulations now have four Residential Short-Term Rental Permit Categories based on location (Department of Planning, Housing and Infrastructure, 2018). Category I refers to all properties located within the City’s Old and Historic District. Within that area, the property must be individually listed on the National Register of Historic Places to be eligible for short-term renting. Category II refers to all other properties located on the Charleston peninsula, if they are outside the Short-Term Rental Overlay Zone. Category III refers to all other properties in the City of Charleston. This includes incorporated areas of West Ashley, James Island, Johns Island, Cainhoy, and Daniel Island. Under the past regulations, these areas are not eligible for any

short-term legal rentals, but the ordinance allows short-term renting in these areas, subject to specific requirements. The STRA Overlay Zone refers to a pre-existing area in Cannonborough-Elliotborough. Commercial Short-Term Rental Permit, which follows the same rules as the past ordinances. Properties within the Short-Term Rental Overlay are still eligible for a Bed & Breakfast Permit as defined under past ordinances. No changes to this area have been made, except that an annual Permit renewal will be required.

In the City of Charleston, to ensure that the STRA does not change the character of the property, a maximum guests rule is applied where up to four adults, regardless of relationship, can stay overnight in an STRA according to the City of Charleston Short Term Rental Ordinance, 2018, whereas studio apartments and dwelling units shall be limited to have one (1) guest bedroom and allowed a maximum of two (2) guests in the City of New Orleans, the U.S. state of Louisiana under Article 20 of Comprehensive Zoning Ordinance, 2016 (20.3.LLL.1). In the City of Charleston also, a host must sleep overnight at the property whenever it is being rented.

Therefore, by preserving the unique characteristics of the best residential neighbourhoods and severely limiting the scope of new development or changes in the intensity and type of use of existing property, the aforementioned approaches aim to protect neighbourhoods from uses that jeopardize the quality of the neighbourhood environment (Abdul Rahman et al., 2012).

Specification of locations which requires planning permission in the operation of STRA would be one of the ways to assist STRA operators in determining the need of planning permission.

Yearly Maximum Day-Cap to Maintain the Character of STRA Premise in Australia

In New South Wales, hosted STRA is not restricted by any day limits and can be carried out 365 days per year (Department of Planning, Housing and Infrastructure, 2024). In some NSW local government areas (LGAs), there are limits on the number of days that a dwelling can be used for non-hosted STRA. Non-hosted STRA is restricted to a maximum of 180 days per 365-day annual period in the following areas:

(a) the Greater Sydney region (not including the Central Coast)
(b) the Ballina area
(c) certain land in the Clarence Valley area
(d) certain land in the Muswellbrook area.

LGAs within the Greater Sydney region that are restricted to a maximum of 180 days per year. From 23 September 2024, non-hosted STRA in the Byron Shire LGA will be restricted to 60 days in any 365-day period across the majority of the LGA, except in two mapped precincts in Byron Bayand Brunswick Heads where non-hosted STRA will not be restricted.

Hosted STRA means that the host lives on the premises during the period of the accommodation provided. For example, a room in a dwelling that is rented for short periods where the host also resides. The host may come and go from the dwelling during the time of the accommodation (e.g. for work or recreation). When a host lives on a property with two dwellings and does not permanently reside in the dwelling being rented (for example a secondary dwelling or granny flat), this is not considered to be hosted STRA. Hosted STRA may be undertaken on any land in a zone in which residential accommodation of a type corresponding to the dwelling is permitted with or without development consent, 365 days per year.

Non-hosted STRA means that the accommodation can be carried out without the host residing on the premises. For example, a holiday house or unit at a premises separate from where the host resides. Non-hosted STRA may be undertaken on any land in a zone in which residential accommodation of a type corresponding to the dwelling is permitted with or without consent. Individual residential units within a premises where there is an onsite manager or concierge are generally considered as non-hosted.

An annual non-hosted STRA day limit is calculated from the date when a dwelling is registered for STRA on the STRA Register. For non-hosted STRA, where the booking is for 21 or more consecutive days, the booking will not count towards the day limits. This supports mobile workforces and the corporate accommodation sector which tend to have longer stays and lower amenity impacts.

Yearly maximum day-cap is one of the ways to maintain the character of STRA premise. Hence, it can also be argued that hosted STRA is also an alternative to ensure that the character of the STRA buildings is maintained. The presence of the host (owner) in the STRA premise is seen as a positive way to control the guests to ensure that their presence in the premise do not cause any unnecessary inconveniences to the other residents. STRA may cause noise-related irritation in the neighbourhood, especially when it comes to parties or visitors coming and going. It is also possible that STRA guests are unfamiliar with regional regulations about animal behaviour (such as dogs), trash management and disposal, etc. On a building level, unease could be linked to more "strangers" having access to common facilities and possibly breaking rules of behaviour (e.g., trash near the pool, loud noises early in the morning). The negative effects of STRA to its surroundings is expected to be more obvious when

the occupants who operate STRA are ignorant of the sensitivity of his surroundings. In 2020, a study was carried out in the Klang Valley employing non-parametric convenience sampling to conduct in-person interviews with 276 tenants of high-rise apartments with varying costs. Tenants were found to be ignorant about the Malaysian Strata Management Act 2013, the Strata Title Act 1985, and the house rules that regulate them with respect to maintenance and management matters. Low understanding of the statutes and regulation among tenants is one of the factors that may contribute to problems associated with long term operation of STRA. Hence, maximum day cap and hosted STRA can be seen as options to reduce the negative impact of STRA to the surroundings (Ummu Sholehah Mohd Nor, 2020) Therefore, if necessary, these two mechanisms—the maximum day cap and hosted STRA—may likewise be used in place of the necessity for planning permission.

CONCLUSION

Whether the operation of STRA causes material change to the STRA property very much depends on the nature of the operation of STRA and as such this article proposed that different terminologies with various methodology of business operation as discussed in this paper may provide some insights as to the possible methods to determine the issue of material change in the use of the buildings for STRA. As it is, governments of many nations are still having concern, in terms of consumer protection, there might be insufficient preparations for accommodating guests (e.g., unsafe neighborhood/property and unsanitary conditions). Therefore, regulators – particularly local governments – are increasingly introducing various ways to restrict this platform in a stringent manner (Jihwan Yeon, Hyoung Ju Song, Seoki Lee, 2020) Hence, easily navigable web interface should be introduced to enable residents to locate information on STRA laws in their community with ease when residents enter their address into the portal. Additionally, the portal will be a useful tool for researchers and policy makers to rapidly comprehend the range of state-wide responses to STRA legislation. In the long run, it might make policy evaluation of best practices in the field of STRA regulation possible.

ACKNOWLEDGEMENTS

The researchers wish to thank the National Real Property Research Coordinator (NAPREC), National Institute of Valuation (INSPEN), Valuation & Property Services Department (JPPH Malaysia) and Ministry of Finance, Malaysia for funding this research. File no: 100-IRMI/GOV 16/6/2 (018/2019).

REFERENCES

Abdul Rahman, N., Omar, D., & Salleh, A. G. (2012). Determinant Factors Of Neighbourhood Quality. *Planning Malaysia*, 10. https://doi.org/10.21837/pm.v10i3.98

Ahmad, F., Mohd @ Ahmad, I., Maidin, S. L., Zainol, R., & Mohd Noor, N. (2013). Malaysian Development Plan System: Issues and Problems, One Decade After Its Reform (2001-2011). *Planning Malaysia*, 11. https://doi.org/10.21837/pm.v11i3.105

Bond, S., Rambaldi, A., Corcoran, J., Sigler, T., & Zou, F. (2023). A Review of the Impacts of Short-term Rental Accommodation in Queensland. https://planning.statedevelopment.qld.gov.au/__data/assets/pdf_file/0020/83333/a-review-of-the-impacts-of-short-term-rental-accommodation-in-queensland.pdf

Buang, S. (2017, June 22). Regulating home – sharing, New Straits Times Online. https://www.nst.com.my/opinion/columnists/2017/06/251179/regulating.

City of Charleston, Short Term Rentals Frequently Asked Questions, 2018, https://www.charleston-sc.gov/DocumentCenter/View/30035/FAQs-for-STR-083121

City of New Orleans STR Office, 2022, https://nola.gov/next/short-term-rental-administration/home/.

Dolnicar, S. (2019). A review of research into paid online peer-to-peer accommodation. *Annals of Tourism Research*, *75*(C), 248–264. https://ideas.repec.org/a/eee/anture/v75y2019icp248-264.html

Grover, J., Glasser, M., & Sullivan, C. (March 1, 2017.). Short-Term Rentals Turn Into Nightmares Next Door. NBC Los Angeles. https://www.nbclosangeles.com/news/i-team-investigation-short-term-rentals-property-airbnb/31843/

Gurran, N. (2017). Global Home-Sharing, Local Communities and the Airbnb Debate: *A Planning Research Agenda. Planning Theory & Practice, 19*(2), 298–304. https://doi.org/10.1080/14649357.2017.1383731

Meng Lee Lik, et al. (2006). How We Failed To Plan for Habitability. *Journal of the Malaysian Institute of Planners*, 1-21.

Mohd Nor, U. S. (2020). Tenants' satisfaction in high residential buildings / Ummu Sholehah Mohd Nor, Wan Nor Azriyati Wan Abd Aziz and Zafirah Al Sadat Zyed. http://malrep.uum.edu.my/rep/Record/my.uitm.ir.30045/Details

New South Wales Department of Planning, Housing and Infrastructure, Frequently Asked Questions, 2024, https://www.planning.nsw.gov.au/sites/default/files/2024-02/stra-legislative-framework-faq.pdf

Otubu, A. K. (2009). Land Use Zoning In a Changing Urban Environment. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.1439742

Protest and Resistance in the Tourist City. (2016). Routledge & CRC Press. https://www.routledge.com/Protest-and-Resistance-in-the-Tourist-City/Colomb-Novy/p/book/9781138342248

What's Old Becomes New: Regulating the Sharing Economy. (2014). Boston Bar Association. Retrieved May 16, 2024, from https://bostonbar.org/journal/whats-old-becomes-new-regulating-the-sharing-economy/

Yeon, J., Song, H. J., & Lee, S. (2020). Impact of short-term rental regulation on hotel industry: a difference-in-differences approach. *Annals of Tourism Research, 83*(C). https://econpapers.repec.org/RePEc:eee:anture:v:83:y:2020:i:c:s0160738320300839

Received: 20th May 2024. Accepted: 17th July 2024

PLANNING MALAYSIA:
Journal of the Malaysian Institute of Planners
VOLUME 22 ISSUE 5 (2024), Page 12 – 24

POLICY DRIVERS OF CHINA'S INTEGRATED ENERGY SERVICES: A CURRENT STATUS REVIEW

Xu Xiangyu[1], Nazatul Syadia Zainordin[2], Amir Hamzah Sharaai[3], Nik Nor Rahimah Nik Ab Rahim[4]

[1,2,3,4] *Department of Environment,*
Faculty of Forestry and Environment,
UNIVERSITI PUTRA MALAYSIA

Abstract

Conventional energy production and consumption patterns seriously restrict global sustainable development. In the energy transformation process, integrated energy services play a key role in integrating clean energy and renewing energy consumption patterns. The European Union, the United States, and Japan are leading in developing policy frameworks and integrating integrated energy services. This paper compares and analyzes how the European Union, the United States, Japan, and China respond to the challenges of energy transformation through different energy policy systems. The energy policy systems of the European Union, the United States, and Japan are discussed for reference by China. The review reveals that (1) assigning tasks based on the energy transformation strength of each region is conducive to accelerating the speed of carbon emission reduction in each region; (2) continuous government support and targeted incentives are conducive to attracting market capital, thereby stimulating the advancement of energy technology; and (3) formulating energy efficiency standards for basic equipment can lay a good foundation for energy transformation.

Keywords: Sustainable Development, Sustainable Energy, Energy Transition, Energy Systems, Regulatory Frameworks

[2] Corresponding Author: nazatulsyadia@upm.edu.my

INTRODUCTION

Energy serves as an essential basement for both societal advancement and day-to-day living across geopolitical borders (Rosa et al., 1988). Since the advent of the Second Industrial Revolution, global economies have witnessed exponential growth, at the same time escalating the demand for fossil fuels such as coal (Atkeson et al., 2001). Such a traditional paradigm of energy production and consumption poses significant limitations on the sustainable and secure progression of the global energy landscape. Consequently, the quest for renewable energy sources that are both clean and safe is no longer optional but has emerged as an unequivocal direction for future research and development (Panwar et al., 2011; Abou Amer et al., 2023). The integrated optimization of a diversified energy portfolio thus becomes an indispensable pathway for sustainable growth (Gao et al., 2014).

To mitigate against such energy inefficiencies, energy services are imperative to diversify the avenues and overall availability of varying energy types, thereby fortifying the material infrastructure requisite for the transformation of energy resources and assets into utilizable capital (Bunse et al., 2011). Simultaneously, energy services accelerate the energy transition through technological innovation and the construction of energy networks, which are essential to facilitate green development (Li et al., 2022).

An overhaul of the existing energy systems is crucial to create a market environment that is conducive to the efficient conversion of energy assets into capital (Gray, 1996). Notwithstanding the existing initiatives, China's energy sector still lags significantly behind those of developed nations. Bridging this gap demands concerted international collaboration as well as indigenous innovation, particularly in the fields of energy technology and associated technical disciplines, to bolster China's energy security. The current energy reforms and strategic international partnerships also lay the groundwork for China's future implementation of a low-carbon development strategy (Liping, 2011). This study aims to comprehensively review the successful experiences of some developed countries, combined with the impact and effectiveness of China's existing energy policies, to help China achieve its goals of energy transformation and carbon emission reduction.

INTEGRATED ENERGY SERVICES

Integrated energy services (IES) include four aspects- energy supply, energy control system, energy consumption optimization, and integrated energy management. IES can optimize the energy supply structure, improve the energy service system, reduce energy consumption, and manage energy usage. IES can optimize the energy supply structure, improve the energy service system, reduce energy consumption, and manage energy usage, in order to achieve the goals of

higher energy efficiency, lower carbon dioxide (CO_2) emissions, and stronger energy supply stability (Wu et al., 2016).

Energy supply is gradually getting rid of sole reliance on traditional energy (Luo et al., 2021). Moreover, integrating renewable energy with traditional energy can improve the reliability and sustainability of energy supply (Zawawi et al., 2024). IES, through the energy supply method that combines conventional energy with renewable energy, not only complies with changing market demands and environmental regulations but also increases the stability of energy supply to social users (Christophers, 2019). The integration of different energy forms requires a strong support framework, including energy storage systems and distributed energy architecture (Li et al., 2010). Energy storage systems are critical to mitigating supply and demand imbalances because renewable energy sources tend to be intermittent in nature (Ibrahim et al., 2008), unlike large power plants that require extensive grid infrastructure and are prone to transmission losses. Distributed energy systems are optimized for local supply. The scope of this localized supply approach could include distributed energy installations and localized "heat, cooling, and power" systems, thus increasing energy security while minimizing transmission costs and inefficiencies (Yang et al., 2015). **Figure 1** shows the IES specific components and optimization measures.

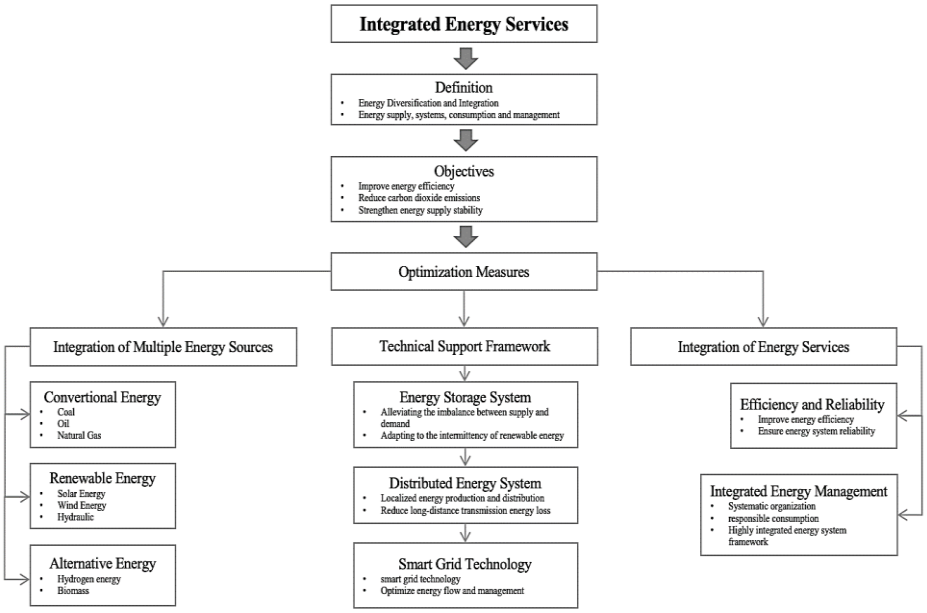


Figure 1: IES specific components and optimization measures
Source: Sugihara & Tsuji (2004); MacCarty & Bryden (2016); Gaspari et al. (2017)

ENERGY DEVELOPMENT IN DEVELOPED COUNTRIES

Before the oil crisis in the 1970s, oil was widely viewed as a cheap and abundant energy source (Stork, 1973). However, the oil crisis shattered this notion and revealed the risks of reliance on a single energy source. The oil crisis also caused a spike in oil prices, affecting global economic activity and inflation rates (Baffes et al., 2015). As awareness of oil dependence deepens, environmental and climate issues are increasingly receiving attention (Ozturk et al., 2013). Therefore, the oil crisis has prompted many countries to explore sustainable energy development to slow down climate change and environmental degradation (Roeder, 2005).

The Kyoto Protocol, established in 1997, serves as a pivotal international accord aimed at mitigating the ramifications of global climate change. The treaty mandates that participant industrialized nations, as well as select economies in transition, curtail their greenhouse gas (GHG) emissions to specified percentages below 1990 levels during the 2008-2012 period (Protocol, 1997). The Kyoto Protocol has catalyzed Western nations to expedite the proliferation and integration of renewable energy sources, including but not limited to wind, solar, hydro, and biomass energies (Omer, 2008). This has culminated not only in reducing dependency on fossil fuels but also in the market expansion for alternative energy sources, simultaneously generating employment in the green sector.

The Paris Climate Agreement, formalized in 2015, represents a cornerstone of international climate policy. The Agreement's strategies include expediting carbon neutrality, fostering renewable energy investments, advancing energy services, and prioritizing climate-related concerns in developing nations (UNFCC, 2024). The EU's 2019 "European Green Deal" plans for the EU to reduce net GHG emissions by at least 55% compared with 1990 in 2030 and strive to become the first climate-neutral continent by 2050 (Fetting, 2020). In terms of investment in renewable energy, the Paris Climate Agreement recognizes the increase in renewable energy targets and the concept of a carbon trading mechanism. Therefore, a large amount of capital flows into renewable resources such as wind energy, solar energy, hydropower, and geothermal energy in Western developed countries (Ram et al., 2022). The Paris Climate Agreement responds to the impact of climate change by strengthening the environmental protection responsibilities of Western developed countries and providing financial and technical support to developing countries in areas such as renewable energy development (Peake & Ekins, 2017). **Figure 2** shows the energy development timeline after the oil crisis in 1970.

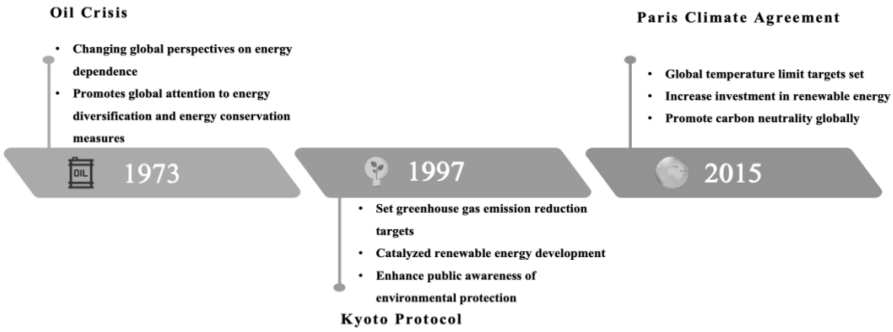


Figure 2: Energy development timeline after 1970
Source: Klimenko & Tereshin (2019)

COMPARISON OF MAIN ENERGY POLICIES IN EU, US, JAPAN AND CHINA

This study extensively compares the energy service policies between China and three developed regions- the EU, the US, and Japan. It explores how these policies promote renewable energy development and improve energy efficiency, highlighting the differences and potential lessons for China. By comparing their policy evolution and achievements in different years, the impact of these policies on promoting sustainable energy development and improving energy efficiency is evaluated (Sorrell, 2007; Saidur et al., 2010; Abdmouleh, 2015).

In the EU context, frameworks such as the "2020 Climate and Energy Package" and the "European Green Deal" unequivocally underscore a robust commitment to both renewable energy sources and energy efficiency (IEA, 2021). Such legislative enactments have increased a propitious market ecology, enabling IES enterprises to offer holistic solutions encompassing energy provision, demand-side governance, and combining renewable resources. In contrast, US policies, exemplified by initiatives such as the Clean Power Plan, Energy Policy Act, and Corporate Average Fuel Economy Standards, have sought to encourage the renewable energy marketplace and enhance the competitive standing of energy service corporations (U.S. EPA, 2024). These policies have achieved this through fiscal mechanisms, including tax exemptions and escalated investment initiatives, thereby diversifying the energy technologies and business model options available for renewable energy and IES development. Japan, meanwhile, has emphasized energy security and technological innovation as the cornerstones of its Strategic Energy Plan and Basic Energy Plan (Ministry of ETI Japan, 2024). Particularly in the post-Fukushima landscape, Japanese policy has increasingly gravitated toward the exploration of alternative, secure, and reliable energy modalities, such as hydrogen energy. Consequently, Japanese IES has preferred efficient, resilient, and agile systems accommodated to the nation's unique geographic and economic settings. Notably, Japan's investment in

research and development for renewable energy and distributed energy systems has offered cutting-edge technological underpinning for its energy services.

In China, the government usually promotes the development of IES through a series of "five-year plans". The government attracts social enterprises to participate in construction through national guidance documents, financial support, and national pilot project initiatives. In addition, the government raises public awareness of comprehensive energy services and sustainable energy development through the promotion of policy documents (NEA of China, 2024). Thus, in the face of the global challenge to catalyze sustainable energy progression, the policy systems of the US, the EU, and Japan offer invaluable referential frameworks for conceptualizing and implementing China's own IES policies. Each of these three economic powerhouses boasts an extensive repository of experiential wisdom and lessons learned in the domains of energy policy articulation, the incentivization of renewable energy sources, and the cultivation of IES- a corpus of knowledge from which China stands to derive considerable insights. **Table 1** shows Energy Policies in the EU, the US, Japan, and China.

Table 1: Energy Policies in the EU, the US, Japan, and China

EU	USA	Japan
➢ 2020 climate and energy package (2007) ➢ EU energy efficiency directive（2012） ➢ 2030 Climate and Energy Framework (2014) ➢ EU energy efficiency directive（2018） ➢ Sustainable and smart transport strategies (2020) ➢ Green Deal (2023)	➢ Energy Policy Act (2005) ➢ Energy Independence and Security Act (2007) ➢ American Recovery and Reinvestment Act (2009) ➢ Clean Power Plan（Abolished in 2017） ➢ Inflation Reduction Act (IRA) (2022)	➢ Top Runner Program (1998) ➢ Japan's carbon trading system (2010) ➢ Japanese Feed-in Tariff Scheme for Renewable Energy (2012) ➢ Hydrogen Strategy (2017) ➢ Strategic Energy Plan（6th）(2022)
China		
➢ Notice on Further Promoting the "Contract Energy Management Mechanism" (2000) ➢ Interim Measures for the Management of Financial Incentive Funds for Contract Energy Management (2010) ➢ Several opinions on further deepening the reform of the electric power system (2015) ➢ Key points of industrial energy conservation and comprehensive utilization in 2018 ➢ Energy work guidance in 2021 ➢ Guiding Opinions on Energy Work in 2022 ➢ "14th Five-Year Plan" Modern Energy System Planning (2022)		

Source: European Commission; U.S. Environmental Protection Agency; Ministry of Economy, Trade and Industry, Japan; International Energy Agency; National Energy Administration of China.

In summary, the EU allocates different energy transformation and emission reduction tasks to its member states based on the development conditions of member states through framework agreements such as the Green New Deal. The US, in turn, facilitates the development of large-scale solar and wind energy projects and encourages social enterprises and residents to choose environmentally friendly energy equipment, such as household photovoltaics and new energy vehicles, through tax exemptions and other means. Japan is gradually improving the energy efficiency of specific products and equipment through its strategic energy plan. China's energy policy promotes national documents and funding to support China's energy transformation through a series of five-year plans and pilot projects. Through the operation of pilot projects, the cooperation and coordination between government agencies and social enterprises are deepened to accelerate the development and innovation of China's energy system.

COMPARISON OF MAIN EMISSION REDUCTION ACHIEVEMENTS IN THE EU, US, JAPAN AND CHINA

Building on the policy comparisons, this section evaluates the emission reduction achievements of the EU, the USA, Japan, and China. Examining their renewable energy capacities, clean energy consumption percentages and CO_2 emissions reduction targets of these regions will provide a clear understanding of the effectiveness of their distinct approaches. This comparison provides valuable insights into how different policy frameworks translate into tangible progress in emission reductions.

The EU's renewable energy capacity stands at 705.8 GWh, with a clean energy consumption percentage of 31.6%. The EU has set a CO_2 emissions reduction target of 55% by 2030. The EU has made the most significant progress in reducing total carbon emissions, achieving 47.13 billion tons in 2020, down from 56.0 billion tons in 2010. The EU's investment in carbon reduction as a percentage of GDP is -2.8%, demonstrating the effectiveness of its stringent regulatory frameworks and coordinated efforts across member states in driving substantial emission reductions. Meanwhile, the USA has achieved a renewable energy capacity of 305 GWh and a clean energy consumption percentage of 22%. Its CO_2 emissions reduction target by 2030 is 50%. The total carbon emissions in the USA were 26.15 billion tons in 2020, down from 34.0 billion tons in 2010. The US's investment in carbon reduction as a percentage of GDP is -1.8%. These achievements are driven by fiscal incentives and technological diversification, promoting renewable energy through tax exemptions and increased investment initiatives. Notably, Japan's renewable energy capacity is 105 GWh, achieving a clean energy consumption percentage of 20.3%; its target is a 50% reduction in CO_2 emissions by 2030. Japan's total carbon emissions in 2020 were 10.46 billion tons, down from 12.0 billion tons in 2010, with an investment in carbon reduction as a percentage of GDP at -0.8%. Significantly, Japan has excelled in improving

energy efficiency, achieving high energy utilization despite its smaller renewable energy capacity. This reflects Japan's policy emphasis on technological innovation and energy efficiency.

Correspondingly, China boasts the highest renewable energy capacity at 1213 GWh and the highest clean energy consumption percentage at 47.3%. China has set an ambitious target of a 65% reduction in CO_2 emissions by 2030. In 2020, China's total carbon emissions were 106.68 billion tons, up from 91.0 billion tons in 2010. Its investment in carbon reduction as a percentage of GDP is -4.5%. While China has made impressive progress in renewable energy capacity and clean energy consumption, the substantial scale of its carbon emissions underscores the need to learn from the successful policies of the EU, USA, and Japan to continue making strides in emission reductions. Accordingly, **Table 2** presents data on renewable energy capacity, clean energy consumption percentages, investment in Carbon reduction as a percentage of GDP, total carbon emissions (2010 and 2020), and target CO_2 emissions reductions by 2030 for the EU, the USA, Japan, and China. **Figure 3** presents comparisons of renewable energy capacity, clean energy consumption percentages, investment in carbon reduction as a percentage of GDP, and total carbon emissions (2010 and 2020) among the EU, the USA, Japan, and China.

Table 2: Key Metrics of Renewable Energy and Carbon Reduction Efforts in EU, USA, Japan, and China

	EU	USA	Japan	China
Renewable Energy Capacity (Unit: GWh)	705.8	305	105	1213
Clean Energy Consumption Percentage (%)	31.6	22	20.3	47.3
Investment in carbon reduction as a percentage of GDP (%)	-2.8%	-1.8%	-0.8%	-4.5%
Total carbon emissions (2010) (Unit: 100 million tons)	56.0	34.0	12.0	91.0
Total carbon emissions (2020) (Unit: 100 million tons)	47.1	26.2	10.5	106.7
Target CO_2 Emissions Reduction by 2030 (%)	55	50	50	65

Source: World Bank 2021 ; The United Nations Economic Commission for Europe 2020; International Energy Agency 2021

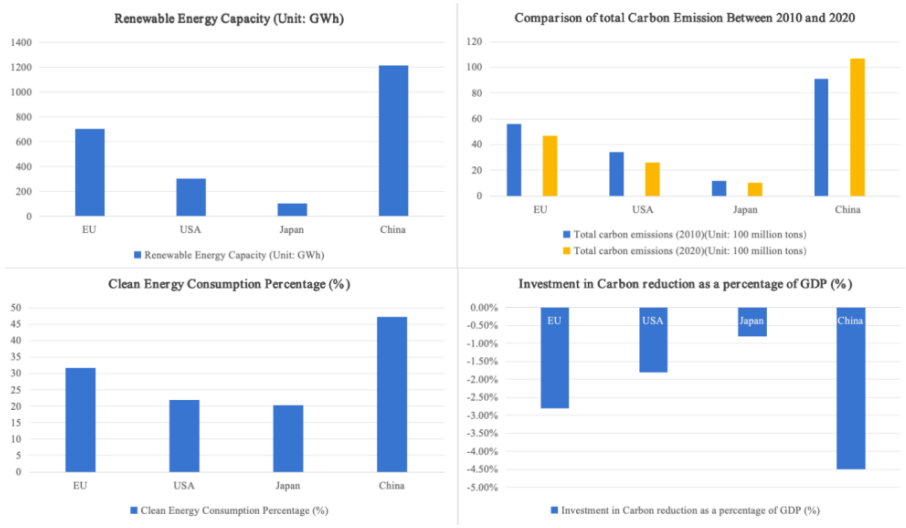


Figure 3. Comparative Analysis of Renewable Energy and Carbon Reduction Efforts among the EU, the USA, Japan, and China
Source: Fragkos et al. (2021) IEA (2021) World Bank (2021) UNECE (2021)

Lamentably, China's carbon emissions from 2010 to 2020 have continued to rise, in contrast to the trends observed in the EU, USA, and Japan. Despite substantial investments in carbon reduction, the highest renewable energy capacity, and the highest clean energy consumption percentage, China's total carbon emissions increased from 91.0 billion tons in 2010 to 106.7 billion tons in 2020. This rise highlights a significant challenge, i.e., even with aggressive renewable energy initiatives and substantial investment in carbon reduction, the total emissions have continued to grow. This stands in significant contrast to the other regions, which have seen reductions in their carbon emissions over the same period.

The EU, USA, and Japan have attained notable successes through their unique policy approaches, and China has also achieved significant progress in renewable energy capacity and clean energy consumption. The EU leads in total carbon emissions reduction, Japan excels in energy efficiency, and the USA demonstrates effective fiscal incentives and technological diversification. From 2010 to 2020, China's carbon emissions increased significantly, whereas the EU, USA, and Japan managed to reduce their total carbon emissions. This indicates that despite China's efforts, additional strategies and policy adjustments are necessary to reverse the trend of rising emissions. China leads in renewable energy capacity, clean energy consumption percentage, and investment in carbon reduction as a percentage of GDP. As these efforts have not yet translated into a reduction in total carbon emissions, China continues to move toward its carbon

reduction and energy transition goals by drawing on these countries' rich experiences and best practices to improve its policies further.

POLICY RECOMMENDATION

According to the comparisons, the EU, the US, and Japan have different policy designs and priorities for IES. Their significant contributions to global climate change offer valuable lessons for China.

Firstly, the EU's "Climate and Energy Framework" and Japan's "Strategic Energy Plan" are constantly updated to improve the development strategy of integrated energy services. Through evolution, these policy frameworks address the issues of sustainable energy development and supply. Moreover, during the evolution process, these policies will continuously adjust emission reduction targets based on the member states' and regions' energy transformation capabilities.

Secondly, the EU's electricity market integration plan and the US Renewable Energy Finance Act both improve energy efficiency by stimulating related markets for IES and renewable energy. At the same time, both the EU and the US attach great importance to public participation. Social media and other means can absorb public feedback on energy transition policies and efficiency improvement and enhance public awareness of sustainable development. These frameworks promote technological upgrading and innovation in IES-related industries. It also ensures that policy development meets public needs and sustainable development goals.

Thirdly, the US and Japan have provided China with rich policy cases in terms of energy portfolio diversification and energy efficiency priority. The US encourages businesses and residents to give priority to renewable energy equipment through tax relief and other bills, thereby promoting the development of a diversified energy supply in society. Through policies and standards, Japan imposes mandatory requirements on the energy efficiency of the equipment itself. The above cases provide China with policy-making directions and solutions when dealing with complex energy transitions and efficiency improvements.

CONCLUSION

Since the oil crisis in the 1970s, developed countries have gradually realized the importance of developing renewable energy and improving energy efficiency. Therefore, they began to improve energy service solutions by gradually formulating corresponding energy policies and ultimately achieving the goal of reducing CO_2 emissions and mitigating global climate change. IES provides excellent energy service solutions. This energy service model includes energy supply, energy system, energy consumption, and energy management. IES achieves energy sustainability goals by integrating multiple energy sources (including traditional energy and renewable energy), improving the level of

energy supply in the energy system, reducing energy consumption, and optimizing energy management. The signing of international agreements such as the Kyoto Protocol and the Paris Agreement marks that the international community has officially set sustainable energy development and carbon emission reduction as global goals. China, as the largest developing country, has also begun to promote changes in its energy industry after the Kyoto Protocol. Since then, China has also listed IES as an essential way to achieve energy transformation and energy efficiency improvement to achieve this goal.

By analyzing and comparing the different policy systems of the EU, the US, and Japan, in response to the challenges of energy transformation, this study proposes references that are significant for China's energy policy system. The study shows that the energy frameworks and plans of the EU and Japan have been continuously updated to improve the development strategy of IES and solve the problem of sustainable energy development and supply. The US and Japan provide rich policy cases in terms of energy portfolio diversification and energy efficiency priority. Moreover, the US encourages enterprises and residents to give priority to renewable energy equipment through tax relief and other bills, which promotes the development of a diversified energy supply. Correspondingly, Japan has put forward mandatory requirements for equipment energy efficiency through policies and standards. These experiences provide China with policy formulation directions and solutions in dealing with complex energy transformation and efficiency improvement. By learning from the successful experiences of these developed countries and regions, China can further improve its own energy policy system and better achieve its emission reduction goals.

REFERENCES

Abdmouleh, Z., Alammari, R. A., & Gastli, A. (2015). Review of policies encouraging renewable energy integration & best practices. *Renewable and Sustainable Energy Reviews*, *45*, 249-262.

Abou Amer, A., Mohamad, D., & Roosli, R. (2023). The impact of green energy & water practices on the development of sustainable tourism: a case study of 5-star hotels in hurghada and mecca. *Planning Malaysia*, *21*.

Atkeson, A., & Kehoe, P. J. (2001). The transition to a new economy after the second industrial revolution.

Baffes, J., Kose, M. A., Ohnsorge, F., & Stocker, M. (2015). The great plunge in oil prices: Causes, consequences, and policy responses. *Consequences, and Policy Responses (June 2015)*.

Bunse, K., Vodicka, M., Schönsleben, P., Brülhart, M., & Ernst, F. O. (2011). Integrating energy efficiency performance in production management–gap analysis between industrial needs and scientific literature. *Journal of cleaner production*, *19*(6-7), 667-679.

Christophers, B. (2019). Environmental beta or how institutional investors think about climate change and fossil fuel risk. *Annals of the American Association of Geographers*, *109*(3), 754-774.

Data Commons. (2022). *China: CO_2 emissions data.* Retrieved from https://datacommons.org/place/country/CHN.

Data Commons. (2022). *European Union: CO_2 emissions data.* Retrieved from https://datacommons.org/place/country/EU.

Data Commons. (2022). *United States: CO_2 emissions data.* Retrieved from https://datacommons.org/place/country/USA.

Data Commons. (2022). *Japan: CO_2 emissions data.* Retrieved from https://datacommons.org/place/country/Japan.

European Commission. (2017). *EU climate policy explained.* Retrieved from https://climate.ec.europa.eu/system/files/2017.

Fetting, C. (2020). The European green deal. *ESDN report*, *53*.

Fragkos, P., van Soest, H. L., Schaeffer, R., Reedman, L., Köberle, A. C., Macaluso, N., ... & Iyer, G. (2021). Energy system transitions and low-carbon pathways in Australia, Brazil, Canada, China, EU-28, India, Indonesia, Japan, Republic of Korea, Russia and the United States. *Energy*, 216, 119385.

Gao, C., Sun, M., Shen, B., Li, R., & Tian, L. (2014). Optimization of China's energy structure based on portfolio theory. *Energy*, *77*, 890-897.

Gaspari, M., Lorenzoni, A., Frías, P., & Reneses, J. (2017). Integrated Energy Services for the industrial sector: an innovative model for sustainable electricity supply. *Utilities Policy*, *45*, 118-127.

Gray, D. (1996). Reforming the energy sector in transition economies: selected experience and lessons. *(No Title)*.

Ibrahim, H., Ilinca, A., & Perron, J. (2008). Energy storage systems—Characteristics and comparisons. *Renewable and sustainable energy reviews*, *12*(5), 1221-1250.

International Energy Agency. (2021). *Japan 2021.* Retrieved May 1, 2024, from https://www.iea.org/reports/japan-2021

Klimenko, V. V., Klimenko, A. V., & Tereshin, A. G. (2019). From Rio to Paris via Kyoto: How the efforts to protect the global climate affect the world energy development. *Thermal Engineering, 66,* 769-778.

Li, F., Qiao, W., Sun, H., Wan, H., Wang, J., Xia, Y., ... & Zhang, P. (2010). Smart transmission grid: Vision and framework. *IEEE transactions on Smart Grid*, *1*(2), 168-177.

Li, J., Dong, K., & Dong, X. (2022). Green energy as a new determinant of green growth in China: The role of green technological innovation. *Energy economics*, *114*, 106260.

Liping, D. (2011). Analysis of the relationship between international cooperation and scientific publications in energy R&D in China. *Applied energy*, *88*(12), 4229-4238.

Luo, F., Xu, J., & Zhang, T. (2021). Quantitative evaluation of power supply reliability improvement in distribution network by customer-side integrated energy system. *Energy Reports*, *7*, 233-241.

MacCarty, N. A., & Bryden, K. M. (2016). An integrated systems model for energy services in rural developing communities. *Energy*, *113*, 536-557.

Ministry of Economy, Trade and Industry, Japan. (2022). *The 6th Strategic Energy Plan.* Retrieved May 1, 2024, from https://www.enecho.meti.go.jp/en/category/others/basic_plan/pdf/6th_outline.pdf

National Energy Administration of China. (2024). *Government Public Information Directory*. Retrieved May 1, 2024, from http://zfxxgk.nea.gov.cn/index.htm

Omer, A. M. (2008). Energy, environment and sustainable development. *Renewable and sustainable energy reviews*, *12*(9), 2265-2300.

Ozturk, S., Sozdemir, A., & Ulger, O. (2013). The real crisis waiting for the world: Oil problem and energy security. *International Journal of Energy Economics and Policy*, *3*(4), 74-79.

Panwar, N. L., Kaushik, S. C., & Kothari, S. (2011). Role of renewable energy sources in environmental protection: A review. *Renewable and sustainable energy reviews*, *15*(3), 1513-1524.

Peake, S., & Ekins, P. (2017). Exploring the financial and investment implications of the Paris Agreement. *Climate Policy*, *17*(7), 832-852.

Protocol, K. (1997). Kyoto protocol", UNFCCC Website. *Available online: http://unfccc. int/kyoto_protocol/items/2830. php (accessed on 1 January 2011).*

Ram, M., Osorio-Aravena, J. C., Aghahosseini, A., Bogdanov, D., & Breyer, C. (2022). Job creation during a climate compliant global energy transition across the power, heat, transport, and desalination sectors by 2050. *Energy*, *238*, 121690.

Roeder, J. L. (2005). What we learned from the oil crisis of 1973: A 30-year retrospective. *Bulletin of Science, Technology & Society*, *25*(2), 166-169.

Rosa, E. A., Machlis, G. E., & Keating, K. M. (1988). Energy and society. *Annual review of sociology*, *14*(1), 149-172.

Saidur, R., Islam, M. R., Rahim, N. A., & Solangi, K. H. (2010). A review on global wind energy policy. *Renewable and sustainable energy reviews*, *14*(7), 1744-1762.

Sorrell, S. (2007). Improving the evidence base for energy policy: The role of systematic reviews. *Energy policy*, *35*(3), 1858-1871.

Stork, J. (1973). Middle east oil and the energy crisis: Part two. *MERIP Reports*, (21), 3-26.

Sugihara, H., Komoto, J., & Tsuji, K. (2004). A multi-objective optimization model for determining urban energy systems under integrated energy service in a specific area. *Electrical Engineering in Japan*, *147*(3), 20-31.

U.S. Environmental Protection Agency. (2024). *Environmental Laws & Regulations* Retrieved May 1, 2024, from https://www.epa.gov/laws-regulations/regulations.

United Nations Economic Commission for Europe. (2020). *Renewable energy share in the total final energy consumption. UNECE*. Retrieved May 1, 2024, from https://w3.unece.org/SDG/en/Indicator?id=28.

United Nations Framework Convention on Climate Change. (2024). *The Paris Agreement.* Retrieved May 1, 2024, from https://unfccc.int/process-and-meetings/the-paris-agreement

Wu, J., Yan, J., Jia, H., Hatziargyriou, N., Djilali, N., & Sun, H. (2016). Integrated energy systems. *Applied Energy*, *167*, 155-157.

World Bank. (2021). *CO_2 emissions (kt)*. Millennium Development Goals. Retrieved from https://databank.worldbank.org/metadataglossary/millennium-development-goals/series/EN.ATM.CO_2E.KT.

Yang, Y., Zhang, S., & Xiao, Y. (2015). Optimal design of distributed energy resource systems coupled with energy distribution networks. *Energy*, *85*, 433-448.

Zawawi, N. H., Asmawi, M. Z., & Zen, I. S. (2024). The performance of Kuala Lumpur's carbon emissions in the context of urban planning. *Planning Malaysia*, *22*.

Received: 19th March 2024. Accepted: 3rd September 2024

PLANNING MALAYSIA:
Journal of the Malaysian Institute of Planners
VOLUME 22 ISSUE 5 (2024), Page 25 – 37

LAND SUITABILITY ANALYSIS USING GEOGRAPHIC INFORMATION SYSTEM (GIS) FOR SUSTAINABLE LAND DEVELOPMENT IN JELI, KELANTAN, MALAYSIA

Amal Najihah Muhamad Nor[1], Muhamad Azahar Abas [2], Jawagar A/L Arumugam[3], Mohamad Pirdaus Yusoh[4*], Normah Abdul Latip[5]

[1,2,3]*Faculty of Earth Science,*
UNIVERSITI MALAYSIA KELANTAN
[1,2]*Environment and Sustainable Development Research Group,*
UNIVERSITI MALAYSIA KELANTAN
[4,5]*Borneo Institute for Indigenous Studies (BorIIS)*,
UNIVERSITI MALAYSIA SABAH

Abstract

Three (3) satellite images (2004, 2014, and 2022) were processed and analysed using a Geographic Information System (GIS) to obtain the land use types. The land suitability parameters were chosen based on population density and landscape factors such as slope, land use, elevation, and distance from rivers. The weights of each evaluation factor were determined using Analytical Hierarchical Analysis (AHP). Additionally, weighted overlay analysis, available in ArcGIS 10.8 software, was used to integrate all the parameters. This study found that Jeli's build-up area increased from 1.9% in 2004 to 24.5% in 2022. The suitability map for Jeli's land development has been reclassified into three (3) highly suitable categories (42.43%), moderately suitable (53.32%), and highly not suitable (4.25%). The area of land suitability for land use increases along with the population density. The findings of this study will help policymakers develop better strategic urban expansion policies.

Keywords: Land Suitability Analysis, Analytical Hierarchical Analysis (AHP), Weighted Overlay, Geographic Information System (GIS)

[3] Senior Lecturer at Universiti Malaysia Sabah. Email: pirdaus@ums.edu.my

INTRODUCTION

Urbanisation, migrating from rural to urban areas, necessitates thoughtful land use planning for sustainable development and economic growth. Efficient urban land assessment is crucial for optimal resource allocation, promoting intensive land use while considering environmental impact. The suitability of land units plays a pivotal role in determining urban use (Ge & Liu, 2021). Built-up activities in urban areas contribute to environmental issues like traffic congestion, pollution, and reduced open spaces. Slums, often located on vulnerable slopes and riverbanks, pose challenges for the urban poor, demanding sustainable land management for environmental health and well-being. Sustainable land management involves accommodating human needs while preserving the land's social, economic, and ecological functions (Al-Taani et al., 2021, Pirdaus Yusoh, 2022). Integrating GIS, Remote Sensing, and landscape ecology, spatial analysis explores the potential of interoperable databases for informed decision-making (Jamru et al., 2023). Landscape ecology focuses on ecological processes and spatial heterogeneity, aiming to understand ecosystem patterns and interactions within a region. The study aims to develop a land suitability map in Jeli, Kelantan, Malaysia, considering landscape factors and population density for informed urban planning (Nizeyimana, 2020).

LITERATURE REVIEW

Urban Development Impact on Landscape Structure

Exposing built-up areas has detrimental environmental consequences, causing traffic congestion, pollution, unsustainable land development, reduced public spaces, and increased strain on public services (Shao et al., 2021). As urbanisation progresses, impermeable surfaces increase, impacting stormwater infiltration and increasing direct runoff, altering urban hydrologic processes. This elevation in runoff raises the risk and severity of flooding, potentially causing substantial property damage. Land use and cover types, encompassing water bodies, built-up areas, vegetation, agriculture, roads, and cleared land, are essential components of the urban landscape (Table 1).

Table 1: Landscape Factor

Landscape Factor	Justification of criteria	Reclassification of maps
Land use	Vegetation cover sustaining natural and aesthetic values of a particular landscape	1. Forest 2. Agriculture 3. Built-up area 4. Cleared land (Schirpke et al., 2021)

Landscape Factor	Justification of criteria	Reclassification of maps
Elevation	Forest areas in lowlands are easier to access compared to those at higher elevations	1. 0-300m 2. 300-750m 3. 750-1200m 4. 1200-1500m 5. >1500m (Whitmore 1986)
Slope	Recreational development will be located in areas with gentle slope	1. 15° 2. 15-25 ° 3. 25-30 ° 4. 30-35 ° (Zhao et al., 2021)
Distance from river	river traces and some arithmetic to determine river distance (or "river mile") from point A to point B.	1. < 500m 2. 500 – 1500m 3. 1500 – 3000m 4. 3000 – 4500m 5. >5000m (Mihalevich et al., 2020)

Land Suitability Analysis for Sustainable Land Development

Land suitability analysis is crucial for determining suitable land uses, addressing environmental concerns arising from rapid urbanisation (Yang et al., 2021), and detecting deforestation, as Latip et al. (2022) mention. Furthermore, Pimid et al. (2020) highlighted the importance of forest management in achieving sustainable land development in forest areas. The study utilised a descriptive quantitative method, employing three land suitability classes (low, medium, and high) based on landscape factors and population density. One model suitability method discussed is the weighted overlay approach, which is implemented in ArcGIS. This method involves assigning weights to each raster layer, reclassifying values using a standard suitability scale, and creating a suitability value by layering and summing results. The values are the basis for the output layer's symbology, enabling control over how different factors interact in the suitability model. The Analytical Hierarchy Process (AHP) was employed to assign numerical weights to factors through pairwise comparisons. These weights, crucial for the weighted overlay method, were determined based on expert opinions using a pairwise comparison matrix (Hassan et al., 2020).

RESEARCH METHODOLOGY

Study Area

Jeli, located in Kelantan, is a crucial gateway to the state and a convenient stopover for travellers on the East-West highway from the East Coast to the West Coast. The Jeli - Dabong road connects the district to South Kelantan. Strategically bordered by Thailand to the north, Tanah Merah District to the east,

Kuala Krai and Gua Musang District to the south, and Perak State to the west, Jeli is deemed a strategic area with significant development potential (Figure 1). The selection of Jeli as a study area is attributed to its status as a developing district in Kelantan that is experiencing urban expansion. The study focuses on the geographical coordinates of Jeli, Kelantan, situated at 5.7007° N and 101.8432° E.

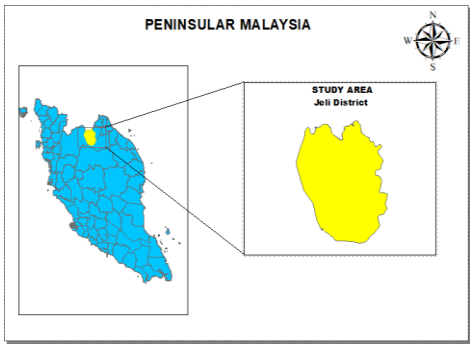


Figure 1: Map of the study area

Data Collection

This study adopted a case study approach, involving three key steps: data collection, processing, and analysis. Satellite imagery interpretation was used to create land use maps, recorded in both soft copy and hard copy formats. The research emphasised the importance of land suitability analysis for long-term reclamation planning, considering various land use alternatives such as agricultural, industrial, recreational, and residential areas (Wang et al., 2017). Satellite images from the United States Geological Survey (USGS) were obtained for selected study areas to develop Land Use Land Cover (LULC) data maps, which included land use, slope, and elevation maps (Table 2).

Table 2: Satellite Images

Year	Type of satellite image	Path/Row Resolution	Coordinate
2004	Landsat 8-9 OLI/TIRS C2 L1	127/056 30m resolution	Lat: 05° 42’ 02” N, Lon: 101° 50’ 35” E
2014	Landsat 8-9 OLI/TIRS C2 L1	127/056 30m resolution	Lat: 05° 42’ 02” N, Lon: 101° 50’ 35” E
2022	Landsat 8-9 OLI/TIRS C2 L1	127/056 30m resolution	Lat: 05° 42’ 02” N, Lon: 101° 50’ 35” E

Image Processing

Three geocoded satellite images were processed with ArcGIS to create Land Use Land Cover (LULC) maps for the Jeli district in 2004, 2014, and 2022. The satellite images were then subset using the boundary of Jeli that was downloaded from Global Administrative Areas (https://earthexplorer.usgs.gov/) to extract the area of interest from the image. For all three selected years, 2004, 2014, and 2022, the satellite images must be of good quality and have less cloud coverage around them to produce more accurate results. Supervised classification in remote sensing analysis involves collecting representative samples for each land cover class, known as "training sites", in ArcGIS (Richards, 2022). Initially focusing on specific features like urban areas, these training samples are progressively added across the entire image until appropriate samples for each class are obtained. The spectral data of these samples is compiled into a signature file, utilised for image classification.

Accuracy Assessment

Google Earth serves as a reference in the classification process, and various accuracy assessment methods, particularly using ground truth data, have been developed for classes with distinct boundaries (Maxwell & Warner, 2020). The comparison involves creating random points from ground truth data and assessing their accuracy against the classified data, a widely adopted method. Base maps and Google Earth aid in comparing outcomes of different classification methods, and ArcGIS is used to convert raster data to vector format. The resulting land use and land cover (LULC) maps are analysed to study the spatial pattern evolution in land suitability analysis.

Land Suitability Analysis

Use a weighted overlay to conduct a comprehensive analysis of land suitability based on a single factor's result. High, medium, and low suitability were assigned to the city's land use, and these integer numbers ranging from 1 to 5 were assigned to each category (Zhang et al., 2010). GIS-based land suitability mapping divides the urban and agricultural areas into zones, each with a different likelihood, or risk, of encountering specific land-use processes (Othman et al., 2021). To determine land class, numerical marks are granted as a weightage to various soil, land characteristics, and natural hazards, and the sum of this weightage determines the class obtained by that land, which is classified accordingly. The distribution of land use suitability for highly, moderately, and lowly suitable land use was shown using the weightage approach (Yang et al., 2021). After processing and classifying land use, elevation, and slope maps downloaded from the USGS, the next step involves categorising slope and elevation using the ArcGIS slope tool and adjusting colours through classification. Following this,

each map is ranked for high, medium, and low suitability on a scale of 1 to 5. To create a land suitability map using the weighted overlay tool in ArcGIS, the weightage of factors like land use, elevation, and slope must be calculated. These calculated results are input into the weighted overlay tool, where the overall sum of weightings is used to classify land. The Analytic Hierarchy Process (AHP) determines the weightage, ranking the significance of factors influencing urban land use changes at the system level through quantitative and qualitative analysis (Zhang et al., 2010). The AHP involves defining criteria weight, normalising pairwise comparison matrices, and creating a weighted matrix, with each criterion's weight influencing the weighted overlay.

Statistical Analysis

A correlation analysis was used to explain the landscape factors and population density by using Pearson's correlation (Abas et al., 2020). The researchers used Microsoft Excel to get the regression and correlation data using the landscape factors and population density data. The correlation coefficients are calculated using land suitability area as the dependent variable and population density as the independent variable.

> H_0: There is no significant relationship between landscape factors and population density.

RESULTS AND DISCUSSION

Image Classification

Figures 2, 3, and 4 represent the land use map for Jeli and Kelantan in 2004, 2014, and 2022, respectively. Each figure contains a land use map with the following class categories: waterbody, cleared land, agriculture, build-up area, and forest. The various uses of land were coded with different colours, and the legend for the map shows which colours correspond to which categories. The weighted overlay mapping results that produced land suitability results are shown in Figure 8 based on three categories for land suitability: highly suitable, moderately suitable, and highly not suitable.

Accuracy Assessment

Remote sensing imaging, using process data, was employed to identify physical factors accurately. Image enhancement assessed the quality of the satellite image, and a validation dataset with similar characteristics was used for accuracy analysis. The precision of the remote sensing-produced map was evaluated by comparing it to a reference map, often derived from different data sets, known as "ground truth." This ground truth could be obtained from high-resolution

imagery, existing classified imagery, or GIS data layers. Classification accuracy was assessed after data image processing, typically reported as a percentage success rate. Random points were selected to create a land use map, and the classification of these points provided a nuanced evaluation of the map's accuracy. Table 3 summarises the data, indicating accuracy rates of 91.33% in 2004, 88.20% in 2014, and 89.53% in 2022. This evaluation method helped gauge precision between the randomly selected points and the resulting land use map.

Table 3: Accuracy Assessment and Kappa Statistic for 2004, 2014 and 2022 using Landsat 8 OLI/TIRS C1

Year	**2004**	**2014**	**2022**
Overall accuracy (%)	91.33	88.20	89.53
Kappa Statistic	0.8538	0.8165	0.8378

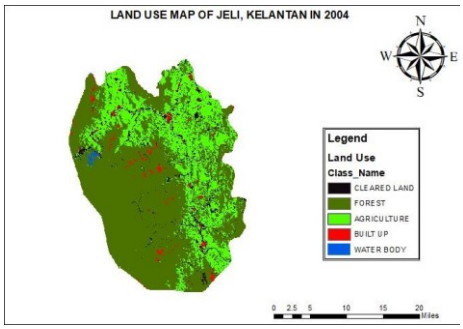


Figure 2: Land Use Map of Jeli, Kelantan in 2004

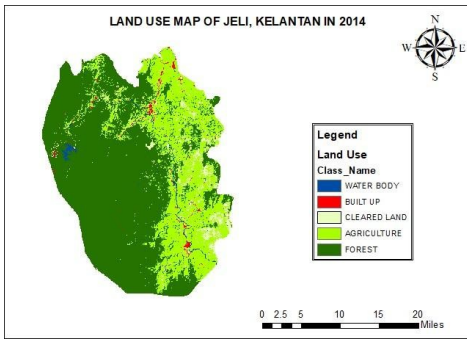


Figure 3: Land Use Map of Jeli, Kelantan in 2014

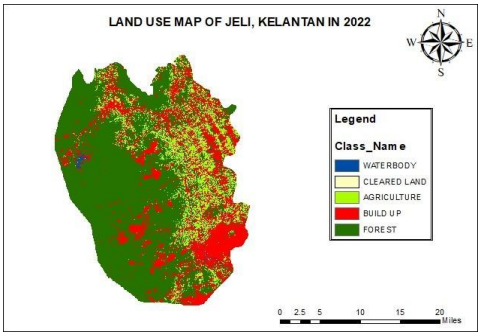


Figure 4: Land Use Map of Jeli, Kelantan in 2022

Land Changes Transition

In 2004, Jeli, Kelantan, had 4.8% cleared land, decreasing to 4.5% in 2014 and projected to be 0.5% in 2022 (Figure 5). The built-up area was 1.6% in 2004, decreasing to 0.9% in 2014 (likely due to the 2014 floods) and rising to 24.5% in 2022. The 2014 floods in Jeli caused substantial destruction to the built-up area. The study indicates urbanisation in Jeli, with open space transforming into built-up areas. Urbanisation involves clearing land for new development after deforestation, indirectly contributing to urban establishment. The research offers insights into land suitability for development, changes in green spaces over time, and the sequences of these changes in the ongoing urbanisation of a specific area.

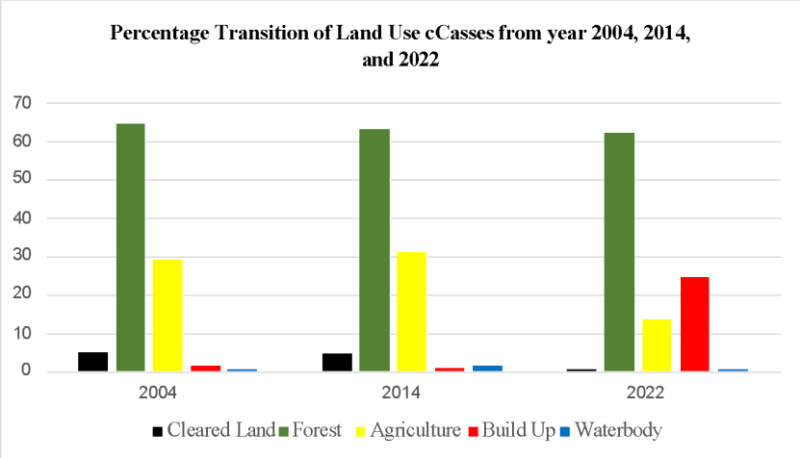


Figure 5: The graph of the transition of the classes from years 2004, 2014, and 2022

Land Suitability Analysis

This study developed a land suitability map for Jeli, Kelantan, in 2004, 2014, and 2022 based on landscape factors and population density. Figures 6 and 7 show the map considering factors like low elevation (prone to floods), high slope (prone to landslides), and land use. For land development, sustainability levels are classified as low, medium, or high. The study highlights the relationship between landscape factors and population density, offering valuable insights for urban planners to evaluate existing policies and develop sustainable development strategies (Rahman et al., 2021). USGS satellite imagery data from 2004, 2014, and 2022, along with Digital Elevation Model (DEM) data from the USGS, were used for image processing and land classification. The Analytic Hierarchy Process (AHP) was employed to assess factors influencing urban land use changes, determining weightage values for land suitability factors like land use, slope, elevation, and distance from the river (Table 4). The resulting land

suitability map categorises areas into highly suitable, moderately suitable, and highly unsuitable for sustainable development (Figure 8). The weighted overlay feature in ArcGIS was utilised for the land suitability analysis, calculating the percentage of each suitability class. Results indicate the spatial distribution of land suitability classes, providing crucial information for sustainable development planning in Jeli, Kelantan (Table 5).

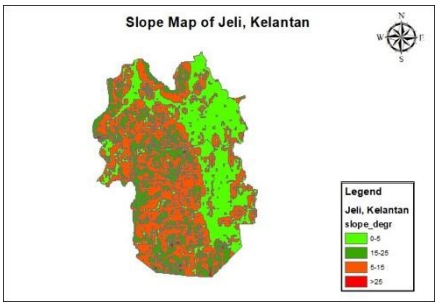


Figure 6: Slope map of Jeli, Kelantan

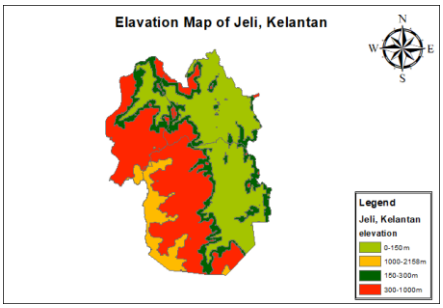


Figure 7: Elevation map of Jeli, Kelantan

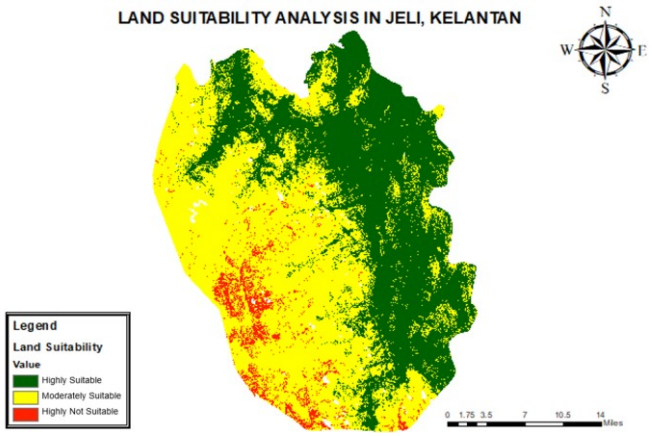


Figure 8: Land Suitability Analysis in Jeli, Kelantan

Table 4: Pairwise Comparison Matrix and Normalised Pairwise Matrix

Pairwise Comparison Matrix	E	S	LU	D
Elevation	1	2	2	4
Slope	1/2	1	2	4
Land use/ land cover	1/4	1/3	1	3
Distance from river	1/3	1/4	1/4	1
Total	2.08	3.58	5.25	12
Normalised Pairwise Matrix	E	S	LU	D
Elevation	0.48	0.56	0.38	0.33
Slope	0.24	0.28	0.38	0.33
Land use/land cover	0.12	0.09	0.19	0.25
Distance from river	0.16	0.07	0.05	0.08
Total	1	1	1	1
Note: E: Elevation, S: Slope, LU: Land use/Land cover, D: Distance from river				

Table 5 also shows that most of the land in Jeli is suitable for moderate, sustainable development. This category covered 75,565 hectares (ha) more land than the other categories combined. With a total area of 60,126 hectares, 42.43 per cent of Jeli's land is highly suitable for sustainable development.

Table 5: Results of Land Suitability Analysis in Jeli, Kelantan

Class	Area (Ha)	Percentage (%)
Highly Suitable	60,126	42.43
Moderately Suitable	75,565	53.32
Highly Not Suitable	6,019	4.25

This could be due to the land, slope, elevation, and distance from the river, which became perfectly suitable for sustainable development. In contrast, Jeli has 6,019 Ha with 4.25% land, which is highly unsuitable for any development. The findings make it abundantly clear that the Jeli have limited suitable land for cultivation.

Relationship between Landscape Factors, Population Density and Level of Suitability Analysis

Table 6 shows that the correlation coefficient is 0.551, indicating a robust positive correlation between the two variables. Because the p-value for the significance test is 0.000, which is less than any reasonable level of significance, the null hypothesis is rejected. Most of the land suitability area can be explained in terms of population density, according to the high value of R square, which is 0.303 for the relationship between population density and land suitability area.

Table 6: Pearson Correlation between Population Density and Land Suitability Area

	Population Density	**Land Suitability Area**
Population Density	1	0.551
Land Suitability Area	0.551	1

However, other factors like urbanisation and landscape may also affect population density.

CONCLUSION

This research focused on classifying land use in Jeli for 2004, 2014, and 2022. The study revealed a significant shift towards urban residential and built-up land, impacting non-land and inappropriate land, agricultural areas, and green spaces. Land suitability analysis based on landscape factors and population density indicated that most of Jeli's land is suitable for moderate development. The research highlighted a strong relationship between population density and land suitability, suggesting that the area of suitable land for development also rises as population density increases. The study underscores the potential influence on future sustainable development practices, aiding in preserving ecological networks and guiding policymakers in strategic urban expansion policies. It provides valuable reference data for city planners, facilitating improved urban planning and development plans, and enhancing the reasonable utilisation of limited urban land resources. The suitability evaluations contribute to informed decision-making for urban improvement.

ACKNOWLEDGEMENT

Thanks to the Ministry of Higher Education, Fundamental Research Grant Scheme (FRGS), Grant Code: FRGS/1/2022/SS02/UMK/02/1, for providing adequate financial assistance. Additionally, gratitude is extended to internal and external grants for financial support, with the assigned code numbers:

i. R/NADMA/A0800/00793A/006/2023/01216,
ii. R/STA/A0800/00793A/005/2022/01065,
iii. R/FUND/A0800/00449A/001/2022/01106.

REFERENCES

Abas, M. A., Ibrahim, N. E., Wee, S. T., Sibly, S., & Mohamed, S. (2020). Disaster resilience education (DRE) programmes in schools: a case study in Kelantan, Malaysia. In *IOP Conference Series: Earth and Environmental Science* (Vol. 549, No. 1, p. 012078). IOP Publishing.

Abdul Latip, N., Roystones Steven, S., Rashid, R., Karim, R., Umzarulazijo Umar, M., Hussin, R., Pirdaus Yusoh, M., Stephen, J., Andin, C., & Kanyo, N.-I. (2022). CHANGE OF FOREST LAND USE BASED ON CONSERVATION POLICY AND PRACTICE: A CASE STUDY IN DANUM VALLEY, MALAYSIA. *PLANNING MALAYSIA*, *20*(23). https://doi.org/10.21837/pm.v20i23.1150

Al-Taani, A., Al-husban, Y., & Farhan, I. (2021). Land suitability evaluation for agricultural use using GIS and remote sensing techniques: The case study of Ma'an Governorate, Jordan. *Egyptian Journal of Remote Sensing and Space Science*. https://doi.org/10.1016/j.ejrs.2020.01.001

Basharat, M., Shah, H. R., & Hameed, N. (2016). Landslide susceptibility mapping using GIS and weighted overlay method: a case study from NW Himalayas, Pakistan. *Arabian Journal of Geosciences*. https://doi.org/10.1007/s12517-016-2308-y

Ge, X. J., & Liu, X. (2021). Urban land use efficiency under resource-based economic transformation—a case study of shanxi province. *Land*. https://doi.org/10.3390/land10080850

Hassan, I., Javed, M. A., Asif, M., Luqman, M., Ahmad, S. R., Ahmad, A., Akhtar, S., & Hussain, B. (2020). Weighted overlay based land suitability analysis of agriculture land in Azad Jammu and Kashmir using GIS and AHP. *Pakistan Journal of Agricultural Sciences*. https://doi.org/10.21162/PAKJAS/20.9507

Jamru, L. R., Sharil, M. N., & Yusoh, M. P. (2023). ASSESSING THE EVOLUTION OF PADDY CULTIVATION IN KOTA BELUD, SABAH USING GIS AND REMOTE SENSING TECHNIQUES. *PLANNING MALAYSIA, 21*(28). https://doi.org/10.21837/pm.v21i28.1327

Maxwell, A. E., & Warner, T. A. (2020). Thematic classification accuracy assessment with inherently uncertain boundaries: An argument for center-weighted accuracy assessment metrics. *Remote Sensing*. https://doi.org/10.3390/rs12121905

Mihalevich, B. A., Neilson, B. T., Buahin, C. A., Yackulic, C. B., & Schmidt, J. C. (2020). Water temperature controls for regulated canyon-bound rivers. *Water Resources Research, 56*(12), e2020WR027566. https://doi.org/10.1029/2020WR027566

Nizeyimana, E. (2020). Remote Sensing and GIS Integration. In Managing Human and Social Systems. https://doi.org/10.1201/9781003053514-17

Othman, A. G., Ali, K. H., & Asli, W. M. F. (2021). Application of geographic information system (GIS) and analytic hierarchy process (AHP) technique to study land use changes in Pendang, Kedah. *Planning Malaysia*, *19* (2), 226-237.

Pimid, M., Abdul Latip, N., Marzuki, A., Umar, M. U., & Krishnan, K. T. (2020). STAKEHOLDER MANAGEMENT OF CONSERVATION IN LOWER KINABATANGAN SABAH. *PLANNING MALAYSIA*, *18*(13). https://doi.org/10.21837/pm.v18i13.776

Pirdaus Yusoh, M., Dering, N. F., Mapjabil, J., Abdul Latip, N., Kumalah, M. J., & Hanafi, N. (2022). COMPARISONS OF TOURIST CIRCUIT PATTERN AT SELECTED TOURISM DESTINATION IN SABAH, MALAYSIA. PLANNING MALAYSIA, 20(23). https://doi.org/10.21837/pm.v20i23.1151

Rahman, M., Ningsheng, C., Mahmud, G. I., Islam, M. M., Pourghasemi, H. R., Ahmad, H., Habumugisha, J. M., Washakh, R. M. A., Alam, M., Liu, E., Han, Z., Ni, H.,

Shufeng, T., & Dewan, A. (2021). Flooding and its relationship with land cover change, population growth, and road density. *Geoscience Frontiers*. https://doi.org/10.1016/j.gsf.2021.101224

Richards, J. A. (2022). Supervised Classification Techniques. *In Remote Sensing Digital Image Analysis*. https://doi.org/10.1007/978-3-030-82327-6_8

Schirpke, U., Zoderer, B. M., Tappeiner, U., & Tasser, E. (2021). Effects of past landscape changes on aesthetic landscape values in the European Alps. *Landscape and Urban Planning*, 212, 104109. https://doi.org/10.1016/j.landurbplan.2021.104109

Shao, Z., Sumari, N. S., Portnov, A., Ujoh, F., Musakwa, W., & Mandela, P. J. (2021). Urban sprawl and its impact on sustainable urban development: a combination of remote sensing and social media data. *Geo-Spatial Information Science*. https://doi.org/10.1080/10095020.2020.1787800

Wang, J., Zhao, F., Yang, J., & Li, X. (2017). Mining site reclamation planning based on land suitability analysis and ecosystem services evaluation: A case study in Liaoning Province, China. *Sustainability*. https://doi.org/10.3390/su9060890

Yang, Y., Tang, X. lan, & Li, Z. hui. (2021). Land use suitability analysis for town development planning in Nanjing hilly areas: A case study of Tangshan new town, China. *Journal of Mountain Science*. https://doi.org/10.1007/s11629-020-6037-z

Zhang, L., Kong, F., Sun, Z., Zhuang, Y., & Yin, H. (2010). Evaluation of the land-use suitability of Jinan City based on GIS and landscape metrics. 2010 18th International Conference on Geoinformatics, *Geoinformatics* 2010. https://doi.org/10.1109/GEOINFORMATICS.2010.5567798

Zhao, D., Xiao, M., Huang, C., Liang, Y., & An, Z. (2021). Landscape dynamics improved recreation service of the Three Gorges Reservoir Area, China. *International Journal of Environmental Research and Public Health*, *18*(16), 8356. https://doi.org/10.3390/ijerph18168356

Received: 4th March 2024. Accepted: 17th July 2024

PLANNING MALAYSIA:
Journal of the Malaysian Institute of Planners
VOLUME 22 ISSUE 5 (2024), Page 38 – 51

STIMULATING SDGS IN RURAL TOURISM DEVELOPMENT- THE MEDIATION EFFECT OF MOTIVATION, OPPORTUNITY AND ABILITY IN THE RELATIONSHIP OF PERCEPTION FOR TOURISM DEVELOPMENT AND COMMUNITY PARTICIPATION

Irhanida Abdul Kadir[1], Chew Leon Ni[2]

[1,2] *School of Hospitality, Tourism, and Culinary Arts,*
UOW MALAYSIA KDU PENANG UNIVERSITY COLLEGE

Abstract

Tourism is increasingly becoming a strategic tool for rural areas worldwide to achieve sustainability and stimulate economic growth. This research explores the application of the motivation, opportunity, and ability (MOA) model in rural tourism development in Kampung Kuala Juru, a fishing village in Bukit Tengah, Seberang Prai, Penang, to promote sustainability and economic opportunities for the B40 communities. A mixed-methods approach was utilised, including the distribution of 100 questionnaires to the local community to assess the impact of the MOA model on their participation in rural tourism development. Interviews with key informants were conducted to corroborate the findings. The research revealed that motivation and opportunity do not mediate the relationship between the community's perception of tourism development and their participation; however, ability does. This indicates that the community in Kampung Kuala Juru is more likely to participate irrespective of their motivation or opportunities. Furthermore, the results from the mixed methods suggest that tourism products and activities in Kampung Kuala Juru have the potential to enhance rural tourism development with the support of local residents and relevant tourism stakeholders, thereby contributing to the achievement of the Sustainable Development Goals (SDGs) and creating economic opportunities for the B40 community in the study area.

Keywords: Community Participation, MOA Model, Perception of Tourism Development, Rural Tourism, Sustainable Development Goals (SDGs)

[1] Corresponding author: irhanida@uow.edu.my

INTRODUCTION

Penang, a northern state in Malaysia, was ranked the second-best travel destination, with development predominantly concentrated on Penang Island (Penang State Government, 2019). To address the issue of tourist concentration, Dr. Neil Khor, Think City's chief operating officer, proposed displacing crowds to Butterworth (Mok, 2016). The Penang Tourism Master Plan 2021-2030 emphasises the need for balanced tourism development between Penang Island and Seberang Perai, advocating for civil participation to ensure the sustainability of tourism development (Penang State Government, 2019). The plan endorses community empowerment and locals' acquisition of managerial skills to align with the state's Structure Plan 2030 goals (Penang State Government, 2019). This research supports state government objectives, contributing to the Shared Prosperity Vision 2030's emphasis on the social well-being of the B40 group (Ministry of Economic Affairs, 2019). The study aims to uplift the B40 community, potentially contributing to national progress and social welfare.

In rural tourism development, stakeholders must actively involve communities in decision-making and planning processes. Residents possess valuable local knowledge (Lo & Janta, 2020), which enhances their sense of ownership and enables autonomous management. Community participation in decision-making has been shown to improve the success of tourism planning (Roxas et al., 2020; Purnomo et al., 2020). This research examines the influence of motivation, opportunity, and ability (MOA) on the relationship between the perception of tourism development and participation in Kampung Kuala Juru, located in Bukit Tengah. The initiative aims to promote sustainability and economic opportunities for the B40 communities, aligning with the state's objective to expand tourism in Seberang Perai. The MOA model evaluates community interest, ensuring active participation and successful planning, which are crucial for achieving the Sustainable Development Goals (SDGs).

LITERATURE REVIEW

Rural Tourism Development

Rural tourism is increasingly recognised as a catalyst for global economic development, contributing to a country's overall prosperity (Shahbaz et al., 2019). Focusing on rural areas inhabited by local communities improves living standards and boosts the economy through increased Foreign Exchange Earnings (An & Alarcon, 2020; Fong et al., 2014). Achieving these objectives requires the sustainable use of tourism resources and active community participation. Tourism development should effectively harness resources while ensuring that local communities benefit socioeconomically and environmentally (Nguyen et al., 2020). Emphasising civil participation in planning and implementation is a core principle of the Tourism Master Plan, aligning with the Penang Structure Plan

2030's emphasis on empowering local populations (Penang State Government, 2019). The relationship between rural tourism and the Sustainable Development Goals (SDGs) is well-established, promoting economic growth, poverty alleviation, cultural preservation, and environmental sustainability (UNWTO, 2019).

Park and Yoon (2011) emphasise that local residents are key to sustainable rural tourism development. Their knowledge of the region is paramount (Wijijayanti et al., 2020; Tseng et al., 2019). Effective community involvement enables locals to promote their culture, secure economic gains, and protect the environment (Masud et al., 2017). Community perspectives significantly influence the success of rural tourism (Ryu et al., 2020; Falak et al., 2014), enhancing tolerance towards tourism among developers and policymakers (Setokoe & Ramukumba, 2019).

Sustainable Development Goals (SDGs) and Motivation-Opportunity-Ability (MOA) Model

The Sustainable Development Goals (SDGs) established by the United Nations address global challenges such as poverty and environmental sustainability. This review examines the intersection of the SDGs with the Motivation-Opportunity-Ability (MOA) framework, which is crucial for promoting sustainable behavior within organisations. The SDGs provide a roadmap for aligning organisational strategies with global priorities (United Nations, 2015), while the MOA framework emphasises that behavior change depends on motivation, opportunity, and ability (Fogg, 2009).

Motivation is linked to the alignment of individual and organisational values with SDG principles (Ryan & Deci, 2000). Opportunity encompasses external factors that facilitate sustainable behavior (Michie et al., 2020). Ability emphasises the importance of empowering individuals with the necessary skills for sustainable practices (Bandura, 1986).

This research aligns with several SDGs: creating economic opportunities (SDG 1), promoting decent work and economic growth (SDG 8), enhancing quality education (SDG 4), and developing sustainable communities (SDG 11). Improving the status of the B40 community can significantly boost the economy, ensuring that residents' needs are met while conserving the environment (SDG 9).

Community's Perception towards Tourism Development

Community perception of tourism development is essential for its success (Nguyen & Rahman, 2023). Sustainable tourism must balance current needs with the preservation of resources, environmental protection, and respect for socio-cultural aspects. Positive perceptions, shaped by benefits such as cultural

preservation and improved living standards, foster community support, as social exchange theory suggests (Pimid et al., 2023). Understanding these perceptions enables authorities to prioritise strategies that empower communities, ensuring sustainability and minimising conflicts (Gannon et al., 2021).

Motivation, Opportunity and Ability in the Development of Rural Tourism Development

The Motivation, Opportunity, and Ability (MOA) framework, originally proposed by MacInnis et al. (1991), is applied to rural tourism development to assess how these factors influence community engagement (Hung et al., 2011). Motivation drives interest, opportunity reflects external factors, and ability reflects knowledge and competence. In tourism, these elements shape community involvement by emphasising the benefits, opportunities, and capabilities for participation. Incorporating additional factors, as suggested by Latip et al. (2018), ensures a comprehensive approach to sustainable tourism development.

Motivation in Community Participation

Whether intrinsic or extrinsic, motivation propels individuals toward goals, as Tang et al. (2022) noted. Latip et al. (2018) proposed that community motivation fosters support for tourism development when perceived benefits outweigh costs. This support hinges on the community's perception of positive impacts (Chang, 2018). Xu et al. (2022) view motivation as a mental stimulus directing behavior. Similarly, Rogos et al. (2021) and Jepson et al. (2014) regard motivation as a significant force driving behavior. Motivation precedes decision-making in participation (Jepson et al., 2014), and encouragement from tourism planners is also vital (Jepson et al., 2014).

Opportunity in Community Participation

The literature on community participation emphasises the significance of opportunity, which entails creating circumstances for community involvement in tourism development (Latip et al., 2018; Rogos et al., 2021). Rogos et al. (2021) highlight the role of political affiliation and social standards in providing such opportunities. Initiatives by tourism planners to create platforms for community involvement are crucial (Jepson et al., 2014; Rogos et al., 2021). However, Ahn and Bessiere (2022), Gohori and van der Merwe (2022), Tian et al. (2023), and Wang and Wall (2005) suggest a tradition of top-down decision-making, particularly in developing countries, which disempowers indigenous communities and restricts their access to opportunities and empowerment (Jepson et al., 2014; Zielinski et al., 2018).

Ability in Community Participation

The ability component of the MOA model depicts the awareness, knowledge, and access to necessary information related to tourism development (Lubis et al., 2020). Lee and Jan (2019) reported that communities could benefit from the tourism industry by increasing their awareness and improving their capabilities. However, the participation of indigenous communities may be obstructed by a lack of awareness and knowledge. This issue has been discussed extensively in the literature (Aref, 2011; Cardenas et al., 2015; Chili & Ngxongo, 2017; Kala & Bagri, 2018; Rasoolimanesh & Jaafar, 2016; Setokoe & Ramukumba, 2022). Productive participation by the community, leading to extraordinary results, can only be accomplished with improved education on tourism development mechanisms. Consequently, the community will be prepared and ready to participate in tourism projects (Latip et al., 2018). Otherwise stated, the community may still lack the ability to participate, even if motivated by available opportunities.

RESEARCH FRAMEWORK

This multidimensional study investigates the mechanisms and relationships between key variables in tourism development and community engagement. The framework synthesises concepts from social psychology, tourism studies, and community development, with a focus on the Perception of Tourism Development (PoTD) and Community Participation (CP). Motivation (MOT) drives individual participation, opportunity (OPP) represents external conditions, and ability (ABLTY) encompasses skills and knowledge. The research hypothesises the following:

H1: Positive perceptions of tourism development enhance motivation to participate, whereas negative perceptions necessitate stronger motivations.
H2: Motivation alone is insufficient without opportunities; a lack of infrastructure or information impedes participation.
H3: Even with opportunities, participation is constrained without the requisite skills or knowledge; high ability facilitates participation regardless of motivation or opportunities.

The framework proposes interventions targeting motivation, opportunity, and ability, such as awareness campaigns, skills development, infrastructure improvements, and policy reforms. These insights are intended to promote sustainable and inclusive tourism development for policymakers, local communities, and developers.

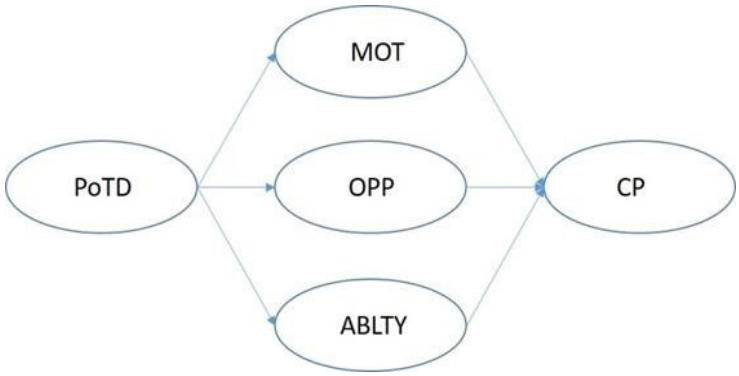


Figure 1: Proposed Research Model – Mediation Effect of MOA in the Relationship of Perception of Tourism Development and Community Participation
Source: Researcher (2024)

RESEARCH METHODOLOGY

A survey was conducted in Kampung Kuala Juru, Bukit Tengah, to assess the potential for rural tourism. Although the area is rich in resources, it has been underexplored in tourism studies. The survey aimed to examine the relationship between the community's perception of tourism development and their participation, with motivation, opportunity, and ability acting as mediators. Out of a population of 400, 100 questionnaires were distributed, employing a five-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). This scale was selected for its efficiency and its capacity to minimise bias (Chyung et al., 2017). Additionally, interviews with key stakeholders in tourism provided further insights, offering an extended understanding of the survey questions. Descriptive analysis was employed to summarise the data, utilising measures of central tendency (mean, median, mode) and variability (standard deviation, minimum, maximum, kurtosis, skewness). Mediation analysis using the Hayes Process Macro was conducted to investigate the mediating effects of motivation, opportunity, and ability on the relationship between community perception and participation in tourism development.

ANALYSIS AND DISCUSSION

Respondents' Demographic Background

Table 1: Demographic Data of Respondents

Demographic Profile		Frequency	Percent	Mode Class
Gender	Male	45	45	Female
	Female	55	55	
Age Group	18 - 24 years old	19	19	45-54 years old
	25 - 34 years old	20	20	
	35 - 44 years old	20	20	
	45 - 54 years old	22	22	
	55 - 64 years old	15	15	
	65 years old and above	4	4	
Race	Malay	100	100	Malay
Occupation	Student	12	12	Factory Worker and Unemployed
	Fisherman	20	20	
	Factory Worker	22	22	
	Civil Servant	7	7	
	Self-employed	7	7	
	Unemployed	22	22	
	Retired	7	7	
	Others	3	3	
Average Monthly Income	Less than RM 2,500	81	81	Less than RM 2,500
	RM 2,500 - RM 3,169	4	4	
	RM 3,170 - RM 3,696	2	2	
	RM 3,970 - RM 4,849	2	2	
	Others	11	11	

Mediation Analysis Results

This study employed mediation analysis using Hayes Process Macro. Table 1 presents the summary of the analysis of this research.

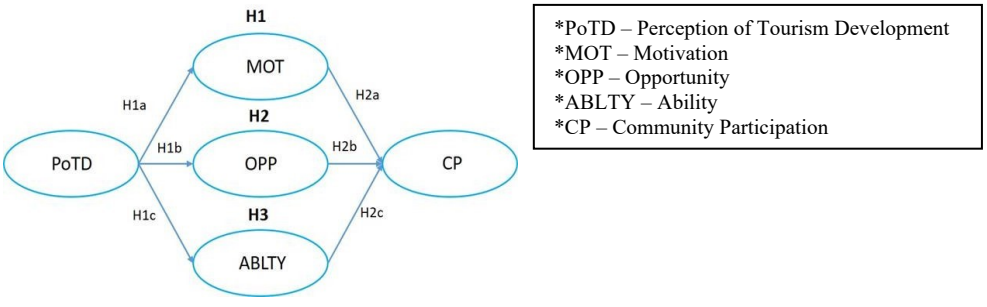


Figure 2: Conceptual Diagram

Table 2: Coefficient Analysis Summary

Relationship	Coefficient	S.E	t-statistics	p-value	Conclusion
PoTD -> MOT	0.2347	0.0709	3.3096	0.0013	Significant relationship H1a is supported
PoTD -> OPP	0.2917	0.0839	3.4756	0.0008	Significant relationship H1b is supported
PoTD -> ABLTY	0.3936	0.0775	5.0803	0.0000	Significant relationship H1c is supported
MOT -> CP	0.0549	0.1529	0.3595	0.7200	Not significant relationship H2a is not supported
OPP -> CP	0.3126	0.1267	2.4661	0.0155	Significant relationship H2b is supported
ABLTY -> CP	0.3516	0.1298	2.7092	0.0080	Significant relationship H2c is supported
PoTD -> CP	0.3021	0.0940	3.2143	0.0018	Significant relationship H3 is supported

Source: Researcher (2024)

Table 3: Mediation Analysis Summary

Total Effect (PoTD -> CP)	Direct Effect (PoTD -> CP)	Relationship	Indirect Effect	Confidence Interval		t-statistics	Conclusion
				Lower Bound	Upper Bound		
0.3021 (p=0.018)	0.0597 (p=0.5188)	H1: PoTD ->MOT ->CP	0.0129	-0.0900	0.1189	0.2549	No mediation H1 is not supported
		H2: PoTD ->OPP ->CP	0.0912	-0.0060	0.2399	1.4227	No mediation H2 is not supported
		H3: PoTD ->ABTY ->CP	0.1384	0.0264	0.2866	2.0906	Full mediation H3 is supported

Source: Researcher (2024)

Table 2 summarises the coefficient analysis of the relationships between Perception of Tourism Development (PoTD), Motivation (MOT), Opportunity (OPP), Ability (ABTY), and Community Participation (CP). Most relationships are significant ($p < .05$), except for the relationship between motivation and community participation. Table 3 presents the mediation analysis, showing that Hypotheses 1 and 2 are not supported, while Hypothesis 3 is fully supported, indicating that ABTY mediates the relationship between PoTD and CP.

Hypothesis 1 is rejected, revealing a lack of motivation among locals for engaging in tourism development, despite its potential for sustainable income. Interviews highlighted concerns regarding business expansion, hiring, and potential financial losses, with some entrepreneurs expressing contentment with their current situation. Additionally, reliance on government aid contributed to

the reluctance to participate. This finding contrasts with Jepson et al.'s (2013) research, which links motivation to awareness of tourism's benefits.

Hypothesis 2, which proposed that opportunity mediates the PoTD-CP relationship, is also rejected. Locals perceive inadequate support from authorities and view their village as unsuitable for large tourist groups due to cramped conditions and river pollution, which negatively impacts local products. Furthermore, they noted a lack of necessary infrastructure and facilities.

Hypothesis 3 is supported, indicating that ability mediates the PoTD-CP relationship. Positive perceptions of tourism can enhance the community's abilities, thereby driving active participation. Interviews revealed that tourism development could improve access to resources, training, and education, facilitating skill development and increasing preparedness for tourism involvement. Additionally, social expectations were found to reinforce participation.

Insights from the Stakeholders

This study engaged key stakeholders in tourism development in Kuala Juru, including the state assemblyman, district councillor, village representatives, local entrepreneurs, and the community. Stakeholders emphasised the significance of community involvement in tourism planning to highlight the area's uniqueness and preserve its character. They stressed that locals should serve as tour guides to uphold the area's distinctive identity and foster responsible, community-driven development. One respondent noted, "Community participation in the development of tourism products is crucial to prepare the community to accept the presence of outsiders (tourists) and to promote local tourism products to them."

Table 2 presents detailed offences under relevant sections and the enforcement actions taken during the year 2020. This table reveals that the four highest numbers of enforcements are related to the collected sums and account matters. Therefore, the conclusion for 2020 is that issues related to fee collection and its accounts exhibited the highest rate of non-compliance, leading to the enforcement actions taken.

CONCLUSION

In conclusion, the evaluation of the MOA model in the context of rural tourism development in Kampung Kuala Juru, Bukit Tengah, Seberang Prai, Penang, offers valuable insights into community participation and sustainability within B40 communities. The study elucidates critical factors influencing participation, identifying motivation as a key determinant. The findings suggest a potential lack of motivation among local communities, emphasising the need to address underlying factors that hinder their engagement in tourism initiatives.

Furthermore, the rejection of the second hypothesis indicates limitations in current opportunities for the community, requiring a comprehensive assessment and enhancement aligned with community aspirations. On a positive note, the support for the third hypothesis underscores the role of ability in mediating the relationship between perceptions of tourism development and community participation. Positive perceptions can enhance local abilities, highlighting the potential for capacity-building programs to empower communities. This research advocates for a holistic approach to address motivation, ability, and opportunities to promote inclusive, sustainable, and economically rewarding rural tourism development in B40 communities.

ACKNOWLEDGEMENT

The authors would like to express their sincere gratitude to the Ministry of Higher Education Malaysia for the financial support provided through the Fundamental Research Grant Scheme (FRGS) under the project code FRGS12022SS10KDUPG022. This funding has been instrumental in the successful completion of this research.

DISCLOSURE STATEMENT

The authors declare that there are no conflicts of interest associated with this research. This study is funded by the Ministry of Higher Education Malaysia, which had no role in the study design, data collection and analysis, decision to publish, or preparation of the manuscript. All data collected during this study were handled in accordance with ethical guidelines, ensuring participant anonymity and confidentiality. The authors confirm that the content of this paper is free from plagiarism and has not been submitted elsewhere for publication.

REFERENCE

Ahn, Y. J., & Bessiere, J. (2022). The role of participative leadership in empowerment and resident participation. *Sustainability, 14*(18), 11223. https://doi.org/10.3390/su141811223

An, W., & Alarcon, S. (2020). How can rural tourism be sustainable? A systematic review.

Aref, F. (2011). Barriers to community capacity building for tourism development in communities in Shiraz, Iran. *Journal of Sustainable Tourism, 19*(3). https://doi.org/10.1080/09669582.2010.517314

Bandura, A. (1986). Fearful expectations and avoidant actions as coeffects of perceived self-inefficacy. *American Psychologist, 41*(12), 1389–1391. https://doi.org/10.1037//0003-066x.41.12.1389

Cardenas, D. A., Byrd, E. T., & Duffy, L. N. (2015). An exploratory study of community awareness of impacts and agreement to sustainable tourism development principles. *Tourism and Hospitality Research*, 1-13.

https://doi.org/10.1177/1467358415580359

Chang, K. C. (2018). The affecting tourism development attitudes based on the social exchange theory and the social network theory. *Asia Pacific Journal of Tourism Research*, 1-16. https://doi.org/10.1080/10941665.2018.1540438

Chili, N. S., & Ngxongo, N. A. (2017). Challenges to active community involvement in tourism development at Didima Resort—A case study of Umhlwazini community in Bergville. *African Journal of Hospitality, Tourism and Leisure, 6*(2), 1-5. https://l1nq.com/VWoBk

Chyung, S. Y., Roberts, K., Swanson, I., & Hankinson, A. (2017). Evidence-based survey design: The use of a midpoint on the Likert scale. *Performance Improvement, 56*(10), 15-23. https://doi.org/10.1002/pfi.21727

Falak, S., Lo, M. C., & Yeo, A. W. (2014). A repositioning strategy for rural tourism in Malaysia: Community's perspective. *Procedia – Social and Behavioral Sciences, 144*, 412-415. https://doi.org/10.1016/j.sbspro.2014.07.310

Fogg, B. (2009). A behavior model for persuasive design. In *Proceedings of the 4th International Conference on Persuasive Technology*. https://doi.org/10.1145/1541948.1541999

Fong, S. F., Lo, M. C., Songan, P., & Nair, V. (2014). The impact of local communities' involvement and relationship quality on sustainable rural tourism in rural area, Sarawak: The moderating impact of self-efficacy. *Procedia – Social and Behavioral Sciences, 144*, 60-65. https://doi.org/10.1016/j.sbspro.2014.07.274

Gannon, M., Rasoolimanesh, S. M., & Taheri, B. (2021). Assessing the mediating role of residents' perceptions toward tourism development. *Journal of Travel Research, 60*(1), 149-171. https://doi.org/10.1177/0047287519890926

Gohori, O., & van der Merwe, P. (2022). Tourism and community empowerment: The perspectives of local people in Manicaland Province, Zimbabwe. *Tourism Planning & Development*, 1-19. https://doi.org/10.1080/21568316.2021.1873838

Hung, K., Sirakaya-Turk, E., & Ingram, L. J. (2011). Testing the efficacy of an integrative model for community participation. *Journal of Travel Research, 50*(3), 276-288. https://doi.org/10.1177/0047287510362781

Jepson, A., Clarke, A., & Ragsdell, G. (2014). Integrating "self-efficacy" theory into the Motivation-Opportunity-Ability (MOA) model to reveal factors that influence inclusive engagement within community festivals. *International Journal of Event and Festival Management, 5*(3), 219-234. https://doi.org/10.1108/IJEFM-11-2013-0027

Kala, D., & Bagri, S. C. (2018). Barriers to community participation in tourism development: Evidence from the mountainous state Uttarakhand, India. *Tourism: An International Interdisciplinary Journal, 66*(3), 318-333. https://hrcak.srce.hr/en/file/303072

Latip, N. A., Rasoolimanesh, S. M., Jaafar, M., Marzuki, A., & Umar, M. U. (2018). Indigenous participation in conservation and tourism development: A case of native people of Sabah, Malaysia. *International Journal of Tourism Research, 20*(3), 400-409. https://doi.org/10.1002/jtr.2191

Lee, T. H., & Jan, F. H. (2019). Can community-based tourism contribute to sustainable development? Evidence from residents' perceptions of sustainability. *Tourism Management, 70*, 368-380. https://doi.org/10.1016/j.tourman.2018.09.003

Lo, Y. C., & Janta, P. (2020). Resident's perspective on developing community-based tourism: A qualitative study of Muen Ngoen Kong community, Chiang Mai, Thailand. *Frontiers in Psychology, 11*, 1493. https://doi.org/10.3389/fpsyg.2020.01493

Lubis, H., Rohmatillah, N., & Rahmatina, D. (2020). Strategy of tourism village development based on local wisdom. *Jurnal Ilmu Sosial dan Humaniora, 9*(2), 320-329. https://doi.org/10.2139/ssrn.3948752

MacInnis, D. J., Moorman, C., & Jaworski, B. J. (1991). Enhancing and measuring consumers' motivation, opportunity, and ability to process brand information from ads. *Journal of Marketing, 55*(4), 32-53. https://doi.org/10.1177/002224299105500403

Masud, M. M., Aldakhil, A. M., Nassani, A. A., & Azam, M. N. (2017). Community-based ecotourism management for sustainable development of marine protected areas in Malaysia. *Ocean & Coastal Management, 136*, 104-112. https://doi.org/10.1016/j.ocecoaman.2016.11.023

Michie, S., van Stralen, M. M., & West, R. (2020). 'Capability', definitions [Preprint]. https://doi.org/10.32388/f3s86p

Ministry of Economic Affairs. (2019, October 5). Shared Prosperity Vision 2030. Institut Masa Depan Malaysia (MASA). https://www.epu.gov.my/sites/default/files/2020-02/Shared_Prosperity_Vision_2030.pdf

Mok, O. (2016, October 29). Massive projects in place to alleviate urbanisation in Penang. *Malay Mail Online*. https://thinkcity.com.my/wp/wp-content/uploads/2018/05/MALAY-MAIL-Massive-projects-in-place-to-alleviate-urbanisation-in-Penang-29-OCT-2016.pdf

Nguyen, H. T., Tran, M. T., Tran, H. H., Phung, T. V., & Nguyen, V. T. L. (2020). Solutions for Tuyen Quang and Binh Phuoc tourism industry sustainable development: Comparative analysis. *International Journal of Research in Marketing Management and Sales, 2*(1), 101-107. https://doi.org/10.33545/26633329.2020.v2.i1b.31

Nguyen, T. N. A., & Rahman, S. (2023). Residents' perception towards the environmental impacts of rural tourism development: The case study of Da Lat City, Vietnam. *Planning Malaysia, 21*(4), 424-437. https://doi.org/10.21837/pm.v21i28.1343

Park, D.-B., & Yoon, Y.-S. (2011). Developing sustainable rural tourism evaluation indicators. *International Journal of Tourism Research, 13*(5), 401-415. https://doi.org/10.1002/jtr.804

Pimid, M., Marzuki, A., Scian, J., & Krishnan, K. T. (2023). Rural development: Motivational factors impacting community support for rural tourism. *Planning Malaysia: Journal of the Malaysian Institute of Planners, 21*(6), 408-424. https://doi.org/10.21837/pm.v21i30.1410

Penang State Government. (2019, October 24). Penang State Structure Plan 2030. *State Government Gazette, 63*(3), Gazette Statement No. 1068. https://petace.gov.my/wp-content/uploads/2021/05/PGTMP_small_version.pdf

Purnomo, S., Rahayu, E. S., Riani, A. L., Suminah, S., & Udin, U. (2020). Empowerment model for sustainable tourism village in an emerging country. *Journal of Asian Finance, Economics and Business, 7*(2), 261-270.

https://doi.org/10.13106/jafeb.2020.vol7.no2.261

Rasoolimanesh, S. M., & Jaafar, M. (2016). Community participation toward tourism development and conservation program in rural world heritage sites. In L. Butowski (Ed.), *Tourism: From Empirical Research Towards Practical Application* (pp. 1-14). Intech Open. http://dx.doi.org/10.5772/61385

Rogos, E., Kwang, S. N., & Teck, W. J. (2021). Factors influencing community participation in community-based ecotourism in Padawan, Sarawak. *SHS Web of Conferences, 124*, 03005. https://doi.org/10.1051/shsconf/202112403005

Roxas, F. M. Y., Rivera, J. P. R., & Gutierrez, E. L. M. (2020). Mapping stakeholders' roles in governing sustainable tourism destinations. *Journal of Hospitality and Tourism Management, 45*, 387-398. https://doi.org/10.1016/j.jhtm.2020.09.005

Ryan, R. M., & Deci, E. L. (2000). When rewards compete with nature. In *Intrinsic and Extrinsic Motivation* (pp. 13–54). https://doi.org/10.1016/b978-012619070-0/50024-6

Ryu, K., Roy, P. A., Kim, H., & Ryu, H. B. (2019). The resident participation in endogenous rural tourism projects: A case study of Kumbalangi in Kerala, India. *Journal of Travel & Tourism Marketing, 37*(1), 1-14. https://doi.org/10.1080/10548408.2019.1687389

Setokoe, T. J., & Ramukumba, T. (2022). Ability to for self: A rural community's view of the importance of capacity building in sustainable tourism development. *GeoJournal of Tourism and Geosites, 41*(2), 583-588. https://doi.org/10.308892/gtg.41232-866

Shahbaz, M., Solarin, S. A., Azam, M., & Tiwari, A. K. (2019). Tourism-induced income distribution in Malaysia: A practical experience of a truly Asian economy. *Current Issues in Tourism*. https://doi.org/10.1080/13683500.2019.1697648

Tang, H., Ma, Y., & Ren, J. (2022). Influencing factors and mechanism of tourists' pro-environmental behavior: Empirical analysis of the CAC-MOA integration model. *Frontiers in Psychology, 13*, 1060404. https://doi.org/10.3389/fpsyg.2022.1060404

Tian, B., Stoffelen, A., & Vanclay, F. (2023). Ethnic tourism in China: Tourism-related (dis)empowerment of Miao villages in Hunan province. *Tourism Geographies, 2-3*, 552-571. https://doi.org/10.1080/14616688.2021.1938657

Tseng, M.-L., Lin, C., Lin, C.-W. R., Wu, K.-J., & Sriphon, T. (2019). Ecotourism development in Thailand: Community participation leads to the value of attractions using linguistic preferences. *Journal of Cleaner Production, 231*, 1319-1329. https://doi.org/10.1016/j.jclepro.2019.05.305

United Nations. (2015). Transforming our world: The 2030 agenda for sustainable development. *Scientific Research Publishing*. https://www.scirp.org/(S(czeh2tfqyw2orz553k1w0r45))/reference/referencespapers.aspx?referenceid=3022399

UNWTO. (2019). *Tourism for rural development: Strategies for sustainable tourism in rural areas*. https://www.unwto.org/tourism-for-rural-development-strategies-for-sustainable-tourism-in-rural-area

Wang, Y., & Wall, G. (2005). Sharing the benefits of tourism: A case study in Hainan, China. *Environments Journal, 33*(1). https://encr.pw/1Khco

Wijijayanti, T., Agustina, Y., Winarno, A., Istanti, L. N., & Dharma, B. A. (2020). Rural

tourism: A local economic development. *Australian Accounting Business and Finance Journal, 14*(1), 5-13. https://doi.org/10.14453/aabfj.v14i.2

Xu, S., Zuo, Y., Law, R., & Zhang, M. (2022). Impact of farmers' participation in tourism on sustainable livelihood outcomes in border tourism areas. *International Sociology, 37*(1), 50-77. https://doi.org/10.1177/02685809211024019

Zielinski, S., Kim, S., Botero, C., & Yanes, A. (2018). Factors that facilitate and inhibit community-based tourism initiatives in developing countries. *Current Issues in Tourism*, 1-17. https://doi.org/10.1080/13683500.2018.1543254

Received: 11th June 2024. Accepted: 30th August 2024

PLANNING MALAYSIA:
Journal of the Malaysian Institute of Planners
VOLUME 22 ISSUE 5 (2024), Page 52 – 65

CHALLENGES IN IMPLEMENTING URBAN LAND READJUSTMENT (ULR) IN MALAYSIA FROM TOWN PLANNER'S PERSPECTIVES

Siti Fairuz Che Pin[1], Anuar Alias[2], Nikmatul Adha Nordin[3], Asma Senawi[4], Mohamad Haizam Mohamed Saraf[5]

[1,2,3]*Centre for Sustainable Planning and Real Estate (SUPRE),*
Faculty of Built Environment,
UNIVERSITI MALAYA, MALAYSIA
[4]*School of Housing, Building and Planning,*
UNIVERSITI SAINS MALAYSIA
[1,4,5]*Department of Built Environment Studies and Technology,*
College of Built Environment,
UNIVERSITI TEKNOLOGI MARA PERAK BRANCH, MALAYSIA

Abstract

Urban land readjustment (ULR) is a land management approach that aims to achieve comprehensive and sustainable urban development by reorganising land ownership patterns, improving infrastructure, and enhancing public spaces. While ULR has been successfully implemented in various countries, its adoption and implementation have been unique challenges in Malaysia. Through semi-structured interviews among planners involved explicitly in land readjustment, this paper examines the challenges of implementing ULR in Malaysia from the planners' perspectives. Data from the interviews were analysed using content analysis techniques. Findings from the analysis revealed that the key challenges of implementing land readjustment are the source of funds, public participation, and the absence of specific laws. By understanding these challenges, policymakers and urban planners can develop strategies to overcome barriers and effectively utilise ULR as a tool for sustainable urban development in Malaysia.

Keywords: Urban Development, Land Readjustment, Development Tool, Public Infrastructure

[1] PHD candidate at Universiti Malaya. Email: sitif288@uitm.edu.my

INTRODUCTION

The rural-to-urban migration phenomenon in Malaysia has led to inevitable urbanisation issues, primarily attributed to rapid population growth. As of the first quarter of 2023, the total population of Malaysia has reached 33.2 million, with approximately 78% residing in urban areas (Department of Statistics Malaysia, 2023). This significant urbanisation process has placed immense pressure on resource availability and management, leading to increased housing and infrastructure costs due to resource scarcity, including limited land area, water and building materials (Rosni et al., 2016). The increasing demand for land creates a market disequilibrium in the urban land market, particularly in densely populated city centre areas with limited land supply (Yilmaz et al., 2015). To address these issues, a strategic approach is required to maximise the utilisation of existing land resources and rejuvenate underutilised or economically viable sites.

Land readjustment emerges as a valuable land development tool that provides avenues for tackling the complexities of rapid urbanisation. It presents a unique proposition by allowing for the comprehensive reorganisation and reallocation of land parcels, followed by land redistribution based on strategic planning objectives (Mugisha et al., 2023). This process enables the creation of more efficient and functional land configurations, which can in turn address issues of land scarcity and promote optimal land utilisation.

Despite its potential to tackle a range of urban development issues such as urban sprawl, inadequate infrastructure provision, and inequitable land distribution, the adoption of ULR in Malaysia remains limited. Its implementation in the country has encountered substantial hurdles, resulting in insufficient execution and limited achievements. Therefore, this research aims to explore the challenges of ULR implementation from the planners' perspectives.

LITERATURE REVIEW

Land Readjustment - Definition and Implementation

The definition of land readjustment varies across the. However, it can be described as an urban development or redevelopment method involving the transformation of an existing property structure, with the development costs and final property holdings distributed among the original titleholders by their initial shares (Alterman, 2007, 2012; Larsson, 1997; Sorensen, 2000; Turk, 2008; Viitanen, 2002). Land readjustment, or spatial land management, is a strategy to resolve land fragmentation issues by reconfiguring and consolidating land parcels in a bottom-up approach. This process creates more functional land units that enhance productivity and living conditions (Huang et al., 2011; Long et al., 2012; Long, 2014).

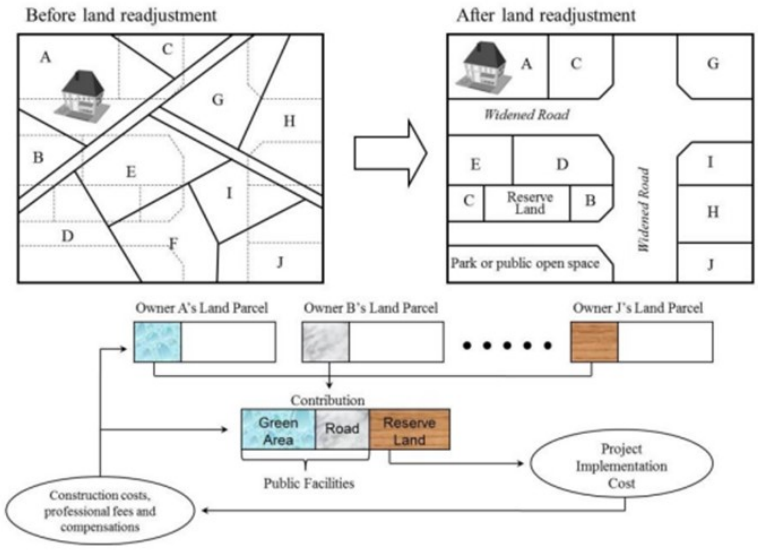


Figure 1: Land Readjustment: Before and After Scenarios
Source: Adapted from (Montandon & Souza, 2007)

In simple terms, land readjustment can be defined as a process of reforming land by changing its original land parcel location and land use within a specific project area. Land readjustment aims to transform rural or unplanned urban land, often characterised by irregular subdivision, into a balanced allocation of land for public and private use per town planning principles. This approach is known by various terms such as land reform (King & Burton, 1982), urban land readjustment (Schnidman, 1988), land re-grouping (Kuppers, 1982), land re-ordering (Davies, 1976), and land pooling (Archer, 1989). Some scholars consider it a technique for reallocating fragmented land areas (Vitikainen, 2004). Land readjustment has proven to be an effective and efficient urban development and management tool in many developed and developing countries, including Japan (Muñoz Gielen, 2016; Sorensen, 2000), Germany (LAI et al., 2022), Australia (Archer, 1992), Thailand (Archer, 1981), and India (Mathur, 2013).

The implementation and success of land readjustment as a land management strategy vary among countries due to differing institutional arrangements (Li & Li, 2007; UN-Habitat, 2018). In Germany, land readjustment has been extensively employed in the postwar reconstruction of damaged cities and in accommodating recent urbanisation trends. Similarly, land readjustment has played a crucial role in Japan's urban planning system since the enactment of the Land Readjustment Act in 1954. It has been utilised to develop new cities, manage orderly growth, and facilitate urban renewal and reconstruction (De

Souza, 2018; Ochi, 1996). In contrast, France considers land readjustment a cumbersome and time-consuming process with relatively low significance compared to other development procedures. It accounts for less than 5% of new development activities (Viitanen, 2002; Renard, 2003). Likewise, in Turkey, although land readjustment has been legally addressed in numerous laws and regulations since the late 19th century, its utilisation in development plans remains limited compared to other land assembling methods, with only about one-third of urban parcels produced through land readjustment projects (Turk & Korthals Altes, 2011).

While land readjustment holds promise as a superior land management approach in theory, its successful implementation remains limited to only a few countries. In many other nations, land readjustment procedures have either yet to be introduced or have fallen short of expected usage and success, mirroring the situation in Malaysia.

Land Readjustment in Malaysia

The Land Readjustment System (LRS) was introduced in Malaysia in 1987 through a series of studies and research conducted by the PLAN Malaysia (formerly known as the Department of Town and Country Planning of Peninsular Malaysia) in collaboration with experts from the Japan International Corporation Agency (JICA). However, the services of JICA experts ended at the end of 2003.

In 1995, a feasibility study on the introduction of LRS in Malaysia was conducted by JICA and PLAN Malaysia, which concluded that the LRS could be implemented in Malaysia. On June 23, 1999, a Cabinet Meeting decided that the LRS would be one of Malaysia's land development methods. The Steering Committee for the Implementation Plan Study, chaired by the Secretary General of the Ministry of Housing and Local Government (KPKT) on August 25, 2006, agreed to expand the planning and implementation of projects using the LRS to other areas throughout the country.

In Malaysia, two sites were identified as the locations for two pilot projects: Kampung Pulau Meranti, Sepang, and Kampung Skudai Kiri, Johor. Nevertheless, no land readjustment projects have been successfully completed yet. This is due to the various challenges encountered during the implementation phase, including disagreement among landowners regarding the projects and lack of government funding (JPBD,2014).

The aspects considered related to land readjustment in Malaysia can be categorised into technical aspects, financial aspects, the implementation body, and landowner participation (JPBD, 2008).

Technical aspects

The technical aspects of land readjustment are location, valuation, land reduction, and replotting.

Location
Land readjustment can be applied in both urban and rural areas but is more suitable for areas under pressure for development. These include the urban fringe and the redevelopment of existing built-up areas where public facilities and infrastructure are inadequate.

Valuation
Several valuation methods are applied in this country. These include the comparison method, cost method, investment method, residual method, and profits method. However, the most common is the comparison method. This method entails valuing the property under consideration by directly comparing it with similar recently sold properties. Although this method is adequate for feasibility studies, it may not be effective for replotting.

Land Reduction
The contribution of both public and financial land affects the reduction ratio. Public land, which includes roads and open spaces, may account for 20 to 30 percent of the area, depending on the planning standards applied to the project.

Replotting
The objective of replotting is to regularise the shape and provide access to individual lots. This process involves allocations for the provision of community facilities and financial land. The final replotting should correspond to the original lots as far as possible. Individual plot reductions can range from 20 to 50 percent of the original plot size. Although there should be some principles on which replotting should be based, it should not be seen merely as a technical exercise.

Implementation body
The successful implementation of land readjustment will require the cooperation of various government agencies and the affected landowners. Four forms of implementation bodies can be established. This could be in the form of: -

i. An association of individuals, residents, landowners, and leases.
ii. Local authorities.
iii. Public development corporations such as Urban Development Authority.
iv. Property developers or local authorities in association with property developers.

Residents' Participation
Residents' participation is vital to the success of any land readjustment project. While it is generally true that residents would enjoy a better quality of life and

environment after the project implementation, some may object to the proposal. Other associated problems could include multiple ownership of land, absentee landlords, and the difficulty of tracing landowners. In some countries, there are laws on land readjustment which prescribe that the project can be implemented if most residents subscribe to the proposal. Given that no specific land readjustment legislation has been introduced in Malaysia to date, it is imperative to persuade any dissenting parties to change their minds otherwise, their property would have to be forcibly acquired.

Furthermore, the land readjustment project allows affected landowners and occupants to participate in its planning and implementation. This will help to promote cooperation between the implementing agency and the residents.

Financial Aspects

The viability of the land readjustment projects also depends on the effective demand for the financial land. Theoretically, the financial land will be sold in the open market to recover infrastructure costs. Without grants, the financial land may be used as collateral to obtain financing to commence infrastructure works.

RESEARCH METHODOLOGY

This study employed qualitative content analysis to comprehensively explore the perspectives and experiences of planners regarding the challenges of implementing land readjustment in Malaysia. In-depth semi-structured interviews were conducted among 10 planners who have deep technical knowledge of ULR and were once involved as a ULR team of the pilot study in Kg Pulau Meranti, to gather data, as they offer valuable means of engaging experts and gaining profound insights on the subject under investigation (Berner-Rodoreda et al., 2018). The semi-structured interview format was specifically selected as it focuses on the respondents' experiences related to the research topic and involves individuals who possess first-hand knowledge of specific experiences (Mansor & Sheau-Ting, 2021).

Semi-structured Interviews

The semi-structured interviews were conducted virtually, and the recorded sessions were securely stored in Google Drive. Each session lasted 20 to 40 minutes. Employing a semi-structured interview approach, an interview guide was utilised to support the researcher in attaining the research objectives (Brinkmann & Kvale, 2015). The interview questions incorporated in the guide were explicitly designed to investigate the challenges encountered in implementing land readjustment in Malaysia.

Table 1: Interview Guide

Procedures	Question Guide
Introductory question	Would you provide your professional background and area of expertise?
Focus question	From your perspective, what would you consider the primary challenges in implementing urban land readjustment in Malaysia? Does the current regulatory framework in Malaysia provide adequate support for the implementation of land readjustment?
Concluding question	Are there any other aspects that should have been addressed in our discussion, but have not?

Source: Authors' research, 2023

The primary aim of this interview guide was to fulfil the research objective by capturing planners' perspectives regarding the challenges associated with implementing ULR in Malaysia.

Sampling Method

A purposive sampling method was used, as expertise in land readjustment is limited and difficult to find. Therefore, it was appropriate to adopt it, as justified by Pandey and Pandey (2015). Respondents have more than 10 years of experience in the related field to provide adequate and justifiable insights. Table 2 displays the characteristics of respondents.

Table 2: Characteristics of Respondents

No.	Years of Experience	Main Area
1	More than 10 years	PLANMalaysia, Selangor
2	More than 10 years	PLANMalaysia, Selangor
3	More than 10 years	PLANMalaysia, Selangor
4	More than 10 years	PLANMalaysia, Selangor
5	More than 10 years	PLANMalaysia, Selangor
6	More than 10 years	PLANMalaysia, Putrajaya
7	More than 10 years	PLANMalaysia, Putrajaya
8	More than 10 years	PLANMalaysia, Putrajaya
9	More than 10 years	PLANMalaysia, Putrajaya
10	More than 10 years	PLANMalaysia, Putrajaya

Source: Authors' research, 2023

DATA ANALYSIS

In analysing the interview data, Brinkmann and Kvale (2015) identified five qualitative content analysis processes: extending invitations, obtaining consent, setting up the virtual meeting space, conducting interviews, and recording. Next is the information generation process, followed by transcribing the generated

information electronically. Then, during the data transcription process, the responses received were coded by determining keywords and phrases commonly used among participants. This involved indexing, highlighting, sorting out quotes, and rearranging them to develop thematic content (Creswell, 2018).

During the transcription process, the phrases and keywords were analysed and encoded with suitable category labels, and afterwards, the concerns or impediments were formed (Saraf et al., 2019). Finally, the interpretation of the findings was carried out. These new emergent findings were narrated to relate to the implications of the research. As it builds directly from the raw data, the process ensures the work's validity (Bryman, 2012). Figure 1 displays the interview procedures and analysis.

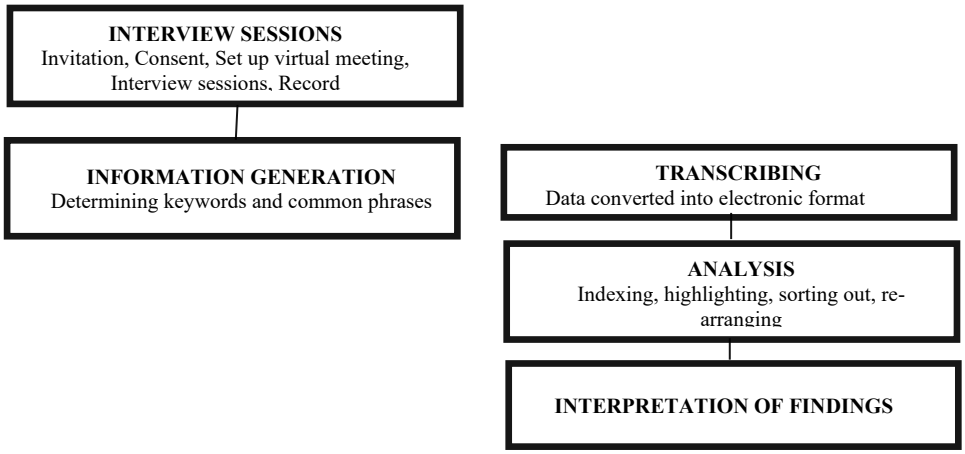


Figure 2: Interview Procedures
Source: Brinkman & Kvale,2015

Rigour and Reliability in Qualitative Data Analysis

To ensure the rigour of data analysis during the qualitative data analysis stage, Othman et al. (2020) employed three strategies: credibility, confirmability, and accuracy. The qualitative content analysis was made reliable by cross-checking the transcribed data with the transcripts. Additionally, the data was carefully indexed, highlighted, sorted, and rearranged multiple times to ensure accuracy.

RESULTS AND DISCUSSION

This section presents the results of a qualitative research study that aimed to explore planners' perspectives regarding the challenges encountered in implementing land readjustment in Malaysia. Interviews were conducted with ten planners directly involved in land readjustment projects. The data obtained from these interviews was analysed, and the findings were organised into three main

categories: source of funds (challenge 1), public participation (challenge 2), and absence in specific law (challenge 3). Each category is described below, accompanied by relevant quotes from the participants.

Challenge 1: Source of Funds

Based on the content analysis of the initial interview question, all ten interviewees acknowledged the availability of funding as a significant challenge in implementing the land readjustment method.

> *'In the context of land readjustment projects, the implementation is typically expected to involve self-financing through cost-sharing mechanisms. However, in the case of Malaysia, particularly in the context of the Kg Pulau Meranti project, the construction costs depend solely on the allocation provided by the Federal Government. As a result, the full implementation of land readjustment in Kg Pulau Meranti becomes challenging and may not be realised to its full potential*.' **N1**

> *'A considerable amount of financial resources is required to initiate the land readjustment method, which includes conducting research activities and undertaking construction on the potential site, to cover development costs*.' **N2**

> *'Insufficient funds will limit the progress of the land readjustment project, as it will be a struggle to finance the high infrastructure costs associated with the project*.' **N3**

> *'For instance, in implementing the land readjustment system in Kg Pulau Meranti, the element of cost-sharing does not exist at all*.' **N4**

> *'Developers were found unable to share costs because they believed the project would not be profitable'.* **N5, N8**

> *'In the long term, there is a need to establish a revolving fund for the land readjustment project*.' **N6**

> *'Securing initial funding is important, but there are often overlooked costs related to managing the land readjustment process. These hidden expenses can strain the project's budget and slow progress.'***N7**

> *'I would say that in many international projects, private developers are looking for funding. However, the absence of incentives and mechanisms*

*to share risks in Malaysia has discouraged private companies from participating in land readjustment initiatives.'***N9**

'Public-private partnerships (PPPs) could provide a more sustainable solution. This would involve both government and private developers contributing to a collective fund, which may ease the financial burden on any one party." **N10**

The literature outlines several financial conditions that can impede the success of urban land readjustment (ULR) initiatives. The main concern is the absence of accessible low-interest loans for ULR (Soliman, 2017) and other financial sources (financial mechanisms) (van der Krabben & Lenferink, 2018). It seems that both the literature and findings have common concerns about the source of funding for ULR development.

Challenge 2: Public Participation

All ten interviewees agreed that public participation challenges arise in the context of urban land readjustment. This challenge aligns with the findings from the research conducted by UN-Habitat 2018, which states that ULR has been criticised for facing difficulties getting landowners' consent to participate in the project.

'...it is tough to obtain the agreement of all landowners to join the urban land readjustment project. This hindered its (urban land readjustment) smooth execution.' **N1**

'There is *limited awareness and understanding among the public about the urban land readjustment process, its benefits and the potential impact on their properties or communities*.' **N2**

'*They (landowners) often display scepticism, resistance, or reluctance to participate due to potential negative impact on landownership and uncertainty about the outcomes of the urban land readjustment process*.' **N4**

'*There have also been issues related to deceased landowners, inheritance matters, tracing heirs and other related complexities*.' **N6**

'*There will always be those who do not wish to participate. Various options to buy or exclude their land from the project could be considered*.' **N5**

Another highlight was the landowners' misinterpretation of the distinction between the land acquisition method and urban land readjustment.

> *'They (landowners) may perceive urban land readjustment as a form of land acquisition, resulting in concerns about losing ownership or receiving inadequate compensation for their land.*' **N3**

In the case of small landowners, they might choose not to accept or cooperate with ULR because they may fear being the first ones forced to vacate:

'Some landowners with smaller plots might have to leave the area.'**N7**

> *'……people would not contribute their lands easily to the project…. even we show how their land would be changed after LR, they may still resist against LR.'**N9, N10***

Challenge 3: Absence of Specific Law

Based on the content analysis of the second interview question, all interviewees agreed that the current regulatory framework in Malaysia does not adequately support the implementation of land readjustment.

> '*Amendments made to legislation such as the Town and Country Planning Act and the National Land Code do not grant any authority to the Implementing Body to compel landowners to provide a Power of Attorney for the development of their land without their consent'*. **N1**

> *'In the absence of a dedicated legislative provision or Land Readjustment Act, and if we are compelled to develop the land under existing laws, the execution of land readjustment will face obstacles unless all landowners agree to participate.'* **N2, N4**

> *'Currently, there is no legal tool exists in this country to help with ULR implementation.*'**N5, N10**

> *'…. I should note that ULR cases vary globally in their legal contexts, so we must create our own model that addresses all aspects of ULR.'***N8**

> *'Without a formal Land Readjustment Act, current laws don't properly cover compensation or reallocation during ULR, which is essential for gaining landowner trust.'***N7**

> *'...I think no specific ULR law creates uncertainty about how public and private interests should be balanced thus create hesitation from both sides.* **N6, N9**

In addition, the literature confirms this challenge, mentioning four legal conditions, including a lack of legislation, legal backup, or regulatory framework (Mittal, 2014), a complicated legal system (Turk, 2005), land ownership structure (Turk 2005, 2008), and enhanced protection of property rights (Alterman, 2007), as among the most challenging regulatory issues in the Urban Land Readjustment literature.

CONCLUSION AND RECOMMENDATION

Based on this study's findings, planners' perspectives on the challenges of implementing ULR in Malaysia have been examined. The critical hurdles identified include the lack of a reliable funding source, difficulties securing public participation, and the absence of specific legislation addressing the issue of ULR. Based on the findings, looking into ways ULR could be improved is essential. Firstly, innovative financial mechanisms that encourage private sector participation and cost-sharing should be introduced. This could involve public-private partnerships, tax incentives, or land value capture mechanisms to generate funding for ULR projects.

Secondly, awareness campaigns should be conducted to inform the public about the benefits and processes of ULR. This could help provide clear and accessible information to dispel misconceptions and build trust. Furthermore, being flexible regarding the ULR project design, such as accommodating the landowners' feedback and suggestions, would also be helpful. Incorporating landowners' inputs ensures the final plan aligns with the community's needs and aspirations.

Last, a specific legal framework dedicated to ULR should be developed. The enactment of a new law (whether named the Land Readjustment Act, *Akta Pembangunan Tanah Bersepakat,* or any other agreed-upon name) to govern the implementation of ULR projects would also go a long way toward providing a comprehensive legal framework specifically designed to address the challenges associated with this approach. It would outline the roles, responsibilities, and powers of the State Authorities and all parties involved in the ULR projects.

In conclusion, while ULR has proven to be a viable alternative for land development, some enhancements are required to ensure its successful implementation. This system can be effectively applied in various regions by making necessary improvements tailored to their specific characteristics and based on all stakeholders' agreement in the development process.

The research is based on some limitations, specifically the respondent selection and semi-structured interview. Therefore, some recommendations for

future research could improve the outcomes of this study. First, another interview session with different stakeholders, professionals, or owners related to the ULR could help better understand the issue. Second, other research methods and analyses, such as a quantitative approach, could be adopted.

ACKNOWLEDGEMENT

The authors wish to acknowledge and thank the respective reviewers for their valuable comments on this paper.

REFERENCES

Archer, R. W. (1981). Republic of China. Department of Land Administration. In *See: Archer. R.W. op. cit., Appendix* (Vol. 1).

Archer, R. W. (1992). Introducing the Urban Land Pooling Adjustment Technique into Thailand to Improve Urban Development and Land Supply. In *PUBLIC ADMINISTRATION AND DEVELOPMENT* (Vol. 12).

Berner-Rodoreda, A., Bärnighausen, T., Kennedy, C., Brinkmann, S., Sarker, M., Wikler, D., Eyal, N., & McMahon, S. A. (2018). From doxastic to epistemic: A typology and critique of qualitative interview styles. *Qualitative Inquiry*, *26*(3–4), 291–305. https://doi.org/10.1177/1077800418810724

Brinkmann, S., & Kvale, S. (2015). Interviews: Learning the Craft of Qualitative Research Interviewing (4th ed.). SAGE Publications, Inc.

Creswell, J. W. (2018). Educational Research: Planning, Conducting, and Evaluating Quantitative and Qualitative Research (6th Edition) (6th ed.). Pearson.

De Souza, F. F. (2018). What is Land Readjustment? *Land Readjustment: Solving Urban Problems Through Innovative Approach*, 1–60.

LAI, L. W. C., DAVIES, S. N. G., CHAU, K. W., CHOY, L. H. T., CHUA, M. H., & LAM, T. K. W. (2022). A centennial literature review (1919–2019) of research publications on land readjustment from a neo-institutional economic perspective. *Land Use Policy*, *120*(November 2020), 106236. https://doi.org/10.1016/j.landusepol.2022.106236

Li, L. H., & Li, X. (2007). Land readjustment: An innovative urban experiment in China. *Urban Studies*, *44*(1), 81–98. https://doi.org/10.1080/00420980601023844

Mansor, R., & Sheau-Ting, L. (2021). Criteria for Occupant Well-being: A Qualitative Study of Malaysian Office Buildings. Building and Environment, 1-14.

Mathur, S. (2013). Use of land pooling and reconstitution for urban development: Experiences from Gujarat, India. *Habitat International*, *38*, 199–206. https://doi.org/10.1016/j.habitatint.2012.06.007

Mittal, Jay. 2014. "Self-Financing Land and Urban Development Via Land Readjustment and Value Capture." Habitat International 44 (C): 314–323. doi: 10.1016/j.habitatint.2014.07.006.

Montandon, D. T., & Souza, F. F. De. (2007). *Land Readjustment and Joint Urban Operations Land Readjustment and Joint Urban Operations Land Readjustment and Joint Urban Operations Daniel Todtmann Montandon and Felipe Francisco de Souza*.

Mugisha, J., Kombe, W. J., Babere, N. J., & Uwayezu, E. (2023). Uncovering 'sleeping

beauty': Land readjustment for self-financing urbanisation in developing countries. *Social Sciences and Humanities Open*, *8*(1), 100539. https://doi.org/10.1016/j.ssaho.2023.100539

Muñoz Gielen, D. (2016). Proposal of Land Readjustment for the Netherlands: An analysis of its effectiveness from an international perspective. *Cities*, *53*, 78–86. https://doi.org/10.1016/j.cities.2016.02.001

Ochi, T. (1996). *JICA' s Technical Cooperation and the Global Dissemination of Land Readjustment the Internationalization of Land Readjustment*. *Hayashi 2000*, 205–226.

Othman, S. M. E., Fleet, J. A., Steen, M., & Jayasekara, R. (2020). Midwives' views and experiences of providing healthy eating advice to pregnant women: a qualitative content analysis of semi-structured interviews. Frontiers of Nursing, 7(4), 345–358. https://doi.org/10.2478/fon-2020-0044

Pandey, P., & Pandey, M. M. (2015). Research Methodology: Tools and Techniques. Romania: Bridge Center.

Rosni, N. A., Noor, N. M., & Abdullah, A. (2016). Managing urbanisation and urban sprawl in Malaysia by using remote sensing and GIS applications. *Planning Malaysia*, *4*(Special Issue 4), 17–30. https://doi.org/10.21837/pmjournal.v14.i4.145

Saraf, M.H.M., Mohd, T., Che Pin, S.F., Nordin, T.E., Hasbullah, M.N. (2019). The Applicability of land allocation approach for post-disaster house construction in Kuala Krai. Planning Malaysia Journal of the Malaysian Institute of Planners, 17(1), 205-218.

Sorensen, A. (2000). Conflict, consensus or consent: Implications of Japanese land readjustment practice for developing countries. *Habitat International*, *24*(1), 51–73. https://doi.org/10.1016/S0197-3975(99)00029-6

Turk, S. S., & Korthals Altes, W. K. (2011). Potential Application of Land Readjustment Method in Urban Renewal: Analysis for Turkey. *Journal of Urban Planning and Development*, *137*(1), 7–19. https://doi.org/10.1061/(asce)up.1943-5444.0000035

UN-Habitat. (2018). Global Experiences in Land Readjustment. Urban Legal Case Studies. In *Urban Legal Case Studies* (Vol. 7).

UN-Habitat. (2018). In Global experiences in land readjustment (UN-Habitat).

van Der Krabben, Erwin, and Sander Lenferink. 2018. "The Introduction of Urban Land Readjustment Legislation as an Institutional Innovation in Dutch Land Policy." Habitat International 75: 114–121. doi: 10.1016/j.habitatint.2018.03.004

Yilmaz, A., Çağdaş, V., & Demir, H. (2015). An evaluation framework for land readjustment practices. *Land Use Policy*, *44*, 153–168. https://doi.org/10.1016/j.landusepol.2014.12.004

Received: 30th June 2024. Accepted: 10th September 2024

PLANNING MALAYSIA:
Journal of the Malaysian Institute of Planners
VOLUME 22 ISSUE 5 (2024), Page 66 – 81

LOCAL RESIDENTS' WILLINGNESS TO DONATE FOR LOW CARBON CITY INITIATIVES IN TAIPING, PERAK: PROPOSED E-BIKE-SHARING PROJECT

Poon Chi Yong[1], Nitanan Koshy Matthew[2], Zakiah Ponrahono[3], Syazwani Sahrir[4,] Mohd Rusli Bin Ya'cob[5]

[1,2,3,4,5]*Department of Environment,*
Faculty of Forestry and Environment,
UNIVERSITI PUTRA MALAYSIA

Abstract

The transport sector in Malaysia ranked second in the country's total energy consumption for 2021, thereby contributing to greenhouse gas emissions. Numerous cities strive to attain low-carbon urban environments. E-bikes, as environmentally friendly vehicles, have the potential to play a significant role in urban transportation by contributing to the creation of low-carbon cities. Taiping, Perak, has been recognised as one of the world's top 3 most sustainable cities for 2019. This prestigious accolade positions it as an ideal location for an e-bike project, further solidifying its commitment to maintaining its status as a sustainable city. This study seeks to evaluate the awareness and attitudes of Taiping residents towards e-bikes, determine the factors that influence their willingness to donate, and ascertain the average amount they are willing to contribute to the e-bike-sharing development project in Taiping, Perak. A survey was conducted with 385 respondents using the Contingent Valuation Method, employing stratified random sampling. The findings indicated a notable level of awareness and favourable attitudes towards e-bikes. Factors such as bid, age, education, income, and awareness impact the willingness to donate. On average, each person contributes RM10.40 towards the proposed e-bike-sharing project in Taiping. The discovery offered valuable insights to the Taiping Municipal Council regarding securing financial support and better understanding residents' perspectives on e-bike sharing.

Keywords: Low carbon city, E-bike, Transportation, Willingness to Donate

[2] Lecturer at UPM Email: nitanankoshy@upm.edu.my

INTRODUCTION

About 75% of worldwide CO_2 emissions come from cities. The primary sources of these emissions are human activities, concrete constructions, and transportation (Abdul & Umar, 2022). "Low Carbon City" refers to an urban sustainability strategy that reduces carbon emissions, primarily from human activity. To create a low-carbon society, public, economic, and community collaborations are needed (Abdullah et al., 2022). A low-carbon city addresses environmental, social, and economic needs using low-carbon methods. According to the 2021 National Low Carbon Cities Masterplan, the city monitors, regulates, and reduces greenhouse gas emissions to mitigate climate change. Low-carbon city projects will help maintain urban growth, infrastructure, and transportation (Ministry of Energy, Green Technology, and Water Malaysia, 2017). It might drastically reduce urban greenhouse gas emissions.

Taiping Municipal Council aims to make the city low-carbon by 2030 (Portal Rasmi Majlis Perbandaran Taiping, 2024). Taiping placed third in the International Tourismus-Börse "Best of Cities" category in 2019. Taiping's municipal government wants to be low-carbon by 2030. E-bike-sharing services help low-carbon cities meet their goals and enhance award rankings (Ministry of Energy, Green Technology and Water Malaysia, 2017).

Due to the building of Jalan Tasik Lestari, a 750-m road connecting Jalan Pekeliling and Jalan Saw Ah Choy near the Taiping Lake Garden, Taiping is experiencing traffic congestion (Loh, 2022). The Road Transport Department Malaysia reported a 0.96% rise in Taiping motor vehicle registrations from 432,425 to 436,565 between 2020 and 2021. Vehicle registrations are rising, which increases the number of cars on the road and greenhouse gas emissions. Therefore, Taiping must develop e-bike services as an alternative option to reduce automobile greenhouse gas emissions.

Understanding Taiping citizens' awareness, attitudes, and willingness to contribute to e-bike-sharing services is vital for building a low-carbon city. However, after reviewing the literature, it is evident that this information is notably lacking for Taiping. Malaysian research attempts to fill this gap by examining public awareness, attitudes, and readiness to support e-bike-sharing services. Rosnan and Abdullah (2018) found that Malaysia's bicycle-sharing culture is still in its infancy. A lack of citizen awareness and positive opinion may hamper Taiping's e-bike-sharing plan. Thus, this research sought to bridge these information gaps and provide vital insights to help Taiping create and implement a successful e-bike-sharing programme. This research assessed the Taiping population's awareness and attitudes regarding e-bikes, identified the elements that impact their readiness to contribute to the planned e-bike-sharing scheme, and estimated their potential contribution to its development.

LITERATURE REVIEW

Past studies on willingness to pay for green transportation

Some Previous studies have examined the willingness of individuals to pay for transport to promote a low-carbon city. In Solo, Indonesia, Guerra (2019) assessed the potential replacement value of gasoline-powered motorcycles with electric motors. Respondents were willing to pay an additional 35,000 to 40,000 rupiah for motorcycles with a 10 km greater range and 10 km/h quicker speed. Respondents were willing to pay an additional 65,508 rupiah to acquire the feature that reduced the charge time by an hour.

Zhu et al. (2019) utilised a questionnaire survey based on the contingent valuation method to gather data. A total of 413 valid responses were obtained. Data were analysed using a binary logistic regression model. The respondents' income, education, and familiarity with Electric Motorcycles significantly influenced their willingness to pay (WTP) and willingness to buy (WTB) behaviours. After careful analysis, the average WTP for electric motorcycles is determined to be 1315.54 Macau Pataca (MOP). Zhang et al. (2023) conducted a study in China and found that 90.14% of respondents expressed a strong desire to purchase an electric vehicle. The participants' willingness to buy was positively correlated with the environmental benefits, battery range, charging convenience, and safety of electric vehicles. The estimated value of the WTP was 15041.10 Macanese Pataca (MOP).

Li et al. (2020) sought to address the lack of information regarding fuel cell electric vehicles (FCEVs) in China. Their objective was to analyse public perceptions of the main features of FCEVs. Data were collected using a choice experiment questionnaire, with 1,072 respondents being interviewed. The results showed that respondents expressed a willingness to pay for specific features: (i) a 200 km increase in driving range, costing Renminbi (China Currency), RMB49,091, (ii) a 5 min reduction in refuelling time, costing RMB12,727, (iii) an RMB 0.5/kilometre reduction in fuel cost, costing RMB3818, (iv) a 20% reduction in emissions, costing RMB47,818, and (v) a 20% improvement in refuelling accessibility, costing RMB12,909.

Son et al. (2022) utilised a double-bound contingent valuation approach (CVM) to evaluate the willingness to pay (WTP) of 500 residents in Pokhara Metropolitan City, Nepal, regarding the implementation of electric buses in the city. Based on the findings, the average WTP per person was 758.6 Nepalese Rupee (NPR). Age, bid value (price), and average usage of the main transport per week were found to have positive correlations with the willingness to pay (WTP). In their study, Bera and Maitra (2021) analysed the decision-making process of potential owners regarding plug-in hybrid electric vehicles (PHEVs) in a typical Indian context. The researchers employed a preference questionnaire to gather data, with 1500 responses recorded. The data was analysed using mixed logit.

The values for the choice attribute are as follows: (i) reduced tailpipe emissions - 5216 Indian rupee (INR), (ii) shorter battery recharge times - 48,541 INR, (iii) longer electric range - 3351 INR.

Previous literature reviews have identified a scarcity of studies investigating Taiping residents' inclination to support the development of e-bike-sharing initiatives. Research on residents' awareness and attitudes towards e-bikes is limited, and e-bikes are not widely studied in Malaysia.

RESEARCH METHODOLOGY

Study area

The research location was situated in Taiping, Perak, Malaysia. Taiping City serves as the capital of the Larut, Matang, and Selama districts in the state of Perak. Taiping spans an area of 186.5 square kilometres. The legislative body of Taiping is the Taiping Municipal Council (The official portal of the Perak government, n.d.; Official website of the Larut Matang & Selama District and Land Office, n.d.). Taiping City was selected as the study area due to its recognition by the International Tourismus-Börse (ITB) in 2019, where it was ranked third in the 'Best of Cities' category (Arif, 2019). This global recognition at the ITB event held in Berlin, Germany, is a significant achievement for Taiping.

Method

Data were collected using the single-bound contingent valuation method, which considers consumers' willingness to pay for a specific environmental service (Nautiyal & Goel, 2021). Respondents were asked to indicate their preferences using this approach, allowing analysts to determine the demand for non-market goods and services (Markandya et al., 2019). The single-bound dichotomous choice method was chosen for its ability to mitigate potential response bias, its minimal information requirements, and its ease of implementation during both data collection and estimation (Calia & Strazzera, 2000).

Model specification

The logit regression method was employed for model specification in this research.

$$\mathrm{WTD}ij = \beta_0 + \beta_1 Bid + \beta_2 Gen + \beta_3 Age + \beta_4 Edu + \beta_5 Mar + \beta_6 Inc + \beta_7 Awa + \beta_8 Att + \varepsilon$$

Where,

i	=	Origin (city of respondents)
j	=	Taiping
WTD	=	Willingness to donate for proposed e-bike-sharing service initiatives in Taiping, Perak (Yes:1, No:0)
Bid	=	Bid price
Gen	=	Gender of respondents, (1=Male, 0=Female)
Age	=	Age of respondents (Years)
Edu	=	Education level of respondents
Mar	=	Marital status
Inc	=	Income
Awa	=	Awareness respondents related to e-bikes (Likert scale: 1: Strongly disagree to 5: Strongly agree)
Att	=	The attitudes of local residents at Taiping, Perak (Likert scale: 1: Strongly disagree to 5: Strongly agree)
β1-β8	=	Coefficients to be estimated
ε	=	Random error

Questionnaire design

The questionnaire consisted of four parts: A, B, C, and D. Part A involved the demographic questions. Section B inquired respondents about their awareness of e-bikes, while Section C focused on their attitudes regarding the use of e-bike-sharing services. Section D of the questionnaire asked respondents about their willingness to contribute to the development of the e-bike-sharing project. The questionnaire was designed to be bilingual, with both English and Malay options. This allowed respondents who were not proficient in either language to answer more easily. Five sets of questionnaires with starting bids of RM5, RM10, RM15, RM20, and RM25 were distributed to the respondents during data collection. The bid price for the WTP section of each questionnaire was established using data from a pilot study, which included an open-ended question about the maximum amount respondents were willing to donate for the e-bike sharing project. The mode for willingness to donate was utilised to determine the range of bid values.

In the previous section, we inquired about the willingness to donate using the Single-Bound Contingent Valuation Method (CVM) format.

Data collection

A stratified random sampling technique was employed, dividing Taiping based on parliament constituency boundaries provided by the government website. The Taiping parliament constituency, coded as P.060, comprises of three state legislative assemblies (DUN): DUN Kamunting, DUN Pokok Assam, and DUN Aulong. The participants in the sample were selected randomly from all the DUNs. The survey was conducted in Taiping using a face-to-face method. The population of Taiping's parliamentary constituency was 130,712, according to the latest data from the Department of Statistics Malaysia. The final sample size was 384, calculated using the formula by Krejcie and Morgan (1970).

Table 1: Sample size per DUN

DUN	Population	Respondent number
Kamunting	40,215	118
Pokok Assam	36,444	107
Aulong	54,053	158

Source: Department of Statistics Malaysia

Kamunting DUN had a population of 40,215, Pokok Assam DUN had 36,444, and Aulong DUN had 54,053. The population of each DUN was divided by a total population of three DUNs, multiplied by a sample size of 384. The formula was as follows:

$$\frac{Population\ DUN}{Total\ population\ of\ 3\ DUNs} \text{ x } 384$$

Questionnaire validation and reliability

The validity of the questionnaire was assessed by three lecturer-experts in the field of Environmental Studies. The questionnaire utilised a validation format, with each statement being evaluated on a 4-point scale: 1=Not relevant, 2=Medium, 3=Relevant, 4=Very relevant. The statement that scored 1 or 2 on the scale was deemed irrelevant to the study and should be eliminated (Wynd et al., 2003). Following the feedback from the validators, the questionnaire was revised accordingly. The questionnaire was distributed to 38 respondents, accounting for 10% of the total respondents in the pilot study, to assess its reliability. Reliability tests were conducted on Sections B and C of the questionnaire, which consisted of Likert scale questions. The awareness score was 0.701, and the attitude score was 0.711. The collected data was analysed using Cronbach's alpha in SPSS

software. Questions with a reliability coefficient above 0.70 were deemed acceptable (Hair et al., 2021).

Data analysis

Descriptive analysis was conducted to analyse the first objective, followed by inferential analysis for the second and third objectives of the research using the STATA software. The analysis involved conducting logit regression to examine the dependent variable, which was a (dummy: 1, 0) (1 for willing, 0 for not willing to donate).

ANALYSIS AND DISCUSSION

Respondent socio-demographic

Table 2 presents an overview of the socio-demographic characteristics of the respondents. The age range of the respondents began at 16 years old, as previous studies on e-bikes have indicated that the youngest participants typically fall within the 16 to 18 age group (Yang et al., 2018; Zheng et al., 2023). Out of the total respondents, 197 (51.2%) were female, while 188 (48.8%) were male. The majority of respondents fell within the age range of 16-24 (41.8%), representing the younger generation. This was followed by the age groups of 25-32 (29.9%), 33-40 (14.5%), 41-48 (5.7%), above 56 (4.9%), and the least represented group 49-56 (3.1%). The majority of respondents, 203 individuals (52.7%), held a bachelor's degree as their highest level of education. This was followed by those with STPM or A-level education (25.7%), a diploma (11.4%), secondary school education (9.1%), and a small percentage with a master's degree or PhD (0.8%) or primary school education (0.3%). The respondents' marital status was as follows: 61.8% were single, while 38.2% were married.

The majority of respondents, specifically those aged between 16 and 24, identified themselves as students (42.9%). This was followed by individuals working in the private sector (27.3%), government sector, and self-employed individuals, accounting for 11.4% of respondents. A smaller percentage of respondents identified as retired (4.7%), housewives (2.1%), and unemployed (0.3%). Approximately 47.8% of the respondents did not report any income, as the majority of them were students. Out of the total respondents, 34.8% fall within the income range of RM2501 to RM5000. The next highest income range is RM1500 to RM2500, accounting for 11.4% of the respondents. Following that, 3.1% fall within the RM5001 to RM7500 range, while only 2.6% have an income below RM1500. Lastly, a mere 0.3% of the respondents have an income between RM7501 and RM10000. The distribution of respondents' residences is as follows: 36.9% in Pokok Assam, 33.2% in Kamunting, and 29.9% in Aulong.

Table 2: Overview of respondents' socio-demographic

Item	Frequency	Percentage (%)
Gender		
Male	188	48.8
Female	197	51.2
Age		
16-24	161	41.8
25-32	115	29.9
33-40	56	14.5
41-48	22	5.7
49-56	12	3.1
Above 56	19	4.9
Highest Education Attainment		
Primary school	1	0.3
Secondary school	35	9.1
Pre-U (STPM, A-level)	99	25.7
Diploma	44	11.4
Bachelor's Degree	203	52.7
Master's Degree/ PhD	3	0.8
Marital Status		
Single	238	61.8
Married	147	38.2
Occupation		
Student	165	42.9
Unemployed	1	0.3
Government sector	44	11.4
Private sector	105	27.3
Self-employed	44	11.4
Housewife	8	2.1
Retired	18	4.7
Individual Gross Monthly Income		
No income	184	47.8
Below RM1500	10	2.6
RM1500-RM2500	44	11.4
RM2501-RM5000	134	34.8
RM5001-RM7500	12	3.1
RM7501-RM10,000	1	0.3
Residential Location		
Kamunting	128	33.2
Pokok Assam	142	36.9
Aulong	115	29.9

Awareness towards the benefits of e-bike-sharing

Table 3 presents an overview of the respondents' awareness regarding the advantages of e-bike-sharing. In general, the statements were highly recognised by the respondents, with a mean score exceeding 3.67. Apostolou et al. (2018) supported the B2 statement that e-bike sharing alleviated traffic congestion by offering an alternative transportation option, with an average score of 4.23. E-

bikes can serve as a viable alternative to conventional modes of transportation, such as cars or buses, particularly for short distances and during periods of high travel demand. The study found that e-bikes had the ability to cover greater distances compared to pedal bicycles, with a mean score of 4.23. Apostolou et al. (2018) found that utilising the battery for robust acceleration in demanding biking situations, like uphill climbs and battling wind resistance, can extend the travel range.

The statement regarding the potential contribution of e-bikes to the development of a sustainable city received a mean score of 4.10. According to Dora and Gouse (2023), e-bikes are more energy-efficient, cost-effective, and widely available. Additionally, it served as a quiet, clean, and eco-friendly means of transportation. The study found that the e-bike-sharing programme significantly raised community environmental awareness, with a mean score of 3.97. Bai et al. (2020) found that individuals with a strong environmental awareness were more likely to choose zero-emission transportation options. E-bike sharing has the potential to enhance environmental awareness within the community.

The B1 statement, which claimed that e-bikes were the most suitable means of transportation for the "last mile" between public transit stations and final destinations, received a mean score of 3.95. According to the research conducted by Bielinski and Wazna (2020), e-bikes were predominantly used for commuting to various destinations and for first and last-mile transportation. The mean score for the B6 statement, which suggested that e-bike sharing promoted a healthful lifestyle in the community, was 3.95, the same as the B1 statement. Azevedo et al. (2023) provided evidence supporting the positive impact of e-bike sharing on sustainable transportation, sports participation, and healthy living. The mean score for the last statement in the awareness section, B4, which suggested that e-bikes had health benefits for users, was 3.86. According to a study conducted by Gojanovic et al. (2011), electric-assisted bicycles have been shown to encourage physical activity and raise heart rate, leading to improved health.

Table 3: Awareness towards the benefits of e-bike-sharing

Item	Likert Scale Frequency					Mean	Level*
	1 (%)	2 (%)	3 (%)	4 (%)	5 (%)		
B2	0	0.5	8.6	58.2	32.7	4.23	3
B5	0	0.8	4.4	66.2	28.6	4.23	3
B3	0	0	12	66.2	21.8	4.10	3
B7	0	0	12.5	78.2	9.4	3.97	3
B1	0	1	18.4	65.5	15.1	3.95	3
B6	0.3	1	12.7	75.8	10.1	3.95	3
B4	0.3	0.5	23.4	64.9	10.9	3.86	3
Average overall mean						**4.04**	**3**

*For a 5-point Likert scale, using the formula (highest value – lowest value)/no. of categories in statistics calculation: low (1) = 1 to 2.339, medium (2) = 2.34 to 3.669, and high (3) = 3.67 to 5.00.

Note: B1: E-bikes are the ideal mode of transportation for the "last mile" from public transit stations to final destinations. B2: E-bike-sharing reduces traffic congestion by providing an alternative mode of transportation. B3: E-bikes as renewable vehicles contribute to the development of a sustainable city. B4: E-bikes are beneficial to the user's health. B5: E-bikes can cover greater distances than pedal bicycles. B6: E-bike-sharing promotes a healthful lifestyle in the community. B7: E-bike-sharing increases community environmental consciousness.

Attitude toward e-bike-sharing

Table 4 shows the respondents' attitudes towards e-bike-sharing. In general, the participants expressed a highly positive attitude towards e-bike-sharing, with a strong agreement to all statements. The e-bike-sharing service received the highest mean score of 4.15 in the attitude section, indicating that respondents would highly recommend it to their friends. The mean score for the C5 statement, indicating respondents' willingness to share information on e-bike-sharing with their peers, family, and social media platforms, was 4.14. In their study, Handy and Fitch (2020) provided support for these two statements. They concluded that there has been a significant increase in e-bike awareness in the research study area following the introduction of the e-bike-sharing programme.

The C2 statement indicating that the use of e-bikes would reduce their carbon footprint received a mean score of 4.03. These findings aligned with the research conducted by McQueen et al. (2020), which demonstrated that individuals can effectively reduce their carbon emissions by transitioning from private cars to e-bikes. The mean score for the statement regarding the potential utilisation of an e-bike-sharing service after the project's implementation was 4.00. Li et al. (2022) provided evidence that individuals were inclined to use e-bike-sharing services based on their attitudes, social norms, perceived control, utility, and ease of use.

The mean score for C7's statement regarding their willingness to pay for e-bike-sharing services was 3.96. Research conducted by Jaensirisak et al. (2017) revealed that individuals in Thailand demonstrated a willingness to pay

for the utilisation of the recently introduced public transport system. The mean score for respondents who expressed their willingness to use the e-bike-sharing service provided it was conveniently accessible, was 3.95. Chen and Chao (2011) discovered that individuals' decisions to utilise public transit were significantly impacted by their perception of its usefulness and ease of use. The mean score for C1's statement, which proposes the use of e-bikes as a solution to city traffic congestion, was 3.75. Li et al. (2022) found that individuals used shared e-bikes for various reasons, including exercise, cost savings, environmental protection, traffic relief, and improved travel efficiency. The study also revealed that perceived usefulness played a significant role in influencing their behavioural intention.

Table 4: Attitude towards e-bike-sharing

Item	Likert Scale Frequency					Mean	Level*
	1 (%)	2 (%)	3 (%)	4 (%)	5 (%)		
C4	0	0.5	5.2	73.5	20.8	4.15	3
C5	0	0.8	5.7	72.5	21.0	4.14	3
C2	0	0.8	15.6	63.1	20.5	4.03	3
C6	0	0.5	9.4	80	10.1	4.00	3
C7	0	0.8	9.4	82.6	7.3	3.96	3
C3	0	1.3	14.6	72.2	12	3.95	3
C1	0	7.0	20.8	62.9	9.4	3.75	3
Average overall mean						**4.00**	**3**

*For a 5-point Likert scale, using the formula (highest value – lowest value)/no. of categories in statistics calculation: low (1) = 1 to 2.339, medium (2) = 2.34 to 3.669, and high (3) = 3.67 to 5.00.
Note: C1: I will advocate for the use of e-bikes to avoid traffic congestion in Taiping City. C2: E-bikes will reduce my carbon footprint. C3: I will utilise an e-bike-sharing if the service is convenient to access. C4: If an e-bike-sharing service were implemented in the Taiping area, I would recommend it to friends. C5: I will share information about the e-bike-sharing service with my peers, family, and even on social media platforms. C6: I would consider utilising an e-bike-sharing service. C7: I am willing to pay for an e-bike-sharing service.

Willingness To Donate

Table 5 summarises the independent variables that will impact the dependent variable, namely willingness to donate. The resulting pseudo R^2 value was 0.3458 upon inputting the independent variables, indicating an explanation of 34.58% for the dependent variable. After careful analysis, it was found that the bid, age, education, income, and awareness variables had a significant impact. In contrast, the variables of gender, marital status, and attitude were found to be insignificant. It was observed that the bid variable had a negative coefficient value, suggesting an inverse relationship between the bid amount and the likelihood of respondents donating. The presence of a negative coefficient aligns with the principles of demand theory. A P-value of 0.000 indicates a high level of significance. Respondents' willingness to donate decreased as age increased, as evidenced by the negative coefficient value of the age variable. Age had a P-value of 0.045,

indicating its significance in influencing the dependent variable. Consistent with Abdullah et al. (2022), the age variable also exhibited a negative coefficient value.

The coefficient value for education level was 0.285, with a P-value of 0.001, suggesting that it was a statistically significant variable. According to Kamri (2013), an education variable had a positive impact on the dependent variable, which aligns with this finding. The coefficient value for income was 0.375 with a P-value of 0.000, indicating its high significance as a variable. These findings corresponded with the study conducted by Mamat et al. (2020), which similarly concluded that income exhibited a positive correlation with the dependent variable, WTP. The awareness variable had a coefficient value of 0.561 and a P-value of 0.035, indicating its significance at a level below 5%. Consistent with Thakur et al. (2022), it was found that the awareness variable had a positive impact on the dependent variable.

Table 5: Single-bound modified logit regression

Single-bound (Initial bid)			
Variables	**Coefficient**	**Standard error**	**P>|z|**
Constant	-2.857	1.108	0.010
Bid	-0.120	0.013	0.000***
Gender	0.122	0.160	0.449
Age	-0.246	0.123	0.045**
Education level	0.285	0.086	0.001***
Marital status	0.277	0.248	0.264
Variables	**Coefficient**	**Standard error**	**P>|z|**
Income	0.375	0.080	0.000***
Awareness	0.561	0.265	0.035**
Attitude	-0.113	0.264	0.670
	LR chi^2 (8) = 174.55, Prob > chi^2 = 0.000, Log likelihood = -165.083, Pseudo R^2 = 0.3458x100% = 34.58%		

*=significant level at the 0.1, **=significant level at the 0.05, ***=significant level at the 0.01

After carefully considering the significant independent variables impacting willingness to donate, the final amount for the proposed e-bike-sharing project was determined to be RM10.40. This monetary value was calculated using the syntax developed by Alejandro (2012) in STATA software to determine the mean willingness to donate value.

Table 6: WTD value for modified model of single-bound CVM

Single-bound (Initial bid)			
Variable	Coefficient	Standard Error	P>|z|
WTD	10.40	0.749	0.000

CONCLUSION

According to the study's findings, it was evident that the residents of Taiping possess a considerable understanding of e-bikes. The mean scores for awareness and attitudes were high. The data revealed that the residents of Taiping possessed a high level of awareness and attitude towards e-bikes. They demonstrated awareness and a willingness to ride e-bikes. The majority of participants expressed their willingness to make a contribution. The factors that influenced the residents of Taiping to donate to the proposed e-bike-sharing development project included bid, age, education level, income, and awareness. Personal demographics can influence an individual's behaviour and thoughts. Taiping residents showed their support for the e-bike-sharing project by willingly donating RM10.40. It is recommended to organise awareness campaigns to disseminate information about e-bike-sharing consistently. Possible campaign content may encompass details regarding the advantages and long-term viability of e-bike-sharing. In addition, organising an e-bike test ride event could allow residents to experience the e-bike firsthand, potentially influencing their perception of this mode of transportation. It is necessary to inform and communicate with the Taiping Municipal Council regarding the RM10.40 donation per person, as providing financial assistance to the project is a possibility. Local municipalities should consider developing a comprehensive and meticulously planned strategy when implementing the project.

ACKNOWLEDGEMENTS

The authors would like to acknowledge the Research Management Centre, Universiti Putra Malaysia, for providing the financial support for publication of this article.

REFERENCES

Abdullah, Y. A., Jamaluddin, N. B., Yakob, H., Hassan, M. A., Nasrudin, N., Yusup, M., Ahmad Zaki, Z., & Zanudin, K. (2022). Urban governance approaches for low carbon cities. The case of Shah Alam local government, Malaysia. *PLANNING MALAYSIA*, *20*. https://doi.org/10.21837/pm.v20i23.1169

Abdul Latip, N., & Umar, M. U. (2022). A sustainable carbon footprint analysis for the city of Kuantan, Pahang Malaysia. *PLANNING MALAYSIA*, *20*. https://doi.org/10.21837/pm.v20i23.1147

Alejandro, L. F. (2012). Introduction to contingent valuation using Stata. MPRA Paper, Munich Personal RePEc Archive, 41018, 1–16.

Apostolou, G., Reinders, A., & Geurs, K. (2018). An overview of existing experiences with solar-powered e-bikes. *Energies*, *11*(8), 2129. https://doi.org/10.3390/en11082129

Arif, Z. M. (2019, March 7). Taiping is No 3 most sustainable city in the world. *New Straits Times*. https://www.nst.com.my/news/nation/2019/03/466934/taiping-no-3-most-sustainable-city-world

Azevedo, B. F., Metzger, K., & Pereira, A. I. (2023). A comprehensive data analysis of e-bike mobility and greenhouse gas emissions in a higher education community: IPBike study of case. *SN Applied Sciences*, *5*(11), 1–17. https://doi.org/10.1007/s42452-023-05504-7

Bai, L., Sze, N. N., Liu, P., & Guo Haggart, A. (2020). Effect of environmental awareness on electric bicycle users' mode choices. *Transportation Research Part D: Transport and Environment*, *82*, 102320. https://doi.org/10.1016/j.trd.2020.102320

Bera, R., & Maitra, B. (2021). Analysing prospective owners' choice decision towards plug-in hybrid electric vehicles in urban india: A stated preference discrete choice experiment. *Sustainability*, *13*(14), 7725. https://doi.org/10.3390/su13147725

Bieliński, T., & Ważna, A. (2020). Electric scooter sharing and bike sharing user behaviour and characteristics. *Sustainability*, *12*(22), 9640. https://doi.org/10.3390/su12229640

Calia, P., & Strazzera, E. (2000). Bias and efficiency of single versus double bound models for contingent valuation studies: A Monte Carlo analysis. *Applied Economics*, *32*(10), 1329–1336. https://doi.org/10.1080/000368400404489

Chen, C.-F., & Chao, W.-H. (2011). Habitual or reasoned? Using the theory of planned behavior, technology acceptance model, and habit to examine switching intentions toward public transit. *Transportation Research Part F: Traffic Psychology and Behaviour*, *14*(2), 128–137. https://doi.org/10.1016/j.trf.2010.11.006

Department of Statistics, Malaysia. (2022, November). *My local stats perak 2021*. Department of Statistics, Malaysia. https://www.perak.gov.my/images/menu_utama/ms/kerajaan_negeri/data_UPEN/MyLocalStatsPerak/Perak/MLSNPerak2021.pdf

Dora, R., & Gouse Basha, M. (2023). Materials for e-bike and end to end design aspects. *Materials Today: Proceedings*. https://doi.org/10.1016/j.matpr.2023.05.519

Gojanovic, B., Welker, J., Iglesias, K., Daucourt, C., & Gremion, G. (2011). Electric bicycles as a new active transportation modality to promote health. *Medicine & Science in Sports & Exercise*, *43*(11), 2204–2210. https://doi.org/10.1249/mss.0b013e31821cbdc8

Guerra, E. (2019). Electric vehicles, air pollution, and the motorcycle city: A stated preference survey of consumers' willingness to adopt electric motorcycles in Solo, Indonesia. *Transportation Research Part D: Transport and Environment*, *68*, 52–64. https://doi.org/10.1016/j.trd.2017.07.027

Hair, J. F., Jr., Hult, G. T. M., Ringle, C. M., Sarstedt, M., Danks, N. P., & Ray, S. (2021). Evaluation of reflective measurement models. In *Classroom Companion: Business* (pp. 75–90). Springer International Publishing. http://dx.doi.org/10.1007/978-3-030-80519-7_4

Handy, S. L., & Fitch, D. T. (2020). Can an e-bike share system increase awareness and consideration of e-bikes as a commute mode? Results from a natural experiment. *International Journal of Sustainable Transportation*, *16*(1), 34–44. https://doi.org/10.1080/15568318.2020.1847370

Jaensirisak, S., Luathep, P., & Paksarsawan, S. (2017). Willingness and ability to pay for a new public transport: A case study of Korat City, Thailand. *Journal of the Eastern Asia Society for Transportation Studies*, *12*, 2310–2320. https://doi.org/10.11175/easts.12.2310

Kamri, T. (2013). Willingness to pay for conservation of natural resources in the Gunung Gading National Park, Sarawak. *Procedia - Social and Behavioral Sciences*, *101*, 506–515. https://doi.org/10.1016/j.sbspro.2013.07.224

Krejcie, R. V., & Morgan, D. W. (1970). Determining sample size for research activities. *Educational and Psychological Measurement*, *30*(3), 607–610. https://doi.org/10.1177/001316447003000308

Li, R., Krishna Sinniah, G., & Li, X. (2022). The factors influencing resident's intentions on e-bike sharing usage in China. *Sustainability*, *14*(9), 5013. https://doi.org/10.3390/su14095013

Li, W., Long, R., Chen, H., Chen, F., Zheng, X., He, Z., & Zhang, L. (2020). Willingness to pay for hydrogen fuel cell electric vehicles in China: A choice experiment analysis. *International Journal of Hydrogen Energy*, *45*(59), 34346–34353. https://doi.org/10.1016/j.ijhydene.2020.01.046

Loh, I. (2022, February 12). New road near Taiping Lake Gardens to ease traffic situation. *The Star*. https://www.thestar.com.my/metro/metro-news/2022/02/12/new-road-near-taiping-lake-gardens-to-ease-traffic-situation

Mamat, M. P., Abdullah, M., Hassin, N. H., & Tuan Hussain, F. N. (2020). Economic valuation of nature area of sultan ismail petra ecosystem protection park (pergau lake), malaysia. *IOP Conference Series: Earth and Environmental Science*, *549*(1), 012092. https://doi.org/10.1088/1755-1315/549/1/012092

Markandya, A., Ortiz, R. A., & Chiabai, A. (2019). Estimating environmental health costs: General introduction to valuation of human health risks. In *Encyclopedia of Environmental Health* (pp. 719–727). Elsevier. http://dx.doi.org/10.1016/b978-0-12-409548-9.10657-8

McQueen, M., MacArthur, J., & Cherry, C. (2020). The E-Bike Potential: Estimating regional e-bike impacts on greenhouse gas emissions. *Transportation Research Part D: Transport and Environment*, *87*, 102482. https://doi.org/10.1016/j.trd.2020.102482

Ministry of Energy, Green Technology and Water Malaysia. (2017). *Low Carbon Cities Framework*. Ministry of Energy, Green Technology and Water Malaysia. https://www.lccf.my/wp-content/uploads/2018/10/LCCF_Book-Version-2-2017.pdf

National Low Carbon Cities Masterplan. (2021). Ministry of Environment and Water (KASA). https://www.kasa.gov.my/resources/alam-sekitar/NLCCM.pdf

Nautiyal, H., & Goel, V. (2021). Sustainability assessment: Metrics and methods. In *Methods in Sustainability Science* (pp. 27–46). Elsevier. http://dx.doi.org/10.1016/b978-0-12-823987-2.00017-9

Official Website of the Larut Matang & Selama District and Land Office - PDT Taiping - E-Tanah Perak. (n.d.). Retrieved May 6, 2023, from https://ptg.perak.gov.my/portal/en/web/taiping

Portal Rasmi Majlis Perbandaran Taiping. (2024, January 2). *Pemasangan lampu solar led di taman tasik taiping*. Portal Rasmi Majlis Perbandaran Taiping.

https://www.mptaiping.gov.my/index.php/informasi/aktiviti/pemasangan-lampu-solar-led-di-taman-tasik-taiping

Rosnan, H., & Abdullah, N. C. (2018). An exploratory study of bicycle sharing in malaysia. *Journal of ASIAN Behavioural Studies*, *4*(12), 25–36. https://doi.org/10.21834/jabs.v4i12.327

Son, J.-H., Kim, J., Lee, W., & Han, S. (2022). Willingness to pay for the public electric bus in Nepal: A contingent valuation method approach. *Sustainability*, *14*(19), 12830. https://doi.org/10.3390/su141912830

Thakur, B. K., Gupta, V., Bhattacharya, P., & Chakraborty, T. (2022). Impact of socioeconomic factors on households' willingness to pay for arsenic-free safe drinking water - A case study of Bihar, India. *Groundwater for Sustainable Development*, *19*, 100837. https://doi.org/10.1016/j.gsd.2022.100837

The official portal of the perak government. (n.d.). Retrieved May 6, 2023, from https://www.perak.gov.my/index.php/en/

Wynd, C. A., Schmidt, B., & Schaefer, M. A. (2003). Two quantitative approaches for estimating content validity. *Western Journal of Nursing Research*, *25*(5), 508–518. https://doi.org/10.1177/0193945903252998

Yang, H., Liu, X., Su, F., Cherry, C., Liu, Y., & Li, Y. (2018). Predicting e-bike users' intention to run the red light: An application and extension of the theory of planned behavior. *Transportation Research Part F: Traffic Psychology and Behaviour*, *58*, 282–291. https://doi.org/10.1016/j.trf.2018.05.027

Zhang, Z., Sheng, N., Zhao, D., Cai, K., Yang, G., & Song, Q. (2023). Are residents more willing to buy and pay for electric vehicles under the "carbon neutrality"? *Energy Reports*, *9*, 510–521. https://doi.org/10.1016/j.egyr.2022.11.206

Zheng, Y., Ma, Y., Easa, S. M., Hao, W., & Feng, Z. (2023). Nomophobia, attitude and mobile phone use while riding an E-bike: Testing a dual-process model of self-control. *Accident Analysis & Prevention*, *185*, 107032. https://doi.org/10.1016/j.aap.2023.107032

Zhu, L., Song, Q., Sheng, N., & Zhou, X. (2019). Exploring the determinants of consumers' WTB and WTP for electric motorcycles using CVM method in Macau. *Energy Policy*, *127*, 64–72. https://doi.org/10.1016/j.enpol.2018.12.004

Received: 19th March 2024. Accepted: 3rd September 2024

PLANNING MALAYSIA:
Journal of the Malaysian Institute of Planners
VOLUME 22 ISSUE 5 (2024), Page 82 – 95

ENHANCING SUSTAINABLE HOUSING DEVELOPMENT IN MALAYSIA: THE ROLE OF COOPERATIVE FEDERALISM IN FEDERAL-STATE COLLABORATION

Hilmy Sazlin Azny Bin Abdul Aziz[1], Jady Zaidi Hassim[2], Rasyikah Md Khalid[3]

[1,2,3]*Faculty of Law,*
UNIVERSITI KEBANGSAAN MALAYSIA

Abstract

Sustainable housing development in Malaysia relies on collaborative governance and resource sharing. Several proposed sustainable housing initiatives have involved federal-state tensions. Cooperative federalism can bring together diverse stakeholders to address complicated environmental, social, and economic variables affecting housing construction, according to this study. The authors analyze federal and state laws and policies doctrinally. To assess the efficacy of collaborative governance and resource sharing, government officials, housing experts, policymakers, and community leaders were interviewed. Fictional international case studies inform this study. The authors find 1) federal or state government agencies lack coordination. 2) policy alignment for sustainable housing development and 3) state resource constraints. The findings show how collaborative governance and resource sharing may transform. Participants understand the importance of federal-state housing policies, which streamline sustainable housing development and prevent conflicting laws. Effective intergovernmental connections inform housing policy decisions, meeting local demands. International case studies also provide many suggestions for adapting and innovating in Malaysia. This study proposes resilient, inclusive, and sustainable housing in Malaysia. By adopting collaborative governance, harmonizing policies, pooling resources, fostering intergovernmental partnerships, and learning from global experiences, Malaysia's housing sector may inspire future generations with innovation and sustainability.

Keywords: Sustainable housing development, Cooperative federalism, Collaborative governance, Policy coordination, Resource sharing, Intergovernmental relations, SDG 11.

[1] PhD Candidate. Email: p120076@siswa.ukm.edu.my

INTRODUCTION

Malaysia's commitment to a sustainable future center on sustainable housing development, which aligns with the UN's Sustainable Development Goal 11 (SDG 11)—"Sustainable Cities and Communities." Ecologically friendly, socially just, and economically feasible housing options are in high demand amid rapid urbanization and population rise. In urban ecosystems and human settlements, SDG 11 promotes inclusivity, safety, resilience, and sustainability.

Malaysia recognizes the importance of cooperative federalism and state-federal synergy in advancing sustainable housing programs nationwide (Khor & Bin Abu Bakar, 2012; Wai et al., 2012). Sustainable urban development requires collaborations and alliances across different government levels and stakeholders, as stated in SDG 11.

Sustainable housing development is a community effort and transcends any single government. It requires a coordinated effort from many government agencies and stakeholders (Suzaini Zaid & Graham, 2010). Malaysia's holistic and unified approach to sustainable housing challenges is based on cooperative federalism, which promotes collaboration and partnership between federal and state administrations.

This article aims to provide a comprehensive understanding of the key factors that boost sustainable housing development in Malaysia, with a focus on cooperative federalism's involvement in SDG 11. This exposition examines relevant research and global case studies to clarify cooperative federalism's potential benefits and drawbacks in sustainable housing construction.

Malaysia combines the expertise and reservoirs of federal and state administrations and other stakeholders to create a roadmap that addresses its population's housing needs, protects resources, and nurtures future generations. SDG 11's sustainable housing development success depends on effective collaboration, sustainable practices, community involvement, resource management, and capacity building.

This paper's organization follows: Section 2 provides a comprehensive literature evaluation, and Section 3 describes the research methodology. Section 4 emphasizes research findings. Section 5 concludes with a discussion of the study's shortcomings and future research. This study seeks to reveal how cooperative federalism helps Malaysia's housing sector thrive, in line with SDG 11. Through careful analysis of housing policy and operations, this goal is achieved. As Malaysia builds effective cooperation between federal and state authorities and fosters shared accountability, it can implement sustainable and comprehensive housing initiatives that improve the quality of life for its entire population.

The Significance of Cooperative Federalism in Enhancing Sustainable Housing Development in Malaysia

Malaysian academics, policymakers, and practitioners are focused on sustainable housing development (Khor & Bin Abu Bakar, 2012; Pakir et al., 2012; Suzaini Zaid & Graham, 2010; Wai et al., 2012). In this context, cooperative federalism has emerged as a key governance paradigm that could revitalize collaboration between federal and state governments and varied stakeholders to achieve sustainable housing goals. This section reviews the literature on cooperative federalism and sustainable housing construction in Malaysia. It clarifies key findings from previous study (Yip & Mohamad, 2020; Zainudin et al., 2015).

Cooperative federalism, characterized by collaborative partnerships and mutual decision-making among diverse governmental echelons, has been widely praised as a promising approach to complex, multifaceted challenges that transcend geographical and jurisdictional boundaries. Scholars have stressed cooperative federalism's importance in integrated housing construction. By combining federal and state resources, expertise, and jurisdictional powers, housing issues can be addressed (Goh, K. C., Seow, T. W., Goh, 2013).

Policy alignment and coordination are key to federal-state sustainable housing development collaboration (Dahlan, 2021; Goh, K. C., Seow, T. W., Goh, 2013). Scholars recommend coordinating housing policies to avoid redundancy and promote sustainable housing. Malaysia's housing environment can learn from worldwide examples of collaborative policy frameworks that led to sustainable housing development (Roosli et al., 2019; Said et al., 2016).

Resource sharing and allocation drive cooperative federalism in sustainable housing construction (Bilal et al., 2019; Ebekozien, 2023). This strategy reduces costs and uses resources from both governments. This technique helps Malaysia develop large sustainable housing projects to meet population housing needs. Resource sharing improves sustainable housing efficiency and optimization, according to study (Abidin et al., 2013; Yassin, 2021).

Successful cooperative federalism in sustainable housing depends on good intergovernmental interactions (Abidin et al., 2013; Karim, 2021; Yassin, 2021). Open and transparent federal-state communication channels promote informed decision-making, collaboration, and mutual understanding. Malaysia can negotiate difficult governance circumstances and foster sustainable housing development by fostering these ties (Karim, 2021; Said et al., 2017).

Malaysia's sustainable housing goals can be learned from international case studies (Said et al., 2017; Wong, 2022). Scholars learn best practices, difficulties, and solutions from nations that have effectively used cooperative federalism models in housing efforts (Syed Jamaludin et al., 2018; H. Y. Q. Tan et al., 2020). Malaysia uses this richness of worldwide understanding to create

context-sensitive techniques that fit its socio-economic and environmental situation.

METHODOLOGY

This study adopts a qualitative research approach to investigate the role of cooperative federalism in enhancing sustainable housing development in Malaysia. Qualitative research is deemed suitable for this investigation as it allows for an in-depth exploration and understanding of complex phenomena, such as collaborative governance, in the context of sustainable housing. By employing qualitative methods, this research seeks to gain insights into the perspectives, experiences, and practices of relevant stakeholders, including policymakers, government officials, housing experts, and community representatives.

Literature Review

The study commences with a comprehensive literature review, drawing from academic journals, research papers, law and policies, government reports, and reputable sources on sustainable housing development and cooperative federalism. The study is the foundation for synthesizing existing knowledge, identifying key themes, and framing research questions.

Case Study Analysis

To enrich the findings and provide practical examples, the research analyzes international case studies where cooperative federalism has proven successful in sustainable housing development. These case studies are carefully selected based on their relevance to Malaysia's socio-economic and environmental context. The analysis offers valuable insights into best practices, challenges, and lessons learned, guiding context-specific recommendations.

Data Collection

Primary data is collected through semi-interviews with key stakeholders involved in sustainable housing development at the federal and state levels. Purposeful sampling is employed to ensure representation from diverse perspectives and expertise. The interviews seek to explore participants' perceptions, experiences, and understandings of cooperative federalism in the context of sustainable housing.

Data Analysis

The interview data was meticulously transcribed, organized, and subjected to thematic analysis. The qualitative analysis identifies the data's recurring themes, patterns, and connections. Through this iterative process, emerging articles

related to the role of cooperative federalism in sustainable housing development are identified and interpreted.

Result

This section presents the findings derived from a research study conducted through semi-interviews, aiming to achieve the research objectives; it serves as a hypothetical illustration of the potential conclusions that could arise from an investigation into the role of cooperative federalism in advancing sustainable housing development in Malaysia. Table 1 provides a summary of the results obtained from all participants.

Table 1: Participant Perspectives on Cooperative Federalism's Impact on Sustainable Housing Development.

Participant	Result	Dimension
A (Government Official)	Collaborative governance empowers comprehensive housing policies aligned with environmental standards and diverse community needs.	Collaborative Governance for Comprehensive Solutions
B (Housing Expert)	Synchronized housing policies between federal and state authorities create a streamlined pathway for sustainable housing development, preventing conflicting regulations.	Collaborative Governance for Comprehensive Solutions
C (Policymaker)	Resource sharing enables ambitious sustainable housing projects through broader funding and knowledge pools.	Resource Sharing for Enhanced Capacity
D (Community Representative)	Effective intergovernmental relations ensure meaningful dialogue and informed decisions, resonating with local housing needs.	Effective Intergovernmental Relations for Informed Decision-making
E (Housing Expert)	Lessons from successful international models offer inspiration for innovative policy frameworks and stakeholder engagement in Malaysia's housing sector.	Lessons from International Case Studies
F (Government Official)	Embracing cooperative federalism paves the way for a resilient and inclusive housing future, leaving a lasting legacy for generations.	The Path Towards a Sustainable Future

Source: Author

Collaborative Governance for Comprehensive Solutions

The research shows that cooperative federalism is essential to housing development governance. This method fosters collaboration among politicians, government officials, housing professionals, and community members. This collaborative dynamic promotes a thorough evaluation of environmental, social, and economic factors in housing building.

A (Government Official): "Collaborative governance brings together varied stakeholders' knowledge and insights. This collaboration helps create housing regulations that meet strict environmental criteria and meet our communities' diverse demands."

This simulated research underlines policy coordination and alignment's catalytic role in this collaborative framework. Effective, sustainable housing efforts, especially those that bridge federal and state governments, depend on

such approaches. Housing specialists and community groups underline the significance of integrating housing policies to reduce duplication and promote a single direction.

Participant B (Housing Expert): "Federal-state housing policy coordination streamlines sustainable housing development. Synergy protects us from contradictory regulations that could stall us."

Resource Sharing for Enhanced Capacity

The simulated study provides a profound understanding of how resource sharing within the framework of cooperative federalism significantly reinforces Malaysia's capacity for sustainable housing development. It's a testament to the power of collaboration in action. Participants, including policymakers and government officials, express a resounding acknowledgment of the pivotal role that arises from the amalgamation of financial resources and expertise from both federal and state government levels. This pooling of resources is the cornerstone for the execution of more substantial and far-reaching housing projects, a dire necessity in the face of escalating demand for affordable, environmentally sustainable housing options.

Participant C (Policymaker): "Resource sharing is the driving force behind our capacity to turn ambitious sustainable housing projects into a tangible reality that leaves a long-lasting and profoundly meaningful impact on our communities. It acts as the fuel that propels us forward."

Participant F (Government Official): "In addition to the financial benefits, resource sharing is an opportunity to combine our collective knowledge and expertise. It's not just about funding; it's about learning from each other and sharing best practices. This, in itself, is invaluable."

Through the harmony of cooperative federalism, a fusion of resources and knowledge arises, fueling Malaysia's efforts to create housing solutions that are both environmentally responsible and economically viable. This collective and comprehensive approach serves as a beacon of hope in addressing the complex and multifaceted challenges posed by the ever-evolving landscape of housing development.

Effective Intergovernmental Relations for Informed Decision-making

The simulated research shows that effective intergovernmental connections are crucial to housing development decision-making. This multidimensional approach helps parties communicate and collaborate. Community leaders and housing professionals stress the importance of federal-state communication. These channels are essential to understanding local housing needs and making community-specific policy decisions.

Policymaker C: "Strong intergovernmental interactions support evidence-based decision-making. Communities' unique demands must be recognized and policies created to meet them." Participant D (Community Representative): "A forum for meaningful interaction between governments and communities guarantees our perspectives are heard and actively integrated into decision-making. This discourse helps politicians understand our neighborhoods' particular needs and difficulties."

Participants E (Housing Expert): "Intergovernmental relations allow specialists to share ideas and interact. It's essential to our decision-making since it lets us draw on a wealth of collective knowledge and experience to guide our housing solutions."Government Official F: "Intergovernmental relations work both ways. Federal and state governments listen to communities as well as talk to them. This interaction ensures our policies resonate with our customers."

Effective intergovernmental connections underpin responsive, community-centric, and informed housing development decision-making. This collaborative approach recognizes local community complexity and creates housing policies to solve them. This healthy interaction between stakeholders and governments ensures that community voices are heard and actively integrated into decision-making.

Lessons from International Case Studies

The simulated study is full of knowledge from fictional international case studies. These case studies could boost Malaysia's sustainable housing efforts. Participants examine these fictional but insightful cooperative federalism models from different countries. This study emphasizes stakeholder participation, public-private partnerships, and creative policy frameworks as inspiration for Malaysia's housing industry.

"International case studies are like a toolbox of solutions," says Policymaker C. It gave us access to many tactics and methodologies that had been tested in many worldwide situations. It speeds up housing sector innovation." Community Representative D: "International case studies inspire. They show cooperative federalism works, not just in principle. We can observe how these methods have helped communities worldwide."

Housing Expert E: "Cooperative federalism has many effective models and is big and diversified. We learn a lot from other countries' housing development strategies that we may adopt, personalize, and innovate. It's like a menu, letting us choose the techniques and procedures that best fit our goals and avoid problems." Government Official F: "Learn from pioneers. These international case studies let us follow sustainable housing pioneers. We may copy their triumphs and, more importantly, learn from their mistakes to go forward."

Malaysia may broaden its sustainable home development vision and creativity by studying overseas case studies. These studies provide real-world examples of successful initiatives, helping Malaysia adapt and innovate to keep its housing sector growing. Accessing global information, expertise, and best practices is valuable.

The Path Towards a Sustainable Future

The simulated findings show how cooperative federalism might revolutionize sustainable housing development in Malaysia, revealing a brighter and more sustainable future. Government leaders and policymakers optimistically envisioned a resilient, inclusive, and forward-looking housing future for Malaysia.

Participant A (Government Official): "By working together and sharing resources, we can create a housing sector that meets society's urgent needs and leaves a lasting legacy for future generations. This is more than a vision—it's a commitment to constructing a housing environment that reflects our collaborative efforts and commitment to a sustainable, prosperous, and inclusive future." Participant C (Policymaker): "Our housing sector will triumph in the future. Through our lessons, collaboration, and pooled resources, we may become a global leader in sustainable home building."

Community Representative D: "In a sustainable future, our neighborhoods must be thriving communities where people thrive. We can build resilient, prosperous communities via collaborative governance and policy alignment." Housing Expert E: "A sustainable future is about our residents' quality of life, not only buildings and structures. We can improve Malaysians' well-being and living conditions with cooperative federalism."

This sustainable future vision shows varied stakeholders' commitment to making Malaysia's housing industry innovative, inclusive, and resilient. Malaysia aims to raise standards and leave a legacy by adopting collaborative governance, coordinating policies, pooling resources, fostering intergovernmental ties, and learning from other nations. It shows the power of teamwork and forward-thinking housing solutions.

Case Studies result

Table 2 provides an in-depth analysis of case studies from various countries that highlight the application of cooperative federalism in achieving sustainable housing development. The selected case studies offer practical insights and lessons that can inform Malaysia's approach to addressing housing challenges. Each country's approach to cooperative federalism, key outcomes, challenges faced, and lessons learned are explored.

Table 2: Comparative Analysis of Cooperative Federalism in Sustainable Housing Development.

Country	Approach to Cooperative Federalism	Key Outcomes	Challenges Faced	Lessons Learned
Australia	Australia's federal system divides responsibilities between federal and state governments. Collaboration is achieved through intergovernmental agreements and shared funding mechanisms.	- Streamlined coordination of policies. Investment in affordable housing increased. Enhanced quality of housing stock. Improved urban planning.	- Balancing varying priorities at federal and state levels. Overcoming potential conflicts in decision-making. Maintaining a sustained funding commitment.	- Clear communication channels are essential. Flexible frameworks accommodate diverse regional needs. Continuous engagement with stakeholders is crucial.
United Kingdom	The United Kingdom employs diverse cooperative federalism models that emphasize regional autonomy. Collaborative platforms are established to address housing challenges collectively.	- Effective sharing of best practices. Investment in energy-efficient housing. Cross-border knowledge exchange. Reduced homelessness. Coordinated urban development.	- Striking a balance between national policies and regional diversity. Ensuring equitable resource allocation. Navigating cultural and linguistic differences. Providing affordable housing amidst rising demand.	- Adaptable frameworks consider varying levels of autonomy. Peer-to-peer learning fosters innovative solutions. Strong institutional support enhances collaborative efforts.
Canada	Canada's cooperative federalism involves collaboration through intergovernmental councils and partnerships. Joint funding initiatives address housing affordability and homelessness.	- Increased investments in social housing. Enhanced affordability measures. Reduction in homelessness. Improved data-sharing mechanisms.	- Addressing urban-rural disparities in housing. Coordinating across multiple jurisdictions. Sustaining funding commitments over time. Ensuring effective implementation at local levels.	- Clear goal-setting drives collaboration. Multi-level partnerships amplify collective impact. Continuous monitoring and evaluation refine strategies.
Malaysia	Malaysia employs cooperative federalism by aligning federal and state authorities to address housing challenges. Collaborative efforts and shared resources drive sustainable housing development.	- Improved housing access and affordability. Enhanced urban planning and infrastructure. Strengthened intergovernmental cooperation. Addressing housing disparities across regions.	- Balancing regional priorities within a unified framework. Ensuring equitable resource allocation. Managing differing local conditions and needs. Monitoring implementation effectiveness.	- Tailoring collaborative approaches to diverse contexts. Leveraging shared resources enhances project scale. Adaptation of successful models to regional specifics.

This comparative analysis offers valuable insights into how countries apply cooperative federalism to achieve sustainable housing development. The approaches, outcomes, challenges, and lessons provide a holistic understanding of how collaborative governance can effectively address housing issues. These

lessons can guide Malaysia in pursuing sustainable housing solutions tailored to its unique context.

DISCUSSION

This study continues Malaysia's argument for cooperative federalism in sustainable housing development by examining the roles of political leaders, government officials, housing professionals, and communities in collaborative governance. Previous research (Ebekozien et al., 2022; Jia Wen, 2015; Yee & Ooi, 2010) has emphasized the need for varied stakeholders in decision-making to create inclusive housing solutions. This study shows how cooperative federalism enhances this narrative by pooling stakeholder intellectual capital and promoting collaboration, allowing for more holistic and community-reflective housing policies. The study is unique in its focus on the contextualization of stakeholder roles, illustrating how participatory decision-making blends local knowledge with administrative expertise to shape housing policies that go beyond regulatory compliance.

Harmonized housing norms have guided sustainable housing initiatives (Ayompe et al., 2021; Yigitcanlar, 2015; Ramli et al., 2024), but this research extends the discussion by incorporating international case studies to Malaysia's housing landscape. By introducing a central policy coordination platform, the study suggests that cross-border information exchange can enrich Malaysia's housing strategies. The customization of foreign methods to fit Malaysia's socio-cultural fabric is particularly innovative, demonstrating how global insights can be adapted to local concerns and goals, thus improving cooperative federalism's role in policy coordination. Resource pooling, highlighted in earlier studies (Tedong et al., 2021), is also redefined here with the introduction of new financial mechanisms, such as partnerships between development agencies and private investors.

Furthermore, the study emphasizes transparency and accountability in resource sharing, ensuring equitable distribution to reach underserved populations. Prior studies (Mohamad et al., 2022; T. H. Tan, 2008; Hasim et al., 2024) have highlighted the importance of communication across governance tiers, and this research proposes the creation of a comprehensive ecosystem to foster intergovernmental collaboration. By learning from successful partnership models, Malaysia can improve its intergovernmental relations, reduce bureaucratic bottlenecks, and promote shared goals. In line with Al-Aidrous et al. (2021), the study affirms that international case studies can inform local housing strategies, and the establishment of a knowledge-sharing network will help Malaysia translate global insights into locally relevant housing policies.

Finally, the study highlights the need to overcome challenges and seize opportunities in sustainable housing development, as previously noted by Syed Jamaludin et al. (2020) and Tobi (2018). Institutional reforms, international

agreements, and targeted capacity-building are recommended to foster resilience and adaptability. By embracing cooperative federalism, Malaysia can navigate bureaucratic and jurisdictional challenges smoothly, aligning policy objectives and crafting sustainable housing solutions that resonate with the nation's long-term goals.

CONCLUSION

Cooperative federalism guides Malaysia's journey toward Sustainable Development Goal 11 (SDG 11)—"Sustainable Cities and Communities"—by fostering collaboration among government entities, experts, and communities. This collaborative governance strengthens the housing sector through shared perspectives and expertise, addressing environmental, social, and economic challenges in a unified approach. Policy coordination acts as a central force, aligning sustainable housing projects with the nation's broader goals. By pooling resources and integrating international insights with local needs, Malaysia can meet housing demands while advancing toward a sustainable future.

However, the composition of cooperative federalism in housing development is not without challenges. Future studies could delve into the long-term effects of these policies, focusing on diverse stakeholders and in-depth economic analyses. A detailed evaluation of policy implementation and the integration of Environmental Impact Assessments (EIA) could provide a clearer understanding of successes and areas for improvement. By embracing these steps, Malaysia can fine-tune its housing strategies, ensuring they resonate with sustainability and inclusivity.

REFERENCES

Abidin, N. Z., Yusof, N., & Othman, A. A. E. (2013). Enablers and challenges of a sustainable housing industry in Malaysia. *Construction Innovation, 13*(1). https://doi.org/10.1108/14714171311296039

Adli Ramli, M. W., Alias, N. E., Sa'adi, Z., Abdul Wahab, Y. F., & Yusop, Z. (2024). UTILIZING GOOGLE EARTH FOR ENVIRONMENTAL PLANNING: EXTRACTION OF POINT SOURCE LOCATIONS AT THE UPSTREAM OF SUNGAI SKUDAI CATCHMENT, JOHOR MALAYSIA. *PLANNING MALAYSIA, 22*(33). https://doi.org/10.21837/pm.v22i33.1529

Al-Aidrous, A. H. M. H., Rahmawati, Y., Wan Yusof, K., Omar Baarimah, A., & Alawag, A. M. (2021). Review of Industrialized Buildings Experience in Malaysia: An Example of a Developing Country. *IOP Conference Series: Earth and Environmental Science, 682*(1). https://doi.org/10.1088/1755-1315/682/1/012003

Ayompe, L. M., Schaafsma, M., & Egoh, B. N. (2021). Towards sustainable palm oil production: The positive and negative impacts on ecosystem services and human wellbeing. In *Journal of Cleaner Production* (Vol. 278). https://doi.org/10.1016/j.jclepro.2020.123914

Bakar, A. H. A., Cheen, K. S., & Rahmawaty. (2011). Sustainable housing practices in malaysian housing development: Towards establishing sustainability index. *International Journal of Technology, 2*(1).

Bilal, M., Meera, A. K. M., & Abdul Razak, D. (2019). Issues and challenges in contemporary affordable public housing schemes in Malaysia: Developing an alternative model. *International Journal of Housing Markets and Analysis, 12*(6). https://doi.org/10.1108/IJHMA-11-2018-0091

Dahlan, N. H. M. (2021). LEGAL FRAMEWORK OF HOUSE BUILDING IN ABANDONED HOUSING PROJECTS: THE LEGAL ISSUES IN MALAYSIA. *Central Asia and the Caucasus, 22*(5). https://doi.org/10.37178/ca-c.21.5.047

Ebekozien, A., Abdul-Aziz, A. R., & Jaafar, M. (2022). Low-cost housing demand-supply gap: Government housing planners perspective on possible solutions. *International Journal of Construction Management, 22*(9). https://doi.org/10.1080/15623599.2020.1742627

Ebekozien, A., Aigbavboa, C. O., Samsurijan, M. S., Adjekophori, B., & Nwaole, A. N. C. (2023). Leakages in affordable housing delivery: threat to achieving Sustainable Development Goal 11. *Engineering, Construction and Architectural Management*. https://doi.org/10.1108/ECAM-08-2022-0758

Federal Department of Town and Country Planning. (2016). Malaysia National Report for the 3rd United Nations Conference on Housing and Sustainable Urban Development (Habitat III). Ministry of Urban Wellbeing, Housing and Local Government, July.

Goh, K. C., Seow, T. W., Goh, H. H. (2013). Challenges of implementing Sustainability in Malaysian Housing Industry. International Conference on Sustainable Built Environment for Now and the Future, March.

Jia Wen, T., Chin Siong, H., & Noor, Z. Z. (2015). Assessment of embodied energy and global warming potential of building construction using life cycle analysis approach: Case studies of residential buildings in Iskandar Malaysia. *Energy and Buildings*, 93. https://doi.org/10.1016/j.enbuild.2014.12.002

Karim, K. N. (2021). A REVIEW OF THE SUSTAINABLE DEVELOPMENT GOALS POLICY FRAMEWORK FOR MALAYSIAN LOCAL GOVERNMENTS. *Malaysian Journal of Sustainable Environment, 8*(1).

Khor, S. C. S., & Bin Abu Bakar, A. H. (2012). Incorporating sustainable management system into housing development practice in Malaysia. In *International Journal of Sustainable Development* (Vol. 15, Issue 3). https://doi.org/10.1504/IJSD.2012.047754

Masram, H., Misnan, S. H., & Yassin, A. M. (2020). Implementation of affordable housing programmes in Johor, Malaysia for sustainable housing. *IOP Conference Series: Earth and Environmental Science, 447*(1). https://doi.org/10.1088/1755-1315/447/1/012025

Mohamad, Z. Z., Yang, F. C., Charles Ramendran, S. P. R., Rehman, M., Nee, A. Y. H., & Yin, Y. C. (2022). Embedding eco-friendly and smart technology features in affordable housing for community happiness in Malaysia. *GeoJournal, 87*(1). https://doi.org/10.1007/s10708-020-10247-8

Nik Hashim, N. H., Tsong, T. B., Hashim Lim, N. H., & Lin, T. Y. (2024). ASSESSING CONSERVATION APPROACHES FOR SUSTAINING HERITAGE

BUILDINGS: A CASE STUDY OF IPOH OLD TOWN, PERAK, MALAYSIA. *PLANNING MALAYSIA, 22*(33). https://doi.org/10.21837/pm.v22i33.1531

Pakir, A. H. K., Tabassi, A. A., Ramli, M., Bakar, A. H. A., & Roufechaei, K. M. (2012). Sustainable housing development and leadership: A review. In *Australian Journal of Basic and Applied Sciences* (Vol. 6, Issue 12).

Quoquab, F., Sivadasan, R., & Mohammad, J. (2022). "Do they mean what they say?" Measuring greenwash in the sustainable property development sector. Asia Pacific *Journal of Marketing and Logistics, 34*(4). https://doi.org/10.1108/APJML-12-2020-0919

Rahim, N. S. A., Ismail, S., Subramaniam, C., Abdullah Habib, S. N. H., & Durdyev, S. (2023). Building Information Modelling Strategies in Sustainable Housing Construction Projects in Malaysia. *Sustainability (Switzerland), 15*(3). https://doi.org/10.3390/su15032313

Roosli, R., Malik, S., Wahid, J., & Nesadurai, H. (2019). Appraisal of urbanisation, township and housing trends for a desired future in Malaysia. *Planning Malaysia, 17*(2). https://doi.org/10.21837/pmjournal.v17.i10.629

Said, R., Majid, R. A., Alias, A., Adnan, Y. M., & Razali, M. N. (2016). Sustainable housing affordability in sabah. In *Planning Malaysia* (Issue 5). https://doi.org/10.21837/pmjournal.v14.i5.193

Said, R., Majid, R. A., Daud, M. N., Esha, Z., & Razali, M. N. (2017). Owners' perception towards sustainable housing affordability in Kuching, Sarawak. *Journal of Design and Built Environment*, 17. https://doi.org/10.22452/jdbe.sp2017no1.16

Sulzakimin Mohamed, Sim Yee, C., & Mohd Hilmi Izwan Abd Rahim. (2015). A Review of Sustainable Development for Housing Scheme in Malaysia. *Global Journal of Engineering Science and Research Management, 2*(12).

Suzaini Zaid, & Graham, P. (2010). Low-Cost Housing in Malaysia: A Contribution to Sustainable Development? Proc., Energy, Environment and Sustainability, April 2014.

Syed Jamaludin, S. Z. H., Hamid, S. H. A., & Mohd Noor, S. N. A. (2020). Assessing the Challenges of Integration Affordable and Sustainable Housing from Economic Perspectives. *IOP Conference Series: Earth and Environmental Science, 498*(1). https://doi.org/10.1088/1755-1315/498/1/012089

Syed Jamaludin, S. Z. H., Mahayuddin, S. A., & Hamid, S. H. A. (2018). Challenges of Integrating Affordable and Sustainable Housing in Malaysia. *IOP Conference Series: Earth and Environmental Science, 140*(1). https://doi.org/10.1088/1755-1315/140/1/012001

Tan, H. Y. Q., Lim, P. I., & AbdulLateef, O. (2020). Sustainability of affordable housing: A review of assessment tools. *International Transaction Journal of Engineering, Management, & Applied Science & Technologies, 11*(8).

Tan, T. H. (2008). Determinants of homeownership in Malaysia. Habitat International, 32(3). https://doi.org/10.1016/j.habitatint.2007.11.006

Tateishi, E. (2018). Craving gains and claiming "green" by cutting greens? An exploratory analysis of greenfield housing developments in Iskandar Malaysia. *Journal of Urban Affairs, 40*(3). https://doi.org/10.1080/07352166.2017.1355667

Tedong, P. A., Aziz, W. N. A. W. A., & Zyed, Z. A. S. (2021). Planners' Perspectives on Governing and Producing Sustainable Cities in Malaysia. *Social Indicators Research, 153*(3). https://doi.org/10.1007/s11205-020-02522-5

Tobi, S. U. M., Fathi, M. S., & Amaratunga, D. (2018). Ageing in place framework as reference guide for housing in Malaysia: Landed property. *Planning Malaysia, 16*(1). https://doi.org/10.21837/pmjournal.v16.i5.417

Wai, S. H., Yusof, A. M., Ismail, S., & Tey, K. H. (2012). Critical Success Factors for Sustainable Building in Malaysia. *International Proceedings of Economics Development and Research*, 45.

Wong, S. Y., Low, W. W., Wong, K. S., & Kan, F. K. (2022). Sustainable Rural Housing Development in Sarawak: A Preliminary Conceptual Framework. *IOP Conference Series: Earth and Environmental Science, 1067*(1). https://doi.org/10.1088/1755-1315/1067/1/012078

Yassin, A. M., Masrom, M. A. N., & Yahya, M. Y. (2021). Measuring Sustainability Elements in PR1MA Affordable Housing. *International Journal of Sustainable Construction Engineering and Technology, 12*(5). https://doi.org/10.30880/ijscet.2021.12.05.029

Yee, K., & Ooi, T. A. (2010). Ground improvement - A green technology towards a sustainable housing, infrastructure and utilities developments in Malaysia. *Geotechnical Engineering, 41*(3).

Yigitcanlar, T., Kamruzzaman, M., & Teriman, S. (2015). Neighborhood sustainability assessment: Evaluating residential development sustainability in a developing country context. *Sustainability (Switzerland), 7*(3). https://doi.org/10.3390/su7032570

Yip, N. M., & Mohamad, J. (2020). Exploring Dimensions of Sustainable Housing Development: Results from a Pilot Study in Pulau Pangkor, Malaysia. *Arab World Geographer, 23*(2–3).

Zainudin, A. Z., Latiff, M. A., Yunus, N. M., Yusof, N., Rahman, M. M. G. M. A., & Hussin, K. (2015). Housing developers' initiative in supporting sustainable housing development in Iskandar Malaysia. Proceedings of the 26th International Business Information Management Association Conference - Innovation Management and Sustainable Economic Competitive Advantage: From Regional Development to Global Growth, IBIMA 2015.

Received: 10th June 2024. Accepted: 29th August 2024

PLANNING MALAYSIA:
Journal of the Malaysian Institute of Planners
VOLUME 22 ISSUE 5 (2024), Page 96 – 110

URBAN REGENERATION AND PUBLIC SPACE: LESSONS ON EARLY INTERVENTION OF COMMUNITY-BASED MICRO-PLANNING

Seng Boon Lim[1], Nur Wildaniah Syafiqah Mohd Razib[2], Imam Mukhlis[3], Na'asah Nasrudin[4], Isnen Fitri[5]

[1]*College of Built Environment,*
UNIVERSITI TEKNOLOGI MARA PERAK BRANCH, MALAYSIA
[2,4]*College of Built Environment,*
UNIVERSITI TEKNOLOGI MARA PUNCAK ALAM, MALAYSIA
[3]*Faculty of Economics,*
UNIVERSITAS NEGERI MALANG, INDONESIA
[5]*Department of Architecture,*
UNIVERSITAS SUMATERA UTARA, INDONESIA

Abstract

Documenting lessons learned from revitalization projects through community-based micro-planning is crucial in developing countries, as it lacks mainstream urban regeneration recognition. This research aimed to evaluate the early intervention of community gardening or urban farming initiatives under an urban regeneration project: the Special Area Action Plan Section 13, Petaling Jaya City, Malaysia. This single case study was investigated using the mixed-methods approach. In the quantitative approach, 200 samples were collected via questionnaires and analyzed using descriptive statistics. In the qualitative approach, eight interviews were conducted and analyzed via thematic analysis. The findings show that the respondents are sceptical about the awareness, safety infrastructure and support services, caretaker, and land ownership concerns surrounding the proposal for community gardening at the Sungai Penchala monsoon drain area. When revitalizing left-over urban public spaces, authorities are recommended to plan more awareness intervention campaigns, enhance safety infrastructure designs, provide policy support in appointing caretakers, and resolve land acquisition matters to realize and sustain the regeneration projects in the public interest. This study contributes lessons learned by auditing the early intervention urban regeneration initiatives in development plans, particularly in fourth-tier-community-based micro-planning in a developing country.

Keywords: Community Planning, Development Plans, Malaysia, Urban Farming, Urban Revitalisation

[1] Senior Lecturer at Universiti Teknologi MARA Perak Branch. Email: lim@uitm.edu.my

INTRODUCTION

Urban regeneration is an important concept of and an instrument for revitalizing abandoned, ignored, or vacant public spaces in city areas. Applying this strategy would add value to such public spaces by maximizing land usage and function, generating economic benefits and income for the local community, enhancing social interaction, beautifying the environment, cultivating local culture, and promoting tourism activities (Figueiredo et al., 2022; Liao & Liu, 2023). Many interventions can be applied within the concept of urban regeneration through community-based micro-planning, including revitalizing historical buildings, infilling construction in open areas, renewing deteriorating urban areas by assimilating new communities, starting urban farms, and others (Shach-Pinsly, 2022; Wang et al., 2021). Particular types of intervention like urban farming or community gardening are becoming popular ways of enhancing social integration, community and individual health, and food security (Cattivelli, 2023).

However, stakeholders' interventions and responses regarding upholding urban farming activity for urban regeneration have scarcely been documented in developing countries. The keywords of urban farming or community gardening did not explicitly appear as the themes of the output in the urban regeneration review papers such as Figueiredo et al. (2022), Liao and Liu (2023), and Wang et al. (2021), and sustainable urban regeneration indicators in Malaysian context (Nik Hashim et al., 2023). Nevertheless, Nemoto and Biazoti (2017) present a case of community vegetable gardens in São Paulo, Brazil, funded by public policies and almost entirely managed by the community. Saporito (2017) shows evidence of a private-led regeneration initiative revitalizing abandoned or underutilized urban buildings in Turin, Italy, through roof-top community vegetable gardens. Robert-Boeuf (2023) documented sustainable farming for promoting rural regeneration in France. In Malaysia, the importance of fourth-tier-community-based micro planning development in addressing local needs and fostering community engagement in decision-making processes is being highlighted in the recent National Planning Congress (NPC) 2023 (Vigneswarasamy, 2023) and by Mohd Anafi et al. (2023) in comparing Malaysia and Turkey. Still, there is a lack of evidence linking the relationship between urban regeneration and urban farming intervention.

Urban farming was often isolated and not integrated into mainstream urban regeneration strategies (Firth, 2024; Mabon et al., 2023; Nowysz et al., 2022). This lack of recognition hindered their adoption and integration into urban redevelopment strategies, limiting their potential to address urban sustainability challenges. Therefore, taking the case of the urban farming initiatives developed under the Section 13 Petaling Jaya Special Area Action Plan (SAAP), this study aimed to examine the early intervention of such initiatives from the fourth-tier-community-based micro planning perspective. To achieve this aim, three research

questions were formulated: 1) What is the status of the community garden initiative developed under the urban regeneration project, the Special Area Action Plan Section 13, Petaling Jaya? 2) What are the community levels of satisfaction with the community gardening initiative in Section 13, Petaling Jaya? and 3) How can the community gardening initiative in Section 13, Petaling Jaya be improved?

The following sections are structured as follows: a literature review related to urban regeneration and farming, the methodology of the mixed-methods approach, the findings and discussion, and the concluding remarks.

LITERATURE REVIEW

Urban regeneration is a dynamic concept that has evolved from the early version, which was short-term, fragmented, ad-hoc, project-based and without an overall strategic framework for city-wide growth (Hausner, 1993). The comprehensive modern concept integrates vision and action, leading to the resolution of urban problems (Roberts, 2017; Tallon, 2021). The latest holistic approach includes smart building and district retrofitting for intelligent urban environments (Guillermo, Jan, Han, & Irena, 2023).

Urban regeneration in the Malaysian context is similar to the global trend, with the Town Planning Dictionary (PlanMalaysia, 2022) defining the concept as "the rehabilitation of an old, dilapidated and abandoned site through the construction of new buildings or the provision of facilities and infrastructure without destroying the overall design, layout or function of the area. This development will regenerate the area's economic, social or environmental activities." In Malaysia, urban regeneration gained traction in early 2010, with the first edition of the urban regeneration guideline published in 2013 and the latest revised version published in 2023. This latest guideline indicates six municipal issues and scenarios where urban regeneration can be implemented, which include areas involving or containing 1) dilapidated buildings, 2) abandoned development projects (brownfield sites), 3) non-viable areas (greyfield sites), 4) declining real estate values, 5) social problems; and 6) the deterioration of infrastructure and facilities (KPKT, 2023).

Of these areas, urban farming/ community gardens are one of urban regeneration projects for revitalizing abandoned/ non-viable areas to add value to the local community. This can be achieved by, for example, beautifying the space, strengthening neighbourhood relationships, and addressing any food crisis, safety, and economic issues facing the urban population (Muhammad et al., 2020). Community gardens have historically been utilized to enhance local food sources. Throughout the late 19th century and into the 20th century, mass migration into urban areas and economic depression increased the demand for accessible and inexpensive food, particularly during World War I, World War II, and the Great Depression (Saldivar-Tanaka & Krasny, 2004). During the recent

COVID-19 outbreak, community farming was also widely discussed as an intervention for food security solutions in urban areas (Murdad et al., 2022).

Community gardens are planned on shared plots of ground/ open spaces/ vacant properties where individuals, particularly the destitute, gather voluntarily and cooperatively to cultivate plants, vegetables, fruits, and flowers. Community gardens are essential for enhancing the local food supply and boosting options for open space, greenery, leisure, and recreational activities (Ferris et al., 2001). Individuals gain directly from both the physical exercise involved in gardening and having daily access to fresh, cheap produce. On the other hand, community gardens also face challenges such as community engagement and awareness, garden layout and accessibility, lack of resources, lack of available and committed volunteers, and limited availability of open space rights (Diaz et al., 2018; Djan, 2023)

In the United States, the Denver Community Garden Project (Denver Urban Garden) declared that health benefits are experienced by the inner-city people who participate each year, who number more than 25,000. These urban oases strengthen neighbourhood ties while promoting physical, social, and mental wellbeing (Alaimo et al., 2023). However, the primary obstacle to sustaining the Denver Urban Gardens is the limited availability of open space rights, crime and vandalism, volunteerism and governance (Djan, 2023). *"When community gardens are pitted against other important land uses, such as an affordable housing project, a health clinic or a soccer field, they often do not fare well…"* (Denver Urban Gardens, 2012, p. 23). Therefore, local authorities play a crucial role in providing community gardens with free or low-cost use of public property, land leases, or outright land dedication.

In another case in San Jose, California, specific health advantages due to increased physical activity and eating fresh vegetables and fruits have been established among community gardeners. Compared to non-gardeners, those engaging in gardening consume far more vegetables. The prospect of improved health can motivate people to participate in community gardening activities (Algert et al., 2016). Nevertheless, waitlists and limited availability, cost and affordability, and maintenance and resource management are some of the challenges that community gardens in San Jose need to overcome. Maintaining soil fertility over time is crucial, as it can impact the quality and yield of crops. Additionally, they may need to purchase fertilizer or soil amendments independently, which can be a financial burden (Reese, 2021).

In China, the community gardens established in 2010 have involved citizens in their construction and management. Shanghai, a representative of the country's many high-density and rapidly growing cities, has introduced such changes in an attempt to achieve sustainable growth. Several documents have been issued regarding the mobilization of citizen initiatives to create a healthy environment. The Shanghai Urban Regeneration Implementation Measures

Policy, which proposed people-oriented approaches to improve public space and neighbourhood revitalization, marked an evolution in the urban regeneration paradigm from land expansion to enhancing the quality and efficiency of land use in old urban areas (Kou et al., 2019; Zhong & Chen, 2017). In terms of community gardens under the Shanghai Urban Regeneration policy, challenges that are being identified include legitimacy issues, capacity building, urban renewal models, differentiated community needs, informal urban gardening, balancing public participation and professional interventions (Kou et al., 2019; Lu & Lu, 2022; Xie & Xing, 2024). Urban gardening policies in China primarily focus on community gardens but lack research on the distinct needs of different urban gardeners, such as urban natives and migrants. This lack of understanding can lead to ineffective policy implementation (Xie & Xing, 2024).

In Malaysia, Since the early 2010s, the government has been preparing to transform Malaysia into a Garden Nation by 2020 (National Landscape Department, 2011). A National Landscape Guideline has been developed to achieve this vision. At the state level, the Selangor State Government, through all the local authorities in the state, has implemented community gardens under the Local Agenda 21 Action Plan to encourage agricultural activities among urban residents (Abidin et al., 2016). These community gardens act as organizations that promote local food production and agricultural product supply to boost the community's economy.

The authors observed one of these community gardens in Bukit Bandaraya, U12 Shah Alam City, Selangor). It is under the Shah Alam City Council (MBSA) supervision. Although the U12 Bukit Bandaraya community garden is located beside a sewage treatment plant and a monsoon drain, it is clean, green, and beautifully well-managed by the local community.

From the review, Malaysia has also faced issues with community gardens in urban regeneration, such as weather fluctuations, access to land, financial problems, lack of commitment, increased pests, and technical factors such as education level (Chong et al., 2024; Ishak et al., 2022; Zainal & Rosmiza, 2021). The lack of commitment from some individuals is another problem that can hinder the overall success of community garden initiatives. From the comparison of US, China and Malaysian cases, the most common challenges facing community gardens in urban regeneration cases are lack of commitment/ awareness/ participation, cost and affordability, land and open space rights, and other cultural barriers.

METHODOLOGY

In this study, the single case study method was applied (Yin, 2018) and the mixed-methods approach was used (Creswell & Creswell, 2018). The single case study method focuses on a particular case, and a deep investigation is conducted by collecting data from multiple sources and presenting the findings through

triangulation (Yin, 2018), such as Xie and Xing (2024) focused on Chongqing city, and Ishak et al. (2022) focused on Kuala Lumpur. The authors selected the community garden case under the Special Area Action Plan (SAAP) Section 13, Petaling Jaya City, Selangor State, Malaysia. The selection rationale is this initiative is in the primary proposal stage and seeking to draw lessons on how to plan the early stages of community gardens better. The following sub-section explains the case study, data collection, and analysis approach.

The Case Study of Section 13, Petaling Jaya City

Petaling Jaya (PJ) was a satellite city planned 60 years ago to cater for the working population spillover from the Kuala Lumpur conurbation that had occurred since independence. PJ began with the development of a commercial area, community centres, and industrial area, and it has now evolved into a mature city with a vibrant city image. As it is an old city, numerous of its public spaces were abandoned, under-utilized, or unable to compete with developing environments. One example in the city centre is Section 13 in the old industrial area, along with its surrounding monsoon drain area along Sungai Penchala.

To regenerate unoccupied public spaces, Majlis Bandaraya Petaling Jaya (MBPJ) decided to gazette the Section 13 area in 2013 and execute an SAAP in 2019, aiming to revitalize the industrial and water elements of Sungai Penchala, improve walking connectivity from Section 13 to Section 51, and add new images and value to the local communities (Majlis Bandaraya Petaling Jaya, 2019). The SAAP comprises three major parcels: the Business, Linear Park, and Knowledge-Based Parcels. The Linear Park proposal along the monsoon drain of Sungai Penchala (within the Jalan 13/6 and Jalan 13/4 industrial area) consists of a community garden, wetland, a floodgate, a wading pool, a bioswale, and a weir bridge

The authors observed the current condition of the proposed Linear Park and community garden area, which is located between the buildings of Hospital Columbia and the Pharmaceutical Services Division owned by the Ministry of Health Malaysia and runs along the reserve of the Sungai Penchala monsoon drain. The area was full of bushes and lacked maintenance, and frequent blockages occurred due to rubbish dumping (refer to Figure 1).

Figure 1: The existing condition of the proposal Linear Park and Community Garden
Source: The authors

Data Collection and Analysis Approaches

The data was obtained using a mixed method of qualitative and quantitative research. The quantitative approach utilized questionnaire surveys, and the qualitative approach involved stakeholder interviews. The questionnaire survey design was divided into four parts: 1) respondents' profiles, 2) respondents' knowledge of the proposed project, 3) satisfaction level (marked on a five-point Likert scale) of the proposed project, and 4) opinions. The semi-structured interview protocol was designed to verify the quantitative data and address the challenges. This protocol was divided into three sections: 1) understanding the status of the community garden initiative, 2) examination of community members' levels of satisfaction with the community garden initiative, and 3) proposed strategies for the community garden initiative in Section 13 Petaling Jaya.

To analyze the data, descriptive statistics were applied to the collected quantitative data using SPSS version 25. Meanwhile, for the qualitative interviews, thematic analysis was executed using Atlas.ti version 23 and various themes were formed. The current population of PJ is 619,925 (Majlis Bandaraya Petaling Jaya, 2019). For the questionnaire survey sampling size, 200 samples were collected to achieve a confidence level of 95%, at the precision level of ±7% (Israel, 1992). Stratified random sampling was applied to collect questionnaire responses in three different areas: Area A (upper left of Jalan 13/6), Area B (central area between Jalan 13/6 and Jalan 13/4), and Area C (bottom right of Jalan 13/4). The data collection was undertaken from May to December 2023.

For the stakeholder interviews, snowball sampling was applied to informants from different backgrounds, including the government, residents, the private sector, and NGOs. The interviews ceased when the informant count reached eight because the answers began to repeat and the content had reached saturation (Laher & Botha, 2012). The interviews were conducted from September 2023 to February 2024, each lasting for half an hour and one hour.

FINDINGS

The study findings are explained in two subsections: 1) quantitative results from the questionnaire survey and 2) qualitative results from the interviews.

Quantitative Questionnaire Survey Results

For the quantitative questionnaire survey, of the 200 samples, the respondents were nearly equal in terms of gender (male 53%; female 47%) and consisted of both locals (45%) and outsiders (55%) who were active in the study area. The outsiders include those not staying but working in the factories in Section 13, PJ, Selangor. In terms of their age groups, the highest number of respondents were aged 30-39 years old (37%) and the smallest age group were those between 40 and 49 years old (4%). The majority of respondents were Malay (67%), married (65%), and working in the private sector (53%)

Respondents' knowledge of and satisfaction with the urban regeneration initiative

Based on the survey, the majority (68.3%) of the respondents did not know about the community garden–urban regeneration initiative along the monsoon drain of Sungai Penchala. Those who were aware had noticed the general urban regeneration initiative through construction signboards and construction activities in industrial areas (30%) (refer to Figure 2).

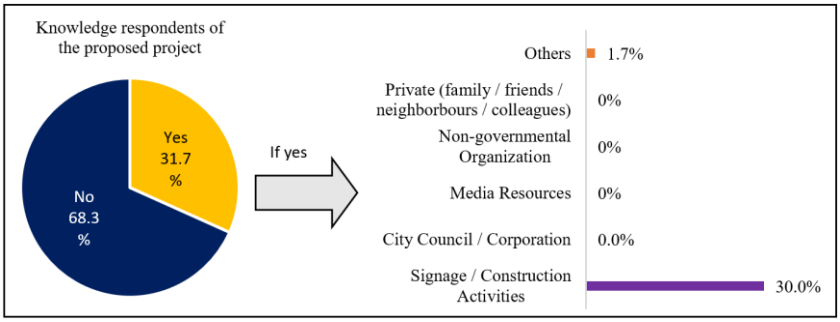


Figure 2: Respondent's knowledge of the Seksyen 13, Petaling Jaya urban regeneration initiative.
Source: The authors

As for the levels of satisfaction with the community garden and other initiatives under the Linear Park Parcel, the survey results showed that community gardening activities were the least satisfying item (3.03 mean value) of all those listed (refer to Table 1). Some respondents mentioned that, firstly, the location of the proposed community garden is in a steep area that is lower than the road level and, secondly, it lacks a staircase and hand bars along the monsoon

drain. They had safety concerns and thought that this was not a suitable or strategic area in which to develop a community garden.

Table 1: The satisfaction level of the Linear Park initiatives

Item	Scale					Mean	Total
	1	**2**	**3**	**4**	**5**		
- Safe and well-planned recreational facilities area	0 (0%)	4 (4.0%)	16 (16.0%)	43 (43.0%)	37 (37.0%)	4.13	100
- Effective drainage management system in Section 13, Petaling Jaya	0 (0%)	5 (5.0%)	48 (48.0%)	30 (30.0%)	17 (17.0%)	3.59	100
- The Wading Pool is safe for kids	1 (1.0%)	11 (11.0%)	50 (50.0%)	31 (31.0%)	7 (7.0%)	3.32	100
- Active community gardening activities in the surrounding Penchala River area	7 (7.0%)	19 (19.0%)	49 (49.0%)	14 (14.0%)	11 (11.0%)	3.03	100

Note: 1 is the least satisfying, 5 is the most satisfying *Source: The authors*

Respondents' opinions on the community garden–urban regeneration initiative
Based on the survey, most respondents (23%) stated that the proposed community garden might help them fill their free time doing simple farming. The second most common response (15% of respondents) was support for the idea that the garden might strengthen relationships and unity among the surrounding community in Section 13, PJ. The third opinion (10% of respondents) was that the community garden could generate income for residents through cultivation.

Qualitative Interview Results
This second stage, the qualitative interviews, involved exploring in more detail the statistical findings from the first stage. Eight respondents from different backgrounds, i.e., two local authority officials (LA), two government official (G), two private-sector employees (P), two residents (R), and one NGOs (N) - were selected. A variety of backgrounds is important to represent the diverse voices of stakeholders. The informants' real names and organizations were not disclosed to protect their privacy and safety (Creswell & Creswell, 2018). Themes were formed according to the research questions, as explained in the introduction.

When answering the first research question about the status of the community garden initiative developed under the urban regeneration of Special Area Action Plan Section 13, PJ, the local authority official mentioned that the community garden was in the proposed stage and did not yet have a detailed layout design, "*The project of a community garden is not started yet, even the layout of the project is not prepared. Why? Because the meeting was not being called."* (LA1)

Another local authority official (LA2) added that nobody from the local authority had visited the site (at the time of the survey), and part of the proposed

area was the private property of factory owners. The government official (G1) from the Pharmaceutical Services Division, Ministry of Health also confirmed that they had never heard of the proposed community garden next to their buildings. If MBPJ wished to execute that initiative, they would need consent from the Ministry of Health because the reserve area was managed by them. None of the other non-government informants – the private hospital manager (P1), the resident (R1), and the non-governmental organization (NGO) staff (N1) - were aware of the proposed community garden initiative but they supported it.

When answering the second question concerning the community levels of satisfaction with the community gardening initiative in Section 13, PJ, two residents (R1 and R2) strongly welcomed and were satisfied with the proposal. They suggested that MBPJ conduct more awareness campaigns about that project and address the safety issues facing those involved in urban farming. The private-sector employee (P2) was also satisfied with the proposal but cautioned that MBPJ needed to ensure the crowd would not affect the hospital's operations. Informant P2 also added another concern that the proposed land was held by private factor owners, hospitals, and the Ministry of Health, saying that both time and consensus would be needed for all parties to agree to and support the proposal.

Regarding the third question about how the community gardening initiative in Section 13, PJ can be improved, LA1 mentioned that MBPJ lacked supporting documents for the community garden project and said that very few members of the public knew about it. She emphasized that no stakeholders had yet taken responsibility for the project. On the issue of overseeing the project, N1 was very willing to help and connect the residents to MBPJ, and they were waiting for MBPJ to call them to discuss the project.

DISCUSSION

Based on the findings, the responses to the community garden proposal were positive, while the concerns were related to enhancing healthy lifestyles, creating social relationships, and generating side income. None of the respondents touched on food security issues. These findings are compatible with those obtained by Liao and Liu (2023) and Shach-Pinsly (2022), whereby community garden–urban regeneration can enhance healthy lifestyles and social interaction among the elderly community. However, some residents might believe that such a community garden is a micro-scale form of urban farming, while the cultivation output might be only for self-consumption and be unable to sustain the food security of the whole community, as imagined by Cattivelli (2023) and Chong et al. (2024) or discussed in the context of the COVID-19 outbreak by Murdad et al. (2022).

From the quantitative survey findings, the community garden was the least satisfying item of the Linear Park initiatives. This finding did not mean that

the community garden was not welcomed by the local community; it just reflects a lack of awareness of the benefits of urban farming. The respondents did not support it because they thought it would be dangerous to conduct farming activities along the 20-foot-wide monsoon drain. However, in the authors' opinion, that safety issue could be resolved by redesigning the river reserve with handrails along the monsoon drain, a pavement walkway, a non-slippery staircase, signboards, and fencing for the compound.

Most importantly, according to the authors' idea, approximately 123 garden boxes, each measuring 4'x8' in size, could be designed to accommodate the suggested 0.26-acre site. With this number of garden boxes, the site could be divided into different segments for communities or families, and residents could plant whatever vegetables they like. Moreover, resting gazebos, store rooms, benches, and children's playgrounds could be provided to make the gardening site more inclusive, multi-purpose, and attractive. Referring to the successful case of the community garden in Bukit Bandaraya, U12 Shah Alam, water sources could be easily accessed from the monsoon drain, and the soil along it is fertile and suitable for vegetable planting.

Based on the qualitative interviews, MBPJ was yet to find caretakers for the community garden initiative. Upon receiving instruction from the management, MBPJ will roll out awareness campaigns, improve the safety facilities, and connect to NGOs or residents' associations; this community garden will then become another success story of the Section 13 community. Informants from civil society also support the initiative and have volunteered to champion the project. As learned from the cases in Denver and San Jose, urban farming activities can also cultivate local leadership and voluntarism among the community, which is essential for cohesive community development (Alaimo et al., 2023; Algert et al., 2016). Other than that, the land rights/ ownership involves both public and private parties (Ishak et al., 2022; Zainal & Rosmiza, 2021), which could be an issue for the proposed community garden initiative. However, this could be resolved with deliberation and stakeholder participation.

The above findings and discussion are summarised in the thematic diagram shown in Figure 3. First, the issues facing the community garden–urban regeneration include low awareness, safety concerns, and reserved land ownership. Second, regarding the satisfaction levels, the community is satisfied and supportive. Third, future improvement can only be ensured through stakeholder participation, i.e., taking part in awareness campaigns, involvement in safety infrastructure designs, and volunteering as caretakers.

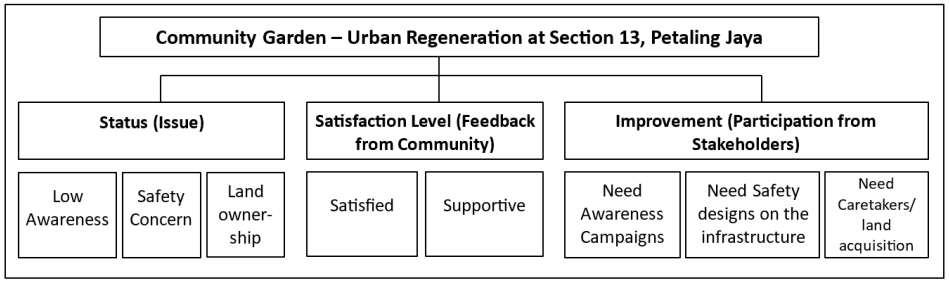


Figure 3: The thematic diagram of the community garden–urban regeneration initiative
Source: The authors

CONCLUSION

This study demonstrates that urban regeneration is an important instrument for fourth-tier community planning in developing countries. Intervention in this under-utilized, unoccupied public space, i.e., the monsoon drain reserve in this case study from Malaysia, could mean this functional community garden becomes a genuine proposal. Although it is still in the initial proposed stage, the quantitative and qualitative survey results indicate its potential for improving healthy lifestyles and enhancing social interaction among the community, as well as creating income for the community by harvesting the cultivated food. Evidently, the community garden projects in Shanghai (China), Denver, and San Jose (United States) have improved the environmental health of the respective communities, with vacant barren plots transformed one after another into gardens that are shared by residents and that have aesthetic, ecological, and social functions. The increased social exchange among neighbours and people's proximity to nature should promote harmonious neighbourhood relations, community cohesion, and residents' mental health (Kou et al., 2019).

This study reveals that the community garden project faces issues - such as a lack of public awareness, poor safety along the monsoon drain, and reserved land ownership - which are worth considering by the local authorities. These can be solved by encouraging participation and deliberation from all stakeholders. The limitations of this study could be the single case study, the small sample size, and the lack of a detailed proposed layout for planning the community garden and determining the execution and management of the initiatives. Thus, further study could be carried out involving cross country multiple case studies, a larger sample size for generalization, and design-based analysis of the detailed community garden layout and the execution and management plans for effectively sustaining the initiatives. In brief, this study contributed important evidence regarding urban farming regeneration initiatives, particularly in relation to fourth-tier-community-based micro-planning in developing countries, and how to plan the early stage of community garden better.

ACKNOWLEDGEMENTS

The authors would like to thank Universiti Teknologi MARA (UiTM) for funding this research through the 600-RMC 5/3/GPM (012/2023) grant and Universitas Negeri Malang for supporting the research.

REFERENCES

Abidin, N. I., Zakaria, R., Aminuddin, E., Saar, C. C., Munikanan, V., Zin, I. S., & Bandi, M. (2016). Malaysia's Local Agenda 21: Implementation and approach in Kuala Lumpur, Selangor and Johor Bahru. *IIOAB Journal*, *7*(1), 554–562.

Alaimo, K., Beavers, A. W., Coringrato, E., Lacy, K., Ma, W., Hurley, T. G., & Hébert, J. R. (2023). Community gardening increases vegetable intake and seasonal eating from baseline to harvest. *Current Developments in Nutrition*, *7*(5), 100077.

Algert, S., Diekmann, L., Renvall, M., & Gray, L. (2016). Community and home gardens increase vegetable intake and food security of residents in San Jose, California. *California Agriculture*, *70*(2), 77–82.

Cattivelli, V. (2023). Review and analysis of the motivations associated with urban gardening in the pandemic period. *Sustainability*, *15*(3), 1–18.

Chong, N. O., Nawawi, F. N., Ali, M. M., Ahmad, M. S., & Juhari, S. K. (2024). Urban agriculture activities scenario in relation to food security. *Planning Malaysia*, *22*(2), 307–319.

Creswell, J. W., & Creswell, J. D. (2018). *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches, Fifth Edition*. California: Sage.

Denver Urban Gardens. (2012). Growing Community Gardens: A Denver Urban Gardens' best practices handbook. Retrieved May 10, 2024, from https://dug.org/wp-content/uploads/2015/02/Best-Practices.pdf

Diaz, J. M., Webb, S. T., Warner, L. A., & Monaghan, P. (2018). Barriers to community garden success: Demonstrating framework for expert consensus to inform policy and practice. *Urban Forestry and Urban Greening*, *31*, 197–203.

Djan, M. A. (2023). *Exploring the Role of Community Gardens in Addressing Food Insecurity*. Master thesis, New Mexico State university.

Ferris, J., Norman, C., & Sempik, J. (2001). People, land and sustainability: Community gardens and the social dimension of sustainable development. *Social Policy and Administration*, *35*(5), 559–568.

Figueiredo, Y. D. dos S., Prim, M. A., & Dandolini, G. A. (2022). Urban regeneration in the light of social innovation: A systematic literature review. *Land Use Policy*, *113*, 105873.

Firth, K. (2024). A more nature based masterplan: how urban farming improves our cities. Retrieved May 6, 2024, from https://www.arup.com/perspectives/a-more-nature-based-masterplan-how-urban-farming-improves-our-cities

Guillermo, B., Jan, V., Han, V., & Irena, K. (2023). Smart building and district retrofitting for intelligent urban environments. In P. Droege (Ed.), *Intelligent Environments (Second Edition)* (pp. 23–24). North-Holland: Science Direct.

Hausner, V. A. (1993). The future of urban development. *RSA Journal*, *141*(5441), 523–533.

Ishak, N., Abdullah, R., Rosli, N. S. M., Majid, H., Halim, N. S. A. A., & Ariffin, F. (2022). Challenges of urban garden initiatives for food security in Kuala Lumpur,

Malaysia. *Quaestiones Geographicae*, *41*(4), 57–72.
Israel, G. D. (1992). Determining sample size. *Fact Sheet PEOD-6*, 1–5.
Kementerian Pembangunan Kerajaan Tempatan. (2023). Siaran Media - KPKT Perkenal Garis Panduan Pelaksanaan Pembaharuan Semula Bandar. Retrieved February 2, 2024, from https://www.kpkt.gov.my/kpkt/resources/user_1/media_akhbar/2023/SM_GP_PEMBAHARUAN_SEMULA_BANDARPLANM.pdf
Kou, H., Zhang, S., & Liu, Y. (2019). Community-engaged research for the promotion of healthy urban environments: A case study of community garden initiative in Shanghai, China. *International Journal of Environmental Research and Public Health*, *16*(21), 4145.
Laher, S., & Botha, A. (2012). Methods of sampling. In C. Wagner, B. Kawulich, & M. Garner (Eds.), *Doing Social Research: A Global Context* (pp. 86–99). Berkshire: McGrawHill.
Liao, Z., & Liu, M. (2023). Critical barriers and countermeasures to urban regeneration from the stakeholder perspective: a literature review. *Frontiers in Sustainable Cities*, *5*, 1115648.
Lu, D., & Lu, H. (2022). Placemaking through community gardens in urban China: Governance models and challenges. Retrieved March 20, 2024, from https://ssrn.com/abstract=4167150
Mabon, L., Shih, W. Y., & Jou, S. C. (2023). Integration of knowledge systems in urban farming initiatives: insight from Taipei Garden City. *Sustainability Science*, *18*(2), 857–875.
Majlis Bandaraya Petaling Jaya. (2019). *Draf Rancangan Kawasan Khas Seksyen 13, Petaling Jaya (Pengubahan 1)*. Petaling Jaya: Majlis Bandaraya Petaling Jaya.
Mohd Anafi, N. F., Mohd Noor, N., & Jaria Maidin, A. (2023). The 4th-tier micro planning development: A review of practices in Malaysia and Turkiye. *Journal of Architecture, Planning & Construction Management*, *13*(2), 82–95.
Muhammad, R. M., Masdek, N. R. N. M., Haimid, M. T., Ponari, S. Z., & Sayuti, Z. (2020). Impact of urban farming technology on urban community in Malaysia. *Economic and Technology Management Review*, *15*, 37–49.
Murdad, R., Muhiddin, M., Osman, W. H., Tajidin, N. E., Haida, Z., Awang, A., & Jalloh, M. B. (2022). Ensuring urban food security in Malaysia during the COVID-19 pandemic—Is urban farming the answer? A review. *Sustainability*, *14*(7), 4155.
National Landscape Department. (2011). *National Landscape Policy*. Kuala Lumpur, Malaysia: Ministry of Housing and Local Government.
Nemoto, E. H., & Biazoti, A. R. (2017). Urban agriculture: How bottom-up initiatives are impacting space and policies in São Paulo. *Journal on Food, Agriculture and Society*, *5*(3), 21–34.
Nik Hashim, N. H., Md. Dali, M., & Alias, A. (2023). Developing Sustainable Urban Regeneration (SUR) evaluation method for the Malaysian context. *Planning Malaysia*, *21*(6), 100–115.
Nowysz, A., Mazur, Ł., Vaverková, M. D., Koda, E., & Winkler, J. (2022). Urban agriculture as an alternative source of food and water security in today's sustainable cities. *International Journal of Environmental Research and Public Health*, *19*(23), 15597.

PlanMalaysia. (2022). *Kamus Perancangan Bandar Dan Desa*. Retrieved from https://medium.com/@arifwicaksanaa/pengertian-use-case-a7e576e1b6bf

Reese, M. (2021). San Jose's community gardens fight food insecurity, build connections. Retrieved December 30, 2023, from https://www.sanjoseinside.com/news/san-joses-community-gardens-fight-food-insecurity-build-connections/

Robert-Boeuf, C. (2023). Promoting rural regeneration and sustainable farming near cities thanks to Facilitating Operators in France? The case of the Versailles Plain's Association Governance Model. *Sustainability*, *15*(9), 7219.

Roberts, P. (2017). The evolution, definition and purpose of urban regeneration. In P. Roberts, H. Sykes, & R. Granger (Eds.), *Urban Regeneration, A Handbook, 2nd Edition* (pp. 9–43). London: Sage.

Saldivar-Tanaka, L., & Krasny, M. E. (2004). Culturing community development, neighborhood open space, and civic agriculture: The case of Latino community gardens in New York City. *Agriculture and Human Values*, *21*(4), 399–412.

Saporito, E. (2017). OrtiAlti as urban regeneration devices: An action-research study on rooftop farming in Turin. *Journal on Food, Agriculture and Society*, *5*(1), 59–69.

Shach-Pinsly, D. (2022). Three strategies of urban renewal for One National Outline Plan TAMA38: The impact of multiparametric decision-making on neighborhood regeneration. *Architecture*, *2*(4), 616–636.

Tallon, A. (2021). *Urban Regeneration in the UK - Third Edition*. London and New York: Routledge Taylor.

Vigneswarasamy, S. (2023). NPC 2023: Micro planning needed to allow city inhabitants to shape their communities. Retrieved May 2, 2024, from https://www.edgeprop.my/content/1907684/npc-2023-micro-planning-needed-allow-city-inhabitants-shape-their-communities

Wang, H., Zhao, Y., Gao, X., & Gao, B. (2021). Collaborative decision-making for urban regeneration: A literature review. *Land Use Policy*, *107*, 105479.

Xie, Y., & Xing, Z. (2024). Adapting to urban gardening in China: how will policymaking help migrant and native gardeners? *Frontiers in Sustainable Food Systems*, *7*, 1287150.

Yin, R. K. (2018). *Case Study Research and Applications: Design and Methods (Sixth Edition)*. Thousand Oaks, California: Sage.

Zainal, M., & Rosmiza, M. Z. (2021). The exploration of social assets condition among urban farmers of the community garden in Klang Valley, Malaysia. *Int. Jour. of Asian Social Science*, *11*(1), 56–64.

Zhong, X., & Chen, X. (2017). Demolition, rehabilitation, and conservation: heritage in Shanghai's urban regeneration. *Journal of Architecture and Urbanism*, *41*(2), 82–91.

Received: 30th June 2024. Accepted: 10th September 2024

PLANNING MALAYSIA:
Journal of the Malaysian Institute of Planners
VOLUME 22 ISSUE 5 (2024), Page 111 – 125

THE ROLE OF URBAN GREEN SPACE IN PROMOTING SUSTAINABLE DEVELOPMENT: A STUDY ON PUTRAJAYA, MALAYSIA

Nurfarhana Mohd Nor[1], Syazwani Sahrir[2]

[1,2] *Department of Environment,*
Faculty of Forestry and Environment,
UNIVERSITI PUTRA MALAYSIA

Abstract

Urban Green Spaces (UGS) contribute to sustainable development, a key goal for every country, encompassing social, economic, and environmental aspects. This study involves two objectives: to identify the elements of UGS that contribute to sustainable development and to explore the role of UGS in contributing to sustainable development. A qualitative research design was chosen to achieve these objectives using document analysis (from official reports, journals, and analyses) and semi-structured interviews. The study's findings show that UGS plays a role in contributing to sustainable development involving environmental, social, and economic dimensions, explained through data triangulation. The elements of UGS identified include buffer zones, conservation green spaces, recreational/community green spaces, amenity green spaces, greenways, building greens, agricultural land, and blue areas. Additionally, the roles of UGS in environmental aspects include air quality benefits, water quality benefits, ecological functions, and support for local nature; in social aspects, they enhance interpersonal relationships, recreational activities, human health, human well-being, educational functions, and overall quality of life; in economic aspects, they contribute to market values. UGS is a crucial component of sustainable urban planning, essential for fostering cities that are both sustainable and resilient. Its multifaceted contributions to environmental health, social interaction, and economic vitality highlight its indispensable role in creating healthier, happier, and more resilient urban environments.

Keywords: Sustainable Development, Urban Green Space, Element of Urban Green Spaces, Role of Urban Green Spaces, Green city

[2] Senior Lecturer at Universiti Putra Malaysia. Email: syazwani_sahrir@upm.edu.my

INTRODUCTION

Sustainable development aims to maintain the future by preserving and conserving the environment during continuous development (Yusliza et al., 2020). It is created in an area to meet sustainable criteria without negatively impacting the environment in the long term for future generations. Due to the increase in environmental issues linked to human behaviour (Yusliza et al., 2020), this forces the population of a country to increase efforts in protecting the environment. Therefore, with various roles, green space needs to be applied in a city because it can be seen that most cities are now more rapidly developing than green areas. Green spaces are one of the criteria that must be met to design sustainable development (Ke et al., 2023; Nor & Abdullah, 2019).

As populations become increasingly urbanised, the preservation of UGS becomes paramount. UGS is not just dedicated recreational space such as a public park but also includes other types of informal green space. Despite the potential of cross-sectional evidence, we know little about how to design new UGS, improve, or promote existing UGS. Today, more than half of the world's population lives in cities due to various factors that make cities the main centres for urban, suburban, and rural populations. By 2050, it is estimated that 7 out of 10 people will likely live in urban areas. This reinforces the importance of UGS in promoting sustainable development. The role of UGS is unclear, as it is of essential significance in sustainable development. The second problem statement that can be constituted is the lack of research on the role of UGS in encouraging sustainable development. Green cities are one of the solutions to the challenges and problems that occur due to human activity, which is rapid development in urban areas.

LITERATURE REVIEW

Sustainable Development

The three pillars (3P) of sustainable development—the economic, environmental, and social pillars—are relevant entry points for identifying issues and developing green economic policies. Goal 12 of the Sustainable Development 2030 Agenda mentions the need to create awareness of sustainable development among people worldwide and promote a healthy lifestyle. Effective, sustainable development benefits a country or an area by allowing them to continue enjoying the environment and people's well-being (Sahrir et al., 2022).

Table 1: Latent of Sustainable Development

Latent/Component	Indicators/Item	Source
Sustainable development	Preserving and conserving the environment	Khoshnava et al., 2019; Yusliza et al., 2020; Muhamad Nor et al., 2021
	Protecting the natural environment	
	Promote a healthy lifestyle	

Latent/Component	Indicators/Item	Source
	Criteria for green spaces that meet sustainable development	Nor & Abdullah, 2019; Ke et al., 2023

Sustainable Development Goals (SDGs)

The SDGs are a collection of 17 interrelated objectives designed to serve as a "shared blueprint for peace and prosperity for people and the planet now and in the future" (Abastante et al., 2021; Khoshnava et al., 2019). The SDGs emphasise sustainable development's interrelated environmental, social, and economic aspects by placing sustainability at the center. SGD11 and SDG8 are highlighted or prioritised, namely "Sustainable cities and communities" (SDG11) and "Decent work and economic growth" (SDG8). SDG3 is related to the UGS "Good health and well-being."

Elements of Urban Green Space (UGS)

The priority of the UGS function is to maintain green areas, such as areas covered with green plants, rivers, or lakes, for the benefit of future generations. The theme elements of UGS include buffer zones, conservation green space, recreational / community green space, amenity green space, green-way, building greens, agricultural land, and blue areas. Element buffer zones, such as green belts, while conserving green space, including lawns and green lungs/forests.

Table 2: Element of UGS

Elements/Component	Indicators/Item	Sources
Conservation green space	Lawns	Muhamad Nor & Abdullah, 2018; UNICEF, 2021; Sangwan et al., 2022
	Green belts (buffer)	Muhamad Nor & Abdullah, 2018; Sangwan et al., 2022; Biodiversity, 2022
	Reserved forest	
	Protected forest	
	Wetlands	
Recreational / community green space	Parks and open spaces	Muhamad Nor & Abdullah, 2018; Jennings and Bamkole, 2019, Venter et al., 2020; UNICEF, 2021; Sangwan et al., 2022; THRIVE, 2022
	Sports centers and playgrounds/tot-lots	Muhamad Nor & Abdullah, 2018; Jennings and Bamkole, 2019; UNICEF, 2021; Palliwoda and Priess, 2021; Sangwan et al., 2022; Biodiversity, 2022; THRIVE, 2022
	Botanical and zoological parks	Sangwan et al., 2022; Biodiversity, 2022

Elements/Component	Indicators/Item	Sources
	Water bodies/other natural features/lake	Muhamad Nor & Abdullah, 2018; Venter et al., 2020; Sangwan et al., 2022; Biodiversity, 2022
	Places of tourist interested strip	Muhamad Nor & Abdullah, 2018; Venter et al., 2020; Sangwan et al., 2022
Amenity green space (residential)	Neighbourhood parks and gardens	Muhamad Nor & Abdullah, 2018; UNICEF, 2021; Palliwoda and Priess, 2021; Sangwan et al., 2022; Biodiversity, 2022; THRIVE, 2022
	Outdoor sports areas	Muhamad Nor & Abdullah, 2018; Palliwoda and Priess, 2021; Sangwan et al., 2022
	Green street space	Muhamad Nor & Abdullah, 2018; UNICEF, 2021; Palliwoda and Priess, 2021; Sangwan et al., 2022; THRIVE, 2022
	Green roofs/greenery at commercial buildings/greenery at housing estates	Muhamad Nor & Abdullah, 2018; UNICEF, 2021; Sangwan et al., 2022; Biodiversity, 2022; THRIVE, 2022
	Private green space	Muhamad Nor & Abdullah, 2018; UNICEF, 2021, Sangwan et al., 2022
	Courtyard	
Greenway		Muhamad Nor & Abdullah, 2018; Jennings and Bamkole, 2019; Auchicloss et al., 2019; Sangwan et al., 2022

Role of Urban Green Space

UGS, agreed upon by ecologists, economists, social scientists, and planners, are public and private open areas in urban areas, mainly covered by vegetation, which are directly or indirectly available for use (Karade R.M. et al., 2017).

Role of UGS (Environmental aspect)

The role of UGS in environmental aspects includes environmental conservation biodiversity and nature conservation as well as ecological benefit/maintaining ecological balance. Another role of UGS in the environmental aspect is to improve urban climate, which contributes to mitigating and reducing the UHI effect and can serve as pollution control and enhance the quality of air and

moderate temperatures. UGS also play essential roles in cleaning urban water, reducing surface runoff, increasing carbon storage, and reducing noise.

Table 3: Role of UGS in Environmental Aspect

Latent/Component	Indicators/Item	Source
Environmental aspect of UGS role	Pollution control/improve air quality	Karade et al., 2017; Maes et al., 2019
	Biodiversity and nature conservation	Karade et al., 2017; Maes et al., 2019; Kasim et al., n.d.;
	Ecological benefit/maintaining ecological balance	Karade et al., 2017; Kasim et al., n.d.; Ke et al., 2023
	Improve urban climate	Kasim et al., n.d.; Ke et al., 2023
	Reducing the urban heat island effect	Romanello et al., 2021; Ke et al., 2023
	Cleaning urban water	Ke et al., 2023
	Reducing surface runoff	Ke et al., 2023
	Increasing carbon storage	Ke et al., 2023
	Moderate temperatures	Romanello et al., 2021
	Reduce noise	Maes et al., 2019

Role of UGS (Social aspect)

Based on the related studies, the role of the social aspect is recreation and well-being / social well-being. UGS play a role in human health/reducing mortality and morbidity from chronic diseases; these spaces provide opportunities for exercise, reducing the risk of obesity and chronic illnesses as well as mental well-being because green spaces have a positive impact on mental health, reducing stress, anxiety, and depression by providing serene environments for relaxation and recreation. Another role is physical exercise. The social aspect's role is to improve the quality of people's lives.

Table 4: Role of UGS in Social Aspect

Latent/Component	Indicators/Item	Source
Social aspect of UGS role	Recreation and well-being / social well-being	Karade et al., 2017; Wang et al., 2019; Turo and Gardiner, 2020; Jabbar et al., 2021; Ke et al., 2023; Kasim et al., n.d.
	Reducing mortality and morbidity from chronic diseases	Karade et al., 2017; Wang et al., 2019; Ke et al., 2023; Kasim et al., n.d.
	Mental well-being	Wang et al., 2019; EEA, 2020; Ke et al., 2023; Fransen, 2023
	Physical exercise	Fransen, 2023

Latent/Component	Indicators/Item	Source
	Reducing obesity	EEA, 2020
	Improving the quality of people's lives	Jabbar et al., 2021; Ke et al., 2023; Fransen, 2023

Role of UGS (Economic aspect)

Involving demand, proximity to well-maintained green areas often leads to an increase in energy savings and property value in real estate values in urban areas while involving financial supply in maintaining beautification and attractiveness, as well as green spaces as safety tools. UGS also creates job opportunities related to its maintenance, landscaping, event management, and tourism-related services, which can be valuable to economic improvement.

Table 5: Role of UGS in Economic Aspect

Latent/Component	Indicators/Item/	Source
Economic aspect of UGS role	Energy savings	Karade et al., 2017
	Property value	
	A valuable asset to economic improvement	Kasim et al., n.d.
	Beautification and attractive	Turo and Gardiner, 2020; Kasim et al., n.d.
	Green spaces as safety tools	

Green city

The concept of a "Green City" is one of the latest findings from various efforts and research to address the problems caused by the dispersed urban development model (Danjaji, A. S. et al., 2021).

RESEARCH METHODOLOGY

The research design used is a qualitative method to have a deep understanding and develop knowledge of the role of UGS. By capturing the subtleties and complexities of research contexts, qualitative approaches can assist in developing a comprehensive understanding of the role of UGS as the main theme in this study.

Document analysis and thematic analysis were used for the data analysis. Through a comprehensive examination of various urban features and planning initiatives, the study identifies and outlines key elements, shedding light on the elements contributing to UGS. The second objective is to discuss the role of UGS in meeting sustainable development goals. The findings explain how implementing UGS contributes to sustainable development across three aspects: environmental, social, and economic. The case study is Putrajaya, one of Malaysia's areas known for sustainable landscape design. As a park and smart city, 38% of the area has been reserved for green areas, emphasising the enhancement of the natural landscape (Chowdhury, n.d).

ANALYSIS AND DISCUSSION

Tables 6 and 7 show the details of UGS elements and UGS roles: semi-structured interviews, document analysis from different sources, including official reports and journal articles.

Table 6: The Findings of the Research Question and Objective 1

Themes element	Indicators/Item	Document Analysis		Semi-structured interview
		Journal and Article	Report Analysis	
Buffer zones	Green belts	✓	✓	✓
Multifunctional zones	Food production areas	✓		
	Places of tourist interested strip	✓	✓	
Conservation green space	Lawns	✓	✓	✓
	Natural vegetation	✓		
	Peri-urban forests	✓		
	Urban woodlands	✓		
	Natural wildlife areas	✓		✓
	National parks	✓	✓	
	Botanical and zoological parks	✓	✓	
	Green lungs / forests	✓	✓	✓
Recreational / Community green space	Public Park / Urban parks / Metropolitan Park	✓	✓	✓
	Community gardens	✓	✓	✓
	School grounds	✓		
	Sport and play areas	✓	✓	
	Functional playgrounds	✓	✓	
Amenity green space	Local Park	✓	✓	✓
	Residential gardens	✓	✓	✓
	Private Park	✓		
	Play-field / Outdoor sports areas	✓	✓	
	Neighbourhood parks	✓	✓	✓
	Residential area with trees	✓	✓	✓
	Shaded areas	✓	✓	✓
	Soft Landscape		✓	✓
Green-way	Pedestrian Pathways	✓	✓	✓
	Bike-ways	✓	✓	✓
	Street trees	✓	✓	✓
	Roadside vegetation	✓	✓	
	Greenery along rail tracks	✓		
	Green channel	✓		

Themes element	Indicators/Item	Document Analysis		Semi-structured interview
		Journal and Article	Report Analysis	
Building greens	Green roofs	✓	✓	✓
	Green corridor	✓		✓
	Greenery buildings		✓	✓
Grey infrastructure	Sidewalks	✓		
	Street lights	✓		✓
	A bus shelter	✓		✓
	Bus stop benches	✓		✓
	Parkways movement	✓		
	Waqfs			✓
	Hard landscape			✓
Agricultural land	Areas with trees, and/or shrubs	✓		✓
	Grassy lawns	✓	✓	✓
Blue areas	Ponds	✓	✓	
	Lakes	✓	✓	✓
	Wetland	✓	✓	

The UGS elements mentioned are the validity of the methods used, making them the primary elements in UGS that contribute to sustainable development.

Table 7: The Findings of the Research Question and Objective 2

Theme's role	Indicators/Item	Document Analysis		Semi-structured interview
		Journal and Article	Official Report	
Environmental Aspect				
Air benefit	Maintenance of air quality	✓	✓	✓
	Carbon storage	✓	✓	✓
	Producing oxygen	✓	✓	✓
	Regulate rainfall	✓	✓	✓
	Reducing the UHI effect	✓	✓	✓
	Moderate temperatures / Reduction of air temperature	✓	✓	✓
	Reduce carbon footprint	✓	✓	✓
Water benefit	Improve water quality	✓	✓	✓
	Groundwater protection	✓	✓	
	Cleaning urban water	✓	✓	
	Maintain a certain degree of humidity	✓	✓	

Theme's role	Indicators/Item	Document Analysis		Semi-structured interview
		Journal and Article	Official Report	
	Reducing surface runoff	✓	✓	
Land benefit	Soil conservation	✓	✓	
	Stabilising soil	✓	✓	
Ecological functions	Conservation of fauna and flora	✓	✓	✓
	Maintain biodiversity	✓	✓	✓
	Environmental well-being	✓	✓	✓
	Nature conservation	✓	✓	
	Maintaining ecological balance	✓	✓	✓
Healthy urban environmental	Protection against natural hazards	✓	✓	
	Improve the urban climate	✓	✓	✓
	Natural filtration system	✓	✓	
	Maintain the balance of the city's natural urban environment	✓	✓	✓
	Mitigation risk of disaster	✓	✓	✓
	Noise buffering	✓	✓	
Local nature	Nature protection	✓	✓	
	Safety in habitats (flora and fauna also wildlife)	✓	✓	✓
	Conserving a diversity	✓	✓	
Promoting the 3R			✓	✓
Reduce energy consumption			✓	✓
Social Aspect				
Interpersonal relationships	Interaction	✓	✓	✓
	Cultural event			✓
	Gathering	✓	✓	✓
	Restoration and relaxation	✓	✓	✓
Recreation activity	Outdoor activity	✓	✓	✓
	Physical exercise	✓	✓	✓
Human health	Mortality and Morbidity form chronic diseases	✓	✓	✓
	Reducing obesity	✓		
	Support longevity	✓		
Human well-being	Physical well-being	✓	✓	✓
	Psychological well-being	✓		
	Mental well-being	✓		✓
	Social well-being	✓		✓
	Subjective well-being	✓		
	Reducing stress	✓		
	Depression	✓		

Theme's role	Indicators/Item	Document Analysis		Semi-structured interview
		Journal and Article	Official Report	
Social Aspect				
Education Functional	Academic education and research	✓	✓	✓
Improving the quality people's lives		✓	✓	✓
Food safety			✓	✓
Safety and comfort for visitors			✓	
Public awareness			✓	✓
Economic Aspect				
Market values	Property value	✓	✓	✓
	Attract investment	✓	✓	✓
	Valuable asset to economy improvement	✓		
	GDP increase / Economic residential	✓	✓	✓
	Beautification and attractiveness	✓		
	Energy savings	✓		
Green spaces as safety tools		✓		

The roles of UGS stated are the validity and reliability of all methods used, making it the primary role in UGS that contributes to sustainable development. However, the findings state that the role involves environmental and social aspects.

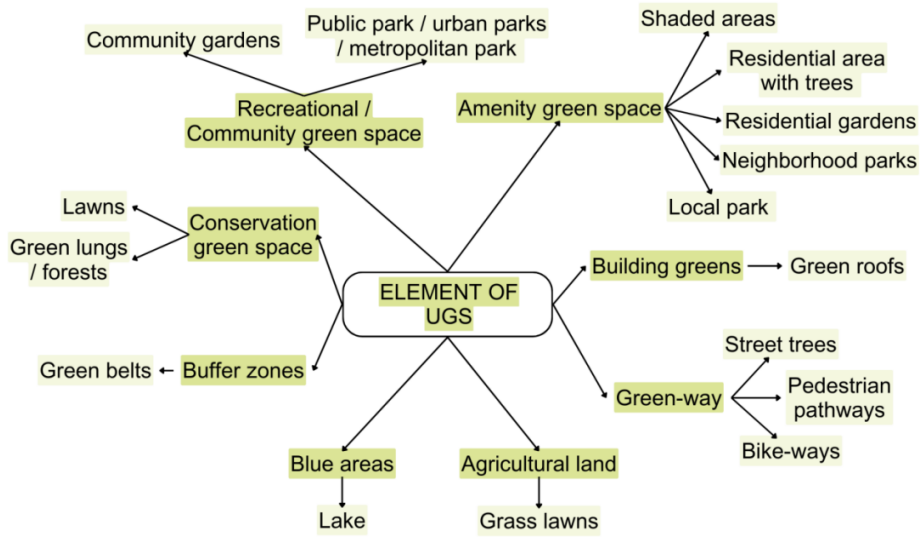


Figure 1: Element of UGS

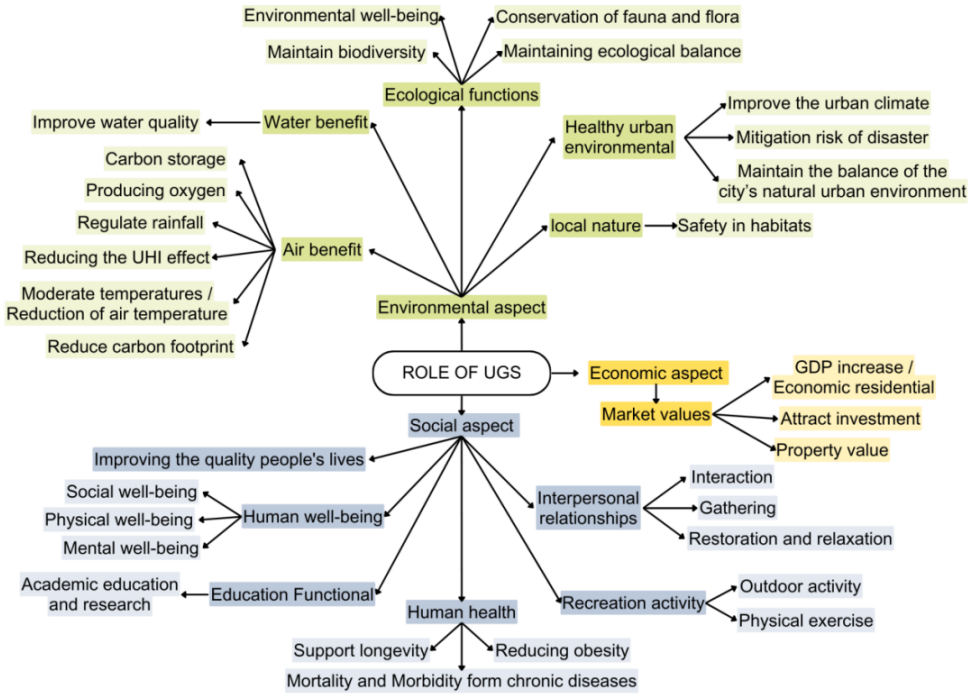


Figure 2: Role of UGS

The issue that prompted this study is the unclear understanding of the role of Urban Green Spaces (UGS) in contributing to sustainable development. It can be concluded that there is a lack of research on how UGS promotes sustainable development. Based on the findings obtained from semi-structured interviews and document analysis from various sources, including official reports, journals, and articles, it is evident that environmental and social aspects are emphasised in achieving sustainable development. Each element involving softscape contributes similarly to sustainable development, while elements involving hardscape have distinct roles that also significantly contribute to social aspects. In planning UGS, it is crucial to consider both softscape and hardscape to foster the relationship between humans and the environment.

CONCLUSION

This study has explored the roles of Urban Green Spaces (UGS) in promoting sustainable development and contributing to environmental, social, and economic aspects. The findings confirm that UGS significantly improves air quality, conserves biodiversity, and fosters social interaction among residents. The study applies three aspects to research the role of UGS, focusing on their elements and contributions toward sustainable urban development, a highly relevant topic.

UGS, known for incorporating green and blue spaces, enhances landscapes, making them more attractive while emphasising the relationship between humans and the environment. The findings of this study aim to expand knowledge about UGS, highlighting their importance and benefits to humans, the environment, ecosystems, and ecology, which are increasingly at risk. The research underscores the need for concerted efforts to improve accessibility, engage communities, and ensure sustainable management practices in UGS initiatives. This comprehensive study of UGS roles spans various environmental, social, and economic dimensions.

In conclusion, UGS is essential to sustainable urban planning, fostering sustainable and resilient cities. Their multifaceted contributions to environmental health, social interaction, and economic vitality highlight its indispensable role in creating healthier, happier, and more resilient urban environments. To maximise their benefits, continued investment, community involvement, sustainable management practices, and equitable access to these spaces are crucial aspects to emphasise in urban planning and development. By implementing recommended strategies and actively involving stakeholders, urban areas can enhance the benefits of green spaces, improving the overall livability and well-being of urban communities. Efforts to protect, develop, and promote UGS are essential for fostering sustainable and inclusive cities for both present and future generations.

REFERENCES

Berglund, E., Westerling, R., & Lytsy, P. (2017). Housing Type and Neighbourhood Safety Behaviour Predicts Self-rated Health, Psychological Well-being and FreAbastante, F., Lami, I. M., & Gaballo, M. (2021). Pursuing the SDG11 targets: The role of the sustainability protocols. *Sustainability (Switzerland), 13*(7). https://doi.org/10.3390/su13073858

Abu Bakar, A., Mustapa, S. I., & Mohammad, N. (2021). Green City: The Lifestyle of Melaka Residents. *Planning Malaysia*. VOLUME (Vol. 19).

Danjaji, A. S., Danladi, M., & Adamu, A. (2021). Urban Green Spaces as Promoters of Healthy Living: Evidence from Putrajaya, Malaysia. https://doi.org/10.21203/rs.3.rs-1166766/v1

García Sánchez, F., & Govindarajulu, D. (2023). Integrating blue-green infrastructure in urban planning for climate adaptation: Lessons from Chennai and Kochi, India. *Land Use Policy*, 124. https://doi.org/10.1016/j.landusepol.2022.106455

Hunter, R. F., Cleland, C., Cleary, A., Droomers, M., Wheeler, B. W., Sinnett, D., Nieuwenhuijsen, M. J., & Braubach, M. (2019). Environmental, health, well-being, social and equity effects of urban green space interventions: A meta-narrative evidence synthesis. In *Environment International* (Vol. 130). Elsevier Ltd. https://doi.org/10.1016/j.envint.2019.104923

Jabbar, M., Yusoff, M. M., & Shafie, A. (2022). Assessing the role of urban green spaces for human well-being: a systematic review. In *GeoJournal* (Vol. 87, Issue 5, pp. 4405–4423). Springer Science and Business Media Deutschland GmbH. https://doi.org/10.1007/s10708-021-10474-7

Kasim, J. A., Johari, M., Yusof, M., Zulhaidi, H., & Shafri, M. (n.d.). THE MANY BENEFITS OF URBAN GREEN SPACES. *CSID Journal of Infrastructure Development, 1*(2), 103–116.

Ke, X., Huang, D., Zhou, T., & Men, H. (2023). Contribution of non-park green space to the equity of urban green space accessibility. *Ecological Indicators*, 146. https://doi.org/10.1016/j.ecolind.2022.109855

Khoshnava, S. M., Rostami, R., Zin, R. M., Štreimikiene, D., Yousefpour, A., Strielkowski, W., & Mardani, A. (2019). Aligning the criteria of green economy (GE) and sustainable development goals (SDGs) to implement sustainable development. *Sustainability (Switzerland), 11*(17). https://doi.org/10.3390/su11174615

Nor, A. N. M., & Abdullah, S. A. (2019). Developing urban green space classification system using multi-criteria: The case of Kuala Lumpur City, Malaysia. *Journal of Landscape Ecology (Czech Republic), 12*(1), 16–36. https://doi.org/10.2478/jlecol-2019-0002

Nor, A. N. M., Aziz, H. A., Nawawi, S. A., Jamil, R. M., Abas, M. A., Hambali, K. A., Yusoff, A. H., Ibrahim, N., Rafaai, N. H., Corstanje, R., Harris, J., Grafius, D., & Perotto-Baldivieso, H. L. (2021). Evolution of green space under rapid urban expansion in southeast Asian cities. *Sustainability (Switzerland), 13*(21). https://doi.org/10.3390/su132112024

Shan, J., Huang, Z., Chen, S., Li, Y., & Ji, W. (2021). Green Space Planning and Landscape Sustainable Design in Smart Cities considering Public Green Space Demands of Different Formats. *Complexity*, 2021. https://doi.org/10.1155/2021/5086636

Yusliza, M. Y., Amirudin, A., Rahadi, R. A., Athirah, N. A. N. S., Ramayah, T., Muhammad, Z., Dal Mas, F., Massaro, M., Saputra, J., & Mokhlis, S. (2020). An investigation of pro-environmental behaviour and sustainable development in Malaysia. *Sustainability (Switzerland), 12*(17). https://doi.org/10.3390/su12177083

Hadjichambis, A.C., Paraskeva-Hadjichambi, D., Sinakou, E., Adamou, A., Georgiou, Y. (2022). Green Cities for Environmental Citizenship: A Systematic Literature Review of Empirical Research from 31 Green Cities of the World. Sustainability 2022, 14, 16223. https://doi.org/10.3390/su142316223

Muhamad Nor A. N., Abdullah S. A. (2018). Developing Urban Green Space Classification System Using Multi-Criteria: The Case Of Kuala Lumpur City, Malaysia. *Journal of Landscape Ecology* (2019), Vol: 12 / No. 1. 10.2478/jlecol-2019-0002

Karade, R.M., Kuchi, V. S., Salma, Z. (2017). The Role of Green Space for Sustainable Landscape Development in Urban Areas. *Int. Arch. App. Sci. Technol*; Vol 8 [2] June 2017: 76-79. 10.15515/iaast.0976-4828.8.2.5154

Auchincloss, A. H., Michael, Y. L., Kuder, J. F., Shi, J., Khan, S., Ballester, L. S. (2019). Changes in Physical Activity After Building a Greenway in a Disadvantaged Urban Community: A Natural Experiment. *Preventive Medicine Reports*, Volume 15, ISSN 2211-3355.; https://doi.org/10.1016/j.pmedr.2019.100941.

Jennings, V., Bamkole, O. (2019). The Relationship between Social Cohesion and Urban Green Space: An Avenue for Health Promotion. *International Journal of*

Environmental Research and Public Health. 16(3):452; https://doi.org/10.3390/ijerph16030452

Mears, M., Brindley, P., Maheswaran, R., Jorgensen, A. (2019). Understanding the Socioeconomic Equity of Publicly Accessible Greenspace Distribution: The example of Sheffield, UK. *Geoforum*, Volume 103, Pages 126-137, ISSN 0016-7185; https://doi.org/10.1016/j.geoforum.2019.04.016.

Venter, Z. S., Barton, D. N., Gundersen, V., Figari, H., Nowell, M. (2020). Urban Nature in a Time of Crisis: Recreational Use of Green Space Increases During the COVID-19 Outbreak in Oslo, Norway. *Environmental Research Letters*, Volume 15, Number 10, 15 104075; DOI 10.1088/1748-9326/abb396

Taylor, L., Hochuli, D. F. (2017). Defining Greenspace: Multiple Uses Across Multiple Disciplines. *Landscape and Urban Planning*, Volume 158, Pages 25-38, ISSN 0169-2046; https://doi.org/10.1016/j.landurbplan.2016.09.024.

Biodiversity. (2022). Typology of green infrastructure. Environmental information systems; https://biodiversity.europa.eu/green-infrastructure/typology-of-gi

THRIVE. (2022). Urban green spaces: Not just a walk in the park; https://blog.strive2thrive.earth/urban-green-spaces-not-just-a-walk-in-the-park/

UNICEF Armenia. (2021). The Necessity of Urban Green Space for Children's Optimal Development. Article; https://www.unicef.org/armenia/en/stories/necessity-urban-green-space-childrens-optimal-development

Palliwoda, J., Priess, J. A. (2021). What do people value in urban green? Linking characteristics of urban green spaces to users' perceptions of nature benefits, disturbances, and disservices. *Ecology and Society 26*(1):28. https://doi.org/10.5751/ES-12204-260128

De Haas, W., Hassink J., Stuiver, M. (2021). The Role of Urban Green Space in Promoting Inclusion: Experiences from the Netherlands. *Front. Environ. Sci*. 9:618198. doi: 10.3389/fenvs.2021.618198

Fransen B. (2023). The Importance of Incorporating Green Spaces in City Planning. EcoMatcher; https://www.ecomatcher.com/the-importance-of-incorporating-green-spaces-in-city-planning/

Harasimowicz, A. (2018). Green Spaces as A Part of The City Structure. *EKONOMIA I ŚRODOWISKO. 2* (65); https://www.ekonomiaisrodowisko.pl/journal/article/view/156/150

Sangwan, A., Saraswat, A., Kumar, N., Pipralia, S., Kumar, A. (2022). Urban Green Spaces Prospects and Retrospect's. Open access peer-reviewed chapter Urban Green Spaces; DOI: 10.5772/intechopen.102857

Sahrir, S., Ponrahono, Z., & Sharaai, A. H. (2022). Modelling the Community Adaptive Behaviour Towards Air Pollution: a Confirmatory Factor Analysis With PLS-SEM. *Planning Malaysia*, *20*(3), 205–216. https://doi.org/10.21837/PM.V20I22.1139

Bans-Akutey, A., Tiimub, B.M. (2021). Triangulation in Research. Academia Letters, Article 3392. https://doi.org/10.20935/AL3392.

Noble, N. & Heale, R. (2019). Triangulation in research, with examples. BMJ Journals, 22(3). Retrieved August 22, 2020 from https://ebn.bmj.com/content/22/3/67

Putrajaya Corporation. (n.d).Towards Putrajaya Green City 2025 - Inventory of Putrajaya GHG Emissions 2012. PUTRAJAYA GREEN CITIES. E-GARIS PANDUAN;

https://www.ppj.gov.my/en/second-page/bandar-hijau-putrajaya
Putrajaya Corporation. (n.d). Rancangan-Struktur-Putrajaya-2025.; https://www.ppj.gov.my/storage/7488/RANCANGAN-STRUKTUR-PUTRAJAYA-2025.pdf
PLANMalaysia. (2021). Garis Panduan Kawasan Lapang 2021. Planning Guidelines (2002 – latest).myTOWNnet; https://mytownnet.planmalaysia.gov.my/index.php/planning-guidelines/?wbg_title_s=Garis+Panduan+Kawasan+Lapang

Received: 19th March 2024. Accepted: 3rd September 2024

PLANNING MALAYSIA:
Journal of the Malaysian Institute of Planners
VOLUME 22 ISSUE 5 (2024), Page 126 – 139

DEVELOPMENT STRATEGIES FOR BACKPACKER TOURISM DEVELOPMENT IN KOTA KINABALU, SABAH, MALAYSIA

Johan Johnes[1], Jabil Mapjabil[2], Normah Abdul Latip[3], Rosazman Hussin[4], Mohd Umzarulazijo Umar[5]

[1,2,3,4,5]*Borneo Institute for Indigenous Studies,*
UNIVERSITI MALAYSIA SABAH
[1]*Faculty of Social Sciences and Humanities,*
UNIVERSITI MALAYSIA SABAH

Abstract

This study investigates the development strategies aimed at enhancing backpacker tourism in Kota Kinabalu, Sabah, with a focus on social, environmental, and economic dimensions. This study uses quantitative methods through the distribution of questionnaires to study the behaviour and opinions of backpackers in Kota Kinabalu. This study focuses on respondents at backpacker accommodation and tourist destinations in Kota Kinabalu. A total of 228 backpackers participated in this study. These strategies encompass social development, environmental development, and economic development, and encompass initiatives such as community engagement, environmental conservation, and collaboration with local businesses. Achieving a balance between economic growth and social and environmental sustainability is crucial in maximizing the potential of backpacker tourism. Successful implementation of these strategies necessitates the active involvement of various stakeholders, including government agencies, local communities, and the tourism industry. Integrating these strategies into destination management plans will elevate the backpacker tourism experience and facilitate sustainable growth. Further research and collaboration among stakeholders are imperative to effectively implement these strategies and harness the opportunities presented by backpacker tourism in the region.

Keywords: Backpacker tourism, development strategies, tourism, sustainable tourism, tourism development

[3] Associates Professor at UMS. Email: normah.abdullatip@ums.edu.my

INTRODUCTION

The tourism industry thrives due to diverse cultural traits, natural resources, and vibrant social life. Malaysia's location in Southeast Asia makes it a prime spot for backpackers traveling the region. Backpacker tourism, noted by Ooi and Laing (2010), has grown significantly, offering substantial economic benefits. However, it can also negatively impact local communities and the environment (Sroypetch, 2016; Sudana et al., 2020; Agyeiwaah & Bangwayo-Skeete, 2021). To ensure sustainable growth, destinations should balance economic gains with social and environmental concerns by limiting visitor numbers, promoting responsible tourism, and investing in sustainable infrastructure (Agyeiwaah et al., 2021; Han, 2021; Yusoh et al., 2022).

Regulating backpacker tourism is challenging due to overpopulation, resource exploitation, and other negative impacts on destination communities. To address these issues, destinations must work with local stakeholders to develop sustainable tourism plans that consider both local needs and environmental concerns. Effective management requires engaging residents and businesses to identify and tackle key issues, promoting responsible tourism practices, and supporting local development initiatives that benefit everyone. By adopting these strategies, destinations can manage backpacker tourism sustainably and minimize its adverse effects (Budeanu et al., 2016). This study aims to create a comprehensive inventory of challenges and strategies for backpacker tourism development in Kota Kinabalu.

LITERATURE REVIEW

In tourism studies, backpackers are often overlooked compared to other topics (Cohen, 2003; Maoz, 2007; Richard & Wilson, 2004). Generally, they are budget-conscious travelers who stay longer in destinations than typical tourists, focusing on low-cost, independent travel with minimal accommodations like hostels and camping (Ryan, 2020; Wodarczyk & Cudny, 2022; Jabil et al., 2022). Typically under 40, backpackers have flexible plans and engage more with local social scenes (Pearce, 2009; Richard & Wilson, 2004). Recently, "flashpackers" have emerged as a term for those who spend more on technology and comfort while remaining budget-conscious.

Strategies in Developing Backpacker Tourism

According to Graci and Van Vliet (2020) and Latip et al (2018), managing tourist destinations is challenging due to the negative effects of poor planning and management. To achieve sustainable backpacker tourism, effective strategies must be implemented. These strategies fall into three categories: social development, environmental development, and economic development. This study aims to explore these strategies in detail by reviewing literature and insights from previous research.

Social Development Strategies:

i. *Long-term planning and capacity building:* This strategy entails creating a detailed tourism plan with extensive training for officials, destination management, and infrastructure support (Hashimoto, 2002; UNWTO, 2006; Graci & Dodds, 2010). By incorporating backpacker tourism into long-term planning, destinations can enhance sustainability, minimize environmental impact, and benefit local communities (Giampiccoli et al., 2020).
ii. *Collaboration and stakeholder participation:* Collaboration among accommodation operators, low-cost airlines, destination operators, and local communities is essential for improving backpacker travel experiences (Gray & Wood, 1991; Giampiccoli et al., 2020). Engaging these stakeholders in decision-making helps address market interests, environmental concerns, and social development (Selin, 1999; Bramwell & Alletorp, 2001; Bramwell & Lane, 2005; Foggin & Munster, 2003).
iii. *Training and education:* Effective training and education for key players—government employees, private sector entrepreneurs, and community members—are crucial for promoting sustainable backpacker tourism (Giampiccoli et al., 2020). Collaboration between the government, tourism sector, and educational institutions can improve local education, raise awareness of environmental conservation and waste management, and foster cultural interaction (Graci, 2020).

Environmental Development Strategies:

i. *Conservation and preservation:* Sustainable backpacker tourism necessitates the protection and conservation of the natural environment (Giampiccoli et al., 2020). Strategies such as promoting responsible tourism practices, limiting the number of backpackers in sensitive areas, and investing in infrastructure that supports sustainable tourism development contribute to environmental preservation (Agyeiwaah et al., 2021; Han, 2021).
ii. *Waste management and resource efficiency:* Effective waste management systems, including recycling initiatives and reducing resource consumption, are crucial for minimizing the environmental footprint of backpacker tourism (Giampiccoli et al., 2020). Implementing sustainable waste management practices and raising awareness among backpackers about the importance of responsible waste disposal contribute to environmental development (Graci, 2020).

Economic Development Strategies:

i. *Economic diversification:* Expanding tourism products beyond backpacker accommodation can boost destination economies (Giampiccoli et al., 2020). Promoting local entrepreneurship and supporting small and medium-sized enterprises can enhance economic benefits from backpacker tourism.
ii. *Community empowerment and inclusive growth:* Economic development strategies should involve local communities to ensure active participation and fair benefit distribution (Giampiccoli et al., 2020). Community-based tourism, cultural exchange, and support for local businesses promote inclusive growth and socio-economic empowerment.

METHODOLOGY

In this study, the researcher used a quantitative method because it is suitable and able to answer the research objective regarding the behavior and opinions of backpackers in Kota Kinabalu. This study was conducted in the city of Kota Kinabalu, Sabah, which has an area of approximately 351 square kilometres. Specifically, the study was conducted in the area around budget hotels and tourist attractions in the Kota Kinabalu area. (Figure 1).

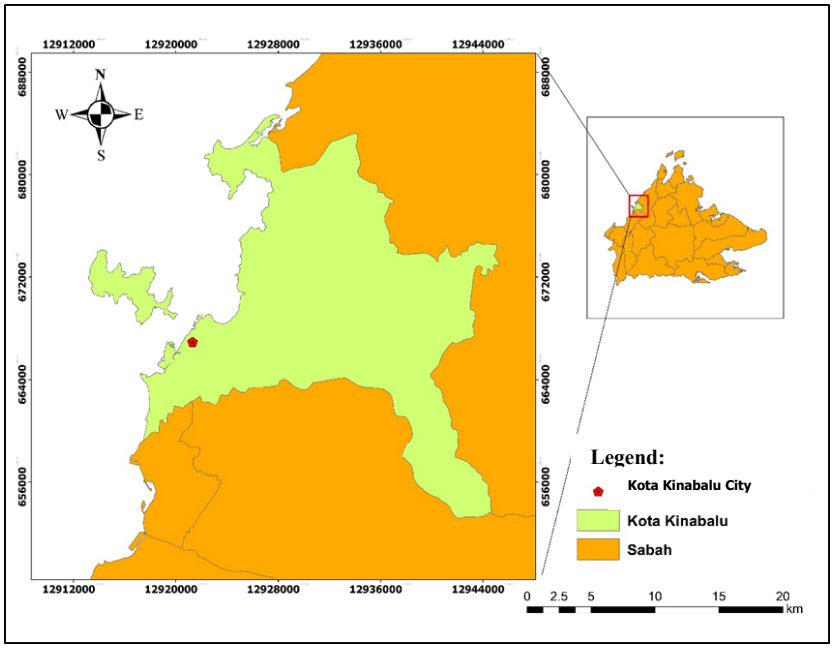


Figure 1: Map of Study Area
Source: Researcher (2023).

In 2018, Sabah Tourism Board recorded 1,361,567 foreign tourists, with 113,043 from Europe, America, and Oceania. Based on Krejcie and Morgan's (1970) sample size table, 383 respondents were recommended. However, due to the Movement Control Order (MCO) starting March 18, 2020 in Malaysia, which restricted international travel, the sample size was adjusted to 228 travelers, as shown in Table 1.

Table 1: Sample size of study

Details	Sample (Number of people)
The number of tourists coming to Sabah in 2018	1,261,567
The number of tourists from the European Continent, America and Oceania	113,043
The total number of study samples should be before the MCO is implemented	383
The total number of study samples studied	**228**

Source: Researcher (2023).

FINDINGS & DISCUSSION

This section discusses the findings of the study regarding the challenges faced by backpackers during travel and the development strategy for backpacker tourism in Kota Kinabalu.

Social Development Strategies

The importance of social development in backpacker tourism cannot be overstated. In Kota Kinabalu, a city known for its diverse and exciting outdoor activities, it is crucial that we consider the ways in which we can improve the quality of the backpacker tourism industry for both visitors and the local community. One way to do this is by implementing a series of social development strategies, as outlined in Figure 2.

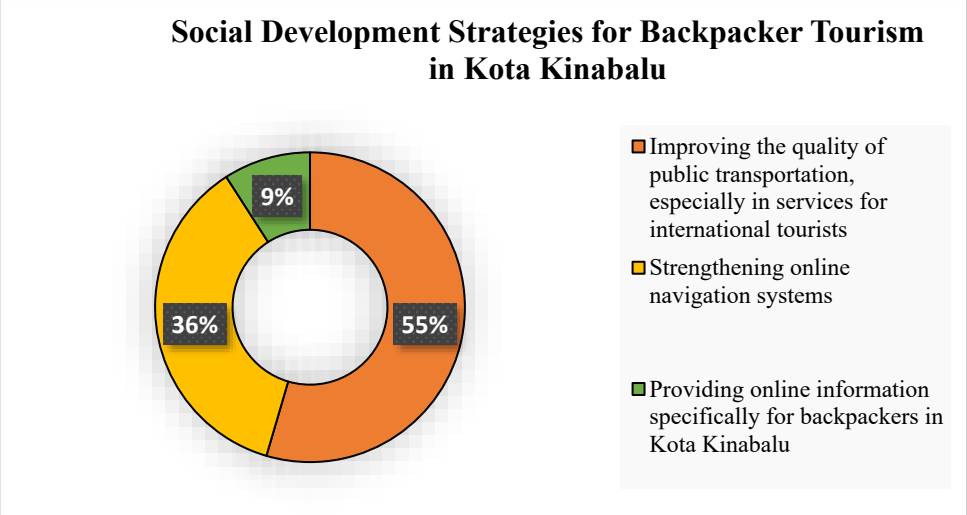


Figure 2: Social Development Strategies for Backpacker Tourism Development in Kota Kinabalu
Source: Researcher (2023)

According to Figure 2, three social development recommendations were made by respondents in a recent field study. 55 percent respondents suggested that the quality of public transportation, specifically in terms of services for international backpackers, should be improved in Kota Kinabalu. Additionally, 36 percent respondents recommended to strenghen online navigation systems. Nine percent respondents recommend providing online information specifically for backpackers in Kota Kinabalu. These findings suggest that there is a need for targeted efforts to address the specific needs and preferences of backpackers in Kota Kinabalu.

Improving the quality of public transportation, especially in services for international tourists

Improving transportation for backpacker tourism in Kota Kinabalu requires long-term planning to enhance convenience and attractiveness. Backpackers need affordable, convenient options (Pearce, 1990; Broocks & Hannam, 2016; Dayour et al., 2016). Upgrading the transportation network, providing clear route and schedule information, maintaining clean vehicles, and offering services like guided tours and airport transfers can make Kota Kinabalu more appealing. Collaborating with local tour operators and businesses to create package deals and seamless itineraries, implementing safety features, discount programs, and training locals as drivers or guides will boost social development and enhance interactions between backpackers and the community.

Strengthening online navigation systems

Enhancing backpacker tourism in Kota Kinabalu requires collaboration with stakeholders to improve online navigation systems, ensure accurate location information, and provide transportation details. Key strategies include partnering with online platforms, implementing wayfinding tools, and creating virtual experiences. A reliable navigation system displaying correct tourist destination locations is essential (Yao et al., 2020). Regular monitoring of location pin accuracy is crucial for backpackers' navigation. Strengthening online navigation, updating transportation info on websites and apps, and collaborating with local businesses for virtual experiences can boost tourism in the region.

Providing online information specifically for backpackers in Kota Kinabalu

The provision of online information targeting backpackers or budget travellers is vital for promoting travel in destination areas. Gomes (2019) emphasizes the importance of online information for backpackers, allowing them to plan trips independently. In Kota Kinabalu, however, most online information is in Malay, making it less accessible to international travellers. Additionally, the information often lacks clarity on fees, activities, and cultural aspects. Some attractive destinations only have a social media presence. To address these gaps, a dedicated website or section within an existing tourism website should be established for backpackers. This platform should provide details on affordable accommodations, budget-friendly activities, and attractions. Collaborating with local businesses to offer discounts and featuring reviews from past backpackers can boost tourism and foster sustainable development in Kota Kinabalu.

Environmental Development

To attract backpackers to Kota Kinabalu, we need to consider the environment. Protecting the natural resources and unique environment of the city is important. Figure 3 shows how often respondents suggested environmental development strategies for backpacker tourism in the area.

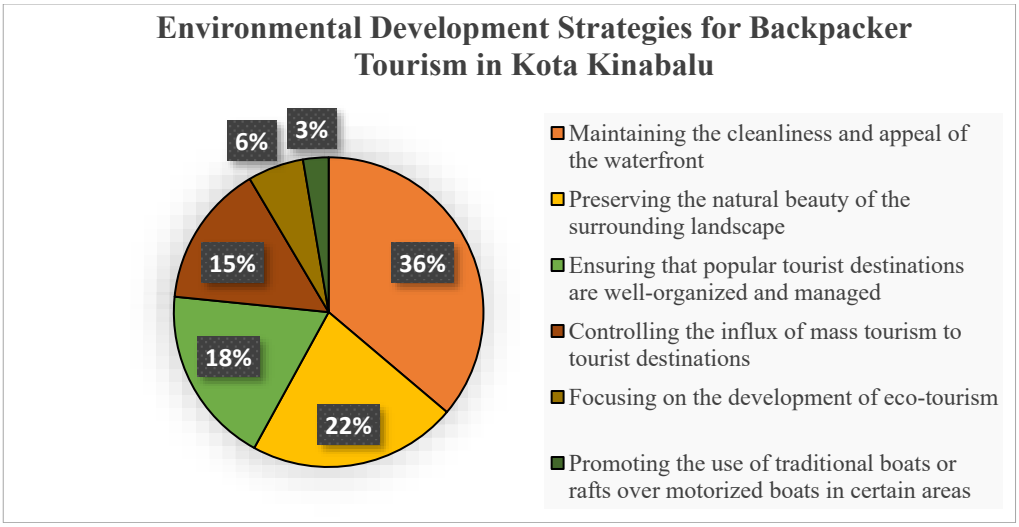


Figure 3: Environmental Development Strategies for Backpacker Tourism in Kota Kinabalu
Source: Researcher (2023).

Figure 3 shows six recommendations for environmental development in the development of backpacker tourism in Kota Kinabalu. 36 percent respondents recommended maintaining the cleanliness and appeal of the waterfront, while 22 percent respondents recommended preserving the natural beauty of the surrounding landscape. 18 percent respondents recommended ensuring that popular tourist destinations are well-organized and managed. Furthermore, 15 percent recommended controlling the influx of mass tourism to tourist destinations and six percent respondents recommended focusing on the development of eco-tourism in Kota Kinabalu. Finally, 3 percent respondents recommended promoting the use of traditional boats or rafts over motorized boats in certain areas in Kota Kinabalu.

Maintaining the cleanliness and appeal of the waterfront

Maintaining a clean waterfront is essential for sustainable backpacker tourism in Kota Kinabalu. Increased litter and poor waste management in nearby islands like Pulau Gaya and Pulau Sepanggar degrade coastal areas. Local authorities' efforts have been inadequate, negatively impacting residents and tourists (Berita Harian, 24 December 2016). The Kota Kinabalu City Council should engage private companies in waterfront cleaning through tenders and run awareness campaigns for island residents. A consistent focus on environmental conservation is needed to tackle marine litter and sustain a tourist-friendly environment.

Preserving the natural beauty of the surrounding landscape
Preserving Kota Kinabalu's natural beauty is vital for sustainable backpacker tourism. Overdevelopment and poor land use threaten this appeal. To address this, enforce land use regulations, promote eco-tourism, and educate tourists and locals on conservation. Limiting construction, land reclamation, and encouraging volunteer waterfront clean-ups can also help maintain the landscape (Canteiro et al., 2018; Hjalager & Kwiatkowski, 2019). Prioritizing environmental preservation will sustain Kota Kinabalu's allure for nature-loving backpackers.

Ensuring that popular tourist destinations are well-organized and managed
Effective maintenance and good governance are crucial for managing backpacker tourism destinations. Continuous maintenance ensures visitor satisfaction (Mahendrawati & Mahaputra, 2018; Pestana et al., 2020). A comprehensive plan involving the local community is needed to address backpacker needs, including crowd management, amenities, and community impact. Good governance ensures stakeholder interests and provides necessary infrastructure and services. Promoting sustainable tourism practices is essential to minimize environmental and social impacts, maintaining the destination's long-term appeal (Mahendrawati & Mahaputra, 2018). Implementing these measures can help destinations like Kota Kinabalu effectively support backpacker tourism and benefit the local community.

Controlling the influx of mass tourism to tourist destinations
Mass tourism at destinations like the Great Wall of China and Santorini, Greece, has led to issues such as congestion and capacity overload (Dodds & Butler, 2019; Jacobsen et al., 2019). Kota Kinabalu's Waterfront and Tunku Abdul Rahman Marine Park also face sustainability challenges due to high tourism levels. To mitigate these issues, strategies like visitor caps, reservation systems, promoting alternative destinations, sustainable practices, tourist taxes, and off-peak travel incentives are recommended (Dodds & Butler, 2019). It's essential to balance the interests of both the local community and tourists to ensure long-term sustainability (Dodds & Butler, 2019).

Focusing on the development of eco-tourism
Eco-tourism offers a promising strategy for sustainable backpacker tourism in Kota Kinabalu, addressing the challenges of mass tourism while minimizing environmental and community impacts (Manoj et al., 2020; Respati et al., 2017). Key actions include promoting sustainable practices like waste reduction and supporting local businesses, investing in eco-friendly infrastructure and transportation for backpackers, educating them on eco-tourism and sustainability, and involving the local community in planning to ensure their interests are considered. These strategies can help Kota Kinabalu preserve its natural and

cultural assets, providing an authentic and sustainable experience for backpackers (Dodds & Butler, 2019; Jacobsen et al., 2019; Coccossis & Mexa, 2017).

Promoting the use of traditional boats or rafts over motorized boats in certain areas

Promoting traditional boats or rafts instead of motorized ones in Kota Kinabalu can reduce tourism's environmental impact and support local communities. Traditional boats are eco-friendly, avoiding emissions and noise pollution, which helps protect delicate habitats and wildlife (Pestana et al., 2020). They also enhance the authenticity of the travel experience and support local craftsmanship, fostering cultural appreciation and community support (Jacobsen et al., 2019; Pestana et al., 2020). To encourage this shift, local communities should receive training and resources for boat tours, and marketing should highlight the benefits of supporting local communities and the environment (Manoj et al., 2020; Pestana et al., 2020). This approach promotes sustainable tourism, strengthens community resilience, and offers backpacker tourists a memorable experience.

Economic Development

Economic development is crucial for tourist destinations, as it boosts job opportunities and income through meeting stakeholders' needs. Figure 4 shows the frequency of respondents' suggestions for economic development strategies for backpacker tourism in Kota Kinabalu.

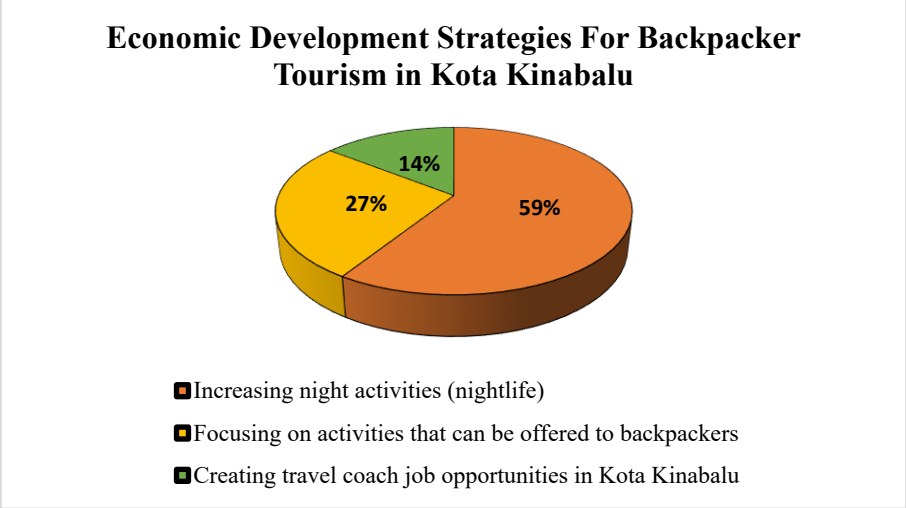


Figure 4: Economic Development Strategies for Backpacker Tourism in Kota Kinabalu
Source: Researcher (2023).

According to Figure 4, respondents suggest five economic development strategies for building backpacker tourism in Kota Kinabalu. 59% of respondents suggest offering more nightlife activities in Kota Kinabalu. Furthermore, 27% of respondents suggest that tourism entrepreneurs focus on activities that can be offered to backpacker tourists. Finally, 14% of respondents suggest that there be more job opportunities as a "travel coach" in Kota Kinabalu.

Increasing night activities (nightlife)
To boost backpacker tourism in Kota Kinabalu, increasing evening activities like Irish-themed bars could be effective. Providing diverse nightlife options such as live music and dancing can attract more backpackers and benefit the local economy (Coccossis & Mexa, 2017). Local entrepreneurs should receive support and resources, including funding, to develop these businesses (Jacobsen et al., 2019). Additionally, enhanced marketing efforts are needed to promote Kota Kinabalu's vibrant nightlife to tourists. These strategies could significantly improve the city's nightlife and support its economic growth.

Focusing on the activities that can be offered to backpacker
One strategy to boost backpacker tourism in Kota Kinabalu is to offer activities that reflect local culture and traditions while appealing to backpackers (Jacobsen et al., 2019). By focusing on outdoor adventures, cultural experiences, and educational tours, the region can increase its appeal and support economic growth (Coccossis & Mexa, 2017). Market research and community involvement are crucial to aligning activities with backpacker preferences and ensuring local economic benefits (Manoj et al., 2020). Additionally, adopting sustainable practices will help mitigate environmental impacts (Respati et al., 2017).

Creating travel coach job opportunities in Kota Kinabalu
To boost economic development in Kota Kinabalu through backpacker tourism, introducing “travel coaches” could be effective. Travel coaches help travelers with itinerary planning and logistics, which could attract more backpackers and create local jobs (Brugulat, 2018). Implementing this strategy requires investing in training programs for locals, in collaboration with educational institutions and tourism organizations. Offering courses on travel planning, customer service, and local culture, as well as internships with local businesses, will prepare residents for travel coach roles. This approach would enhance services for backpackers, improve their experience, and strengthen Kota Kinabalu's reputation.

CONCLUSION

In conclusion, the development plan for backpacker tourism in Kota Kinabalu aimed to address social, environmental, and economic factors. By focusing on improving transportation, enhancing online resources, preserving the

environment, and promoting economic initiatives, the plan aimed to foster sustainable backpacker tourism growth. The insights from this study provide potential solutions for enhancing backpacker tourism in Kota Kinabalu and contribute to a better understanding of the context of backpacker tourism both locally and globally.

REFERENCES

Agyeiwaah, E., & Bangwayo-Skeete, P. (2021). Backpacker-community conflict: the nexus between perceived skills development and sustainable behavior. *Journal of Sustainable Tourism, 30*(8), 1992-2012.

Agyeiwaah, E., Dayour, F., Otoo, F. E., & Goh, B. (2021). Understanding backpacker sustainable behavior using the tri-component attitude model. *Journal of Sustainable Tourism*, *29*(7), 1193-1214.

Berita Harian. (24 Disember 2016). *36 penempatan setinggan punca masalah kepada Kota Kinabalu.* From https://www.bharian.com.my/bhplus-old/2016/12/227719/36-penempatan-setinggan-punca-masalah-kepada-kota-kinabalu (accessed 15 February 2023).

Bramwell, B., & Alletorp, L. (2001). Attitudes in the Danish tourism industry to the roles of business and government in sustainable tourism. *International Journal of Tourism Research*, *3*(2), 91-103.

Bramwell, B., & Lane, B. (2005). From niche to general relevance? Sustainable tourism, research and the role of tourism journals. *Journal of Tourism Studies*, *16*(2), 52-62.

Broocks, A. K., & Hannam, K. (2016). The artisan backpacker: a development in Latin American backpacker tourism. *International Journal of Tourism Anthropology*, *5*(1-2), 152-164.

Brugulat Cortada, M. (2018). Solo female backpackers in Southeast Asia: experience and risks.

Budeanu, A., Miller, G., Moscardo, G., & Ooi, C. S. (2016). Sustainable tourism, progress, challenges and opportunities: an introduction. *Journal of Cleaner Production*, *111*, 285-294.

Canteiro, M., Córdova-Tapia, F., & Brazeiro, A. (2018). Tourism impact assessment: A tool to evaluate the environmental impacts of touristic activities in Natural Protected Areas. *Tourism Management Perspectives*, *28*, 220-227.

Coccossis, H., & Mexa, A. (2017). Tourism carrying capacity: Future issues and policy considerations. In *The Challenge of Tourism Carrying Capacity Assessment* (pp. 293-304). Routledge.

Cohen, E. (2003). Backpacking: Diversity and change. *Journal of tourism and cultural change*, *1*(2), 95-110.

Dayour, F., Adongo, C. A., & Taale, F. (2016). Determinants of backpackers' expenditure. *Tourism Management Perspectives*, *17*, 36-43.

Dodds, R., & Butler, R. (2019). The phenomena of overtourism: A review. *International Journal of Tourism Cities*, *5*(4), 519-528.

Foggin, T., & Münster, D. O. (2003). Finding the middle ground between communities and tourism. *Africa Insight*, *33*(1/2), 18-22.

Giampiccoli, A. (2020). A conceptual justification and a strategy to advance community-based tourism development. *European Journal of Tourism Research*, *25*, 2503-2503.

Gomes, T. A. G. L. (2019). *Exploring online travel reviews of backpackers: motivations and travel decision-making process* (Doctoral dissertation).

Graci, S. and Dodds, R. (2010) Sustainable Tourism in Island Destinations. Earthscan, London.

Graci, S., & Van Vliet, L. (2020). Examining stakeholder perceptions towards sustainable tourism in an island destination. The Case of Savusavu, Fiji. *Tourism Planning & Development*, *17*(1), 62-81.

Graci, S. (2020). Collaboration and partnership development for sustainable tourism. In *Tourism and Sustainable Development Goals: Research on Sustainable Tourism Geographies* (pp. 232-249). Routledge.

Gray, B., & Wood, D. J. (1991). Collaborative alliances: Moving from practice to theory. *The Journal of applied behavioral science*, *27*(1), 3-22.

Han, H. (2021). Consumer behavior and environmental sustainability in tourism and hospitality: A review of theories, concepts, and latest research. *Journal of Sustainable Tourism*, *29*(7), 1021-1042.

Hashimoto, A. (2002) Tourism and sociocultural development issues, in: R. Sharpley & D. J. Telfer (Eds) Tourism and Development: Concepts and Issues, pp. 202–230 (Clevedon: Channel View Publications).

Hjalager, A. M., & Kwiatkowski, G. (2019). Relational environmentalism in coastal recreation and tourism. *Sustainability*, *11*(21), 6011.

Mapjabil, J., Johnes, J., & Abdul Latip, N. (2022). BACKPACKER TOURISM CIRCUIT IN KOTA KINABALU, SABAH. *PLANNING MALAYSIA*, *20*(23). https://doi.org/10.21837/pm.v20i23.1149

Jacobsen, J. K. S., Iversen, N. M., & Hem, L. E. (2019). Hotspot crowding and over-tourism: Antecedents of destination attractiveness. *Annals of tourism research*, *76*, 53-66.

Latip, N. A., Rasoolimanesh, S. M., Jaafar, M., Marzuki, A., & Umar, M. U. (2018). Indigenous participation in conservation and tourism development: A case of native people of Sabah, Malaysia. *International Journal of Tourism Research*, *20*(3), 400-409. https://doi.org/10.1002/jtr.2191

Mahendrawati, N. L. M., & Mahaputra, I. G. A. (2018). Anticipating Global Business Competition through Economic Democracy Principles. In *International Conference on Business Law and Local Wisdom in Tourism (ICBLT 2018)* (pp. 80-83). Atlantis Press.

Manoj, M., Ram Das, A., Chandran, A., & Mandal, S. (2020). Antecedents of environmental engagement and environmental learning behaviour. *Journal of Hospitality and Tourism Insights*, *3*(4), 431-450.

Maoz, D. (2007). Backpackers' motivations the role of culture and nationality. *Annals of tourism research*, *34*(1), 122-140.

Ooi, N., & Laing, J. H. (2010). Backpacker tourism: Sustainable and purposeful? Investigating the overlap between backpacker tourism and volunteer tourism motivations. Journal of Sustainable Tourism, 18(2), 191-206.

Pearce P. L, Murphy L, & Brymer E. (2009). *Evolution of the Backpacker Market and the Potential for Australian Tourism.* CRC for Sustainable Tourism Pty Ltd: Gold Coast, Queensland: Australia.

Pearce, P. L. (1990). *The Backpacker Phenomenon: Preliminary Answers to Basic Questions.* Department of Tourism, James Cook University of North Queensland: Australia.

Pestana, M. H., Parreira, A., & Moutinho, L. (2020). Motivations, emotions and satisfaction: The keys to a tourism destination choice. *Journal of Destination Marketing & Management*, *16*, 100332.

Respati, A., Purwanto, E., Santoso, S., & Handayani, I. G. A. K. R. (2017). The Reconstruction of Ecotourism Model Based on Resources and Local Wisdom. *International Journal of Business, Economics and Law*, *13*(4).

Richards, G., & Wilson, J. (Eds.). (2004). *The global nomad: Backpacker travel in theory and practice* (Vol. 3). Channel View Publications.

Ryan, C. (2020). *Advanced Introduction to Tourism Destination Management*. Edward Elgar Publishing.

Selin, S. (1999). Developing a typology of sustainable tourism partnerships. *Journal of Sustainable tourism*, *7*(3-4), 260-273.

Sroypetch, S. (2016). The mutual gaze: Host and guest perceptions of socio-cultural impacts of backpacker tourism: A case study of the Yasawa Islands, Fiji. *Journal of Marine and Island Cultures*, *5*(2), 133-144.

Sudana, I. P., Putra, D., Nyoman, I., Sunarta, I. N., Dwijendra, S. T., SDs, M. A., & IPU, A. (2020). Impact of Backpacker Tourists on the Social, Economic and Environmental Aspects in Ubud, Bali, Indonesia. *Journal of Social and Political Sciences*, *3*(4).

United Nations World Tourism Organization (UNWTO). (2006) Tourism Barometer. Available at http://www.world-tourism.org/facts/menu.html (accessed 15 February 2023).

Włodarczyk, B., & Cudny, W. (2022). Individual Low-Cost Travel as a Route to Tourism Sustainability. *Sustainability*, *14*(17), 10514.

Yao, Y., Sun, J., Tian, Y., Zheng, C., & Liu, J. (2020). Alleviating water scarcity and poverty in drylands through telecouplings: Vegetable trade and tourism in northwest China. *Science of the Total Environment*, *741*, 140387.

Pirdaus Yusoh, M., Dering, N. F., Mapjabil, J., Abdul Latip, N., Kumalah, M. J., & Hanafi, N. (2022). COMPARISONS OF TOURIST CIRCUIT PATTERN AT SELECTED TOURISM DESTINATION IN SABAH, MALAYSIA. *PLANNING MALAYSIA*, *20*(23). https://doi.org/10.21837/pm.v20i23.1151

Received: 11th March 2024. Accepted: 17th July 2024

PLANNING MALAYSIA:
Journal of the Malaysian Institute of Planners
VOLUME 22 ISSUE 5 (2024), Page 140 – 155

EXPLORING BANDUNG CITY ON FOOT: WHAT MOTIVATES TOURISTS TO JOIN WALKING TOURS?

Nurrohman Wijaya[1], Maulia Wijayati[2]

[1,2]*Department of Urban and Regional Planning,*
BANDUNG INSTITUTE OF TECHNOLOGY (ITB), INDONESIA

Abstract

Walking is a practical and popular tourist activity, but it remains underexplored in the field of tourism. Although extensive literature has been published on topics related to walking and walkability driven by public health, sustainability, livability, and urban design concerns, tourism sector requires deeper exploration, particularly in urban settings. Walking tourism has been observed to possess the capability to promote sustainable tourism. Therefore, this study aims to examine the influence of motivation on the decision of tourists to engage in walking tour in urban tourism areas of Bandung City, Indonesia. Data from 220 tourists and interviews with resource persons were subsequently analysed using multiple linear regression to assess the impact of push and pull factors on walking tourism decisions. The results showed that tourist motivation significantly influences walking tourism decisions. The motivating factors include physical health, pleasure and satisfaction, knowledge gained, and local community behaviour. Physical health and relaxation were considered crucial push factors, while tourists' attractions and social media promotions were categorized as significant pull factors. This study provides valuable input for local governments and tourism agencies seeking to develop sustainable urban tourism destinations.

Keywords: Walking Tour, Push and Pull Factors, Sustainable Tourism, Tourists' Decision, Urban Environment

[1] Assistant Professor, Email: nurrohman.wijaya@itb.ac.id

INTRODUCTION

Indonesia's tourism sector has grown steadily, contributing to the national GDP, though the COVID-19 pandemic caused a sharp decline in 2020. In response, the government promotes sustainable tourism to support local communities and the environment (Kemenparekraf, 2021). With tourism expected to grow in the next two decades (UNWTO, 2011), low-carbon approaches, such as walking tourism, are essential. Walking tourism offers economic and environmental benefits (Chapman, 2007; Weston & Mota, 2012) while enhancing tourist experiences through active engagement with destinations (Thompson, 2003). In Indonesia, cities like Jakarta, Bandung, and Semarang host walking tours showcasing cultural and historical highlights. Bandung, known for its art-deco architecture, stands out for its rich cultural heritage, earning the nickname "The Pearl of Art-Deco" (Solikhah, 2024).

Tours requiring walking can help achieve sustainable tourism, particularly in Bandung, Indonesia. As a low-carbon activity, this form of tour only requires walking to enjoy destinations, making it environmentally friendly and suitable for a city often plagued by traffic jams and air pollution. Socially and emotionally, walking tourism has been observed to foster feelings of joy, calm, and togetherness (Rabbiosi & Meneghello, 2023). Economically, the activity has the potential to significantly improve local businesses, promote environmental protection, and raise public awareness of historic buildings and cultural heritage, providing a promising future for the local economy. Previous studies on this subject matter have predominantly focused on natural destinations such as the Dieng Plateau (Rahmiati & Dani, 2020). The subject has also often been examined in international contexts, such as in New Delhi, India (Chandran et al., 2021) and Bursa, Turkey (Vural Arslan et al., 2018). Focusing on Indonesia, Musthofa (2023) and Annisa (2023) have extensively and qualitatively explored the subject of walking tourism in relation to the development of urban tourism destinations. However, more quantitative research is needed on the perceptions of tourists towards activities requiring walking, specifically in urban settings. This study aims to explore factors capable of motivating tourists to engage in walking tourism. It categorizes motivating factors into push and pull factors, all of which were analysed based on the perspectives of tourists. Accordingly, the results are anticipated to offer information that is relevant to the development of walking tourism in urban areas of Bandung City.

LITERATURE REVIEW

Sustainable Tourism

According to Hadiwijoyo (2012), sustainable tourism is not just about meeting the needs of current tourists but also prioritizing environmental preservation and creating employment opportunities for the younger generation. This statement was further supported by Janusz & Bajdor (2013) who emphasized sustainable

tourism as a balanced approach that considered environmental, social, and economic dimensions. It ensures a harmonious balance between resource use and conservation. In this context, social sustainability, which is a key component, comprises community participation to maximize local benefits, while economic sustainability enhances income, foreign exchange earnings, employment, stable prices, and fair distribution of benefits. In other words, sustainable tourism is a comprehensive strategy that meets present tourists' needs while prioritizing future environmental, social, and economic sustainability, with a strong emphasis on fair distribution of benefits.

Urban Tourism

Urban tourism is typically centered in a city, with tourism areas, city elements, or the city being the main attractions (Prijadi et al., 2014). Dissimilar to agricultural tourism, this form of tourism leverages urban elements and all aspects of city life as tourists' attractions. It has become a globally expanding phenomenon, facilitating the appreciation of cities, which are complex entities closely related to culture, lifestyle, as well as varied holiday and travel demands (Page, 1995). As stated in a previous study, urban tourism combines various attractions, facilities, and ease of accessibility, drawing interest from tourists (Priono, 2012). Presently, individuals visit cities for diverse purposes, including business, recreation, entertainment, and personal needs such as spending time with family. These locations have become multi-motivational destinations, offering a variety of cultural experiences, architectural marvels, technological advancements, social interactions, and natural beauty, all of which serve as attractive tourism destinations (Bhawana et al., 2019). The growth of urban tourism is increasing worldwide and has become a compelling trend for further development (Prijadi et al., 2014). This form of tourism typically comprises a collection of tourists' attractions and activities in cities that can attract tourists from other places.

Walking Tourism

Walking tourism, a form of physical recreational travel, emphasizes environmentally friendly exploration, community engagement, and destination visits (Ram & Hall, 2018). It significantly benefits local communities socially and economically by involving various stakeholders and encouraging visits to less popular areas, thereby boosting local economies (UNWTO, 2011). Walking tourism allows for a deep, sensory engagement with nature, culture, and locals, promoting meaningful interactions. It also enhances environmental and economic sustainability, particularly in areas of natural beauty (Weston & Mota, 2012). As tourism grows, low-carbon activities like walking and cycling will be vital to reducing environmental pressures and supporting sustainable tourism (Chapman, 2007; UNWTO, 2011).

The Decision to Participate in Walking Tourism

Decision is a conclusion reached after careful consideration, comprising the selection of one option over others (Salusu, 1996). This process includes analyzing several alternatives before making a choice. Based on observations, prospective tourists have been found to consider various factors such as timing, duration, destination, and transportation before embarking on a trip. This decision is influenced by multiple factors, including tourism marketing and promotions, which play a crucial role in tourism development (Pitana & Gayatri, 2005). Typically, tourists do not make travel decisions based on a single option, instead, thorough considerations are given to multiple aspects such as destinations, accommodations, and companions (Cohen et al., 2014). According to Shaikh et al. (2020), tourists often create descriptions of several destinations based on available information, which influences the respective decision-making process. As stated in a previous study, tourists generally rely on the experiences of others to avoid potential issues (Kotler & Keller, 2016). This decision-making process is in line with consumer behavior theories, where purchasing decisions are analogous to visiting decision. The decision-making process for walking tourism in Bandung City involves several stages namely recognizing the need to travel, searching for and assessing information, deciding to travel, planning and preparing, experiencing the trip, and evaluating satisfaction (Kotler & Keller, 2016). Table 1 shows the decision-making process variables used in this study.

Table 1: Decision-Making Process Variables for Walking Tourism

Variable	Description	Source
Information investigation	Decision-making process is carried out before trip, and various factors are considered until the final decision. In walking tourism, tourists usually search for information regarding travel routes and how to register.	Kotler, 2013; Samuel, 2021
Several alternatives comparison	From searching for information and then conducting an assessment process, one option is finally selected from several available options. The joy of discovering new walking tourism routes adds an element of excitement to the process.	Kotler, 2013; Samuel, 2021; Shaikh et al., 2020
Travel preparation	After determining the primary choice, preparations are made before walking tourism, such as wearing a hat and sunscreen.	Kotler & Keller, 2016
Feedback provision	A way to connect with walking tourism community, sharing experiences and insights for the benefit of others.	Samuel, 2021
Intention to recommend to others	Tourists recommend walking tourism to other people through social media or directly as a form of satisfaction after taking walking tourism trip.	Eugenio-Martin, 2003; Kotler, 2013
Intention to walk again in another destination	After walking tourism trip, tourists intend to walk again at a destination other than urban tourism area of Bandung City.	Eugenio-Martin, 2003
Intention to walk again at	After walking tourism trip, tourists intend to walk again in urban tourism area of Bandung City.	Eugenio-Martin, 2003; Kotler, 2013

Variable	Description	Source
the same destination		

Push and Pull Factors for Walking Tourism

The decision-making process for travel is multifaceted and comprises various factors, including destinations, travel methods, timing, and tourist numbers. This decision has been found to significantly impact both the success of tourism destinations and businesses (Hin et al., 2024; Rachmadi, 2021). As observed, several variables influence travel decisions including internal variables, external variables, and situational variables. In this context, internal variables pertain to the personal aspects of tourists, such as lifestyle, motivation, personality, self-image, beliefs, and values (social, emotional, conditional, functional, and epistemic). External variables encompass factors such as pull factors from the destination, marketing, social influences, as well as cultural and social class considerations. Lastly, situational variables relate to specific aspects of the trip, including the type of attraction, timing, distance, and duration (Dahiya & Batra, 2016). An understanding of these variables helps tourists analyze travel decisions, which impacts tourism outcomes.

Visits to tourism destinations are influenced by both internal motivations (push factors) and external attractions (pull factors) (Tanjung et al., 2022). Generally, tourism destinations aim to provide pleasure and satisfaction, catering to internal factors including relaxation, escape from routine, health, and social interaction (Yoon & Uysal, 2005). According to Crompton (1979), push factors include the intrinsic desires of tourists, such as the need for rest or adventure, while pull factors are external attractions of the destination. Understanding these factors helps in comprehending and catering to tourists' behavior. Table 2 outlines push and pull factors used in this study, focusing on walking tourism in Bandung City.

Table 2: Push and Pull Factors to Decide Walking Tourism

Variable	Description	Source
Push factors		
Physical health	The desire for a healthy and fit body drives engagement in physical activities, with walking being a beneficial option.	Davies et al., 2012; Pitana & Gayatri, 2005
Experience	Engaging in walking tourism provides participants with new experiences through both the activities and the destinations visited.	Davies et al., 2012; Deci & Ryan, 1990
Relaxation	Escaping the daily routine by doing walking tourism can benefit mental well-being.	Davies et al., 2012; Tanjung et al., 2022; Yoon & Uysal, 2005
Pleasure and satisfaction	Carrying out walking tourism activities to get pleasure and satisfaction from the experience gained	Tanjung et al., 2022; Davies et al., 2012

Variable	Description	Source
Social interaction	Walking tourism is typically conducted in groups, facilitating meetings and interactions among participants.	Davies et al., 2012; Deci & Ryan, 1990
Cultural interest	The desire to experience a region's authentic culture, food, and arts can be fulfilled through walking, which offers better views of historical buildings in tourism destinations.	Pitana & Gayatri, 2005
Knowledge gained	The desire to travel with the aim of gaining new knowledge in the form of information related to historical stories originating from tour guide.	Pitana & Gayatri, 2005; Deci & Ryan, 1990
Pull factors		
Climate situation	The destination area's climatic conditions usually differ from tourist's area of origin.	Awaritefe, 2004; Som et al., 2012
Person reference	Individuals engage in walking tourism to obtain recommendations from other people.	Awaritefe, 2004
Quality of tour guide	The quality of a tour guide as a travel guide and someone who tells stories about walking tourism activities.	Cooper, 1995; Alfisyahr & Deasyana, 2019
Tourist attraction	Walking tourism offers unique attractions by highlighting the historical stories of the locations visited.	Crompton, 1979; Jackson & Burton, 1989; Zakaria et al., 2020
Pedestrian condition	Pedestrian facilities are essential for walking tourism, as the condition of these paths greatly affects the experience.	Cooper, 1995; Jackson & Burton, 1989
Accessibility	The accessibility of the gathering point at the start of a walking tour is a key factor in attracting tourists.	Crompton, 1979
Cleanliness at tourist location	Cleanliness conditions at tourism area passed on the walking tourism route.	Alfisyahr & Deasyana, 2019; Jackson & Burton, 1989
Local people behaviour	Conditions of local communities passed during walking tourism routes.	Alfisyahr & Deasyana, 2019; Som et al., 2012
Social media promotion	Individuals participate in walking tourism based on promotions made on social media, such as Instagram.	Awaritefe, 2004; Jackson & Burton, 1989

METHODOLOGY

This study was carried out using an explanatory sequential mixed method. It began with a quantitative study, followed by an analysis of the results, and then a detailed exploration through qualitative investigation. This sequential method ensures a comprehensive understanding of the results (Creswell & Creswell, 2018).

Data Collection Method

This study adopted both primary and secondary data collection methods. Primary data were obtained through questionnaires and interviews. Meanwhile, secondary data were sourced from tourism planning documents, such as the 2012-2025

Regional Tourism Development Master Plan (RIPPARDA), general tourism documents from Culture and Tourism Agency (Disbudpar) of Bandung City, and previous studies for theoretical references. The questionnaire mainly included closed questions, with some open-ended questions for additional suggestions. It was structured into sections with the aim of collecting relevant information on respondent characteristics, travel patterns, push and pull factors, and decision-making. Subsequently, sampling was carried out using a convenience method, selecting individuals based on factors such as ease of access and relevant characteristics (Johnson & Christensen, 2014). Respondents comprised individuals over 15 years old who had participated in walking tourism in Bandung City. The sample size was determined using Hair Theory in accordance with the number of variables in the study (Hair et al., 2010), as follows:

$$\text{Sample} = (5 – 10) \text{ x number of variables}$$

This study considered 40 variables, leading to the requirement of a minimum of 200 and a maximum of 400 respondents. The actual sample size was 220, and the sampling process was conducted online through social media and offline during walking tourism activities. Accordingly, the questionnaire was incorporated with a five-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree). In this study, interviews were conducted using purposive sampling, both in-person and online through Zoom. Unstructured interviews were held with key stakeholders, including: 1) Disbudpar: manages and oversees tourism in Bandung City; 2) Bandung Heritage: a community focused on historical buildings in Bandung, comprising academics and heritage tourism practitioners; 3) Bandung Good Guide: a private tour guide service specializing in walking tourism since 2020; and 4) Bandung City Cultural Heritage Expert Team (TACB): manages cultural heritage in Bandung City.

Data Analysis Method

Quantitative descriptive analysis was adopted to show respondent characteristics and individual answers regarding push factors, pull factors, and decision-making. Accordingly, responses were expressed as percentages and weighted using Weighted Average Index (WAI) method. This method, as adopted by Wijaya et al. (2020), consolidates various indicators into a single score by assigning weights to each indicator. It was applied to convert the responses from an ordinal scale (strongly agree to strongly disagree) into numeric scores. The following is the process for calculating using WAI method:

$$WAI = (n1(0.20) + n2(0.40) + n3(0.60) + n4(0.80) + n5(1.00))/N$$

Where *n1* to *n5* represents the number of respondents who answered from 1 to 5, respectively, and *N* comprises the total number of respondents. Multiple linear regression analysis was utilized to evaluate the impact of push and pull factors (independent variables) on the decision to carry out walking tourism (dependent variable). This analysis showed which indicators significantly affected the decision-making process of tourists and determined the nature of the relationship between dependent variable and the indicators.

URBAN TOURISM AREA OF BANDUNG CITY

This study focuses on three critical areas in Bandung City namely Educational and Historical Tourism (Ganesha—Gedung Sate), Cultural Heritage Tourism (Braga Square), and Shopping Tourism (Otto Iskandardinata—Kepatihan) areas. Educational and Historical Tourism Area includes sites such as Bandung Institute of Technology (ITB) Campus, Padjadjaran University (UNPAD) Campus, Satay Building, Geological Museum, and Indonesian Postal Museum. Meanwhile, Cultural Heritage Tourism Area features historic Art Deco buildings and landmarks, including Bandung Well Site at PLN Office, Braga Road heritage buildings, Grand Mosque, Merdeka Building, Bandung Square, Bandung Post Office, Indonesian Bank Building, Banceuy Prison, Savoy Homan Hotel, and Grand Preanger Hotel. Shopping Tourism Area comprises shopping destinations such as Kings Plaza, *Pasar Baru*, Paskal Hyper Square, and other shops along Otto Iskandardinata and Kepatihan roads, as well as Cibadak Road, a culinary tourism hub. Figure 1 shows a map of these delineated areas.

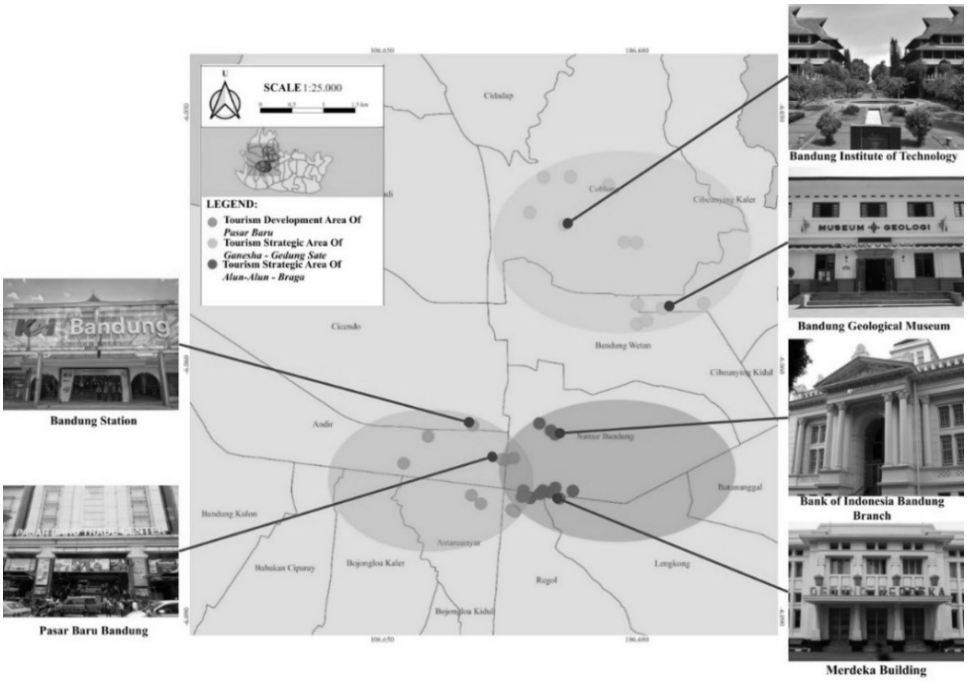


Figure 1: Delineation of Study Area
Source: modified from Google website and Geoportal Data of Bandung City (2024)

CHARACTERISTICS OF RESPONDENTS

The socio-economic profile of the 220 respondents shows that 74.5% are female (164 respondents) and 25.5% are male (56 respondents). The age distribution includes early adults (45.45%), late adolescents (34.55%), and late adults (12.73%). Furthermore, most respondents are from Bandung and the surrounding areas, including Cimahi City, Bandung Regency, and West Bandung Regency. Table 3 presents the detailed socio-economic characteristics of respondents.

Table 3: Socio-economics Characteristics of Respondents (*N = 220*)

Variable	Item	Frequency	%
Gender	Male	164	74.50
	Female	56	25.50
Age	<26	77	35.00
	26-35	100	45.45
	36-45	28	12.73
	46-55	11	5.00
	>55	4	1.82
Origin area	Bandung and the periphery	138	62.73
	West Java Province without Bandung and the periphery	22	10.00
	Outside West Java without Jakarta Metropolitan Area	8	3.64
	Jakarta Metropolitan Area	52	23.60

Variable	Item	Frequency	%
Education	Primary and high schools	36	16.36
	Vocational school	15	6.82
	University	168	76.37
	Others	1	0.45
Employment	Private and business sector	109	49.55
	Students	44	20.00
	Civil servant	18	8.18
	Own-stated government company	5	2.27
	Unemployment	6	2.73
	Others	38	17.28
Income level	< IDR 2,100,000	46	20.91
	IDR 2,100,000 – 4,200,000	60	27.27
	IDR 4,200,000 – 6,300,000	49	22.27
	> IDR 6,300,000	65	29.55

Source: Questionnaire results (2024)

ANALYSIS AND DISCUSSION

This study identified seven motivation factors for walking tourism in Bandung City, as shown in Table 4. The responses obtained from the 220 respondents showed a high level of agreement, with over 80% either strongly agreeing or agreeing with these factors. Accordingly, the motivational factors include physical health, seeking experience, pleasure, knowledge gained, social interaction, and cultural authenticity. Interviews with tour guides showed that walking tourism typically covered between 2 to 3 kilometres and included group interactions, knowledge sharing about historical sites, and pre-tour games to foster participant connections. Nine pull factors were identified with the capability to attract individuals to engage in walking tourism in Bandung City (see Table 4). Most respondents agreed with these factors, but some variables, such as weather, pedestrian facilities, transportation, cleanliness, and local behaviour, had significant percentages of moderate responses. This shows that the outlined factors were less influential in motivating walking tourism. Meanwhile, promotion and reviews on social media were observed to be significant motivators, with many respondents discovering walking tours through social media rather than personal referrals. The social media account organizing these tours has approximately 20,000 Instagram followers and regularly posts updates on respective activities.

Table 4: Push dan Pull Factors for Walking Tourism

Variable	Agreement (%)					WAI	Category
	Very Agree	Agree	Moderate	Disagree	Very Disagree		
Push factors							
Physical health	79.09	15.00	4.55	0.91	0.45	0.94	Very high
Experience	85.45	13.18	0.00	0.91	0.45	0.96	Very high
Relaxation	50.91	31.82	11.82	3.64	0.85	0.85	Very high
Satisfaction	60.91	33.18	4.55	0.91	0.91	0.91	Very high
Social interaction	56.36	25.91	11.36	5.45	0.86	0.86	Very high
Circumstance	75.00	18.64	4.09	1.82	0.93	0.93	Very high
Knowledge gained	75.00	19.09	4.09	1.36	0.93	0.93	Very high
Pull factors							
Climate	40.00	27.73	21.82	8.18	2.27	0.79	High
Person reference	25.91	23.18	17.27	18.18	15.45	0.65	High
Tour guide quality	61.82	30.00	5.45	2.73	0.00	0.90	Very high
Attraction	65.91	26.82	5.45	1.36	0.45	0.91	Very high
Pedestrian condition	35.45	29.09	20.45	9.55	5.45	0.76	High
Accessibility	20.00	38.18	20.45	14.55	6.82	0.70	High
Cleanliness	25.91	29.55	27.27	12.73	4.55	0.72	High
Attitude	36.36	35.91	20.45	6.36	0.91	0.80	High
Promotion	51.82	27.27	14.09	4.55	2.27	0.84	Very high

Source: Analysis results (2024)

Decision-making process for walking tourism comprises several stages before and after the trip. Before traveling, key indicators include searching for information, selecting from alternatives, and preparing for the trip. However, indicators after the trip include providing feedback, recommending the experience to others, considering similar holidays in other cities, and planning to participate in other similar tours. The most significant factors in the decision-making process for walking tourism are information investigation, with an 82.27% approval rate, and travel preparations, which are crucial at 90%. This result is plausible, since respondents commonly search for details about the organizer, registration, and routes before embarking on a tour. After the trip, high agreement was found on providing feedback and the intention to repeat the activity, with over 80% of respondents expressing a willingness to recommend the experience to others or re-engaging in similar tours in other cities. Accordingly, based on the interviews conducted with tour guides, conclusions were drawn that the guides play a crucial role in the feedback collection process, using Google Forms at the end of each session to ensure the tour experience is

continually improved. Table 5 presents the perceptions of respondents towards decision-making aspects of walking tourism.

Table 5: Respondents' Perception of Decision to Walking Tourism

Variable	Agreement (%)					WAI	Category
	Very Agree	Agree	Moderate	Disagree	Very Disagree		
Information investigation	50.00	32.27	12.73	4.09	0.91	0.85	Very high
Alternatives comparison	23.64	31.82	24.55	14.09	5.91	0.71	High
Preparation	62.73	27.27	5.91	3.18	0.91	0.90	Very high
Feedback	57.27	31.82	7.73	2.27	0.91	0.88	Very high
Ability to recommend	66.82	27.73	4.55	0.45	0.45	0.92	Very high
Re-walking tourism	68.18	25.91	3.64	0.91	1.36	0.92	Very high
Re-visiting	62.27	24.09	12.27	0.91	0.45	0.89	Very high

Source: Analysis results (2024)

The regression analysis (Table 6) shows that both push and pull factors significantly influence walking tourism decision in urban tourism area of Bandung. Key factors in this context include physical health, pleasure and satisfaction, knowledge gained, and friendly local behaviour.

Table 6: Significant Variables of Walking Tourism

Variable	Coefficient	p-value
Physical health	0.195	0.001*
Satisfaction	0.255	0.000*
Knowledge gained	0.267	0.000*
Behaviour of local people	0.069	0.036**
Constant	**0.7301**	
Prob>F	**0.000**	
R-squared	**0.544**	

Source: Analysis results (2024)

Table 7 presents several strategies that can be adopted to optimize these variables. During interviews with Disbudpar, a strategy was proposed to facilitate walking tourism. This strategy includes collaboration between the government and private sectors, such as tour guides and lodging services. Subsequently, TACB suggested the establishment of Supervision Unit Team at cultural heritage sites to enable local officials to report any form of violation. Bandung Heritage recommended regular meetings between expert communities and tour guides to share information and improve historical narratives. Lastly, Disbudpar was admonished to disseminate the historical data of Bandung Heritage to enrich tour content.

Table 7: Proposed Optimization Strategy for Significant Variables

Variable	Proposed strategy
Physical health	- Increasing trees and green spaces along routes for health benefits (Singh et al., 2021) - Expanding pedestrian areas while reducing vehicle traffic to minimize pollution - Adopting inclusive and sustainable tourism practices
Pleasure and satisfaction	- Restoring historical buildings along routes - Collaborating with stakeholders to maintain clean and well-conditioned sidewalks - Improving crossing facilities with dedicated management - Establishing a Monitoring Unit Team Task to oversee cultural heritage
Knowledge gained	- Reactivating the TACB *Sigaya Pinter* app for cultural heritage info - Collaborating with Disbudpar and Bandung Heritage to share historical content on social media and short films - Installing QR-coded information boards at historical sites for detailed building information
Behaviour of local people	- Providing extensive support and training for cultural heritage building maintenance - Enhancing community engagement in local events - Collaborating with *Pokdarwis* (Tourism Awareness Groups) to involve residents in tourist attractions

CONCLUSION

In conclusion, this study examined factors influencing decisions of tourists to engage in walking tourism, emphasizing walking as a healthy, low-carbon activity. The obtained results were in line with previous studies (Davies et al., 2012; Rabbiosi & Meneghello, 2023), showing that walking promotes physical and mental well-being, joy, calmness, and a sense of community. Several strategies were recommended for enhancing walking tourism include stakeholder collaboration to improve historical information distribution, reactivating cultural heritage application, and creating engaging promotional events. Furthermore, considering the limitations of the investigation, future explorations were recommended to expand the scope by increasing respondent numbers, exploring the relationship between walking tourism and other tourism types, as well as using alternative methods namely the theory of planned behaviour to assess the impact on sustainable tourism development.

ACKNOWLEDGMENT

The authors are grateful to respondents and resource persons engaged in this study.

DISCLOSURE STATEMENT

The authors declare no conflict of interest.

REFERENCES

Annisa, L. (2023). *Walking tour sebagai strategi pengembangan wisata perkotaan*. *Warta Pariwisata, 21*(1), 1–6. https://doi.org/10.5614/wpar.2023.21.1.01

Awaritefe, O. (2004). Motivation and Other Considerations in Tourist Destination Choice: A Case Study of Nigeria. *Tourism Geographies, 6*(3), 303–330. https://doi.org/10.1080/1461668042000249638

Bhawana, R. S., Sari, N., & Utomo, D. M. (2019). *Potensi Daya Tarik Wisata Sebagai Pengembangan Wisata Perkotaan Kota Malang*. *Planning for Urban Region and Environment, 7*(2), 1–8.

Chandran, A., Kashyap, S., & Golla, S. B. (2021). Low Carbon Tourism: an Explorative Study on Walking Tours Fostering Responsible Tourism in Delhi. *Atna Journal of Tourism Studies, 14*(2), 13–31. https://doi.org/10.12727/ajts.22.2

Chapman, L. (2007). Transport and climate change: a review. Journal of Transport Geography.

Cohen, S. A., Prayag, G., & Moital, M. (2014). Consumer behaviour in tourism: Concepts, influences and opportunities. *Current issues in Tourism, 17*(10), 872-909. https://doi.org/10.1080/13683500.2013.850064

Cooper, C. P. (1995). Tourism: Principles and Practice (3rd ed.). Longman.

Creswell, J. W., & Creswell, J. D. (2018). Mixed Methods Procedures. In Research Design: Qualitative, Quantitative, and Mixed Methods Approaches.

Crompton, J. L. (1979). Motivations for pleasure vacation. *Annals of Tourism Research, 6*(4), 408–424. https://doi.org/10.1016/0160-7383(79)90004-5

Dahiya, K. S., & Batra, D. K. (2016). Tourist decision making: Exploring the destination choice criteria. *Asian Journal of Management Research, 7*(2), 140-153.

Davies, N. J., Lumsdon, L. M., & Weston, R. (2012). Developing Recreational Trails: Motivations for Recreational Walking. *Tourism Planning and Development, 9*(1), 77–88. https://doi.org/10.1080/21568316.2012.653480

Deci, E. L., & Ryan, R. M. (1990). A Motivational Approach to Self: Integration in Personality. In Nebraska symposium on motivation (Vol. 38). https://www.researchgate.net/publication/21026291

Eugenio-Martin, J. L. (2003). Modelling Determinants of Tourism Demand as a five-stages process. *Tourism and Hospitality Research, 4*(4). https://doi.org/10.1177/146735840300400407

Hadiwijoyo, S. S. (2012). *Perencanaan Pariwisata Perdesaan Berbasis Masyarakat*. Graha Ilmu.

Hair, J. F., Anderson, R. E., Black, W. C., & Babin, B. J. (2010). Multivariate Data Analysis (7th ed.). Pearson; 7th edition.

Hin, Y. S., Mohamed, B., Marzuki, A., & Paisar, S. M. (2024). Travel Motivations of Domestic Tourists to Penang, Malaysia. *Planning Malaysia, 22*(33). https://doi.org/10.21837/pm.v22i33.1565

Jackson, E. L., & Burton, T. L. (1989). Understanding Leisure and Recreation: Mapping the Past, Charting the Future. Venture Pub.

Janusz, G. K., & Bajdor, P. (2013). Towards to sustainable tourism–framework, activities and dimensions. *Procedia economics and finance, 6*, 523-529. https://doi.org/10.1016/S2212-5671(13)00170-6

Johnson, R. B., & Christenses, L. (2014). Educational Research Quantitative, Qualitative,

and Mixed Approaches. SAGE Publications, Inc.

Kemenparekraf. (2021). *Destinasi Wisata Berbasis Sustainable Tourism di Indonesia*. https://kemenparekraf.go.id/ragam-pariwisata/Destinasi-Wisata-Berbasis-Sustainable-Tourism-di-Indonesia

Kotler, P. (2013). Strategy Brand Management (14th ed.). Pearson Education Limited.

Kotler, P., & Keller, K. L. (2016). Marketing Management (15th ed.). Pearson Education Limited.

Som, A. P. M., Marzuki, A., Yousefi, M., & Abu Khalifeh, A. N. (2012). Factors Influencing Visitors' Revisit Behavioral Intentions: A Case Study of Sabah, Malaysia. *International Journal of Marketing Studies, 4*(4). https://doi.org/10.5539/ijms.v4n4p39

Musthofa, B. M. (2023). *Wisata Jalan Kaki sebagai Alternatif Aktivitas Wisata di Masa dan Pasca Pandemi Covid-19 di DKI Jakarta*. *Jurnal Sosial Humaniora Terapan, 5*(2). https://doi.org/10.7454/jsht.v5i2.1023

Page, S. (1995). Urban Tourism. Routledge.

Pitana, I. G., & Gayatri, P. G. (2005). Sosiologi pariwisata: kajian sosiologis terhadap struktur. *Sistem, dan Dampak-Dampak.*

Prijadi, R., Sangkertadi, & Tarore, R. C. (2014). *Pengaruh Permukaan Jalur Pedestrian Terhadap Kepuasan dan Kenyamanan Pejalan Kaki di Pusat Kota Manado*. *Media Matrasain, 11*, 43-54. https://doi.org/10.35793/matrasain.v11i1.4984

Priono, Y. (2012). *Identifikasi Produk Wisata Pariwisata Kota (*Urban Tourism*) Kota Pangkalan Bun sebagai Urban Heritage Tourism*. *Jurnal Perspektif Arsitektur, 7*(2), 72–84. https://doi.org/10.36873/jpa.v7i02.841

Rabbiosi, C., & Meneghello, S. (2023). Questioning Walking Tourism from a Phenomenological Perspective: Epistemological and Methodological Innovations. *Humanities (Switzerland), 12*(4). https://doi.org/10.3390/h12040065

Rachmadi, H. (2021). *Model Pengambilan Keputusan Berwisata*. *Media Wisata, 14*(2). https://doi.org/10.36276/mws.v14i2.249

Rahmiati, F., & Dani, A. N. (2020). *Pengaruh Atribut Tujuan Terhadap Kepuasan Wisatawan: Studi Pada Walking Tourism*. *Jurnal Pariwisata, 7*(2). https://doi.org/10.31294/par.v7i2.8728

Ram, Y., & Hall, C. M. (2018). Walking tourism in cities: introducing the special issue. In International Journal of Tourism Cities (Vol. 4, Issue 3, pp. 281–284). Emerald Group Holdings Ltd. https://doi.org/10.1108/IJTC-09-2018-098

Rizal Alfisyahr, O., & Deasyana D, L. R. (2019). *Faktor Pendorong dan Faktor Penarik dari Wisatawan Domestik di Kabupaten Malang, Indonesia*. *Media Bina Ilmiah, 14*(3), 2217-2222. http://ejurnal.binawakya.or.id/index.php/MBI

Salusu, J. (1996). *Pengambilan Keputusan Stratejik: untuk Organisasi Publik dan Organisasi Nonprofit*. Grasindo.

Samuel. (2021). *Pengaruh Kesadaran Wisatawan akan Destinasi dan Motivasi Terhadap Keputusan Berkunjung di Taman Safari Indonesia Cisarua Bogor. Turn Journal, 1*(2), 1-19

Shaikh, A. S., Dars, A., Memon, K., & Kazi, A. G. (2020). A Study of Factors Affecting Travel Decision Making of Tourists. *Journal of Economic Info, 7*(1), 1–10. https://doi.org/10.31580/jei.v7i1.1157

Singh, K. K., Katewongsa, P., Wijaya, N., & Kwan, S. C. (2021). Green, Open Spaces

and Transport for Healthy and Sustainable Cities in Asian Developing Countries. *Malaysian Journal of Medicine & Health Sciences*, (3).

Solikhah, N. (2024). Streamline Moderne: Perkembangan Gaya Modern Arsitektur Art Deco di Kota Bandung Tahun 1930-1950. *Jurnal Muara Ilmu Sosial, Humaniora, dan Seni, 8*(1), 8-19. https://doi.org/10.24912/jmishumsen.v8i1.26428.2024

Tanjung, R., Munajat, M. D., & Novianti, E. (2022). *Pengaruh Faktor Pendorong dan Penarik Terhadap Keputusan Berkunjung ke Devoyage Bogor*. *Jurnal Inovasi Penelitian, 3*(7), 7059–7072.

Thompson, K. J. (2003). Urban Transport Networks and Overseas Visitors: Analysis of The Factors Affecting Usage and The Implications for Destination Management. University of Salford (United Kingdom).

UNWTO. (2011). Tourism Towards 2030.

Vural Arslan, T., Durak, S., Dizdar Gebesce, F., & Balcik, B. (2018). Assessment of factors influencing walkability in shopping streets of tourism cities: case of Bursa, Turkey. *International Journal of Tourism Cities, 4*(3), 330–341. https://doi.org/10.1108/IJTC-11-2017-0071

Weston, R., & Mota, J. C. (2012). Low Carbon Tourism Travel: Cycling, Walking and Trails. *Tourism Planning and Development, 9*(1), 1–3. https://doi.org/10.1080/21568316.2012.658168

Wijaya, N., Nitivattananon, V., Shrestha, R. P., & Kim, S. M. (2020). Drivers and benefits of integrating climate adaptation measures into urban development: Experience from coastal cities of Indonesia. *Sustainability, 12*(2), 750. https://doi.org/10.3390/su12020750

Yoon, Y., & Uysal, M. (2005). An examination of the effects of motivation and satisfaction on destination loyalty: a structural model. *Tourism Management, 26*(1), 45–56. https://doi.org/10.1016/j.tourman.2003.08.016

Zakariya, K., Che Haron, R., Tukiman, I., Ab. Rahman, S. A., & Harun, N. Z. (2020). Landscape Characters for Tourism Routes: Criteria to Attract Special Interest Tourists to The Kuala Selangor – Sabak Bernam Route. *Planning Malaysia, 18*(14). https://doi.org/10.21837/pm.v18i14.843

Received: 28th June 2024. Accepted: 6th September 2024

PLANNING MALAYSIA:
Journal of the Malaysian Institute of Planners
VOLUME 22 ISSUE 5 (2024), Page 156 – 167

THE RELATIONSHIP BETWEEN TOURIST EXPERIENCE, PLACE ATTACHMENT, AND POST-VISIT INTENTIONS: AN APPLICATION OF S-O-R PARADIGM IN THE CONTEXT OF HANGZHOU, CHINA

Bai Fan[1], Mohd Ismail Isa[2*], Badaruddin Mohamed[3]

[1,2,3]*School of Housing, Building and Planning,*
UNIVERSITI SAINS MALAYSIA

Abstract

A key challenge facing destination practitioners and policymakers is to sustain a competitive advantage and to ensure its destination's success and prosperity under the impact of globalisation. Evidence suggests that the tourist experience can enhance tourists' attachment and post-visit intention, which is an essential concept in travel and tourism study, as well as destination positioning. Still, there are limitations in the research concerning the relationship between these three factors. This study investigates the mediating effect of place attachment on the relationship between tourist experience and post-visit intention using Stimulus–Organism–Response (S-O-R) paradigm. The data were gathered from 213 respondents among the West Lake Heritage Site users in Hangzhou, China, using the self-administered questionnaires. According to statistical findings, tourist experience influences post-visit intention both directly and indirectly through the mediating role of place attachment. Drawing from these findings, practical information on design, marketing, and experiences for tourism destinations is offered.

Keywords: Tourist Experience, Place Attachment, Post-visit Intention, S-O-R Theory, Mediating effect, Hangzhou

[2] Lecturer at Universiti Sains Malaysia Email: mohdismail.isa@usm.my

INTRODUCTION

Tourism is among the most vibrant industries in today's economy. The ongoing increase in international travellers is vital in driving worldwide economic growth (Ab Dulhamid et al., 2022). However, under the impact of globalisation, regions have led to cultural convergence and the gradual disappearance of local individuality and characteristics. Numerous types of tourism activities and tourist needs can be substituted. Therefore, destination practitioners and policymakers must sustain a competitive advantage. Tourism destinations are obliged to understand what the market demands. In the emerging experience economy, consumers no longer pursue consistent and high-level products or services but prefer unique experiences (Pine & Gilmore, 1998). To maintain a competitive advantage and succeed, tourist destinations must provide market demand experiences. Another critical factor for the success of tourist destinations is place attachment. It is a necessary construct that reflects the multi-faceted nature of the meaning tourists ascribe to physical environments. For many tourism destinations, tourists' post-visit intentions—such as the desire to return and share their experiences—constitute a valuable market segment. Previous research has established a positive correlation between tourist experience and place attachment (e.g., Wu et al., 2022) and between place attachment and post-visit intention (e.g., Sthapit et al., 2017). However, empirical research regarding the relationship among these three variables remains limited. This study adopts the S-O-R paradigm to explore how place attachment mediates the relationship between tourist experience and post-visit intention.

LITERATURE REVIEW

Stimulus–organism–response (S-O-R) Theory

The S-O-R model posits that environmental stimuli can influence an individual's cognitive and emotional responses, which subsequently lead to corresponding behavioural actions (Lee et al., 2011). According to this theory, stimuli (S) in various settings trigger changes in a person's internal or organismic state (O), which then prompts either approach or avoidance behaviour (R) in response to these stimuli (Şahin & Kılıçlar, 2023).

Stimulus: Tourist experience

A stimulus refers to environmental factors that trigger individuals' internal reactions to their surroundings. In the S-O-R theory, stimuli encompass both physical and sensory components. These external factors include various aspects such as visuals, sounds, tastes, or the overall ambiance. Stimuli represent all external influences on an organism (Şahin & Kılıçlar, 2023). The tourist experience is shaped by the act of visiting, learning, and enjoying activities in a setting away from home. Stamboulis and Skayannis (2003) described the tourist

experience as the interaction between tourists and sites, where sites serve as venues for experiences, and tourists act as participants. Consequently, tourist experiences provoke reactions from tourists, which can be seen as a "stimulus".

Organism: Place Attachment

The "organism" encompasses a spectrum of elements, including attitude, emotion, feeling, affect, value, and consciousness (Jacoby, 2002). In this model, an individual's emotional states represent the internal processes and structures that mediate between external stimuli and final actions or responses. The term "attachment" emphasizes the emotional aspect, while "place" highlights the environmental settings to which people develop emotional and cultural ties (Altman & Low, 2012). Place attachment represents the positive connection or emotional bond between a person and a specific location (Williams & Vaske, 2003). It has been widely applied to study the connection between tourists and destinations. Therefore, place attachment is recognized as an "organism".

Response: Post-visit Intention

Within the S-O-R paradigm, the response is the outcome of the organism. In tourism studies, the response dimension often examines behavioural intention (Kucukergin et al., 2020), which can be viewed as the result of the environmental stimulus. In tourism research, post-visit intention typically refers to the willingness to return and recommend a destination (Yoon & Uysal, 2005). The rate at which tourists revisit significantly influences the total number of visitors and their purchase intentions. This study examines post-visit intention as it relates to the "response" dimension in the model.

Relationship Between Tourist Experience and Post-visit Intention

Previous research has thoroughly tested the effect of tourist experience on post-visit intention. For example, empirical findings from De Nisco et al. (2015) demonstrate that a high-quality tourism experience can positively influence the revisit intention and their inclination to endorse a destination as a preferred travel choice.

Relationship Between Tourist Experience and Place Attachment

From a tourism perspective, the role of the tourist experience in shaping an emotional bond with destinations has been well substantiated. For instance, Wu et al. (2022) revealed a significant positive correlation between tourist experience and their attachment to mountain tourism. Similarly, Xiang and Mohamad (2023) confirmed this finding, highlighting a close interrelationship between tourist experience and place attachment.

Relationship Between Place Attachment and Post-visit Intention

Prior studies have explored the effect of place attachment on tourists' behavioural intentions, like recommending and revisiting a destination. Sthapit et al. (2017) concluded that a strong positive connection between tourists and a place increases the likelihood of them sharing recommendations. Similarly, findings from Pandey and Sahu (2020) indicate that destination attachment is a key predictor of recommendation intentions. The proposed research framework is displayed in **Figure 1**.

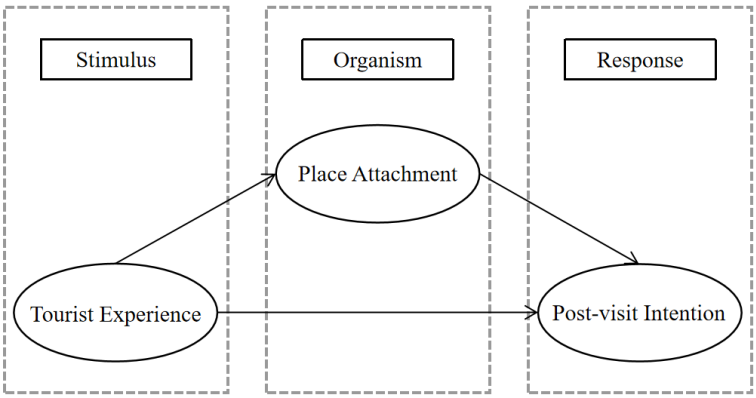


Figure 1: Conceptual Framework
Source: Authors

RESEARCH METHODOLOGY

Study Area

This study focuses on the West Lake Heritage site in Hangzhou, China. Situated on the southern edge of the Yangtze River Delta and the Qiantang River Basin, Hangzhou is a prominent national scenic tourism city, as shown in Figure 2. The West Lake Cultural Landscape of Hangzhou was inscribed on the World Heritage List in 2011. Therefore, Hangzhou is an ideal location for exploring the interrelationship between tourist experience, satisfaction, and place attachment.

Figure 2: The West Lake Heritage Site's Location.
Source: https://en.wikipedia.org/wiki/Yangtze_Delta

Research Instrument

The questionnaire comprises four sections: (i) demographics, (ii) tourist experience, (iii) place attachment, and (iv) post-visit intention, featuring a total of 37 items. Except for the demographic questions, all other items were assessed using a 5-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree), with intermediate points being 2 (disagree), 3 (neither agree nor disagree), and 4 (agree).

Demographic information: According to Skare et al. (2023), tourists choose different attractions based on various factors, including sex, age, education, marital status, and annual income. Therefore, this section of the questionnaire includes questions about sex, age, education, marital status, monthly income, and occupation.

Tourist experience: As pioneers of the experiential economy, Pine and Gilmore (1998) categorized experiences into four types based on customer participation: entertainment, education, escapist, and aesthetic experiences. This "4E" scale has been extensively studied and validated in contexts such as rural tourism, wine tourism, gastronomic experiences, and heritage sites. Consequently, this study applies the four dimensions to measure tourist experience, with the 16 items from Minh et al. (2023).

Place attachment: Both conceptual and empirical studies have indicated that place attachment is generally characterized by two aspects: place dependence and place identity. Place dependence refers to functional attachment, involving a relationship with a setting that offers opportunities to meet specific needs (Ramkissoon et al., 2012). In contrast, place identity represents an emotional attachment. The 12 items used in this section are adapted from Isa (2020) and Han et al. (2023).

Post-visit Intention: The three items used to measure post-visit intention, including tourists' intentions to revisit and their likelihood of recommending the destination, are adopted from Azinuddin et al. (2022).

Quantitative Approach

This study adopts a quantitative approach, utilizing a survey methodology with self-administered questionnaires for data collection. Correlation analysis and mediation model testing were conducted to analyse the relationships among the three factors. According to Fricker and Hengartner (2001), correlation is a statistical tool used to determine the strength of the relationship between two or more variables. In this research, Pearson Correlation Analysis was employed to assess the significance and interrelationship among the three variables.

ANALYSIS AND FINDINGS

Demographic Characteristics

Of the respondents, 57.7% are male, while 42.3% are female. Most respondents fall within the 26 to 35 age group, with 62.0% of them being unmarried. Additionally, 90.2% of respondents have attained higher education, specifically "university or college" (46.5%) or "postgraduate or higher" (43.7%). As shown in **Table 1**, the monthly income of respondents is reported in Chinese Yuan (CNY, ¥). The findings reveal that 21.1% of respondents earn less than ¥3,000 monthly, followed by income groups of ¥5,000-6,999 (18.3%), ¥7,000-8,999 (16.9%), and ¥3,000-4,999 (7.0%). In contrast, 36.6% earn more than ¥9,000. Respondents primarily consist of private sector employees (31.9%) and public sector employees (31.5%), with stay-at-home parents representing the smallest proportion.

Table 1: Sample Demographic Characteristics.

Characteristics	Classification	Number	Percentage (%)
Gender	Male	123	57.7
	Female	90	42.3
Age	＜18	3	1.4
	18 ~ 25	66	31.0
	26 ~ 35	105	49.3
	36 ~ 45	15	7.0
	46 ~ 60	21	9.9
	＞60	3	1.4
Marital status	Unmarried	132	62.0
	Married	81	38.0
Education background	Middle school or lower	0	0
	High school	21	9.9
	University or college	99	46.5
	Postgraduate or higher	93	43.7

Characteristics	Classification	Number	Percentage (%)
Monthly income (CNY)	＜3000	45	21.1
	3000 ~ 4999	15	7.0
	5000 ~ 6999	39	18.3
	7000 ~ 8999	36	16.9
	> 9000	78	36.6
Occupation	Students	25	11.7
	Stay-at-home parent	5	2.3
	Public sector employee	67	31.5
	Unemployed	6	2.8
	Self-employed	24	11.3
	Private sector employee	68	31.9
	Retired	2	0.9
	Others	16	7.5

Source: Authors

Descriptive Analysis

According to **Table 2**, the mean scores for these variables ranged from 3.700 (Standard Deviation = 0.590) to 4.325 (Standard Deviation = 0.662). This indicates that most respondents rated these variables at three or above on a five-point scale, reflecting their importance to the respondents. Thus, tourist experience, place attachment, and post-visit intention are significant to the respondents.

Table 2: Descriptive Statistics

	Min	Max	Mean	Stan. Dev. (SD)
Tourist Experience	1	5	3.700	.590
Place Attachment	1	5	3.844	.645
Post-visit Intention	2	5	4.315	.662

Source: Authors

Correlation Analysis

The findings from the correlation analysis are detailed in **Table 3**. As suggested by Jia et al. (2018), a positive correlation coefficient signifies a positive correlation. The absolute value of the correlation coefficient lies between 0.8 and 1, showing a high correlation. The range of 0.5 to 0.8 suggests a moderate correlation, while 0.3 to 0.5 shows a weak correlation. Values from 0 to 0.3 suggest an extremely weak correlation, reflecting minimal or negligible relationships between variables. The analysis revealed a significant and strong positive correlation between tourist experience and place attachment, with a correlation coefficient of 0.690. The findings further show a substantial and robust positive correlation between place attachment and post-visit intention (correlation value is 0.779). Also, the correlation value between tourist experience and post-visit intention is 0.658, which is significant. Thus, it can be

concluded that the relationship between the independent variable (tourist experience), dependent variable (post-visit intention), and mediator (place attachment) is significant.

Table 3: Correlation Analysis

	Tourist experience	**Place attachment**	**Post-visit Intention**
Tourist experience	1		
Place attachment	.690**	1	
Post-visit Intention	.658**	.779**	1
**. Correlation is significant at the 0.01 level (2-tailed).			

Source: Authors

Assessment of Structural Model

Based on the criteria established by Hu and Bentler (1999), the measurement model demonstrates an acceptable level of fit (see **Table 4**). Cronbach's alpha for the examined constructs ranged from 0.882 to 0.948, surpassing the standard for sufficient internal consistency as recommended by Fornell and Larcker (1981). This indicates that the scales used in the questionnaire are reliable.

Table 4: The Reliability of Tourist Experience, Place Attachment, and Post-visit Intention.

Dimensions	Cronbach's Alpha	Items
Tourist Experience	0.892	16
Place Attachment	0.911	12
Post-visit Intention	0.851	3
Total	0.948	31

Source: Authors

To examine the mediating effect of place attachment on the relationship between tourist experience and post-visit intention, this study uses Model 4 (Simple Mediation) in PROCESS, a versatile modelling tool developed by Hayes (2012) in SPSS. The results in **Table 5** show that the predicting role of tourist experience to post-visit intentions is significant ($B=0.658$, $t=7.251$, $p<0.01$). After incorporating place attachment as a mediator, the predictive effect remains significant ($B = 0.230$, $t = 2.265$, $p<0.01$). As such, the conclusion can be made that there is an optimistic prediction from tourist experience to place attachment ($B=0.690$, $t=7.921$, $p<0.01$), and place attachment positively predicts post-visit intention ($B=0.620$, $t=6.115$, $p<0.01$).

Table 5: The Test of Mediation Model.

Regression Equation (N=213)		**Assessing fit**			**Significance of coefficients**	
Outcome	Predict variable	R	R^2	F	B	t
Post-visit intention	Tourist experience	0.796	0.634	58.849	0.658	7.251**
Place attachment	Tourist experience	0.690	0.476	62.743	0.690	7.921**
Post-visit intention	Tourist experience	0.796	0.634	58.850	0.230	2.265**
	Place attachment				0.620	6.115**

**. Correlation is significant at the 0.01 level.

Source: Authors

The direct and indirect effects of tourist experience on post-visit intention range from 0.082 to 0.685 (greater than 0) within the bootstrap 95% confidence interval, as shown in **Table 6**. This indicates that tourist experience can not only predict post-visit intention directly but also predict it through the mediating effect of place attachment. Additionally, the direct and indirect effects account for 34.959% and 65.041% of the total effect, respectively.

Table 6: Total Effect, Direct Effect, and Indirect Effect.

	Size Effect	**Boot SE**	**Boot LLCI**	**Boot ULCI**	**Relative response value (%)**
Total effect	0.738	0.113	0.524	0.967	
Direct effect	0.258	0.097	0.082	0.468	34.959
Indirect effect	0.480	0.098	0.303	0.685	65.041

Source: Authors

CONCLUSION

The following conclusions emerge from the data analysis and rigorous testing procedures. The results indicate that, among the 213 participants, 57.7% were identified as male and 42.3% as female. The age group of 26-35 years was the most prevalent, comprising 49.3% of the respondents, and 62% were unmarried. 192 respondents held at least a bachelor's degree. The highest income group consisted of individuals earning over 9000 Chinese Yuan. The largest groups of respondents were those employed in the private sector (68) and the public sector (67). The descriptive analysis shows that tourist experience, place attachment, and post-visit intention are all significant to tourists, as the mean values for these factors all exceed three on a 5-point scale.

Empirical results of this study highlight the complex interplay among these variables. The findings show that the tourist experience positively impacts the formation of place attachment, which influences tourists' post-visit intention.

Additionally, the tourist experience has both direct and indirect effects on post-visit intention, providing a nuanced understanding of the dynamics shaping tourists' behavioural intentions after their visit. The direct effect, accounting for 34.959%, underscores the immediate influence of tourist experiences on post-visit intentions. The indirect effect, representing 65.041%, emphasizes the importance of place attachment as a mediating factor. The findings suggest that enhancing the overall tourist experience not only directly impacts post-visit intentions but also indirectly shapes them by fostering a strong sense of place attachment.

This comprehensive approach is essential for a more accurate understanding of visitor behaviour and for developing effective methods to promote sustainable tourism and positive destination outcomes. This study encourages future research to verify the relationships among tourist experience, place attachment, and post-visit intention using public participation GIS, web-text analysis, and other innovative techniques to provide additional perspectives.

ACKNOWLEDGEMENTS

The authors wish to acknowledge the support from the School of Housing, Building and Planning at Universiti Sains Malaysia for this research.

REFERENCES

Ab Dulhamid, H., Isa, M. I., Mohamed, B., & Sazali, M. F. (2022). Motivational Factors in Influencing the International Tourist's Travel to Tourism Attractions in Penang. *Planning Malaysia*, 20. https://doi.org/10.1177/1356766716676300

Altman, I., & Low, S. M. (Eds.). (2012). *Place attachment* (Vol. 12). Springer Science & Business Media.

Azinuddin, M., Som, A. P. M., Saufi, S. A. M., Zarhari, N. A. A., Amin, W. A. A. W. M., & Shariffuddin, N. S. M. (2022). Investigating overtourism impacts, perceived man-made risk, and tourist revisit intention. *Planning Malaysia*, 20. https://doi.org/10.21837/pm.v20i22.1142

De Nisco, A., Mainolfi, G., Marino, V., & Napolitano, M. R. (2015). Tourism satisfaction affects the general country image, destination image, and post-visit intentions. *Journal of Vacation Marketing, 21*(4), 305-317.https://doi.org/10.1177/1356766715577502

Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. Journal of marketing research, 18(1), 39-50. https://doi.org/10.1177/002224378101800312

Fricker, R. D., & Hengartner, N. W. (2001). Environmental equity and the distribution of toxic release inventory and other environmentally undesirable sites in metropolitan New York City. *Environmental and Ecological Statistics*, 8, 33-52.

Han, T. Y., Isa, M. I., & Marzbali, M. H. (2023). Influencing factors of neighbourhood attachment: A case study of Penang, Malaysia. *Planning Malaysia*, 21. https://doi.org/10.21837/pm.v21i28.1339

Hayes, A. F. (2012). PROCESS: A versatile computational tool for observed variable mediation, moderation, and conditional process modelling [White paper]. Retrieved from http://www.afhayes.com/ public/process2012.pdf

Hu, L. T., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural equation modelling: a multidisciplinary journal, 6*(1), 1-55. https://doi.org/10.1080/10705519909540118

Isa, M. I. (2020). Evolution of Waterfront Development in Lumut City, Perak, Malaysia. PLANNING MALAYSIA, p. 18. https://doi.org/10.21837/pm.v18i13.778

Jacoby, J. (2002). Stimulus-organism-response reconsidered: an evolutionary step in modelling (consumer) behavior. *Journal of consumer psychology, 12*(1), 51-57. https://doi.org/10.1207/S15327663JCP1201_05

Jia, J. P., He, X. Q., Jin, Y. J. (2018). Statistics (7th ed.). China Renmin University Press.

Kucukergin, K. G., Kucukergin, F. N., & Dedeoglu, B. B. (2020). An overview of the destination physical servicescape with SOR paradigm: The importance of prestige sensitivity. *Asia Pacific Journal of Tourism Research, 25*(5), 473-488. https://doi.org/10.1080/10941665.2020.1737160

Lee, Y. K., Son, M. H., & Lee, D. J. (2011). Do emotions play a mediating role in the relationship between owner leadership styles and manager customer orientation, and performance in service environment? *International Journal of Hospitality Management, 30*(4), 942-952. https://doi.org/10.1016/j.ijhm.2011.02.002

Minh, H. N., Rahman, S., & Thi, T. C. (2023). THE EFFECT OF TOURIST EXPECTATIONS AND TOURIST EXPERIENCES ON TOURIST SATISFACTION WITH HERITAGE ATTRIBUTES: A CASE STUDY OF HỘI AN, VIETNAM. *PLANNING MALAYSIA*, 21. https://doi.org/10.21837/pm.v21i28.1337

Pandey, A., & Sahu, R. (2020). Modeling the relationship between service quality, destination attachment and eWOM intention in heritage tourism. *International Journal of Tourism Cities, 6*(4), 769-784. https://doi.org/10.1108/IJTC-08-2019-0125

Pine, B. J., & Gilmore, J. H. (1998). Welcome to the experience economy. Harvard Business Review Press. https://enlillebid.dk/mmd/wp-content/uploads/2012/03/Welcome-to-the-Experience-Economy-Pine-and-Gilmore.pdf

Şahin, A., & Kılıçlar, A. (2023). The effect of tourists' gastronomic experience on emotional and cognitive evaluation: an application of SOR paradigm. *Journal of Hospitality and Tourism Insights, 6*(2), 595-612. https://doi.org/10.1108/JHTI-09-2021-0253

Ramkissoon, H., Weiler, B., & Smith, L. D. G. (2012). Place attachment and pro-environmental behaviour in national parks: The development of a conceptual framework. *Journal of Sustainable tourism, 20*(2), 257-276. https://doi.org/10.1080/09669582.2011.602194

Skare, M., Gavurova, B., Polishchuk, V., & Nawazish, M. (2023). A fuzzy model for evaluating the level of satisfaction of tourists regarding accommodation establishments according to social class on the example of V4 countries. *Technological Forecasting and Social Change*, 193, 122609.

https://doi.org/10.1016/j.techfore.2023.122609
Stamboulis, Y., & Skayannis, P. (2003). Innovation strategies and technology for experience-based tourism. *Tourism management, 24*(1), 35-43. https://doi.org/10.1016/S0261-5177(02)00047-X
Sthapit, E., Björk, P., & Coudounaris, D. N. (2017). Emotions elicited by local food consumption, memories, place attachment and behavioural intentions. *Anatolia, 28*(3), 363-380. https://doi.org/10.1080/13032917.2017.1322111
Williams, D. R., & Vaske, J. J. (2003). The measurement of place attachment: validity and generalizability of a psychometric approach. *Forest Science, 49*(6),830–840. https://doi.org/10.1093/forestscience/49.6.830
Wu, D., Li, K., Ma, J., Wang, E., & Zhu, Y. (2022). How Does Tourist Experience Affect Environmentally Responsible Behavior? *Sustainability, 14*(2), 924. https://doi.org/10.3390/su14020924
Xiang, T. H., & Mohamad, D. (2023). The effect of placemaking attributes on tourism experiences: a case study of Petaling Street in Malaysia. *Planning Malaysia*, 21. https://doi.org/10.21837/pm.v21i28.1336
Yoon, Y., & Uysal, M. (2005). An examination of the effects of motivation and satisfaction on destination loyalty: a structural model. *Tourism management, 26*(1), 45-56. https://doi.org/10.1016/j.tourman.2003.08.016

Received: 18th March 2024. Accepted: 30th August 2024

PLANNING MALAYSIA:
Journal of the Malaysian Institute of Planners
VOLUME 22 ISSUE 5 (2024), Page 168 – 182

EFFECTS OF TOURIST MOTIVATION ON TOURISM PLANNING: A CASE STUDY OF DOMESTIC TOURISTS IN VIETNAM

Ho Nhu Ngoc[1*], Shida Irwana Omar[2], Nguyen Ngoc Chau Ngan[3]

[1,3]*Tourism Program, Faculty of Cultural Industries Sport and Tourism,*
THU DAU MOT UNIVERSITY, VIETNAM
[2]*School of Housing Building and Planning,*
UNIVERSITI SAINS MALAYSIA, MALAYSIA

Abstract

Tourist motivations is a fundamental aspect of tourism planning as it enhances marketing efforts, product development, competitive positioning, and facilitates informed policymaking. As such, the present study provides accurate data with which to develop tourism planning in Vietnam based on the push motivation and pull motivation factors of Vietnamese domestic tourists. A quantitative method, namely, a questionnaire that was designed based on a self-desk study, expert opinions, and tour guide opinions, was used to collect data. Out of 670 questionnaire returned, 664 were ultimately usable for analysis. Descriptive analysis, factor analysis, and regression binary logistic models were then used to analyse the collected data. Seven important push motivation factors, namely, fulfilling prestige, fun and entertainment, escape, family and friends' togetherness, fulfilling spiritual needs, social relationships, and gaining knowledge were identified as important to Vietnamese domestic tourists. Meanwhile, the four important pull motivations for Vietnamese domestic tourists were events and activities; destination's facility, service, and trip sponsor; historical and cultural attractions; and natural resources. The findings can be used to develop tourism planning for domestic tourism in Vietnam. Destinations may use the insights on tourist motivations to attracts tourists and provide them with fulfilling experiences, which would, ultimately, contribute to the overall success and sustainability of Vietnam's tourism industry. Besides, the findings contribute to extant literature on the tourist motivations and tourist behaviours of Vietnamese domestic tourists. Lastly, the case study of Vietnam may serve as confirmation of the value of tourist motivations in tourism planning.

Keywords: domestic tourists, push and pull theory, tourist behaviour, tourist motivation, Vietnam

[1] Lecturer at Thu Dau Mot University, email: ngochn@tdmu.edu.vn

INTRODUCTION

Domestic tourism is taking on an important role in world tourism According to the UNWTO (2020), there were an estimated 9 billion domestic tourist arrivals (overnight visitors) worldwide in 2018, with more than half of those trips occurring in Asia and the Pacific. Vietnam is a country in Southeast Asia with numerous beautiful natural sceneries and landscapes and rich potential features for tourism development. In 2023, while the international tourism market was still experiencing a downward trend as a consequence of the COVID-19 pandemic, domestic tourism in Vietnam recorded 108 million tourist arrivals (The People, 2024). However, according to the official newspaper of the Communist Party of Vietnam (2023), the market is facing a significant challenge. In fact, in 2022, although there was an increase in domestic tourist arrivals, the number of domestic tourists who stayed overnight at their destination dropped. The downturn in the proportion of overnight tourists resulted in a reduction in tourism revenue. According to the State, the tourism sector needs to improve its service quality, diversify its tourism products, develop its technical infrastructure to serve tourists, etc.

To create suitable products for a market, market research needs to be conducted to understand the behaviour of potential customers (Kotler et al., 2021). In the context of tourist behaviour, tourist motivation is one of nine key concepts that has received excellent attention from scholars (Cohen et al., 2014). Scholars of tourism, especially, agree that studies into tourist motivations can explain why people travel (Camilleri, 2018). Even though the topic has been researched widely and early, scholars are still challenged by tourist motivation as it is a psychological aspect that is complex and dynamic and may, therefore, vary among individuals according to their nationality or destination (Kozak, 2002). Hence, tourist motivation is continually considered a contemporary research topic in tourism studies.

Given the deficiency and imperativeness of essential insights on domestic tourists, this study thus endeavoured to use the push-and-pull motivation theory to examine the motivations of Vietnamese domestic tourists. The findings will serve to address the gaps in the literature on the tourist behaviours of Vietnamese domestic tourists. Besides, the knowledge about tourist motivations will also be useful for the government in tourism planning and the formulation of tourism policies. The specific objectives of this study were (i) to identify the underlying tourist motivations perceived in Vietnamese domestic tourists; (ii) to examine the push motivation and pull motivation factors of Vietnamese domestic tourists; and (iii) to identify the effects of tourist motivations on tourism planning to increase domestic tourism in Vietnam.

LITERATURE REVIEW

Tourist Motivation

Solomon et al. (2019) defined motivation, from a psychological perspective, as a process that causes human behaviour, is aroused by a need, and drives people to act to reduce the tension of a need or satisfy a demand. The term 'motivation', namely tourist motivation, is applied in tourism. Tourist motivations are determined by social and personal factors concerning needs. Tourists usually have multiple motives, based on their expectations of purchase values. In the context of studies on tourist behaviours, tourist motivation is one of nine key concepts that has received significant attention from tourism scholars (Cohen et al., 2014). Even though the topic has been researched widely and early, scholars are still challenged by tourist motivations (Cohen et al., 2014). Firstly, since tourist motivation is a psychological aspect that is complex and dynamic, it will vary between individuals. Crompton (1979) stated that understanding why people travel is more complicated than describing when, what, where, and how they travel. Secondly, tourist motivations vary according to nationality and destination (Cengizci et al., 2020). Thirdly, there are different tourist motivations across various types of tourism, such as between adventure tourism (Michael et al., 2017), and pilgrimage tourism (Bideci & Albayrak, 2016). Hence, tourist motivation has always been considered as a contemporary research topic in tourism studies.

Push motivation and pull motivation factors are widely used by tourism scholars when it comes to studies into tourist motivation. From the outset, Dann (1977) was a pioneer in applying the push-and-pull theory in his research into tourist motivation. From a sociological perspective, he explored tourist motivations in Barbados based on two conceptualisations: anomie and ego-enhancement, which are tied to socio-psychological needs. In continuing the work of Dann (1977), Crompton (1979) explored the dimensions of tourist motivation and leisure motivation using the push-and-pull theory. However, Crompton argued that the push motivation and pull motivation factors are two components of tourist motivation. According to Crompton, the push motivation factors are related to individual socio-psychological motives and the interpersonal world that induce a person to travel. In contrast, the pull motivation factors contain an attractiveness that draws an individual to travel to a specific destination. Two clusters of motives are specified, namely, socio-psychological motives and cultural motives. Remarkably, Crompton stated that the underlying motives provide helpful insights into understanding the destination selection decision process. Previous studies have proved the relationship between pull motivation and push motivation and explain them as two components of one feature, namely, tourist motivation (Shahrin & Marzuki, 2018).

Tourism Planning and Tourist Motivation

It can be a challenging task to define planning. The term "planning" can be applied in several circumstances, including to individuals, groups, organisations, and governments. It can be utilised in various geographical contexts, including in urban and rural areas, and can be implemented at multiple levels such as at municipal, regional and national levels. A plan can range from rudimentary and vaguely expressed ideas to a comprehensive and meticulously crafted document. The objective of tourism planning is to ensure that tourists have access to fun and rewarding experiences, while also providing benefits to enhance the quality of life of the people and the destination areas (Rahmafitria et al., 2020). An action plan has five primary components, namely, attractions or the development of tourism products, promotions, infrastructure, services, and hospitality (Mason, 2020). The seven phases in the process of tourism planning include identifying present tourism markets, developing market profiles, determining potential markets, stating tourism goals and objectives, developing action steps, involving the community, implementing the action plan, and monitoring the results (Mason, 2020).

Understanding tourist motivations allows tourism planners to design more effective strategies, create attractive products, allocate resources wisely, and promote sustainable and economically beneficial tourism practices. In fact, the insight into what motivates tourists will help in crafting marketing campaigns that effectively attract potential tourists (Kotler et al., 2021). By knowing whether tourists are seeking adventure, relaxation, cultural experiences, or other activities, tourism planners can tailor their promotional materials to highlight the specific attractions that will draw these visitors. Besides, when tourism planners are aware of the tourist motivations behind why people choose certain destinations, they can create new tourism products and services that meet tourist expectations or satisfy unfulfilled needs. This will lead to higher satisfaction, positive reviews, repeat visits, and increased tourist spending. Moreover, tourism planners must decide where to allocate resources such as funds and labour (Mason, 2020). Once they understand tourist motivations, they can prioritise those developments that will have the greatest impact. If most tourists visit a region for its natural beauty, resources can be allocated to preserve and enhance these natural sites. Additionally, destinations need to stand out in a competitive global market. Understanding what drives tourists to choose one destination over another enables tourism planners to emphasise unique selling points and differentiate their offerings from those of competitors (Kotler et al., 2021).

Domestic Tourism

Domestic tourism contributes to improving the economy of a country, equilibrating the socio-economic growth within regions, and maintaining and developing the regional economy (Urzha et al., 2017). Domestic tourism

stimulates the redistribution of the national income from the developed or urban areas to the poor or rural ones. The domestic market is taking on an important role in world tourism. According to the UNWTO (2020), there were an estimated nine billion domestic tourist arrivals (overnight visitors) worldwide in 2018, with more than half of those trips occurring in Asia and the Pacific.

Vietnam is a country in Southeast Asia with numerous beautiful natural sceneries and landscapes and rich and diverse cultural and historical features that attract millions of tourists from around the world. The tourism industry is attracting more and more attention from the state and private sectors. To ensure the sustainable development of tourism in Vietnam, the industry is also receiving the attention of the local people to reduce its impact on the environment (Ngan et al., 2022). It has been confirmed that tourism planning and tourism policies, especially in Vietnam, have been effective in responding to the crisis brought about by the Covid-19 pandemic (Ngoc & Omar, 2022). Domestic tourism in Vietnam has been growing steadily since 2010 and promises to continue growing in the future (Ngoc & Omar, 2021). Remarkably, in 2022, one year after the COVID-19 pandemic, this figure reached 101.3 million tourists, while the number of international tourists continued to drop (My, 2022).

Domestic tourism is still a market that is expected to continue to "boom". It is the main driver of growth in the tourism industry in Vietnam. However, according to the Vietnamese Government (Communist Party of Vietnam, 2023 , the market is facing a significant challenge. In fact, in 2022, the number of domestic tourist arrivals increased, but the number of domestic tourists staying overnight at their destinations dropped. The downturn in the proportion of overnight tourists resulted in a reduction in tourism revenue. Besides, the difficulty with domestic tourism is that the proportion of tourists taking package tours, long-stay tourists, tourist spending and room occupancy rates seem to be decreasing (Communist Party of Vietnam, 2023). In order to overcome the challenges of Vietnamese tourism after COVID-19, the State has stated that the focus would be on maintaining the growth rate of domestic tourism, which is truly the "pillar" and main driving force of the entire industry (Communist Party of Vietnam, 2023). However, domestic tourists have different cultural backgrounds from international tourists. These differences in cultural characteristics induce differences in tourist behaviours and the needs and wants of tourists. The scholar emphasized the impact of place identity, place attachment, and placemaking on tourist experiences (Minh et al., 2023; Xiang & Mohamad, 2023). Consequently, a well-developed master plan in tourism could significantly enhance the quality of experiences offered to tourists. In tourism planning and destination management, before products or services can be created, market research should be conducted to understand the needs of potential customers (Mason, 2020). Thus, to create suitable products for the market, it is first necessary to understand what factors incite Vietnamese domestic tourists to travel and what factors

motivate them to choose to travel within Vietnam. Market research is also a part of the tourism planning process. It is important to gain insight into the tourist motivations for selecting a product or service in the domestic tourism market.

RESEARCH METHODOLOGY

The fundamental goal of this research was to identify the tourist motivations of Vietnamese domestic tourists. A quantitative approach was applied using a questionnaire that was developed based on previous studies involving push motivations and pull motivations in tourism. The questionnaire comprised three sections, namely, a section on socio-demographic items, 24 items on push motivations that motivate Vietnamese domestic tourists to travel, and 23 items on pull motivations. A five-point Likert scale, ranging from *strongly disagree* to *strongly agree*, was used to measure the push motivation and pull motivation items. The questionnaire was first developed in English and then translated into Vietnamese. A pilot study was undertaken to check the content validity.

Under the tourism crisis caused by the COVID-19 pandemic, the number of domestic tourists in Vietnam was fluctuated. So the authors used the number of domestic tourist arrivals in 2019, before crisis. With a population size of 85,000,000 domestic tourists in 2019, a margin of error of 5%, and a confidence level of 99%, a total of the 670 questionnaires were distributed. The survey was conducted in the five biggest cities in Vietnam, namely, the capital, Hanoi, Hai Phong, Danang, Ho Chi Minh City, and Can Tho. Finally, 664 usable questionnaires were returned and used for the data analysis. The data analysis procedures were coded and processed using IBM® Statistical Product and Service Solutions (SPSS®). The mean (M) analysis and factor analysis (with a principal component analysis, (PCA)) were run.

ANALYSIS AND DISCUSSION

Sample Characteristics

Out of the 664 respondents, the proportion of men and women were nearly equal. There were slightly more females (51.1%) than males. Most of the respondents were aged 18-45 (77.2%) followed by 18-35 (42.1%). Most of them were married (54.4%) and worked as office staff, salespersons, waiters/waitresses, vendors, students, or teachers (64.4%). Lastly, the mostly earned 6-15 million de Dong a month (72.7%).

Push Motivations and Pull Motivations of Vietnamese Domestic Tourists

Push Motivations

The significance levels of the tourist motivations of the Vietnamese domestic tourists were measured on a five-point Likert scale, ranging from 1 = *strongly disagree* to 5 = *strongly agree*. Table 1 indicates the significant mean (M) rankings of the 24 push motivations. The most critical factor that pushed the

Vietnamese domestic tourists to travel was *to seek religious practices* (M = 3.42), followed by *to learn new skills and new things* (M = 3.41). Four other essential factors that motivated the Vietnamese domestic tourists to travel were *to find thrills and excitement* (M = 3.38), *to rest and relax physically doing nothing* (M = 3.38), *to strengthen family or friendship bonds* (M = 3.37), and *to have fun and enjoyment* (M = 3.37). Overall, these findings highlighted the diverse tourist motivations that drove these Vietnamese domestic tourists to travel. While some of them were motivated by spiritual or educational experiences, others were seeking adventure, relaxation, or social connections. It can be said that Vietnamese domestic tourists are individuals seeking meaningful, authentic, and personally fulfilling travel experiences.

Table 1: The Significant Ranks of Push Motivations

	Push Motivations	N	Mean	SD
Most significant	To seek religious practices	664	3.42	0.612
	To learn new skills, and new things, such as cooking new dishes, making local handicrafts, etc.	664	3.41	0.585
	To find thrills and excitement	664	3.38	0.603
	To rest and relax physically doing nothing	664	3.38	0.557
	To strengthen family or friendship bonds	664	3.37	0.592
	To have fun and enjoyment	664	3.37	0.582
Least significant	To experience luxury, enjoy nice food, and have a comfortable place to stay	664	3.19	0.610
	To take beautiful travel pictures and videos	664	3.18	0.627
	To visit places on their dream list	664	3.16	0.653
	To visit popular destinations	664	3.16	0.660
	To be able to share their travel experiences on their social media accounts	664	3.14	0.632

Note:
Likert scale: 1= strongly disagree; 2 = disagree; 3 = neutral; 4 = agree; and 5= disagree
SD = Standard deviation

Pull Motivations

The pull motivations were measured based on the same five-point Likert scale as the push motivations (Table 2). The mean values of the push motivations reflected the driving force that was pushing the Vietnamese domestic tourists to travel. In contrast, the mean values for the pull motivations represented the critical level of the destination attributes that appealed to them. In the context of the Vietnamese domestic tourists in this study, the top five underlying pull motivation items were (1) *activities for the entire family*, (2) *beautiful natural scenery and landscape*, (3) *cooler weather*, (4) *chance to practise light sports*, and (5) *big theme parks*. The mean values for these top five items ranged from 3.42-3.31.

Table 2: The Significant Ranks of Pull Motivations

	Pull Motivations	N	Mean	SD
Most significant	Activities for the entire family	664	3.42	0.628
	Beautiful natural scenery and landscapes, such as beaches, forests, lakes, mountains, etc.	664	3.40	1.056
	Cooler weather	664	3.39	1.242
	Chance to practice light sports, such as walking, running, cycling, swimming, fishing, paddle surfing	664	3.32	1.072
	Big theme parks	664	3.31	0.552
Least significant	Feels safe and secure enough to go out alone	664	3.14	0.736
	Pure unpolluted environment	664	3.05	1.035
	Experience a lifestyle that differs from current one, such as ethnic customs, rural life, etc.	664	2.97	1.000
	Cultural, art, and traditional performances	664	2.91	1.110
	Access to famous local products and cuisine, such as handicrafts and local delicacies	664	2.76	1.188

Note:
Likert scale: 1= strongly disagree; 2 = disagree; 3 = neutral; 4 = agree; and 5= disagree
SD = Standard deviation

Overall, the Vietnamese domestic tourists were attracted by *activities for the entire family*, *the chance to practice light sports*, and *beautiful natural scenery and landscapes*. The findings suggest that Vietnamese domestic tourists are motivated by a combination of family-oriented activities, natural beauty, climate considerations, recreational opportunities, and entertainment experiences. Destinations offering a diverse range of attractions and activities catering to these tourist motivations are likely to be preferred by Vietnamese domestic tourists seeking memorable and enjoyable travel experiences.

Push Motivation and Pull Motivation Factors of Vietnamese Domestic Tourists

Push Motivation Factors

After the first round of the PCA in SPSS®, two items were loaded into two components simultaneously, and the difference between the values was < 0.3. They were *to visit places that their friends and family members had visited before* and *to find thrills and excitement*. The item *to visit places that their friends and family members had visited before* was deleted in the second round of the PCA. The item *to find thrills and excitement* still appeared in two components, and the difference between the values was < 0.3. Then, the item *to find thrills and excitement* was deleted in the third round of the PCA. The final output from the PCA was satisfactory (Tables 3 and 4). Table 3 outlines the Kaiser-Meyer-Olkin (KMO) and Barlett's test of sphericity for the push motivation variables. The KMO was 0.829 or > 0.5 and the significance value of the Bartlett's test was 0.00

or < 0.05. The factor loading (FL) for each item was > 0.5, while the total variance explained (VE) was 70.365 or > 50%.

Table 3: The KMO and Barlett's Test Results of the Push Motivation Variables

KMO of sampling adequacy		0.829
Bartlett's test of sphericity	Approx. chi-square	6003.990
	df	231
	Sig.	0.000

Table 4 depicts the results of the varimax rotation extracted from the seven push motivation factors. Overall, these seven push motivation factors provided a comprehensive framework for understanding the diverse tourist motivations driving the Vietnamese domestic tourists to travel. They encompassed a wide range of psychological, social, cultural, and experiential dimensions, highlighting the multifaceted nature of tourist motivations in this population.

The first push motivation factor was *fulfilling prestige* (CA=0.885; VE=15.877%) and comprised five push motivation items with factor loading between 0.882 and 0.751, indicating high correlation among the items in this dimension. The second factor was *fun and entertainment* and comprised four motivational items related to and sports activities, rest and relax, fun and enjoying the trip, and sightseeing touristic spots (CA=0.799; VE=11.775%). The third factor was *escape* and included four motivational items concerning the needs of being in an unusual environment, escape from daily life and a busy job, and feeling free (CA=0.769; VE=11.123%). The fourth factor was *family and friends' togetherness* (CA=0.821; VE=10.177%) while the fifth was *fulfilling spiritual needs* including two items (CA=0.805; VE=7.232%). The sixth factor was *Gaining knowledge*, which comprised two items (CA=0.725; VE=7.113%) and the seventh was *social relationships* and included two items (CA=0.716; VE=7.113%).

Table 4: The Push Motivation Factors of Vietnamese Domestic Tourists.

Push Motivation Factors	Factor Loading	Cronbach Alpha (CA)	Variance Explained
Fulfilling prestige		0.885	15.877
To visit popular destinations	0.882		
To experience luxury, enjoy nice food, and have a comfortable place to stay	0.850		
To take beautiful travel pictures and videos	0.797		
To be able to share their travel experiences on their social media accounts	0.763		
To visit places on their dream list	0.751		
Fun and entertainment		0.799	11.775
To participate in sports	0.844		
To rest and relax physically doing nothing	0.763		
To have fun and enjoyment	0.754		
To sightsee famous and beautiful tourist spots, be they natural or constructed	0.687		
Escape		0.769	11.123
To satisfy the desire to be somewhere else, in a strange environment	0.831		
To be free of the stresses of daily life	0.759		
To be free to act the way that they feel	0.751		
To get a break from a busy job	0.630		
Family and friends' togetherness		0.821	10.177
To spend time with family or friends	0.842		
To visit friends and relatives	0.825		
To strengthen family or friendship bonds	0.822		
Fulfilling spiritual needs		0.805	7.232
To seek religious practices	0.854		
To experience spirituality	0.806		
Gaining knowledge		0.725	7.113
To gain knowledge and learn new lifestyles or traditions	0.864		
To learn new skills, and new things, like cooking new dishes, making local handicrafts, etc.	0.806		
Social relationships		0.716	7.068
To enhance interactions with local people and exchange cultures	0.858		
To meet new people with similar interests	0.842		
Total Variance Explained			**70.365**

Pull Motivation Factors

To obtain the final result of the factor analysis for the pull motivation factors, five rounds of the factor analysis had to be run to ensure an acceptable value. Four

pull motivation items were deleted, namely, (1) *different lifestyle than yours*, (2) *activities for the entire family*, (3) *cultural, art, and traditional performances*, and (4) *less tourists, not too crowded*. Table 5 shows the KMO and Bartlett's test results for the pull motivation items. They indicate that the KMO was 0.821 or > 0.5 with a significance level of < 0.05, which was satisfactory for conducting a factor analysis. Table 6 points out the PCA and the varimax rotation extraction. Overall, the factor analysis requirements were satisfied with VE = 63.114% or > 50%, all the factor loading values being > 0.5, and the CA of each dimension being > 0.7.

Table 5: The KMO and Barlett's Test Results of the Pull Motivation Variables

Kaiser-Meyer-Olkin measure of sampling adequacy		0.821
Bartlett's test of sphericity	Approx. chi-square	6046.946
	Df	171
	Sig.	0.000

Four pull motivation factors were extracted from the final results of the EFA, including (1) *events and activities*, (2) *destination's facility, service, and trip sponsor*, (3) *historical and cultural attractions*, and (4) *natural resources*. In sum, the first two factors, namely *events and activities* (CA = 0.895) and *destination's facility, service, and trip sponsor* (CA = 0.828; VE = 38.447%) accounted for more than half of the total VE. These two dimensions explain much about, "*Why do Vietnamese domestic tourists choose a particular destination?*". The third factor was *historical and cultural attractions* (CA = 0.795; VE = 13.449%). This factor reflects the allure of historical sites, cultural landmarks, and heritage attractions at a destination. The fourth factor was *natural resources*, which included three items (CA = 0.895; VE = 11.219%). This factor pertains to the natural beauty, resources, and landscapes of a destination.

Regarding previous studies, historical and cultural attractions, along with natural resources, are key pull factors for tourists (Cengizci et al., 2020; Michael et al., 2017). However, for Vietnamese tourists, these factors are less significant compared to events and activities. This is likely due to their existing familiarity with local history and culture. While historical sites, heritage, local food, and natural resources are important, they are less compelling than tourism events and activities in influencing destination choice.

Table 6: The Pull Motivation Factors of Vietnamese Domestic Tourists

Pull Motivation Factors	Factor Loading	Cronbach Alpha	Variance Explained
Events and activities		0.895	22.735
Chance to practice light sports	0.822		
Many adventurous activities to choose from	0.798		
Variety of tourist attractions	0.795		
Big theme parks	0.777		
Attractive festivals and entertaining events	0.767		
Many nature-based activities	0.764		
Lively nightlife entertainment and activities	0.755		
Destination's facility, service, and trip sponsor		0.828	15.712
Conveniences of a modern metropolis	0.805		
Friendliness of the locals and staffs	0.788		
Sponsored by their company	0.771		
Inexpensive price of hotels, food and beverages, and entry to tourist spots etc.	0.770		
Easy to access the destination from their home by many modes of transport	0.714		
Historical and cultural attractions		0.795	13.449
Interesting historical sites/places	0.821		
Many cultural, religious, and heritage sites	0.817		
Access to famous local products and cuisine, such as handicrafts and local delicacies	0.736		
Cultural, art, and traditional performances	0.705		
Natural resources		0.805	11.219
Cooler weather	0.831		
Beautiful natural scenery and landscapes	0.830		
Pure unpolluted environment	0.792		
Total Variance Explained			**63.114**

EFFECTS OF TOURIST MOTIVATION ON TOURISM PLANNING

Push motivation factors are linked to an individual's socio-psychological traits and are difficult for destination management organizations to influence. In contrast, pull motivation factors, which are related to destination attributes, can be shaped by tourism planners to enhance destination competitiveness. By understanding these pull factors, planners can better address tourists' needs and preferences, ensuring that the destination offers suitable products that meet customer expectations.

For tourism product development in Vietnam, while domestic tourists primarily seek participation in events and activities, planners should also focus on enhancing historical and cultural attractions. Vietnamese tourists favor light sports, adventurous activities, sightseeing, nature-based pursuits, and nightlife. Current offerings are mainly limited to sightseeing, but there is a clear demand

for active and diverse experiences. Popular theme parks like Vinpearl and Sunworld attract many visitors daily with their wide range of activities and should be integral to tourism packages. Additionally, festivals and entertainment events are key motivators for domestic travel. The State should emphasize these elements to boost the domestic tourism market.

In tourism promotion, planners should create targeted campaigns that highlight relaxation and a break from daily routines. Emphasizing family-friendly and group-oriented packages, such as discounts and multi-generational attractions, is crucial. Additionally, promoting the conveniences of modern cities, including infrastructure, local friendliness, affordability, and accessibility, is important. Vietnamese domestic tourists value these aspects highly, along with the quality of service provided by staff and ease of access. Improved infrastructure in Vietnamese cities enhances their appeal, but difficult access can deter potential visitors. Therefore, focusing on these elements can boost domestic tourism.

CONCLUSION

The study was conducted to identify TM and its implications on tourism planning. Overall, the findings highlighted the push motivations and pull motivations of Vietnamese domestic tourists. It can be concluded that tourist motivations provide helpful and important information for tourism planning. Specifically, the seven push motivations that were found to be most significant for Vietnamese domestic tourists were religious practices, learning new things, feeling thrills and excitement, rest and relaxation, strengthening family or friendship bonds, and having fun and enjoyment. The five pull motivations that were found to be the most important at the destination were activities for the entire family, beautiful natural scenery and landscape, cooler weather, a chance to practice light sports activities, and big theme parks.

The study contributes to both the practical implications and academic literature. Academically, it enriches the understanding of tourist behaviours and the choice of a destination, particularly in the context of Vietnam, and provides a framework for future research into tourism. Its practical implications are that it offers insights for tourism planning that are aligned with the tourist motivations of Vietnamese domestic tourists.

To provide fundamental knowledge about domestic tourists in developing tourism planning in Vietnam, other unresolved matters require attention in the future. Scholars should focus particularly on analysing the interconnectedness of several concepts within tourist behaviours. Subsequent research could explore the correlation between tourist motivations and anticipation, experience and satisfaction, satisfaction and loyalty, personality and purchase behaviour, etc. Furthermore, it should consider the effects of technological progress on local tourism. The impact of technology on tourism has

led to significant transformations in this sector. The dynamic nature of the tourism industry is seen in the evolving methods by which tourists obtain travel information and share their experiences through various technology-mediated platforms. Therefore, it is crucial to research the impact of social networking websites, social media, and video-sharing websites on domestic visitors.

REFERENCES

Bideci, M., & Albayrak, T. (2016). Motivations of the Russian and German tourists visiting pilgrimage site of Saint Nicholas Church. *Tourism Management Perspectives*, *18*, 10–13. https://doi.org/10.1016/j.tmp.2015.12.022

Camilleri, M. A. (2018). Tourism planning and destination marketing. In *Tourism Planning and Destination Marketing* (1st ed.). Emerald Publishing Limited. https://doi.org/10.1108/9781787562912

Cengizci, A. D., Başer, G., & Karasakal, S. (2020). Exploring push and pull motivations of Russian tourists to Turkey. *Tourism Review International*, *24*(2–3), 127–141. https://doi.org/10.3727/154427220X15912253254419

Cohen, S. A., Prayag, G., & Moital, M. (2014). Consumer behaviour in tourism: Concepts, influences and opportunities. *Current Issues in Tourism*, *17*(10), 872–909. https://doi.org/10.1080/13683500.2013.850064

Communist Party of Vietnam. (2023, February 9). *Du lịch Việt Nam: cơ hội và thách thức [Vietnam tourism: opportunities and challenges]*. https://dangcongsan.vn/cung-ban-luan/du-lich-viet-nam-co-hoi-va-thach-thuc-631073.html

Crompton, J. (1979). Motivations for pleasure vacation. *Annals of Tourism Research*, *6*(4), 408–424. https://doi.org/10.1016/0160-7383(79)90004-5

Dann, G. M. S. (1977). Anomie, ego-enhancement and tourism. *Annals of Tourism Research*, *4*(4), 184–194. https://doi.org/10.1016/0160-7383(77)90037-8

Kotler, P., Bowen, J. T., Makens, J. C., & Baloglu, S. (2021). Marketing for Hospitality and Tourism, Global Edition. In *Pearson*.

Kozak, M. (2002). Comparative analysis of tourist motivations by nationality and destinations. *Tourism Management*, *23*(3), 221–232. https://doi.org/10.1016/S0261-5177(01)00090-5

Mason, P. (2020). Tourism impacts, planning and management: Fourth edition. In *Tourism Impacts, Planning and Management: Fourth Edition*. https://doi.org/10.4324/9780429273544

Michael, N., Wien, C., & Reisinger, Y. (2017). Push and pull escape travel motivations of Emirati nationals to Australia. *International Journal of Culture, Tourism and Hospitality Research*, *11*(3), 274–296. https://doi.org/10.1108/IJCTHR-04-2016-0039

Minh, H. N., Rahman, S., & Thi, T. C. (2023). The effect of tourist expectations and tourist experiences on tourist satisfaction with heritage attributes: a case study of Hội An, Vietnam. *Planning Malaysia*, *21*(4), 334–348. https://doi.org/10.21837/PM.V21I28.1337

My, N. Van. (2022). Du lịch nội địa bùng nổ: Mừng nhiều, lo cũng nhiều [Domestic tourism booms: Much joy, much worry]. *The Leader. Retrieved from: Https://Theleader.vn/Du-Lich-Noi-Dia-Bung-No-Mung-Nhieu-Lo-Cung-Nhieu-1655960673021.Htm. Accessed on November 1st, 2022.*

Ngan, N. N. C., Omar, S. I., & Ngoc, H. N. (2022). Local perceptions towards the environmental impact of tourism on the Chàm islands, Vietnam. *Planning Malaysia*, *20*(4). https://doi.org/10.21837/pm.v20i23.1174

Ngoc, H. N., & Omar, S. I. (2021). The Determinants of Domestic Tourism Growth In Vietnam: A Review. *International E-Conference On New Normal In Education 2020*, 235–246.

Ngoc, H. N., & Omar, S. I. (2022). Tourism Crisis Caused by Covid-19 And Policy Responses in Vietnam. *Res Militaris*, *12*(2), 2128–2137.

Rahmafitria, F., Pearce, P. L., Oktadiana, H., & Putro, H. P. H. (2020). Tourism planning and planning theory: Historical roots and contemporary alignment. *Tourism Management Perspectives*, *35*. https://doi.org/10.1016/j.tmp.2020.100703

Shahrin, N., & Marzuki, A. (2018). Long-Haul Travel Motivation by International Tourist to Penang. In *Mobilities, Tourism and Travel Behavior - Contexts and Boundaries* (pp. 57–67). InTech. https://doi.org/10.5772/intechopen.72411

Solomon, M. R., Bamossy, G., Askegaard, S., & Hogg, M. K. (2019). Consumer Behaviour: A European Perspective 7th Edition. In *Pearson Education*.

UNWTO. (2020). *UNWTO briefing note – Tourism and COVID-19, issue 3. Understanding domestic tourism and seizing its opportunities*. https://doi.org/https://doi.org/ 10.18111/9789284422111

Urzha, O., Mikhoparov, N., Kryukova, E., Shalashnikova, V., & Sulyagina, Y. (2017). Sociological analysis of domestic tourism in the Chuvash Republic. *Journal of Environmental Management and Tourism*, *8*(8), 1504–1516. https://doi.org/10.14505/jemt.v8.8(24).06

Xiang, T. H., & Mohamad, D. (2023). The effect of placemaking attributes on tourism experiences: a case study of Petaling street in Malaysia. *Planning Malaysia*, *21*(4), 322–333. https://doi.org/10.21837/PM.V21I28.1336

Received: 18th March 2024. Accepted: 17th August 2024

PLANNING MALAYSIA:
Journal of the Malaysian Institute of Planners
VOLUME 22 ISSUE 5 (2024), Page 183 – 193

EXPLORING THE RELATIONSHIP BETWEEN PLACE ATTACHMENT AND YOUTH'S INVOLVEMENT IN RICE FIELD ACTIVITIES

Puteri Yuliana bt. Samsudin [1], Wan Nur Rukiah Mohd Arshard[2]

[1,2] *Department of Built Environment Studies and Technology, College of Built Environment,*
UNIVERSITI TEKNOLOGI MARA, PERAK BRANCH, MALAYSIA

Abstract

Youth's experience, knowledge and values in relation to rice field activities play an important role in motivating the youth to get involved in these activities. However, there is a lack of research that focuses on the relationship between place attachment and activity involvement. The aim of this paper is to explore the relationship between place attachment and rural youth's involvement in rice field activities. Three homestays in Kedah were selected as case studies and quantitative (302 questionnaires) approaches were applied to achieve the objective. The questionnaire survey was conducted among youth aged 20 - 34 years old. Major findings in this study include a positive relationship between place attachment and youth activity involvement. Youth who have knowledge, experience, and values in relation to rice field activities are inclined to be involved in homestay activities. The findings of this study contribute to the theories regarding youth activity involvement and place attachment. It is suggested that practitioners in built environment, tourism planning and landscape planning as well as parents should help to encourage the youth to get involved in rice field activities in homestay programmes and in their daily lives.

Keywords: Place Attachment, Activity Involvement, Knowledge, Experience, Values

[1] Senior Lecturer at Universiti Teknologi MARA Perak Branch. Email: puteriyuliana@uitm.edu.my

INTRODUCTION

Homestays in rural areas that are connected to well-preserved cultural landscapes have higher potential as a tourism destination and currently, they are slowly gaining attention among tourists. Homestay programmes have become more active as the government realizes that this programme has the potential in developing communities, especially among rural communities (Aminudin & Jamal, 2006). The Ministry of Tourism, Arts and Culture Malaysia, (MOTAC, 2012) identifies homestay as a viable CBT project for rural people to take on since it utilises existing resources, such as the local culture, lifestyle, and heritage; economic activities; recreation; natural attractions; and environmental conservation. It is recommended that homestays to be a primary activity of agro-based tourism (Bachok, 2019). There are 224 homestay programmes including 494 villages and 3,323 homestay operators throughout Malaysia (MOTAC, 2024). The homestay programmes involve learning the culture of locals in rural settings hence, the local involvement plays an important role in activities provided in the programme. The activities involved in the setting of rice fields need the involvement of local resident to represent the authenticity of real products. Therefore, the youth play an important part in homestay programmes as they depict the lifestyle of local communities. In tourism studies, focuses on community-based tourism (CBT), youth play an important role to develop the homestay programme in rural areas. Based on the figure from the Institute for Youth Research Malaysia in 2015, there were 13.88 million youth aged 15-39 which represents 45.8% of 30.26 million of the population in Malaysia. To ensure that the homestay programme will be sustained, youth involvement is a crucial component. They should be encouraged to get involved in the homestay activities. The main factors that influence youth to get involved in homestay programmes are due to interest (Kayat and Mohd Nor, 2006; Rasid et al., 2011), income (Kayat and Mohd Nor, 2006; Rasid et al., 2011; Harun et al., 2017), family support (Kayat, 2007; Harun et al., 2017), natural environment (Rasid et. al.,2011) and motivation (Kayat, 2007). In Malaysia, the government took the alternative to improve the tourism sector as there is a concern that the growth of the tourism activities will degrade the environment, society and decrease the value of the culture in the local community (Seventh Malaysia Plan, 1996-2000). However, youth living in rural areas are less interested in participating in the tourism industry, especially in homestay activities.

LITERATURE REVIEW

The combination of involvement and place attachment occurred in tourism development whereby in 2003, Kyle combined these concepts where they were successful in measuring the relationship between involvement and place attachment among hikers in leisure activities (Kyle et al., 2003). Meanwhile, Kyle et al*.,* (2004) conceptualised place attachment as an attitudinal

construct that consists of three components: affect, cognition, and behavioural intention. According to the authors' conceptualisation, the 'effect' component refers to emotional responses or activity in the sympathetic nervous system (Jorgensen and Stedman, 2001). The cognitive component refers to beliefs and knowledge structures that relate to the object or place (p. 442). Finally, behavioural intention refers to behavioural commitment or an action that affects both 'affect' and 'cognitive' components (p. 442). Studies that focused on place attachment have shown relationships between place attachment and several other variables, including management preferences and user behaviour (Ji et al., 2023, Bricker & Kersetter 2000; Kyle, Bricker, Graefe, & Wickham 2004), and activity involvement (Kyle et al. 2003). Place attachment can have significant implications for recreation resource planners and managers (Williams, 2002), ranging from support for new developments to managing user conflicts in existing areas. The experience with a place may involve economic, social or political aspects, for example, the usage of natural resources in generating a source of income. Social interaction among the local community including youth also enriches people's experience with the concept of place. Activity involvement can be defined as unobservable motivation or interest towards a recreational activity (Kyle et al., 2003). Place attachment is the sense of purpose and the sense of belonging that people associate with a specific place. It is the relationship people have with an environment, including the extent that a place helps give meaning to people's lives (Bricker & Kerstetter, 2000).

A number of studies have looked at the relationships of activity involvement and place attachment to visitor satisfaction. Hwang, Lee, and Chen (2005) showed that both activity involvement and place attachment have significant effects on visitor satisfaction with interpretative services. Some studies have shown that activity involvement has a positive effect on place attachment (Kyle, Graefe, Manning, & Bacon, 2003; Hou, Lin, & Morais, 2005; Kyle & Mowen, 2005). A study by Hou, Lin, and Morais (2005) indicated that enduring activity involvement has a direct effect on attachment to a cultural tourism destination, and Kyle and Mowen (2005) showed that activity involvement partially influences place attachment (both place dependence and place identity). Lee (2003) investigated the relationships among service quality, satisfaction, activity involvement, and place attachment in predicting destination loyalty. The results showed that activity involvement positively influenced satisfaction. Finally, Pan, Wu, and Chou (2018) specifically looked at the impacts of activity involvement and place attachment on the satisfaction of volunteer interpreters at Taiwan's National Museum of Natural Science. They concluded that both have positive influences on satisfaction and observed that the higher the involvement or place attachment, the higher the satisfaction.

As already noted, existing studies demonstrated the relationship between two of the recreation motivations, activity involvement and place

attachment, in the recreationists' psychological context. Furthermore, many studies used place dependence and place identity as dimensions for measuring place attachment (Bricker & Kerstetter, 2000; Gross & Brown, 2008). Thus, we suggest that the relationship between place dependence and place identity should be included as part of the overall test model to obtain a more complete understanding of the formative process of place attachment.

RESEARCH METHODOLOGY

This study used a quantitative method, which is a questionnaire survey. The target population of youth is according to the statistics of youths in homestay villages and the selection of youth involved youth aged between 15 - 39 years old. To select the sample, the researcher needs to have a list of the units of the investigated population as a sampling frame. The researcher used census data as a technique to distribute the questionnaire surveys. Census is a technique that the researcher gives the questionnaire surveys to every member of the population in the study sites. In this research, the researcher used the census surveys in three homestays (Homestay D'Belimbing, Homestay Kg. Pantai Jamai and Homestay Kg. Jeruju). The three case studies have the same rice field settings. The rationale for choosing these three homestays is to explore the similarities and differences on place attachment and youth's involvement in rice field activities in homestay. Moreover, the selected case studies have different age distributions and social interactions between local communities The researcher distributed the questionnaire to the Chairman of the Youth's Association and *Majlis Pengurusan Komuniti Kampung* (MPKK). From the census data, total youths aged 15 - 39 years old in three homestays are 320. The researcher distributed the questionnaire to all youths through homestay operators in each homestay but the total collected questionnaires were only 302 respondents. The questionnaire was developed to explore the perspective of cognitive elements, place attachment and activity involvement among rural youth in homestay villages. The questionnaire for this study has three sections as listed:

i. Section A: Respondents' profiles
ii. Section B: Activity Involvement
iii. Section C: Perception on Place attachment dimension

Multiple regressions were used to explore the relationship between one continuous dependent variable and a number of independent variables or predictors. Multiple regressions can be used to examine how well a set of variables or constructs predict another variable or construct. Also, multiple regression can identify which variable is the best predictor of the outcome (Pallant, 2013). There are three types of multiple regression analyses, namely, standard or simultaneous, hierarchical or sequential, and stepwise (Pallant, 2013).

This study adopted the stepwise type of multiple regressions to examine the relationship between place attachment and youth's activity involvement in the rice field. In stepwise multiple regression, the goal is to find a set of independent variables which significantly influence the dependent variable.

ANALYSIS AND DISCUSSION

Multiple regressions were employed to determine whether knowledge, experience and values are related to rural youth's involvement in rice field activities. Multiple regression is a test that explains the relationship between one dependent variable and a number of independent variables or predictors (Pallant, 2013). In simple regression, the aim is to predict the dependent variable with a single independent variable. Meanwhile, multiple regression aims to predict the dependent variable with any independent variables. From the results from three homestays, only one predictor variable which is knowledge has the strongest relationship with activity involvement. Although knowledge is the main predictor in three homestays, the other two predictors which are values and experience also have a relationship with youth's involvement. In Homestay Kg. D'Belimbing, two predictors have a strong relationship with youth's involvement. The predictor variables are experience and knowledge. In contrast with Homestay Kg. Jeruju, the main predictors are values and knowledge. Similar to both homestays Kg D'Belimbing and Kg Jeruju, the results from Kg. Pantai Jamai showed that knowledge is the main predictor variable that has a relationship with youth's involvement in homestay activities. In conclusion, the main predictor variable in this research is knowledge but three predictors which are knowledge, experience and values have a strong relationship with youth's involvement in homestay activities.

Relationship between place attachment and activity involvement in Kg. D' Belimbing

In Kg. D'Belimbing, significantly, [F (1,104) = 780.16, $p < 0.05$], accounted for 88.2 percent of the variance (R2 = 882).) in relation to the involvement of youth in the homestay activities. This means that experience (B = -.94, p <0 .05) is a major indicator that causes youth's activity involvement in homestay programmes. The combination of experience (B = -.91), $p < 0.05$) and knowledge (B = -0.12), $p < 0.05$) increased (89.5-88.2) percent or 1.3 percent of the variance R2 = 0.895) in the variable criterion [F (2,103) = 438.01, $p < .05$]. ANOVA test results show that there is a correlation between the two predictor variables with the criterion variable significant level of $p < 0.05$.

Table 1: Relationship between activity involvement and place attachment dimension in Kg. D' Belimbing

Model		Unstandardised Coefficients		Standardised Coefficients
		B	Std. Error	Beta
1	(Constant)	2.918	.056	
	Experience	-.507	.018	-.939
2	(Constant)	3.454	.163	
	Experience	-.488	.018	-.906
	Knowledge	-.171	.049	-.116

Note: R-squared= 0.882, R- square adjusted = .0.882, [F (2,103) = 438.01, p<.05],
**Significant at .05 level
ANOVA test results show that there is a correlation between the two predictor variables with the criterion variable significant level of p < .05.

Table 2: ANOVA test results in Homestay Kg. D'Belimbing

ANOVA[a]						
Model		Sum of Squa	Df	Mean Square	F	Sig.
1	Regression	22.850	1	22.850	780.161	.000[b]
	Residual	3.046	104	.029		
	Total	25.896	105			
2	Regression	23.172	2	11.586	438.013	.000[c]
	Residual	2.724	103	.026		
	Total	25.896	105			

a. Dependent Variable: Involvement
b. Predictors: (Constant), acttt
c. Predictors: (Constant), acttt, knowledge

Relationship between place attachment and activity involvement in Kg. Pantai Jamai

Table 3 shows the relationship between activity involvement and place attachment in Homestay Kg. Pantai Jamai. In Kg. Pantai Jamai, significantly, [F (1, 94) = 34.76, p < 0.05] accounted for 27 percent of the variance (R2 = 270) in relation to the involvement of youth in activities of the homestay. This explains that knowledge (B = 0.52, p < 0 .05) is a major indicator that causes youth's activity involvement in homestay programmes compared to experience and values. Even though experience and values are not major indicators, these two indicators have positive relationships with rural youth's activity involvement. This data also explains that youth who have a higher knowledge of rice field activities have a strong attachment to the place and are more involved in homestay activities.

Table 3: Relationship between activity involvement and place attachment dimension in Homestay Kg. Pantai Jamai

Model		Unstandardised Coefficients		Standardised Coefficients
		B	Std. Error	Beta
1	(Constant)	-1.682	.513	
	Knowledge	.768	.130	.520

Note: R-squared = 0.882, R- square adjusted = .0.262, [F (1, 94) =34.76, p< 0.05] Significant at .05 level

ANOVA test results in Homestay Kg. Pantai Jamai is shown in Table 3. The data shows that there is a correlation between the two predictor variables with the criterion variable significant level of $p < 0.05$. ANOVA test results show that there is a correlation between the two predictor variables with the criterion variable significant level of $p < 0.05$.

Table 4: ANOVA test results in Homestay Kg. Pantai Jamai

ANOVA[a]

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	5.759	1	5.759	34.759	.000[b]
	Residual	15.574	94	.166		
	Total	21.333	95			

a. Dependent Variable: Involvement
b. Predictors: (Constant), Knowledge

The data confirms that rural youth who have higher knowledge have a positive relationship with activity involvement. When youth have knowledge on the activities, they are interested to do the activities and learn about the activities. When tourists come to their village, the rural youth can help the homestay operators to prepare the homestay activities. It is crucial to know about traditional activities because the activities can be passed on to future generations.

Relationship between place attachment and activity involvement in Homestay Kg. Jeruju

Table 5 indicates the relationship between activity involvement and place attachment in Homestay Kg. Jeruju. In Kg. Jeruju, significantly, [F (1,98) = 58.86, p< .05], accounted for 37.5 percent of the variance (R2 = 0.375) in relation to the involvement of youth in homestay activities. This means that values (B = -0.61, $p < 0.05$) is a major indicator that causes youth's activity involvement in homestay programmes. The combination of values (B = -0.57), $p < 0.05$) and knowledge (B = -0.21), $p < 0.05$) increased (41.9-37.5) percent or 4.4 percent of the variance (R2 = 0.419) in the variable criterion [F (2,97) = 34.91, $p < 0.05$].

Table 5: Relationship between activity involvement and place attachment dimension in Homestay Kg. Jeruju

Model		Unstandardised Coefficients		Standardised Coefficients
		B	Std. Error	Beta
1	(Constant)	2.394	.100	
	Values	-.248	.032	-.613
2	(Constant)	3.125	.289	
	Values	-.230	.032	-.568
	Knowledge	-.259	.096	-.213

From the data, values and knowledge have positive relationships with youth involvement in homestay activities. Youth who have a strong attachment to rice field landscapes are motivated to be involved in homestay activities. This explains that youth who appreciate their surrounding landscapes are attached to the landscape and are excited to get involved in the activities.

Additionally, Table 6 presents the table of ANOVA test results in Homestay Kg. Jeruju. The data shows that there is a correlation between the two predictor variables with the criterion variable significant level of $p < 0.05$. Based on the data, knowledge is most related to the involvement of youth aged between 20-40 years in homestay activities.

Table 6: ANOVA test results in Homestay Kg. Jeruju

ANOVA[a]						
Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	8.165	1	8.165	58.857	.000[b]
	Residual	13.595	98	.139		
	Total	21.760	99			
2	Regression	9.108	2	4.554	34.914	.000[c]
	Residual	12.652	97	.130		
	Total	21.760	99			

a. Dependent Variable: Involvement
b. Predictors: (Constant), Values
c. Predictors: (Constant), values, knowledge

This study goes deeper into the relationship between youth's involvement in rice field activities and place attachment that focuses on the cognitive element. This research has combined the landscape perception model and the place attachment model to answer the research objectives. This study shows a positive relationship between youth's involvement in rice field activities and place attachment. It is clear that youth who have knowledge, experience, and values in relation to rice field activities are more involved in homestay activities. From the questionnaire survey, the results from the multiple regression analysis

revealed that youth who are involved in rice field activities have a higher relationship with a place attachment element which is knowledge compared to values and experience. The result revealed that the highest factors of youth involvement are because of the interaction with tourists and the opportunity to manage the homestay. This study has proven that youth's involvement in rice field activities has a relationship with a place attachment dimension which is cognitive that includes the elements of experience, knowledge, and values. Social, physical, and economic factors are the main factors that motivate youth to get involved in homestay activities. Although previous studies have discussed homestay involvement, those studies lack focus on youth's homestay activities (Samsudin, 2021). These cognitive elements are also important to sustain traditional activities for future generations. Although the study has brought attention to the connection between landscapes and human perceptions, it should be noted that further research with different methods and larger samples are recommended to strengthen the findings.

Place attachment and activity involvement are positively correlated (Kyle, Graefe, Manning, & Bacon, 2004; Hou, Lin, & Morais, 2005; Kyle, Mowen, & Tarrant, 2004). This study found that activity involvement has positive relationship with place attachment dimensions which are knowledge, experience and values on rice field activities. Moreover, more topics on place attachments and activity involvement should also be covered. Therefore, future study is needed to explore into the affective and behavioural elements in place attachment models to know the perception of youth and to sustain the rice field activities in homestay programmes.

CONCLUSION

This study makes two important contributions to the body of knowledge. These include practical and methodological contributions. Practically, findings from this study provide insights into the initiatives to reconnect youth with place attachment in various ways. Government authorities (planners, landscape architects), homestay operators, local community, parents and youth themselves should play an important role to encourage rural youth to get involved in homestay activities. Methodologically, this study has added to the existing literature on reliable methods to be used when conducting research with rural youth in villages. Several limitations in this study need to be addressed in future research. Furthermore, several directions for future research have been delineated. Future research should explore into other factors that influence youth and conduct research in different locations. As a whole, this study gives a significant impact on the development of future generations concerning environmental and cultural landscapes. This study further contributes to rural development and ensuring that Malaysian youth have knowledge on cultural heritage while sustaining the cultural elements for future generations.

REFERENCES

Aminudin N. & Jamal S.A. (2006). *Homestay Selangor: Keunikan dan Pengalaman Pengusaha. Selangor*: Pusat Penerbitan Universiti (UPENA).

Bachok, S., Hasbullah, H., & Tuan Mohd Amin, T. A. (2019). Rural agro-tourism and local community income: The case study of clustered homestays in Kelantan and Terengganu. *Planning Malaysia*, *17*(9). https://doi.org/10.21837/pm.v17i9.592

Bricker, K.S., & Kerstetter, D.L., (2000). Level of specialization and place attachment: An exploratory study of whitewater recreationists. *Leisure Sciences, 22*(4)*,* 233-257.

Chou, C.L., & Chang, H.M. (2018). A Study of Cyclists Activity Involvement, Place Attachment, Satisfaction and Loyalty. *Asian Journal of Environment & Ecology*, *5*(3), 1–10.

Gross, M. J., & Brown, G. (2006). Tourism experiences in a lifestyle destination setting: The roles of involvement and place attachment. *Journal of Business Research*, *59*(6), 696–700.

Harun, H., Rasid A. R., Mohd Noor, N. S., & Soh, Z. N. (2017). Youth driven engagement in the Homestay Program. *Jurnal Pendidikan Teknologi dan Kejuruan*, *23*(3), 250-255.

Hou, J. S., Lin, C. H., & Morais, D. B. (2005). Antecedents of attachment to a cultural tourism destination: The case of Hakka and non-Hakka Taiwanese visitors to Pei-Pu, Taiwan. *Journal of Travel Research, 44*(2)*,* 221–233.

Hwang, S. N., Lee, C., & Chen, H. J. (2005). The relationship among tourists' involvement, place attachment and interpretation satisfaction in Taiwan's national parks. *Tourism Management*, *26*(2), 143–156.

Ji, X., Niu, Y., & Acheampong, A. (2023). A Study on the Causes and Effects of Place Attachment-Based on the Perspective of Person. E3S Web of Conferences, 409.

Jorgensen, B. S., & Stedman, R. C. (2001). Sense of place as an attitude: lakeshore owners attitudes toward their properties. *Journal of Environmental Psychology, 21*(2001), 233–248.

Kayat, K. (2007). Exploring factors influencing individual participation in community - based tourism : The case of Kampung relau homestay program . *Asia Pacific Journal of Tourism Research,7*(2)*,* 37–41.

Kayat, K. & Nor, N. A. M. (2006). Penglibatan Ahli Komuniti Dalam Program Pembangunan Komuniti: Satu Kajian ke Atas Program Homestay di Kedah. *Akademika, 67*(1), 77-102.

Kyle, G. T., Absher, J. D., & Graefe, A. R. (2003). The moderating role of place attachment on the relationship between attitudes toward fees and spending preferences. *Leisure Sciences, 25*(1), 33–50.

Kyle, G., Bricker, K., Graefe, A., Wickham, T. (2004). An examination of recreationists' relationships with activities and settings. *Leisure Sciences, 26(*2), 123-142.

Kyle, G., & Mowen, A. J. (2005). An examination of the leisure involvement–agency commitment relationship. *Journal of Leisure Research, 37*(3), 342–363.

Lee, J. (2003). *Examining the antecedents of loyalty in a forest setting: Relationships among service quality, satisfaction, activity involvement, place attachment, and destination loyalty.* (Doctorate Thesis, The Pennsylvania State University).

Ministry of Tourism, Art and Culture, (2024). *Statistics of Homestay Programmes in*

Malaysia.
Moore, R. L., & Scott, D. (2003). Place attachment and context: Comparing a park and a trail within. *Forest Science, 49*(6), 877–884.
Pallant, J. (2013). *SPSS survival manual: A step by step guide to data analysis using IBM SPSS* (5th ed.). Milton Keynes, UK: Open University Press.
Samsudin, P. Y., Maliki, N. Z., Rahman, S., & Wan Omar, W. R. (2021). Attachment and factors involvement among youth to paddy field activities in homestay programmes. *Planning Malaysia*, *19*(16). https://doi.org/10.21837/pm.v19i16.954
Sood, J., Lynch, P., & Anastasiadou, C. (2017). Community non-participation in homestays in Kullu, Himachal Pradesh, India. *Tourism Management*, *60*(2017), 332–347.

Received: 30th June 2024. Accepted: 10th September 2024

PLANNING MALAYSIA:
Journal of the Malaysian Institute of Planners
VOLUME 22 ISSUE 5 (2024), Page 194 – 208

STAKEHOLDER ANALYSIS OF THE PERCEIVED BENEFITS OF A NONPROFIT FESTIVAL IN BINH DUONG PROVINCE, VIETNAM

Nguyen Phuong Hong Phuc[1], Suraiyati Rahman [2*]

[1] *Faculty of Cultural Industries,*
THU DAU MOT UNIVERSITY, VIETNAM
[2] *School of Housing, Building, and Planning,*
UNIVERSITI SAINS MALAYSIA

Abstract

Festival stakeholders have different power levels in relation to an event, and this depends on their investment or importance to the event's success. Governments or associations commonly organise non-profit festivals to celebrate a particular event or achieve a specific goal with less profit-making priority. As a long-established festival in Asia, the Tianhou Festival in Vietnam benefits the tourism sector and the local community. This festival is bound to the religious beliefs of local people originating from Hong Kong, Taiwan and mainland China, who immigrated to Vietnam and are now living in Binh Duong Province (BDP), Vietnam. Over the years, the festival's success has intensified the socioeconomic development of Binh Duong Province. Undeniably, the festival quality can be enhanced with substantial and solicitous collaboration amongst stakeholders. Despite the contributions of such events, thus far, only a few studies have focused on the perceived benefits of non-profit-oriented events. To address this gap, the current study used the qualitative method by using semi structured interviews with key stakeholders to collect data, which were then transcribed by thematic analysis. The findings reveal that organising non-profit festivals may enhance interpersonal skills as well as bring about economic benefits, social incentives, and community cohesiveness. This research envisions the impacts of the Tianhou Festival on the stakeholders of this non-profit-oriented event. The findings of the study can provide guidelines to other key stakeholders in improving the same concept of event management in the future.

Keywords: stakeholder analysis, non-profit event, religious festival, perceived benefits and Vietnam

[2] Corresponding Author: Senior Lecturer at Universiti Sains Malaysia. Email: suraiyati@usm.my

INTRODUCTION

In tourism, non-profit organisations that conceptualise and organise cultural events or festivals receive part of their financial support from public sources and other parts of business revenue. Consequently, they can cooperate with the public and private sectors depending on their wants and needs (Giannoulakis, 2014). In the festival tourism literature, public and non-profit festivals centre themselves as events that do not pay focus on seeking sponsorships and donations. As they have already successfully lobbied the government for money or other benefits, non-profit festivals seem less concerned about sponsors (Andersson & Getz, 2009).

The World Tourism Organisation (UNWTO) assesses that 300–330 million tourists visit the world´s key religious sites annually. This is mainly because tourists often travel to events and festivals directly or indirectly related to religions (UNWTO, 2014). Therefore, studies have been conducted on festivals and events worldwide for their crucial role in social development and cultural preservation and for being promoted and created as tourist attractions (Tommy, Andersson, & Getz, 2008). As a subfield of festival studies, religious festivals are also becoming an interesting topic for researchers and policymakers due to their functions in terms of enhancing and protecting local culture and economy. However, to date, only a few studies have specifically addressed stakeholder analysis in religious festival contexts (Zhang et al., 2019). The management side of festivals is less prevalent in the literature than the broader cultural, social and touristic aspects of festivals, especially in political and religious festivals. Thus, the site management, sustainability issues and importance of different stakeholders involved in religious festivals have been given less focus in the literature (Kim et al., 2020). Therefore, the objective of this paper is to identify the perceived benefits received by TRF stakeholders, which motivate them to organise this festival. The findings of this paper will help identify the benefits that can be obtained by stakeholders from non-profit festivals in ways that can contribute to the empirical study and methodological approaches employed in the literature.

LITERATURE REVIEW

Stakeholder Analysis

Identifying the stakeholders makes it more effective for managers to manage the festival and the relationships between various stakeholders, resulting in a smoother organising process. However, it can be quite challenging to identify the stakeholders without applying the stakeholder analysis. Stakeholder analysis is ‘an approach for understanding a system by identifying the key actors or stakeholders in the system and assessing their respective interest in that system’ (Grimble & Chan, 1995). Similarly, Freeman (1984) proposed ‘stakeholder management’ as a framework to help managers understand turbulent and complex

business environments. By gathering and analysing qualitative data, researchers can identify stakeholders' interests, the position in which they are supported or against the project/programme, the convergence and alliance between stakeholders and the ability to affect the policy process with their power and leadership (Schmeer, 1999). Furthermore, by analysing stakeholders, policymakers and managers can interact more effectively with key stakeholders and increase their support and engagement. Potential misunderstandings can also be prevented if stakeholder analysis is conducted before a policy or programme is implemented and likely to succeed (Schmeer, 1999).

Governance, as a reflexive self-organisation with multiple stakeholders, helps promote the growth of an area. By analysing the governance approach toward stakeholder participation and collaboration in festivals, innovative channels of communication, public participation, and the most committed and proactive performers selection can be evaluated (Ng & Rahman, 2021). Stakeholder analysis can also enhance local people's awareness of the conservation of sacred destinations or festivals (Pimid et al., 2020). Hence, enhancing awareness and the authorisation of local communities could lead to greater support for tourism (Fitri Amir et al., 2024). In the TRF context, festival stakeholders also play a crucial role in determining the success of a festival. Subsequent studies have developed different models in identifying and analysing stakeholders. However, these models focus on music festivals and festivals that are more profit-oriented, thus leaving a gap for developing a new research direction that is focused on non-profit festivals.

Religious Festivals and Perceived Benefits

Religious festivals have been shown to have positive impacts on their host communities. Nowadays, religious festivals are becoming increasingly important for local policymakers and tourism agencies due to their ability to protect local cultures while boosting local economies simultaneously. In particular, festival tourism positively influences material heritage by promoting it and increasing profits from tourism. Moreover, festivals make it possible to cultivate and develop the local nonmaterial cultural heritage and promote ideas related to its preservation (Cudny, 2013). Empirical studies on the perceived socioeconomic impacts of festivals on host communities vary. For example, from 1970 to 1996, the economic and financial impacts of these festivals were the most frequent research topics (Donald Getz, 2010).

Recently, researchers have examined studies on large-scale events and festivals and concluded that the most frequent topics were economic development and the impacts of events, followed by sponsorship and event marketing from the corporate perspective (Getz, 2008; Hede et al., 2002). Meanwhile, studies on the socioeconomic impacts of festivals focus on four dimensions: community cohesiveness, economic benefits, social incentives and social costs (Gursoy et al.,

2004). As shown in Figure 1, festivals bring back the benefits that outweigh the social costs and, according to organisers, serve as means for achieving socioeconomic development rather than posing threats to communities by creating a host of social problems. A festival's length can explain this conclusion; most festivals last for two to three days, so it is assumed that there will be no major social problems. At the same time, festivals that are customer-oriented, which means they adjust to the tourists' preferences, often risk losing their authenticity.

RESEARCH METHODOLOGY

This qualitative research conducted semi structured interviews with topic guides. The topic guides were provided beforehand so that the participants could be well prepared and guided in focusing on the scope of the discussion (Marshall & Rossman, 2014). However, this type of research differs from empirical studies, which only have one set of topic guides for all respondents. In the current work, the respondents' interviews were guided by different topic guides based on their respective roles in the Tianhou Festival and whether they came from the private, public or nongovernment organisation (NGO) sectors. All interviewees gave individual and departmental consent. The face-to-face interviews were conducted at their own workplaces. The targeted sample size for this research is 15, and 8 agreed to be interviewed, and the answers obtained reached the point of saturation. A summary of the brief descriptions of the respondents is shown in Table 1.

Table 1: Respondent's background

Respondent	Occupation	Private/ public sector	Years of experience (festival's background)	Festival's position
A	University student	Private	3	Coordinator (manage volunteers)
B	University student	Private	2	Volunteer
C	Vice Chairman of the Phu Cuong Ward People's Committee - TDMC	Public	5	Facilitator
D	Deputy Head of Culture and Information Division of TDMC	Public	25	Organizer
E	Deputy Head of the Tianhou Temple's	Private	30	Organizer

Respondent	Occupation	Private/ public sector	Years of experience (festival's background)	Festival's position
	organisational management board			
F	Public's security officer of TDMC	Public	3	Regulator
G	Officer of the Broadcasting Division - TDMC	Public	4	Promoter
H	Officer of the Natural and Environment Division - TDMC	Public	5	Regulator

Source: Fieldwork

The interviews were audio-recorded, and notes were taken. Thematic analysis was used because it provided researchers with greater flexibility while retaining rich and valuable data. Following the six steps of conducting thematic analysis introduced by Braun and Clarke (2006), the collected data were manually coded by the researcher into codes and themes, in accordance with the study objectives.

ANALYSIS AND DISCUSSION

The Tianhou Temple is currently located at No. 04, Nguyen Du Street, Chanh Nghia Ward, TDMC, BDP, Southeast Vietnam (Dang, 2014). BDP, an economic gateway between Ho Chi Minh City and other provinces in Southeast Vietnam, is famous for the steady growth of industrial parks and its tourism industry, especially cultural and festival tourism (Hào, 2016). The Tianhou Palace is monitored by four Chinese communities whose members worship the Goddess of Tianhou. Pilgrims are mostly Vietnamese with Chinese origin from all over the country. The others came from nearby cities and provinces or even neighbouring countries, such as Thailand or Laos, who visit the place for tourism purposes (Choi, 2019).

Figure 1: Vietnam map and Binh Duong Province map
Source: (Google Photo)

Figure 2 shows the extracted data from key stakeholders' interview sessions, indicating the benefits they obtained from organising the Tianhou Festival. Based on the interview sessions, the most frequent benefits involve interpersonal skills, economic benefits, social incentives and community cohesiveness. These findings have similar patterns with the perceived impacts of festivals from a festival organiser's perspective (Gursoy et al., 2004).

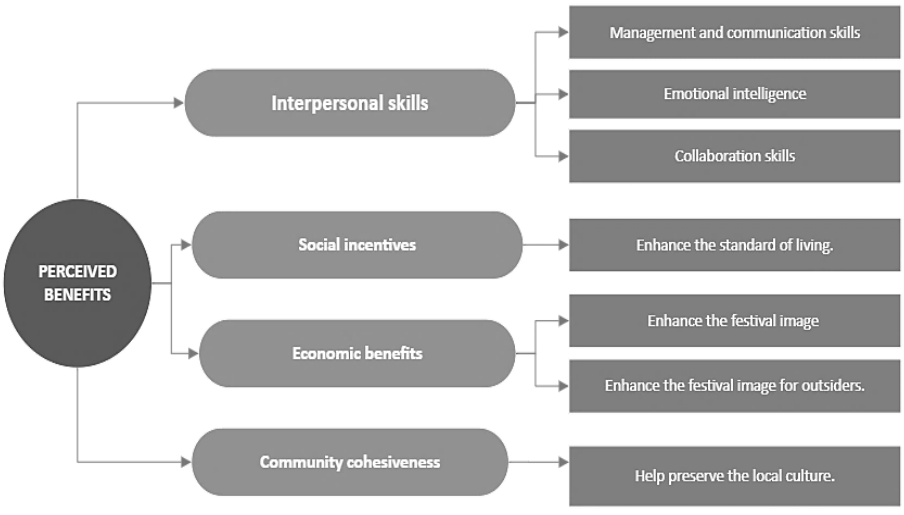


Figure 2: The perceived impacts of festivals by organisers at TRF, BDP, Vietnam
Source: Author

Key stakeholders stated that their interpersonal skills were improved, especially their management skills (time management, planning and communication skills), emotional intelligence (how they handle urgent situations before or during the festival) and collaboration skills (how they collaborate in harmony). These skills are not only crucial in organising the Tianhou Festival but also in performing their daily work requirements.

Theme 1: Interpersonal skills

Code 1. Management and communication skills

The key organisers of the Tianhou Festival agreed that being stakeholders improved their management skills in general, including time management, planning and communication skills. These are crucial not only in organising the Tianhou Festival but also in their daily life contexts, in which they need to communicate with people and sketch out plans for their divisions.

> *R2: Being a member of the volunteers' team helps me develop my social skills and emotional intelligence…Attitude is [also] key to the festival's success. … For volunteers, we have a hotline connected with key stakeholders…. [We also developed] negotiation skills during this process… Even when conflicts and issues occur, organisers and stakeholders must be calm first and promptly contact each other for solutions.*

> *R3: First, the attitude in communication between stakeholders and myself is undeniably essential. Second, respect is the critical work on an excellent harmonious relationship between stakeholders…I also improved my management skills, helping enhance the position of the People's Committee in the organising process for festivals and other events.*

> *R5: Being one of the main stakeholders who organise this festival, I also help promote religious tourism in BDP and the Tianhou Temple, particularly by drawing more people to participate each year… From the excellent promotion, more people and pilgrims will come to the Tianhou Festival and promote its image, especially the unique name that tourists gave it: the 'Free festival', with its distinct features that can be spread out to outsiders.*

> *R8: Planning and monitoring the tasks during the festival are the most significant skills that I learned. We also understood more about budget management for unforeseen circumstances.*

Code 2. Emotional intelligence

Aside from management and communication skills, emotional intelligence was another skill gained by key stakeholders from organising the Tianhou Festival. The interview sessions with key stakeholders reveal that conflicts in organising festivals are inevitable. By having greater control over their emotions and attitudes, key stakeholders can tackle emergent conflicts, as expressed in the following excerpts:

> *R1: The skills that I gained in network development will help me in my future work and encourage me to socialise more… It also helps me control my emotions.*
>
> *R2 Being a member of the volunteers' team helps me develop my social skill and emotional intelligence… Attitude is [also] key to the festival's success. ... For volunteers, we have the hotline contact connected with higher-level stakeholders ....*
>
> *R3: First, the attitude I have when other stakeholders and I communicate with each other is undeniably essential. Second, respect is critical to creating an excellent harmonious relationship between stakeholders.*

Code 3. Collaboration skills

Each event and festival needs excellent collaboration between stakeholders to make it successful. Tianhou Festival also follows the same trait, with key stakeholders revealing that they struggled for the first few years to create good harmony and collaboration amongst themselves. However, through many years of experience in organising the festival, they developed their collaboration skills to improve the overall organising process. They also stated that they learned about the importance of good collaboration and developed negotiation skills, which are crucial in organising the Tianhou Festival. They believed that thoroughly understanding each other's responsibilities and negotiating on the rightful issues helped create a good foundation that could make the festival more successful:

> *R1: … It is crucial to cooperate reasonably with the Steering Committee of the festival….*
>
> *R2: I developed negotiation skills during this process. Even when conflicts and issues occurred, organisers and stakeholders must be calm first and promptly contact each other for solutions.*

R3: The most significant benefit from being a part of the organising process of the festival is that we need to respect each other, listen and analyse each of the situations carefully to have a wisely final decision. Thus, meetings before the festival happens are crucial for better understanding between stakeholders.

Since 2017, a new team has been formed entirely in charge of continuously checking the activities of the business people around the venue during the festival. This is a product of good collaboration in establishing an examination team involving different divisions. It aims to ensure a safer Tianhou Festival that can detect any business without proper permission.

R5: It is also crucial to collaborate with other stakeholders in harmony so that the festival can run smoothly.

R6: [We must apply] conflict resolution when we need to thoroughly communicate with other stakeholders and understand each other's tasks so that we can help each other out in a satisfactory way.

R7: [We] have a chance to improve teamwork with other stakeholders.

R8: Moreover, I also improved my problem-solving and teamwork skills when organising the festival with other stakeholders.

Theme 2: Economic benefits

Improving one's interpersonal skills benefited key stakeholders by facilitating smooth collaboration in organising a successful festival and enhancing the province's economic development.

Code 1. Enhance the standard of living

Key stakeholders stated that they did not directly gain economic benefits for themselves, as Tianhou Festival is mainly a nonprofit festival. However, they revealed that by being a stakeholder in organising the festival, they indirectly brought more livelihood opportunities for the local community by selling spots for businesspeople and encouraging new facilities to serve pilgrims. Consequently, the profits gained by the tourism sector will also enhance the economic development of the whole province.

R5: Being one of the main stakeholders who organise this festival can help promote religious tourism in BDP. By doing so, the economic development of the province and in TDMC can also rapidly improve, which then brings back the economic benefits to the local community.

R6: Being one of the stakeholders is a way for me to support the socioeconomic growth of BDP.

R7: I can contribute to the province's socioeconomic development if the broadcasting team performs its role well in organising the festival.

Theme 3: Social incentives

Tianhou Festival is a long-established festival in BDP, so it is reasonable for key stakeholders to gain social incentives from organising the festival. This would raise people's awareness of the festival and enhance its image to outsiders. In turn, this would eventually promote and attract more tourists and pilgrims each year.

Code 1. Educational - Raising public awareness

The interviewees stated that being a stakeholder gives them the benefit of having more chances to raise awareness, not only among the BDP people but also among tourists and even themselves, about the importance of this festival, its history, beauty and invaluable heritage:

R1: I can listen to the history of the festival and understand how the festival celebrates the customs and the beauty of our religion. This information cannot be fully explained in newspapers or magazines [alone].

R2: I can visit sooner and listen to the stories from the management board about the beauty of the cult, the history of the Goddess Tianhou and the remarkable things about the festival and share it with my friends.

R3 …In addition, raising people's awareness about this festival can help make it more sustainable and feasible for everyone.

Key stakeholders also benefited from experiencing the festival themselves, enabling them to pass on their knowledge to younger generations:

R5: Another benefit is the awareness of culture and religious preservation that has been transferred from one generation to another. Organising the Tianhou Festival is a way for us to raise awareness amongst the young generation about its history and importance. Hence, more people will support in preserving the festival's values.

Code 2. Enhancing the festival's image to outsiders

Key stakeholders also claimed that being a stakeholder in organising the Tianhou Festival makes them more responsible and think more about its goal: to organise a successful festival and bring out the beautiful image of the festival to outsiders within a safe and comfortable environment.

> *R1: [I aim] to be polite so that tourists will not feel disrespected and to help increase the reputation of the festival….[I am] willing to help the visitors feel more secure.*
>
> *R2: To bring harmony to the organising process…providing a safe environment for TRF.*
>
> *R3: To provide safer, more comfortable religious tourism….*

Key stakeholders also stated that being a stakeholder is a way for them to promote religious tourism development in the province, which has been its major focus in recent years.

> *R4: It is also a way to promote religious tourism activities in the province and emphasise the importance of my role in the festival organising process in ensuring the festival's success.*
>
> *R5: Being one of the main stakeholders who organise this festival also helps promote religious tourism in BDP and Tianhou Temple, particularly by drawing more people to come to the festival each year…The festival is not only linked to the local people's minds but also an alternative way to promote religious tourism.*

Due to the excellent promotion, more people and pilgrims will join the Tianhou Festival each year, and the image of the festival, especially the special name that tourists give it—the 'Free' festival with its unique features—can be spread to outsiders.

> *R6: Being one of the stakeholders involved in the organising process of Tianhou Festival is a way for me to improve the festival's image.*
>
> *R7: Being one of the stakeholders in organising the successful Tianhou Festival, I help increase its brand image. Therefore, I help the promotion process of the festival run smoothly and attract more people … [I also] enhance the image of the province.*

R8: Participating in the festival to ensure its success, bringing a beautiful image of a safe and exquisite festival.

Theme 4: Community cohesiveness

By organising the festival, key stakeholders can raise pilgrims' awareness of the festival's values, as well as encourage the local community and pilgrims to preserve these values and pass them on to the next generation. Key stakeholders' interview sessions reveal that the religious and cultural values of the Tianhou Festival have been successfully transferred throughout the generations.

Code 1. Helping preserves the local culture

Both primary and secondary stakeholders agree that the collaboration between stakeholders in organising the Tianhou Festival helps preserve the local religious and cultural values. People know more about history and are blessed with good fortunes. Consequently, more tourists come every year to join the exquisite festival and feel at ease because of the organising process. As some stakeholders from the university and the People's Committee emphasised:

> *R1: From a tourism perspective, I have certain benefits from organising the festival...I can listen to the history of the festival and understand how the festival celebrates the customs and the beauty of our religion. This information cannot be fully explained in newspapers or magazines [alone].*
>
> *R2: From a tourism perspective… I can visit sooner and listen to the stories from the management board about the beauty of the cult, the history of the Goddess Tianhou and the remarkable things about the festival and share it with my friends.*
>
> *R4: The festival is the beauty of the Tianhou cult that is strongly religiously attached to the Binh Duong people in general and Chinese people who live in BDP in particular. This is why being a stakeholder in the festival organising process is a way for me to celebrate the beauty of the religion.*

The findings show similar patterns between the perceived impacts of the festival by organisers (Gursoy et al., 2004) and the extracted data from interview sessions, which include the four dimensions comprising positive benefits (economic benefits, social incentives and community cohesiveness) and negative costs (social costs). However, key stakeholders' interview sessions also revealed another component of the festival's benefits, that is, stakeholders gain interpersonal skills development (Table 2).

Table 2. Perceived benefits of stakeholders in TRF, BDP in comparison with Gursoy's model

The original model of perceived benefits and cost of the festival (Gursoy et al., 2004)	**Obtained model for this study**
	Interpersonal skills
	Management and communication skills Emotional intelligence Collaboration skills
Economic benefits	Economic benefits
Increase employment opportunities **Increase the standard of living** **Encourage locals to develop new facilities**	Enhance the standard of living
Social incentives	Social incentives
Promote organisations and businesses. **Offer family-based recreation activities.** **Provide more recreational opportunities**	Educational – make people aware Enhance festival image to outsiders
Community cohesiveness	Community cohesiveness
Build community pride **Enhance community image** **Help preserve the local culture** **Generate revenues for civic projects**	Help preserve the local culture

Source: Fieldwork

CONCLUSION

The application of Freeman's (1984) stakeholder theory is valuable even for the tourism sector. From the perceived benefits analysed in this study, a well-arranged collaboration between key stakeholders can be formed to ensure the sustainable growth of the festival. A single stakeholder's model from the empirical studies cannot be used to identify varying stakeholder roles, as each festival has distinct characteristics. In fact, the findings show that depending on the scenario and groups of stakeholders, different stakeholders' structures can adopt more than one stakeholder model. Furthermore, key stakeholders can receive the benefits directly and indirectly through the growth of the local community.

Public and non-profit festivals have effectively encouraged investment and support from governments. Hence, non-profit festivals appear less concerned about sponsors (Andersson & Getz, 2009). The current study discloses the motives of stakeholders to join the organising process of the festival through perceived benefits and how the festival can operate while being a non-profit-oriented event. Future studies can consider evaluating the differences from multiple countries that organise similar festivals to obtain more diverse findings.

ACKNOWLEDGEMENT

"The author would like to extend their appreciation to Thu Dau Mot University for sponsoring the scholarship; the author also expresses gratitude toward Universiti Sains Malaysia invaluable support".

REFERENCES

Andersson, T D, & D Getz, D. (2009). Festival ownership. Differences between public, nonprofit and private festivals in Sweden. *Scandinavian Journal of Hospitality and Tourism*, *9*(2–3), 249–265. https://doi.org/10.1080/15022250903217035

Andersson, Tommy D, & Getz, D. (2008). Stakeholder management strategies of festivals. *Journal of Convention & Event Tourism*, *9*(3), 199–220.

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, *3*(2), 77–101. https://doi.org/10.1191/1478088706qp063oa

Choi, C. (2019). Beyond hegemony and sisterhood: transnational Tianhou-Mazu cult in East Asia. *Asian Education and Development Studies*.

Cudny, W. (2013). Festival tourism–the concept, key functions and dysfunctions in the context of tourism geography studies. *Geographical Journal*, *65*(2), 105–118.

Dang, H. L. (2014). Tian Hou festival of Hoa people in the south of Vitenam (the case of Tian Hou palace—Thu Dau Mot, Binh Duong and Tian Hou temple—district 5, Ho Chi Minh city. *Mother Goddess Worship in the South of Vitenam—Identity and Value*.

Fitri Amir, A., Jamal, S. A., Shahril, R., & Puad Mat Som, A. (2024). From Perception to Support: the Role of Political Bureaucracy in rual tourism development in Lombok, Indonesia. In *Planning Malaysia* (Vol. 22).

Freeman, R. (1984). Edward: Strategic Management. In *A Stakeholder Approach*.

Getz, D. (2008). Event tourism: Definition, evolution, and research. *Tourism Management*, *29*(3), 403–428.

Getz, Donald. (2010). The nature and scope of festival studies. *International Journal of Event Management Research*, *5*(1), 1–47.

Giannoulakis, C. (2014). Sponsorship of non-profit sporting events: The case of the Well-Being Festival. *Sport Marketing Quarterly*, *23*(4), 244.

Grimble, R., & Chan, M. K. (1995). Stakeholder analysis for natural resource management in developing countries: some practical guidelines for making management more participatory and effective. *Wiley Online Library*.

Gursoy, D., Kim, K., & Uysal, M. (2004). Perceived impacts of festivals and special events by organizers: an extension and validation. *Tourism Management*, *25*(2), 171–181.

Hào, N. X. (2016). Phát triển sản phẩm du lịch đặc thù để xây dựng thương hiệu du lịch tỉnh Bình Dương. *Tạp Chí Khoa Học Đại Học Văn Hiến*.

Hede, A., Deery, M., Jago, L., Harris, R., & Allen, J. (2002). Events and place making: proceedings of international Event Research Conference. *Australian Centre for Event Management*.

Kim, B., Kim, S., & King, B. (2020). Religious tourism studies: evolution, progress, and future prospects. *Tourism Recreation Research*, *45*(2), 185–203.

Marshall, C., & Rossman, G. B. (2014). *Designing qualitative research*.

Ng, P. S. K., & Rahman, S. (2021). Conceptualising Governance Approach on Stakeholders Participation and Collaboration in George Town Festival, Penang, Malaysia. *IOP Conference Series: Earth and Environmental Science*, *799*(1). https://doi.org/10.1088/1755-1315/799/1/012016

Pimid, M., Latip, N. A., Marzuki, A., Umzarulazijo Umar, M., & Krishnan, K. T. (2020). Stakeholder management of Conservation in lower Kinabatangan Sabah. In *Planning Malaysia* (Vol. 18).

Schmeer, K. (1999). Stakeholder analysis guidelines. *Policy Toolkit for Strengthening Health Sector Reform*, *1*.

UNWTO. (2014). *Tourism Highlights*.

Zhang, C. X., Fong, L. H. N., Li, S. N., & Ly, T. P. (2019). National identity and cultural festivals in postcolonial destinations. *Tourism Management*, *73*(73), 94–104. https://doi.org/10.1016/j.tourman.2019.01.013

Received: 18th March 2024. Accepted: 17th August 2024

PLANNING MALAYSIA:
Journal of the Malaysian Institute of Planners
VOLUME 22 ISSUE 5 (2024), Page 209 – 223

FLOOD VULNERABILITY IN JAKARTA COASTAL SETTLEMENT: A STUDY AT KALIBARU SUBDISTRICT, NORTH JAKARTA, INDONESIA

Calista Mutia Gunandar[1], Hayati Sari Hasibuan[2], Rudy Parhalutan Tambunan[3]

[1,2,3,] *Environmental Science, School of Environmental Science,*
UNIVERSITAS INDONESIA

Abstract

The efforts to alleviate slum settlement in the coastal areas of Jakarta are required to consider the sustainability of flood disaster protection measures. This is essential for reducing vulnerability issues, particularly in Kalibaru Subdistrict with the highest flood risk. The vulnerability issues refer to aspects of community exposure level, sensitivity, and adaptive capacity as main indicators of coastal areas due to climate change. Therefore, this study aimed to analyze the vulnerability of slum settlement in coastal area of Kalibaru Subdistrict, North Jakarta. A quantitative method was used to measure vulnerability level of settlements to flood using statistical and scoring analysis. The results showed that vulnerability level of settlement to floods was within the moderate category. The adaptive capacity serving as a significant element, was influenced by collective actions, cooperation, and mutual assistance in addressing disaster threats. This showed the need to optimize both physical and non-physical aspects of slum settlement eradication interventions.

Keywords: Flood Vulnerability, Coastal Settlement, North Jakarta

[1] Master student Email: calista.mutia@ui.ac.id

INTRODUCTION

Coastal settlement is the most vulnerable area to flood risks due to the dynamics of anthropogenic activities causing an increase in sea levels on temporal and spatial scales (Glavovic et al., 2022). In a socio-ecological system, the interaction between humans and their environment forms local capital, determining the vulnerability to flood (Yuliastuti et al., 2023). Flood vulnerability is considered significant for community of slum settlement due to limited access to infrastructure and social protection (Adegun, 2023; Pu et al., 2024). According to UN-Habitat (2018), slum settlement is an inadequate housing area consisting of dwellings made of low-quality materials and lacking proper infrastructure.

A total of 40% of the area in Jakarta is below sea level, particularly in North Jakarta, which directly borders the sea (World Bank, 2011), causing high vulnerability to flood. Generally, Jakarta is located on a low, flat alluvial plain with 13 rivers that cause major flood during heavy rains (World Bank, 2011). The condition of coastal settlement is influenced by land subsidence and high poverty rates (Bott et al., 2021; World Bank, 2011). Based on the Regulation of the Governor of DKI Jakarta Province Number 90 of 2018 concerning the Improvement of Settlement Quality in the Framework of Integrated Area Arrangement, North Jakarta has 80 slum RWs that need to be improved to enhance the quality of settlements. The slum upgrading includes fostering the environment physical, social, cultural, and economic aspects to meet the need for decent housing and reduce vulnerability.

In the Medium-Term Regional Development Plan of DKI Jakarta for 2017-2022, nine priority RWs (neighborhood units) have been identified for intervention. Among the priority RWs, six are located in Kalibaru Subdistrict, which is predicted to face a high risk of flood by 2040 (Rahayu et al., 2020). Therefore, slum upgrading aims to enhance access to urban infrastructure and improve flood hazard anticipation. The anticipated redevelopment of slum areas, with consideration of flood risks, is expected to enhance community resilience significantly.

Based on the description, this study aimed to analyze vulnerability of coastal slum settlement to flood after upgrading. Previous reports have shown the relationship between flood vulnerability in slum settlement and disaster aspects, focusing on increasing adaptive capacity through social resilience (Parvin et al., 2023; Yeboah et al., 2021) as well as enhancing infrastructure and local community sensitivity (Elghazouly et al., 2024; Yu et al., 2016). Moreover, this study examined vulnerability of coastal settlements to flood through three components, namely exposure, sensitivity, and adaptive capacity. The results were expected to fill the literature gap and serve as a reference in implementing efforts to improve the quality of settlement in coastal slum upgrading to mitigate flood vulnerability.

LITERATURE REVIEW

Vulnerability is perceived as the integration between physical events and the characteristics of the population, leading to risk exposure and limitations in community capacity to respond to threats (Dolan, 2004; Yahia Meddah et al., 2023). Previous studies have shown that vulnerability of coastal areas due to climate change refers to three leading indicators, namely disaster exposure, sensitivity, and adaptive capacity (Borbor-Cordova et al., 2020; Mondal et al., 2020; Astuti et al., 2021; Sarker, 2022; Meddah et al., 2023). These indicators represent the interdependent relationship between community and the surrounding elements, including environmental, social, and economic aspects that affect vulnerability level of coastal areas to flood disasters (Salata & Yiannakou, 2020)

Exposure comprises external pressures, including the characteristics of flood disasters, such as frequency, depth, and duration (Babanawo et al., 2022). Sensitivity is defined as the internal conditions of a system that influence vulnerability, including the socio-economic conditions of community and the physical conditions of the environment (Borbor-Cordova et al., 2020). The socio-economic components of sensitivity include the number of family members (Atiglo et al., 2022; Babanawo et al., 2022) and income levels (Astuti et al., 2021; Owusu & Nursey-Bray, 2019). Meanwhile, the physical environmental components include infrastructure and access to essential services (Bernard et al., 2022; Borbor-Cordova et al., 2020). Adaptive capacity shows the resilience or ability of community to prepare for, avoid, and recover from disaster risks (Dolan, 2004). Table 1 shows the 14 indicators for assessing flood vulnerability in coastal slum settlement.

Table 1: Flood Vulnerability Indicators

Indicator	Description	Sources
Exposure		
Flood Frequency (FB)	The frequency of flood experienced by the community in the past year	(Anh et al., 2018; Borbor-Cordova et al., 2020; Damte et al., 2023)
Flood Dept (KLB)	The depth of flood is measured from the ground surface to the water surface. Greater flood depth correlates with higher levels of damage.	(Anh et al., 2018; Babanawo et al., 2022; Hadipour et al., 2020)
Flood Duration (DRB)	The time they are required for floodwaters to recede. Longer flood duration correlates with higher levels of damage.	(Anh et al., 2018; Babanawo et al., 2022)
Sensitivity		
Number of Family Members (JAK)	Larger family size correlates with higher vulnerability	(Atiglo et al., 2022; Babanawo et al., 2022).
Household Income (TPD)	Lower monthly household income correlates with higher vulnerability	(Astuti et al., 2021; Owusu & Nursey-Bray, 2019)

Indicator	Description	Sources
Clean Water Access (KAB)	Access to safe water sources free from pollutants	(Astuti et al., 2021; Linh & Huan, 2022)
Sanitation (STS)	Access to adequate sanitation facilities	(Bernard et al., 2022)
Drainage Network (KLD)	Limitations and poor quality of drainage infrastructure that can cause flood	(Owusu & Nursey-Bray, 2019)
Waste Management (FPSH)	Access to waste collection services	(Adegun, 2023; Borbor-Cordova et al., 2020)
Adaptive capacity		
Education (TPT)	Higher education correlates with a better understanding of flood risks and improved flood mitigation and adaptation efforts.	(Hadipour et al., 2020)
Information Media (MI)	The availability of information media can provide opportunities for preparedness, early warning, and emergency information.	(Babanawo et al., 2022; Owusu & Nursey-Bray, 2019).
Family Cooperation (KJK)	Mutual assistance among family members for better flood mitigation and adaptation efforts	(Sadeka et al., 2020; Tammar et al., 2020)
Gotong royong (GTR) and Neighbor Cooperation (KJT)	Mutual assistance among community members for better flood mitigation and adaptation efforts	(Pazhuhan et al., 2023; Sadeka et al., 2020; Tammar et al., 2020)
Outreach Activities (PKPE)	Activities aimed at increasing community capacity to deal with disasters, thereby enhancing environmental awareness and preparedness for flood	(Astuti et al., 2021; Yahia Meddah et al., 2023).

Source: Literature review

STUDY METHODOLOGY

Study Area

Study area was Kalibaru Subdistrict, Cilincing District, North Jakarta City, DKI Jakarta Province. Kalibaru Subdistrict is recognized for distinctive topography, which is situated below sea level. The predominant cause of flood in this area is the occurrence of high-intensity rainfall. After the completion of the coastal embankment as part of the National Capital Integrated Coastal Development (NCICD) project in 2018, there has been a significant reduction in the incidence of tidal flood. Based on settlement conditions, Kalibaru Subdistrict is among the 10 subdistricts with the highest number of slum RWs that are vulnerable to pluvial and coastal flood risks (BPS, 2017; Rahayu et al., 2020). This subdistrict comprises 15 RWs, with one RW being uninhabited and managed by a business entity engaged in port and logistics services.

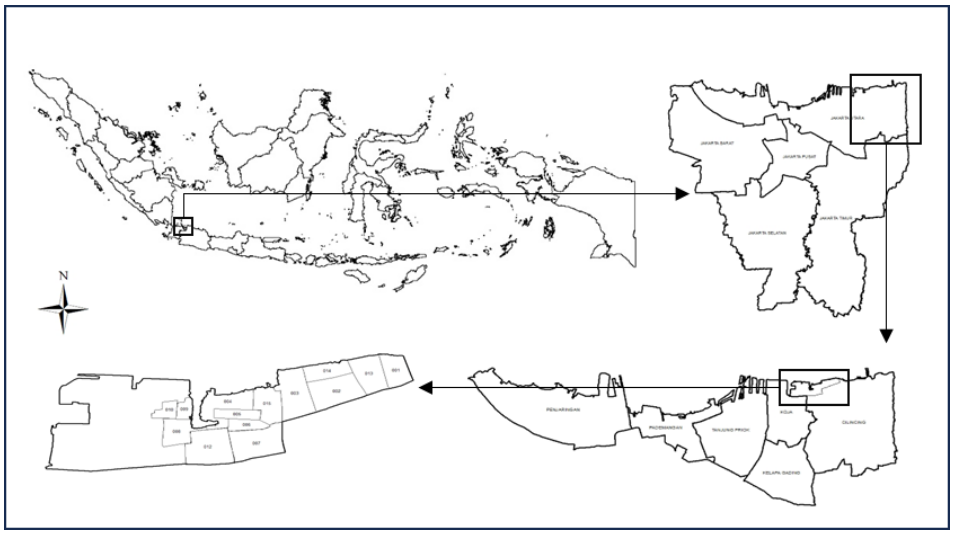


Figure 1: Location of Study Area

Data Resources

This used a quantitative method with a mixed-methods methodology. Data were collected through questionnaires and interviews with community leaders between March-April 2024. The study included 208 respondents selected through purposive sampling. The respondents were either the household head or their designated representatives residing within the Kalibaru Subdistrict, specifically sourced from six RWs identified as priority areas for slum upgrading initiatives. These RWs include RW 1, RW 6, RW 7, RW 10, RW 12, and RW 13.

Analysis Method

Data analysis was conducted using Structural Equation Modeling (SEM) and the scoring method. In SEM analysis, flood vulnerability indicators and the three dimensions were validated using second-order Confirmatory Factor Analysis (CFA). The model developed in this study was reflective (Figure 1), indicating a causal relationship between the indicators and their dimension variables (Kurniawan et al., 2018). The CFA method used two testing models, namely the measurement and the structural.

The measurement model was tested to identify the validity and reliability of variables and their indicators. Several criteria in the model included (1) The Cronbach's alpha value must be greater than 0.7 to measure internal reliability consistency, (2) The composite reliability (CR) value, where a higher value indicates more excellent reliability (Hair et al., 2019). However, a CR value between 0.6 and 0.7 could be acceptable, and values between 0.7 and 0.9 were considered good, while those greater than 0.90 indicated redundancy (Hair et al., 2022). (3) The average variance extracted (AVE) value should be greater than 0.5

(Hair et al., 2022). (4) The outer loading value must be above 0.7 to show the correlation of indicators representing the dimension (Hair et al., 2019). However, in exploratory studies, values between 0.5 and 0.6 are considered sufficient (Kurniawan et al., 2018).

Testing the structural model to assess the significance of the relationships between variables refers to (1) The coefficient of determination (Adjusted R square), where a higher R square value indicates a better model. (2) Goodness of Fit (GoF), which is obtained through the square root of the product of AVE and R square. The GoF is considered good when it exceeds 0.38. (3) The T-statistic must be greater than 1.96, and (4) the Significance (*p*-value) must be less than 0.05.

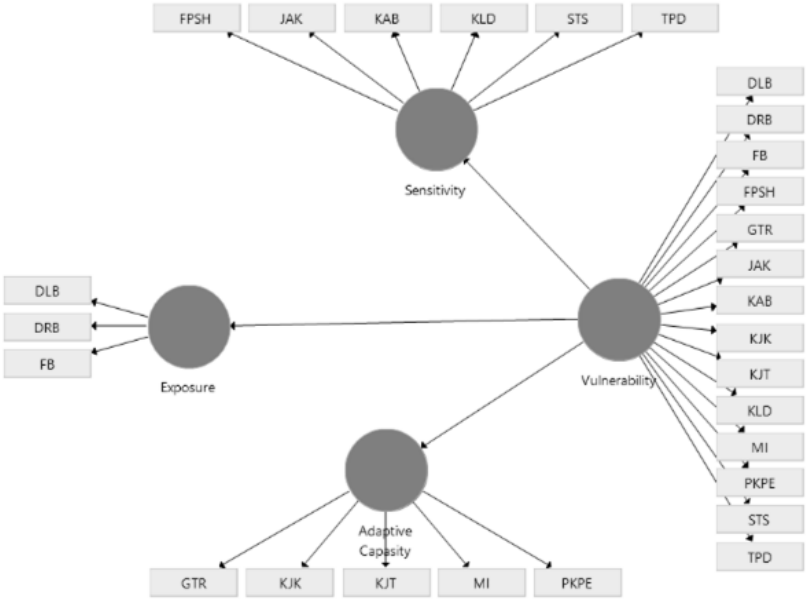


Figure 2: Model Structure
Source: Smart PLS output

The second-order CFA analysis obtained the outer loading values as weights to assess flood vulnerability. The level of flood vulnerability was analyzed using a scoring method derived from the sum of the exposure, sensitivity, and adaptive capacity indexes. Moreover, the index for each dimension of vulnerability was calculated by multiplying the outer loading with the acquired value. The flood vulnerability results were classified into three categories, namely high, medium, and low.

Flood Vulnerability Index = $\sum(f_e * n_e) + \sum(f_s * n_s) + \sum(f_{ca} * n_{ca})$ …..... (1)

ANALYSIS AND DISCUSSION

The measurement model was tested to obtain valid and reliable indicators. In the initial iteration, the Cronbach's alpha, CR, and AVE values of sensitivity and vulnerability variables did not meet the criteria. However, adaptive capacity only met CR threshold, and exposure variables fulfilled the requirements. Table 2 shows the outer loading values from the first iteration, indicating that there are still low outer loading values (<0.7). This shows that eliminating indicators with lower values needs to consider their influence on other values. Outer loading values between 0.4 and 0.7 should be regarded to avoid affecting the validity of dimensions (Hair et al., 2022). Therefore, indicators with outer loading values below 0.4 are eliminated (Hair et al., 2022).

Table 2: Result of Outer loading Iteration 1

Indicator	Exposure	Sensitivity	Adaptive Capacity	Vulnerability
DLB	0.846			0.483
DRB	0.869			0.521
FB	0.698			0.408
JAK		-0.308		-0.14
TPD		0.216		0.013
KAB		-0.421		-0.127
STS		0.033		0.04
KLD		0.815		0.815
FPSH		0.583		0.257
TPT			0.099	0.096
MI			0.292	0.279
GTR			0.894	0.789
KJK			0.748	0.645
KJT			0.878	0.782
PKPE			0.722	0.661

Source: Smart PLS Output

Table 3 shows the outer loading values from several iterations, where all indicators have values that meet the threshold. The constructs of exposure, sensitivity, adaptive capacity, and vulnerability satisfy the required thresholds. Exposure shows a Cronbach's alpha value of 0.729, CR 0.84, and AVE 0.636. Meanwhile, sensitivity has a Cronbach's alpha value of 0.701, CR 0.769, and AVE 0.36. Adaptive capacity shows a Cronbach's alpha value of 0.833, CR 0.889, and AVE 0.669. Vulnerability shows a Cronbach's alpha value of 0.713, CR 0.832, and AVE 0.577.

Table 3: Result of Outer Loading in Measurement Model

Indicator	Exposure	Sensitivity	Adaptive Capacity	Vulnerability
DLB	0.815			
DRB	0.899			0.332
FB	0.688			
KLD		0.602		
FPSH		0.954		
GTR				0.872
KJK			0.784	0.798
KJT			0.892	0.896
PKPE			0.685	

Source: Smart PLS Output

Structural model testing refers to the R square value indicating the magnitude of latent constructs on their dimensional constructs, where a value indicates a better model (Hair et al., 2019). In this study, adaptive capacity had an R square value of 0.805 (n>0.67), indicating that the variable was a robust model predictor and could explain vulnerability by 80.4%. Exposure was a variable with moderate explanatory power, and an R square value of 0.355 (n>3.3), explaining vulnerability by 35.2%. Meanwhile, sensitivity was a weak model predictor with R square value of 0.014 (n<0.19) and an explanatory power of 9%. The measurement and structural models were validated through GoF value obtained from the square root of AVE and R square multiplication. Based on the results, GoF value was 0.379 (n>0.36), exceeding the prescribed threshold.

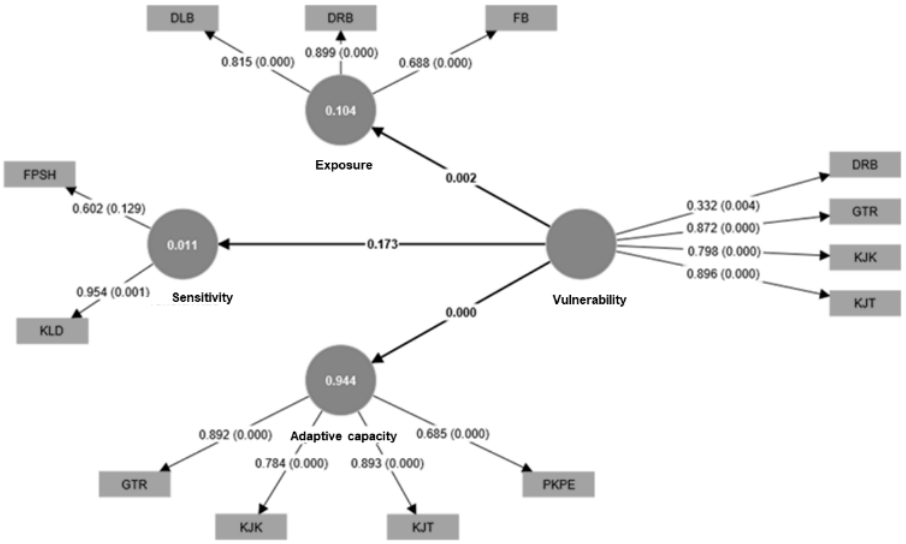


Figure 3: Result of Structural Evaluation Model
Source: Smart PLS output

As shown in Figure 3, the analysis results indicated that only two variables were significant in measuring vulnerability, along with four valid and reliable indicators. These indicators comprised exposure consisting of flood duration and adaptive capacity including family cooperation, neighbor cooperation, and *gotong royong* or mutual assistance. Based on the results, adaptive capacity variable was dominant in determining vulnerability of settlement to flood, as majority showed significant factor loading values.

The exclusion of indicators related to exposure, sensitivity, and adaptive capacity variables was influenced by the empirical conditions of the Kalibaru Subdistrict. Regarding frequency and depth, exclusion indicators were from variations in experiences among respondents. Similarly, the exclusion of indicators of clean water, sanitation, and waste collection services was attributed to differing respondent perceptions.

Results of the interviews showed that there were households lacking access to piped water, as major needs were fulfilled through well, water kiosks, and *nyelang*. Water kiosks represented a program for areas without piped water access, serving as a source from tanks routinely filled by tanker trucks. Meanwhile, *nyelang* referred to piped water purchased from neighbors using hoses. Some respondents also raised concerns regarding the water quality, as there was an indication of turbidity and foul-smelling characteristics.

Figure 4: The Condition of Settlement Infrastructure
Source: Author's Documentation

Adequate sanitation facilities equipped with septic tanks were lacking for some respondents, leading to the direct discharge of waste into water channels. This was attributed to unavailable access to waste disposal services to community, causing reliance on informal waste collection methods. The drainage system in Kalibaru Subdistrict was considered a critical component of settlement. Consequently, the drainage system was among the aspects targeted for

improvement under slum upgrading program to enhance the quality of living conditions. After the settlement upgrading, the drainage conditions were assessed to have improved, thereby mitigating flood in several areas.

The exclusion of media information indicators could be due to some respondents not receiving information about flood threats. Similarly, regarding indicators of outreach and educational activities, some respondents expressed infrequent or nonexistent participation.

Table 4: Result of Flood Vulnerability Levels in Kalibaru Subdistrict

Vulnerability Indicator	Outer loading	Score	Result
DRB	0.332	538	178.616
KJK	0.798	629	501.942
GTR	0.872	617	538.024
KJT	0.896	615	551.040
Total			**1,769.622**

Source: Author's Calculation

Table 4 shows the vulnerability level of coastal settlement in Kalibaru Subdistrict to flood obtained using a scoring method through the multiplication of the loading factor results by respondent assessments. Based on the analysis, the calculation showed a vulnerability value of 1,769.622. This study categorized vulnerability into three classes, namely high (07.076-1,714.74), moderate (1,714.75-2,522.41), and low (2,522.42-3,330.08). Based on this classification, coastal settlement in the Kalibaru Subdistrict were considered moderately vulnerable to flood. As shown in Figure 5, there were three RWs with low vulnerability, two RWs had moderate, and one was high.

Based on the flood vulnerability assessment scores obtained, the majority of community in the six locations had higher scores for GTR (mutual assistance) and KJT (neighborhood cooperation) compared to DRB (flood duration) and KJK (family cooperation) indicators. This showed that participation in community cooperation and neighborhood cooperation activities during flood was considered more vital or significant in reducing vulnerability. Meanwhile, family cooperation had lower assessment scores because some respondents mentioned that family members who could assist did not reside at home due to employment outside the community.

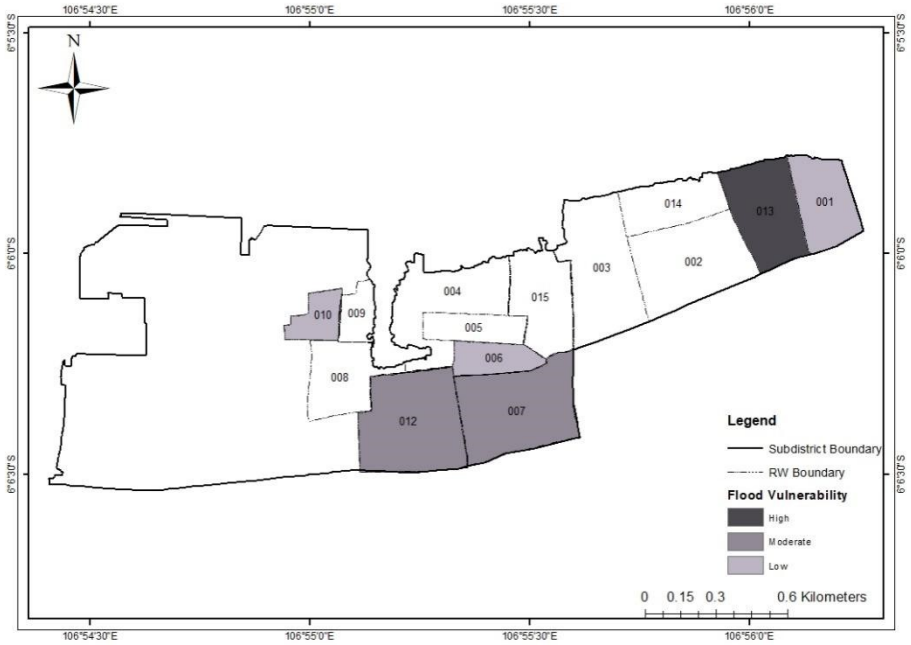


Figure 5: Flood Vulnerability in Kalibaru Subdistrict According to Neighborhood Units (RWs).

The results showed the role of social capital in accessing aid from social community (Chen et al., 2021), forming collective actions to respond to flood impacts by accelerating community and infrastructure recovery (Fatemi et al., 2021) and reinforcing each other to enhance their capacity to cope with disasters (Azad & Pritchard, 2023). The influence of adaptive capacity on vulnerability to flood was affected by the socio-economic conditions of community (Mruksirisuk et al., 2023). The Kalibaru Subdistrict community was diverse, with various cultural influences affecting perceptions of flood threats. This diversity led to differing willingness to enhance flood resilience (Soetanto et al., 2017). Strong social norms, cooperative abilities, and solidarity facilitated access to social capital (Wannewitz & Garschagen, 2024). Chong and Bin Kamarudin (2023) also stated that close social connections could enhance community ability to cope with disasters such as flood. Therefore, improving the quality of settlement included enhancing physical aspects and strengthening community resilience during disasters. Community resilience was considered crucial for better understanding both natural and built environments (Sulaiman et al., 2019), and for enhancing the community's ability to adapt to changing conditions, endure, and recover swiftly from disasters.

CONCLUSION

In conclusion, this study explored flood vulnerability levels in Kalibaru Subdistrict, which was within the moderate category. The classification of levels produced was closely related to indicators of adaptive capacity that predominantly determined flood vulnerability. These results showed that the social relationships formed within community were crucial in addressing the disaster risks. The analysis showed that the physical environmental components did not significantly influence the determination of flood vulnerability at the study location despite settlement planning efforts. This was attributed to the community differing perceptions of environmental conditions and the ease of access to basic urban services.

The increased flood risk due to climate change was predicted to escalate, with coastal settlements expected to experience significant impacts. Besides settlement planning aimed at improving infrastructure and essential services, enhancing social capital also required attention to mitigate vulnerability to flood.

ACKNOWLEDGEMENT

This research was funded by School of Environmental Science, Universitas Indonesia, Grant No. PKS-0311/UN2.F13.D1/PPM.00.04/2024.

REFERENCES

Adegun, O. B. (2023). Climatic disasters within a flood-prone coastal slum in Lagos: coping capacities and adaptation prospects. *International Journal of Disaster Resilience in the Built Environment*, *14*(2), 212–228. https://doi.org/10.1108/IJDRBE-11-2021-0154

Anh, H. H., Hanh, T. M. Da, Vi, N. T. T., & Shunboa, Y. (2018). Examining the interaction of flood vulnerability determinants in Cambodia and Vietnam using partial least squares structural equation modeling. *Water Policy*, *20*(6), 1256–1278. https://doi.org/10.2166/wp.2018.198

Astuti, K. D., Pangi, P., Yesiana, R., & Harjanti, I. M. (2021). Slum Upgrading Spatial Model Based on Level of Vulnerability to Climate Change in Coastal Area of Semarang City. *Geoplanning*, *8*(1), 23–40. https://doi.org/10.14710/geoplanning.8.1.23-40

Atiglo, D. Y., Abu, M., Jayson-Quashigah, P.-N., Addo, K. A., & Codjoe, S. N. A. (2022). Sociodemographic and geophysical determinants of household vulnerability to coastal hazard in the Volta Delta, Ghana. *International Journal of Disaster Risk Reduction*, *78*(103146), 1–11. https://doi.org/10.1016/j.ijdrr.2022.103146

Azad, M. J., & Pritchard, B. (2023). Bonding, bridging, linking social capital as mutually reinforcing elements in adaptive capacity development to flood hazard: Insights from rural Bangladesh. *Climate Risk Management*, *40*(February), 100498. https://doi.org/10.1016/j.crm.2023.100498

Babanawo, D., Mattah, P. A. D., Agblorti, S. K. M., Brempong, E. K., Mattah, M. M., & Aheto, D. W. (2022). Local Indicator-Based Flood Vulnerability Indices and

Predictors of Relocation in the Ketu South Municipal Area of Ghana. *Sustainability (Switzerland)*, *14*(9). https://doi.org/10.3390/su14095698

Bernard, A., Long, N., Becker, M., Khan, J., & Fanchette, S. (2022). Bangladesh's vulnerability to cyclonic coastal flooding. *Natural Hazards and Earth System Sciences*, *22*(3), 729–751. https://doi.org/10.5194/nhess-22-729-2022

Borbor-Cordova, M. J., Ger, G., Valdiviezo-Ajila, A. A., Arias-Hidalgo, M., Matamoros, D., Nolivos, I., Menoscal-Aldas, G., Valle, F., Pezzoli, A., & Cornejo-Rodriguez, M. D. P. (2020). An operational framework for urban vulnerability to floods in the guayas estuary region: The duran case study. *Sustainability (Switzerland)*, *12*(1092), 1–23. https://doi.org/10.3390/su122410292

Bott, L. M., Schöne, T., Illigner, J., Haghshenas Haghighi, M., Gisevius, K., & Braun, B. (2021). Land subsidence in Jakarta and Semarang Bay – The relationship between physical processes, risk perception, and household adaptation. *Ocean and Coastal Management*, *211*. https://doi.org/10.1016/j.ocecoaman.2021.105775

BPS. (2017). *Pendataan RW Kumuh DKI Jakarta 2017* (Satriono (ed.)). BPS Provonsi DKI Jakarta.

Chen, Y., Liu, T., Ge, Y., Xia, S., Yuan, Y., Li, W., & Xu, H. (2021). Examining social vulnerability to flood of affordable housing communities in Nanjing, China: Building long-term disaster resilience of low-income communities. *Sustainable Cities and Society*, *71*(April). https://doi.org/10.1016/j.scs.2021.102939

Chong, N. B. O., & Bin Kamarudin, K. H. (2023). Disaster Resilience Rural Community (DRRC) Community Capitals: Case Studies in the Rural Area of East Coast, Peninsular Malaysia. *Planning Malaysia*, *21*(2), 40–51. https://doi.org/10.21837/pm.v21i26.1258

Damte, E., Manteaw, B. O., & Wrigley-Asante, C. (2023). Urbanization, climate change, and health vulnerabilities in slum communities in Ghana. *The Journal of Climate Change and Health*, *10*(100189), 1–9. https://doi.org/10.1016/j.joclim.2022.100189

Dolan, A. H. et I. J. W. (2004). Understanding vulnerability of coastal communities to climate change related risks. *Journal of Coastal Research*, *3*(39), 1316–1232. https://www.jstor.org/stable/25742967

Elghazouly, H. G., Elnaggar, A. M., Ayaad, S. M., & Nassar, E. T. (2024). Framework for integrating multi-criteria decision analysis and geographic information system (MCDA-GIS) for improving slums interventions policies in Cairo, Egypt. *Alexandria Engineering Journal*, *86*(December 2023), 277–288. https://doi.org/10.1016/j.aej.2023.11.059

Fatemi, M. N., Okyere, S. A., Diko, S. K., Abunyewah, M., Kita, M., & Rahman, T. (2021). Flooding in mega-cities: using structural equation modeling to assess flood impact in Dhaka. *International Journal of Disaster Resilience in the Built Environment*, *12*(5), 500–514. https://doi.org/10.1108/IJDRBE-08-2020-0094

Glavovic, B., Dawson, R., Chow, W., Garschagen, M., Haasnoot, M., Singh, C., & Thomas, A. (2022). Cross-Chapter Paper 2: Cities and Settlements by the Sea. In *Climate Change 2022 – Impacts, Adaptation and Vulnerability*. Cambridge University Press. https://doi.org/10.1017/9781009325844.019

Hadipour, V., Vafaie, F., & Kerle, N. (2020). An indicator-based approach to assess social vulnerability of coastal areas to sea-level rise and flooding: A case study of Bandar

Abbas city, Iran. *Ocean and Coastal Management*, *188*(105077), 1–16. https://doi.org/10.1016/j.ocecoaman.2019.105077

Hair, J. F., Hult, G. T. M., Ringle, C. M., & Sarstedt, M. (2022). *A Primer on Partial Least Squares Structural Equation Modeling (PLS-SEM)* (Third edit). SAGE Publications. https://doi.org/10.1201/9781032725581-7

Hair, J. F., Risher, J. J., Sarstedt, M., & Ringle, C. M. (2019). When to use and how to report the results of PLS-SEM. *European Business Review*, *31*(1), 2–24.

Kurniawan, R., Yuniarto, B., Caraka, R. E., Siagian, T. H., & Nasution, B. I. (2018). Construction of social vulnerability index in Indonesia using partial least squares structural equation modeling. *International Journal of Engineering &Technology*, *7*(4), 6131–6136. https://doi.org/10.14419/ijet.v7i4.

Linh, P. T. T., & Huan, V. D. (2022). Assessing the vulnerability to tidal-induced flooding of the low-income coastal community in the Mekong Delta: A case study in Bac Lieu Province, Vietnam. *IOP Conference Series: Earth and Environmental Science*, *1028*(1), 1–13. https://doi.org/10.1088/1755-1315/1028/1/012008

Mruksirisuk, P., Thanvisitthapon, N., Pholkern, K., Garshasbi, D., & Saguansap, P. (2023). Flood vulnerability assessment of Thailand's flood-prone Pathum Thani province and vulnerability mitigation strategies. *Journal of Environmental Management*, *347*(September), 119276. https://doi.org/10.1016/j.jenvman.2023.119276

Owusu, M., & Nursey-Bray, M. (2019). Socio-economic and institutional drivers of vulnerability to climate change in urban slums: the case of Accra, Ghana. *Climate and Development*, *11*(8), 687–698. https://doi.org/10.1080/17565529.2018.1532870

Parvin, A., Mostafa, A., & Syangadan, R. (2023). Disaster adaptive housing upgrading: insights from informal settlements in Bangladesh and Nepal. *Journal of Housing and the Built Environment*, *38*(3), 2129–2149. https://doi.org/10.1007/s10901-023-10031-3

Pazhuhan, M., Amirzadeh, M., Värnik, R., Pietrzykowski, M., Lopez-Carr, D., & Azadi, H. (2023). The impact of social capital on the resilience of flood-prone communities: The case study of northern Iran. *Environmental Development*, *48*(February), 1–19. https://doi.org/10.1016/j.envdev.2023.100902

Pu, C., Yang, F., & Wang, X. (2024). Flood risk assessment of slums in Dhaka city. *Geocarto International*, *39*(1). https://doi.org/10.1080/10106049.2024.2341802

Rahayu, H. P., Haigh, R., Amaratunga, D., Kombaitan, B., Khoirunnisa, D., & Pradana, V. (2020). A micro scale study of climate change adaptation and disaster risk reduction in coastal urban strategic planning for the Jakarta. *International Journal of Disaster Resilience in the Built Environment*, *11*(1), 119–133. https://doi.org/10.1108/IJDRBE-10-2019-0073

Sadeka, S., Mohamad, M. S., Sarkar, M. S. K., & Al-Amin, A. Q. (2020). Conceptual Framework and Linkage Between Social Capital and Disaster Preparedness: A Case of Orang Asli Families in Malaysia. *Social Indicators Research*, *150*(2), 479–499. https://doi.org/10.1007/s11205-020-02307-w

Salata, K. D., & Yiannakou, A. (2020). The quest for adaptation through spatial planning and ecosystem-based tools in resilience strategies. *Sustainability (Switzerland)*, *12*(14), 1–16. https://doi.org/10.3390/su12145548

Soetanto, R., Mullins, A., & Achour, N. (2017). The perceptions of social responsibility for community resilience to flooding: the impact of past experience, age, gender and ethnicity. *Natural Hazards*, *86*(3), 1105–1126. https://doi.org/10.1007/s11069-016-2732-z

Sulaiman, N., She, T. W., & Fernando, T. (2019). Community resilience frameworks for building disaster resilient community in Malaysia. *Planning Malaysia*, *17*(1), 94–103. https://doi.org/10.21837/pmjournal.v17.i9.589

Tammar, A., Abosuliman, S. S., & Rahaman, K. R. (2020). Social capital and disaster resilience nexus: A study of flash flood recovery in Jeddah City. *Sustainability (Switzerland)*, *12*(11), 4668. https://doi.org/10.3390/su12114668

UN-Habitat. (2018). *SDGs Indicator 11.11 Training Module: Adequate Housing and Slum Upgrading*.

Wannewitz, M., & Garschagen, M. (2024). The role of social identities for collective adaptation capacities– general considerations and lessons from Jakarta, Indonesia. *International Journal of Disaster Risk Reduction*, *100*(December 2023), 1–17. https://doi.org/10.1016/j.ijdrr.2023.104194

World Bank. (2011). *Jakarta: Urban challenges in a changing climate (Mayor's Task Force On Climate Change Disaster Risk & The Urban Poor)*. 1–29. http://documents.worldbank.org/curated/en/132781468039870805/pdf/650180WP0Box360ange0Jakarta0English.pdf

Yahia Meddah, R., Ghodbani, T., Senouci, R., Rabehi, W., Duarte, L., & Teodoro, A. C. (2023). Estimation of the Coastal Vulnerability Index Using Multi-Criteria Decision Making: The Coastal Social–Ecological System of Rachgoun, Western Algeria. *Sustainability (Switzerland)*, *15*(12838), 1–28. https://doi.org/10.3390/su151712838

Yeboah, V., Asibey, M. O., & Abdulai, A. S. J. (2021). Slum upgrading approaches from a social diversity perspective in the global south: Lessons from the Brazil, Kenya and Thailand cases. *Cities*, *113*(103164), 1–13. https://doi.org/10.1016/j.cities.2021.103164

Yu, J., Shannon, H., Baumann, A., Schwartz, L., & Bhatt, M. (2016). Slum Upgrading Programs and Disaster Resilience: A Case Study of an Indian 'Smart City.' *Procedia Environmental Sciences*, *36*, 154–161. https://doi.org/10.1016/j.proenv.2016.09.026

Yuliastuti, N., Sariffudin, & Syafrudin. (2023). Social Vulnerability Level Appraisal at Tidal Flood Areas the Case of a Coastal Settlement in Indonesia. *International Review for Spatial Planning and Sustainable Development*, *11*(2), 99–113. https://doi.org/10.14246/irspsd.11.2_99

Received: 12th June 2024. Accepted: 6th September 2024

PLANNING MALAYSIA:
Journal of the Malaysian Institute of Planners
VOLUME 22 ISSUE 5 (2024), Page 224 – 235

ENVIRONMENTAL PLANNING AND DESIGN: EXPLORING URBAN RESILIENCE THROUGH E-HAILING

Deila Deilaila Mohamad Fuazee[1], Aldrin Abdullah[2*], Massoomeh Hedayati Marzbali[3]

[1,2,3]*School of Housing, Building and Planning,*
UNIVERSITI SAINS MALAYSIA

Abstract

Sustainable cities strive for balance in environmental health, economic vitality and social equity through efficient and resilient urban planning. Crucial to this balance, sustainable transportation systems reduce carbon emissions, ease traffic congestion and promote clean energy. Among various sustainable transportation options, e-hailing has gained global popularity, offering convenient rides through smartphone apps. This quantitative research focuses on exploring the usage patterns of e-hailing services among university students at the main campus of Universiti Sains Malaysia. A total of 392 university students were surveyed using stratified random sampling, and SPSS analysis revealed a moderate positive correlation between attitudes towards e-hailing and satisfaction with safety, price, convenience and availability. Furthermore, regression analysis confirmed significant relationships between attitude and satisfaction levels. By investigating how travel behaviour patterns and attitudes towards e-hailing influence student satisfaction, the study aims to understand e-hailing's role as an alternative mode of transportation in enhancing overall transportation service satisfaction. These insights offer valuable guidance for transport planners, e-hailing companies and university administrations seeking to improve transportation options and student satisfaction.

***Keywords**:* Transportation, E-Hailing, Satisfaction, University Students, Travel Behaviour

[2] Corresponding Author Email: aldrin@usm.my

INTRODUCTION

In the 21st century, the pervasive influence of internet-based technologies, particularly mobile technology, has fundamentally altered consumer behaviour, spurring the emergence of diverse online and mobile platforms to meet evolving customer demands. In response to global imperatives for sustainable development, governments have introduced initiatives to promote eco-friendly transportation options, aimed at diminishing reliance on private vehicles (Nasrudin et al., 2017). These transportation options include enhanced public transport accessibility, walking and cycling. E-hailing services are a pivotal development in the transportation landscape. Facilitated by the integration of information and communication technologies, these services have revolutionised travel by connecting passengers with drivers using their own vehicles. Popularised by industry giants like Uber, Lyft and Grab, e-hailing services have disrupted traditional taxi models. They offer users a more convenient, cost-effective mode of transportation by leveraging GPS and electronic payment systems.

Malaysia's rapid urbanisation over the past three decades has necessitated substantial investments in transport infrastructure, primarily in road networks and parking facilities, to accommodate escalating automobile dependency (Othman & Ali, 2020). In this context, e-hailing services have emerged as a sustainable alternative, potentially mitigating private car reliance.
This study investigates how travel behaviour patterns and attitudes towards e-hailing influence students' satisfaction levels. By scrutinising the factors shaping students' decision-making processes, whilst considering their demographics, the research aims to pinpoint the key determinants influencing the utilisation of e-hailing services as a public transportation mode. Safety, pricing, convenience and availability are emphasised vis-à-vis students' demographics.

E-hailing service users without private vehicles are often members of racial or ethnic minority groups, younger individuals and highly educated adults (Lim et al., 2022). These findings raise questions about potential disparities in e-hailing service selection among students in the main campus of Universiti Sains Malaysia (USM). Investigating the demographic variables significantly influencing e-hailing service choices among USM students is imperative to rectify possible inequalities and ensure equitable transportation access. Identifying these variables can inform measures promoting equal access and enhancing e-hailing service availability and affordability for all students at USM's main campus.

University students frequently encounter commuting challenges, such as extended bus wait times and limited transportation options. A 2017 *The Straits Times* article underscores these challenges and the potential of e-hailing services to alleviate them. However, university students' travel behaviour patterns when using e-hailing services should be examined to elucidate their role as an

alternative commuting means. This investigation can offer valuable insights into enhancing students' travel experiences and addressing transportation challenges. Concerns regarding price surges and driver shortages during peak hours in e-hailing services, as highlighted in a 2022 *Bernama* article, have contributed to user dissatisfaction. Against the backdrop of USM's main campus, assessing students' satisfaction levels with e-hailing services is crucial to address these concerns and improve service quality. Insights gleaned from the assessment can guide policymakers and service providers in making informed decisions and service enhancements aligned with the preferences of USM students. This research aims to provide invaluable insights that can drive policy adjustments and service delivery enhancements, thereby fostering a satisfactory and efficient e-hailing service experience for USM students.

LITERATURE REVIEW

The literature on e-hailing encompasses various definitions, ranging from the simple act of booking a car and driver through a smartphone to broader concepts involving the use of mobile apps for any transportation booking. Reflecting the dynamic nature of ride-hailing services, the global market was valued at USD 28.34 billion in 2021, with a projected compound annual growth rate of 15.7% from 2022 to 2030 (Grand et al., 2023). This valuation underscores its expanding role across different contexts.

This study emphasises key principles of e-hailing services, including safety, pricing, convenience, availability and user experience. Safety measures, competitive pricing, seamless user experience, service availability and efficient issue resolution are pivotal for e-hailing service providers to enhance their offerings and meet user expectations. The Statista Research Department (2019) revealed that e-hailing services in Malaysia are predominantly favoured by individuals aged 25–34, constituting 35.4% of users. This demographic includes university students and young professionals who strongly prefer e-hailing platforms as their primary transportation mode. Conversely, the survey findings suggest lower adoption rates among individuals aged 55–64. A possible reason is their limited familiarity with smartphone apps and concerns regarding technological complexity among older demographics.

E-hailing services have revolutionised transportation, providing convenient and accessible options through smartphone apps that considerably enhance mobility, particularly in developing countries, where they surpass traditional taxis in efficiency and user-friendliness. As a complement to traditional public transit, e-hailing services are especially effective as feeder options in low-demand suburban areas, according to regional departments of transportation (Hayakawa & Chikaraishi, 2023). The integration of e-hailing services with public transit systems, which offer direct routes to common public destinations, aims to reduce reliance on private vehicles (Acierto et al., 2023).

Improving transport infrastructure and enforcing vehicle emission standards can enhance fuel efficiency, substantially cutting carbon dioxide emissions.

E-hailing apps address challenges during peak hours and adverse weather conditions by ensuring quick and responsive transportation bookings, reducing travel stress and time spent in queues and crowded public transportation. Moreover, by allowing individuals to join as drivers, e-hailing platforms create income opportunities and economic empowerment, contributing to the gig economy and fostering grassroots economic development (Pasquali et al., 2022). The rise of e-hailing services not only transforms travel but also positively affects societal mobility and economic empowerment.

E-hailing services face many challenges and regulatory obstacles, notably in their competition with traditional taxi services. Traditional taxi drivers often perceive e-hailing as a threat to their livelihoods, resulting in protests and concerns regarding unfair competition, regulatory frameworks and market share loss. Regulatory adjustments and clear guidelines are imperative to foster fair competition and address the apprehensions of e-hailing services and traditional taxis. Customer satisfaction is another pivotal concern for e-hailing services. These companies prioritise enhancing customer experience by implementing features and strategies aimed at improving service quality and reliability (Sabar et al., 2023). By cultivating trust and fostering customer loyalty, e-hailing platforms can ensure repeat business, which is crucial for their sustained success. The theory of planned behaviour by Ajzen (1991) offers a conceptual framework for comprehending the factors influencing behavioural intentions and subsequent actions within the context of e-hailing services (Arumugam et al., 2020). Figure 1 illustrates the conceptual framework utilised in this study, wherein travel behaviour and attitudes towards e-hailing serve as independent variables that potentially influence the level of satisfaction with travel experiences. By integrating these variables, the conceptual framework endeavours to scrutinise how patterns of travel behaviour and attitudes towards e-hailing affect the satisfaction levels of university students with these services.

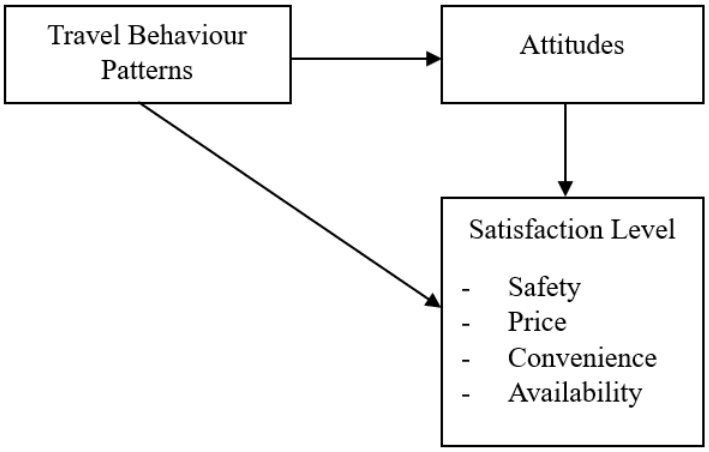


Figure 1: Conceptual Framework of the Study
Source: Authors

RESEARCH METHODOLOGY

The research adopted a quantitative approach. The primary research site was the main campus of USM in Penang, Malaysia. USM stands out as a prestigious institution renowned for its exceptional academic programmes and diverse student body. As such, it is an optimal setting for investigating university students' commuting habits and e-hailing service utilisation. Students enrolled at USM, who were the primary respondents. The objectives of the survey are to gather the perspectives of USM students, assess their travel behaviour patterns, gauge their satisfaction levels with e-hailing services and solicit their opinions regarding the utilisation of these services as an alternative mode of transportation. The survey instrument was a questionnaire featuring multiple-choice questions. The questionnaire was divided into four distinct sections, as outlined in Table 1.

Table 1: Development of Questionnaires

Question	Description	Sources
Section I	Demographic information of the respondents	Chung and Al-Khaled (2020)
Section II	Attitude towards e-hailing services as mode of transportation	Ubaidillah et al. (2019) Salim et al. (2021)
Section III	Travel preferences of the participants	Jaiz and Marzuki (2020)
Section IV	Level of satisfaction and potential strategies for enhancing e-hailing services	Adam et al. (2020)

Source: Various Researchers

The data collection approach primarily relied on surveys. The collected data underwent statistical analysis to extract meaningful insights. The study population encompassed all students enrolled at the main campus of USM in Penang, Malaysia. These students were from diverse faculties, courses and academic levels, spanning undergraduate, graduate and postgraduate programmes. According to the Academic Management Division Registry, the total student enrolment at USM in 2021 was 33,787. The questionnaire was distributed to all enrolled students at USM across various academic disciplines.
The sample population was meticulously chosen based on diverse criteria to guarantee a comprehensive and representative selection of respondents. Demographic factors such as gender, year of study and academic level were considered in selecting the respondents. This approach was used to mirror the broader student population and generate findings with wider applicability. The sample size of 380 respondents was determined using the Krejcie and Morgan formula, which ensures a 95% confidence level in the obtained results. Consequently, 760 online questionnaires were disseminated, doubling the initial sample size. A total of 394 responses were received, resulting in a response rate of 52%.

ANALYSIS AND DISCUSSION

Respondents' Profile

The analysis of demographic data for USM's main campus in Penang revealed several noteworthy findings. Table 2 shows that among the respondents, 59% (233) were female, indicating a predominant representation of younger female students. The age group of 19–22 accounted for 58% (229) of the total population, implying a substantial presence of younger students. Malaysian students constituted the majority, accounting for 86% (340) of the respondents, whereas international students represented only 14% (54). Undergraduate students comprised 75% (295) of the sample, with 40% (156) of the respondents enrolled in pure science programmes. Regarding transportation preferences on campus, walking was the preferred mode of transportation, chosen by 37% (146) of students, whereas e-hailing services were the least favoured, chosen by only at 7% (26). However, outside campus, e-hailing services were the most preferred mode, selected by 50% (198) of respondents, underscoring their popularity.

Table 2: Descriptive Analysis of Demographic Characteristics

Variable	Frequency (N = 394)	Percentage (%)	Variable	Frequency (N = 394)	Percentage (%)
Gender			**Nationality**		
Male	161	41	Malaysian	340	86
Female	233	59	International	54	14
Age			**Level of Education**		
19–22	229	58	Undergraduate student	295	75
23 and above	165	42	Postgraduate student	99	25
Year of Study			**Field of Study**		
Year 1	67	23	Pure Sciences	156	40
Year 2	83	28	Applied Sciences	92	23
Year 3	71	24	Pure Arts	92	23
Year 4	74	25	Applied Arts	54	14
Main Mode of Transportation Used in Campus			**Main Mode of Transportation Used Outside Campus**		
Beam Scooter	73	19	Beam Scooter	-	-
Biking	39	10	Biking	16	4
Own Vehicle (Car and Motorcycle)	34	8	Own Vehicle (Car and Motorcycle)	44	11
E-Hailing	26	7	E-Hailing	198	50
Public Transportation (USM Bus)	76	19	Public Transportation (USM Bus)	90	23
Walking	146	37	Walking	46	12
Race					
Malay	209	53			
Chinese	68	17			
Indian	36	9			
Others Bumiputera	27	7			
Others	54	14			

Source: Authors

The analysis of travel behaviour patterns among USM students yielded the following insights. As shown in Table 3, a majority of respondents (51%) reported using e-hailing services occasionally (two to three times per month), with 28% using them rarely (one to two times per month) and 21% using them frequently (five or more times per month). Shopping was the most common trip purpose for using e-hailing services (27%), followed by visiting friends/family

(21%) and school/university (19%). Over half of the respondents (56%) travelled distances greater than 5 km, with the majority (61%) reporting travel durations of less than 30 minutes. Additionally, a large percentage (66%) of respondents had a monthly expenditure of more than RM50 on e-hailing services.

Table 3: Descriptive Analysis of Travel Behaviour Patterns

Variable	Frequency (N = 394)	Percentage (%)	Variable	Frequency (N = 394)	Percentage (%)
Frequency of E-Hailing Service Usage			**Trip Purpose**		
Frequently (five or more times monthly)	81	21	Academic	74	19
Occasionally (three to four times per month)	202	51	Work	49	12
Rarely (one to two times per month)	111	28	Shopping	106	27
Travel Distance			Leisure/Recreation	59	15
Less than 5 km	173	44	Visiting Friends/Family	81	21
More than 5 km	221	56	Religious Services	25	6
Travel Duration			**Monthly Expenditure on E-hailing**		
Less than 30 minutes	241	61	Less than RM50	135	34
More than 30 minutes	153	39	More than RM50	259	66

Source: Authors

Relationship Between Variables

Table 4 presents the results of the internal consistency analysis for each dimension. The overall findings demonstrated that the reliability test, using Cronbach's alpha, yielded values exceeding 0.70, which is considered acceptable in accordance with the criterion outlined by Taber (2018).

Table 4: Reliability Test Results (N = 394)

Variable	Cronbach's Alpha	Number of Items
Travel Behaviour Patterns	0.862	3
Attitudes Towards E-Hailing Services	0.946	4
Levels of Satisfaction on E-Hailing Services	0.967	12

Source: Authors

A Pearson correlation analysis was conducted on six variables, as illustrated in Figure 4. The purpose is to investigate the relationship between travel behaviour patterns; attitudes towards e-hailing and satisfaction levels regarding safety, price, convenience and availability. Table 5 reveals significant correlations among the study variables.

Specifically, the analysis revealed a moderate positive correlation between attitudes and safety ($r = 0.393$, $p < .01$), attitudes and price ($r = 0.418$, $p < .01$), attitudes and convenience ($r = 0.412$, $p < .01$) and attitudes and availability ($r = 0.414$, $p < .01$). These findings suggest that positive attitudes are associated with perceptions of enhanced safety, favourable pricing, increased convenience and greater availability of e-hailing services.

The observed correlations underscore the importance of maintaining high service standards and continually improving the user experience to cultivate positive attitudes and elevate satisfaction levels. Moreover, the identified relationships suggest the presence of a reinforcing loop, wherein positive attitudes enhance the likelihood of positive experiences, thereby further reinforcing positive attitudes. Such insights are instrumental in guiding strategies aimed at optimising service delivery and enhancing customer satisfaction within the e-hailing industry.

Table 5: Results of Pearson Correlation Test

	Travel behaviour pattern	Attitude	Safety	Price	Convenience	Availability
Travel behaviour pattern	1					
Attitude	.041	1				
Safety	.058	.393**	1			
Price	−.015	.418**	.768**	1		
Convenience	.057	.412**	.859**	.779**	1	
Availability	.026	.414**	.753**	.824**	.855**	1

*** Indicates a strong correlation (r > 0.4) and statistical significance (p < .01)* *Source: Authors*

However, some correlations are weak or non-significant, including the correlation between travel behaviour pattern and attitude ($r = 0.041$, $p > .05$), safety ($r = 0.058$, $p > .05$), price ($r = −0.015$, $p > .05$), convenience ($r = 0.057$, $p > .05$) and availability ($r = 0.026$, $p > .05$). These results indicate a lack of meaningful linear relationship between these pairs of variables. The weak or non-significant correlations between travel behaviour, attitudes towards e-hailing and satisfaction levels can be attributed to the multifaceted nature of travel choices and diverse array of factors influencing them. It underscores the complexity

inherent in understanding and influencing consumer behaviour within the context of e-hailing services.

These findings highlight the necessity of addressing a broader spectrum of factors to effectively influence travel behaviour. Strategies aimed at enhancing the reliability and accessibility of e-hailing services, integrating them seamlessly with public transportation systems and addressing specific local issues can strengthen these relationships over time. By recognising and addressing the intricate interplay of various factors influencing travel behaviour, policymakers and industry stakeholders can develop nuanced and effective interventions to promote the adoption and usage of e-hailing services. Ultimately, these interventions can contribute to the advancement of sustainable and efficient transportation systems.

A multiple regression analysis was conducted to predict satisfaction from travel behaviour patterns and attitudes. These variables statistically significantly predicted satisfaction, $F\ (2, 391) = 47.903$, $p < .0005$, $R^2 = .197$. Travel behaviour patterns and attitudes contributed significantly to the prediction, with p-values < .05. These results suggest that travel behaviour patterns and attitudes collectively explain approximately 19.7% of the variance in satisfaction.

The regression equation derived was Satisfaction = 2.043 + (0.011 × Travel Behaviour Pattern) + (0.504 × Attitudes). This equation suggests that the independent variables included in the model account for a modest portion of the variability in the dependent variable. It also indicates that other unexplored factors may play significant roles in determining satisfaction levels.

The coefficient for Predictor 1, travel behaviour pattern ($\beta = 0.011$, $p > .05$), suggests a very small positive relationship with the dependent variable. However, since the p-value is greater than .05, this relationship is not statistically significant. In contrast, Predictor 2, attitudes ($\beta = 0.504$, $p < .01$), indicates a moderate positive relationship with the dependent variable. The low p-value (<.01) suggests that this relationship is statistically significant.

Therefore, the regression analysis results confirm significant relationships between attitudes and satisfaction levels. This finding underscores the importance of prioritising user perceptions and experiences. By focusing on improving service quality, building trust, enhancing technological features and promoting positive attitudes through effective communication strategies, e-hailing companies can achieve high user satisfaction and great overall success.

CONCLUSION

The study's findings regarding the positive correlation between attitudes towards e-hailing and overall satisfaction levels align with the results of recent research. For example, Rayle et al. (2016) highlighted the significant influence of perceived convenience and availability on user satisfaction with e-hailing services. Similarly, Wang (2019) emphasised the critical roles of safety and price

in shaping user satisfaction, with positive perceptions of these aspects correlating with high overall satisfaction.

The insights gleaned from this study underscore the importance for e-hailing companies to continually innovate and enhance their service offerings. Leveraging technology to improve convenience and availability, whilst maintaining a strong focus on user safety and affordability, can better address user needs and expectations. These findings hold practical implications for transport planners, e-hailing companies and campus planning initiatives, particularly in advancing sustainable transportation initiatives. Drawing on quantitative data analysis and literature review, the study offers insights into how e-hailing services can contribute to sustainable urban mobility and resilience.
Collaborative efforts among stakeholders, including policymakers, e-hailing companies and campus planners, are crucial. Together, they can devise policies, infrastructure improvements and awareness campaigns to promote e-hailing as a sustainable and practical transportation option. These efforts can influence public attitudes towards car ownership and foster sustainable travel behaviours.

However, this study has limitations, particularly its reliance on quantitative methods. Future research endeavours can benefit from integrating qualitative approaches to gain a more comprehensive understanding of user perceptions and experiences with e-hailing services. Future studies should also explore the long-term effects of e-hailing services on user satisfaction, urban traffic dynamics and environmental sustainability across diverse demographics and geographic regions. Additionally, investigating the effects of various policy interventions and incentives on user satisfaction and the promotion of e-hailing as a sustainable transport option will be valuable.

ACKNOWLEDGEMENT

The authors would like to thank the Ministry of Higher Education Malaysia for providing financial supports under FRGS grant number 203/PPBGN/6711997, with a Reference Code of FRGS/1/2021/SSI02/USM/01/2.

REFERENCES

Adam, M., Kee, D. M., Junaina, I., Fadhilah, N., Uwais, N., Rashidi, F. A., Pandey, R. (2020). The Influence of Customer Satisfaction on Grab Services in Malaysia. *International Journal of Tourism & Hospitality in Asia Pacific*, Volume 3, 26-37.

Arumugam, V., Ismail, M. R., & Joeharee, M. (2020). A Review and Conceptual Development of the Factors Influencing Consumer Intention towards E-Hailing Service in Malaysia. *International Journal of Innovation, Creativity and Change*, Volume 11, Issue 11, 224-242.

Aziz, A., & Mohamad, J. (2020). Public Transport Planning: Local Bus Service Integration And

Derek D. Wang, Assessing road transport sustainability by combining environmental impacts and safety concerns, Transportation Research Part D: *Transport and Environment,*

Volume 77,2019, Pages 212-223, ISSN 1361-9209, https://doi.org/10.1016/j.trd.2019.10.022.

Grand View Research (2023). Ride hailing services market size, share & trends analysis report by offering (E-hailing, car sharing, rental), by region (North America, Europe, Asia Pacific, Central & South America, Middle East & Africa), and segment forecasts, 2022 – 2030 Retrieve on January 2024 from https://www.grandviewresearch.com/industry-analysis/ride-hailing-services market

Hayakawa, K., & Chikaraishi, M. (2023). Modeling the impact of e-hailing services on regional public transit considering transit-dependent people. *Transportation Research Part B: Methodological*, *170*, 91-118.

Improvements In Penang, Malaysia. *Planning Malaysia*, 18(13).

Jais, A. S., & Marzuki, A. (2020). E-Hailing Services In Malaysia: Current Practices And Future Outlook. *Planning Malaysia*, *18*(13). https://doi.org/10.21837/pm.v18i13.780

L. Acierto, J. M., H. Quilla, S. M., N. Valencia, B. J., L. Cueto, G., F. Monjardin, C. E., & Wan Mohamed, W. M. (2023). Comparative Study On Urban Transport And The Environment (Cute) Framework As Strategy For The Reduction Of Carbon Dioxide Emissions Of Road Vehicles At Zapote Street. *Planning Malaysia*, *21*(28). https://doi.org/10.21837/pm.v21i28.1311

Lim, E. S., & Fernandez, J. L. (2022). Determinants of Using Ride-Hailing Service: Evidence from Malaysia. Malaysian Journal of Economic Studies, 27–48.

Nasrudin, N., Abdullah, Y. A., & Hoon Leh, O. L. (2017). Promoting Sustainable Travel Behavior Through Transport Policy Measures. *Planning Malaysia*, *15*(2).

Othman, A. G., & Ali, K. (2020). Transportation and Quality of Life. *Planning Malaysia*, *18*(13).

Pasquali, P., Commenges, H., & Louail, T. (2022). "It's a three-way ring": E-hailing platforms, drivers and riders reshaping Accra's mobility landscape. *Case Studies on Transport Policy*, Volume 10, 1743-1753.

Rayle, Lisa & Dai, Danielle & Chan, Nelson & Cervero, Robert & Shaheen, Susan. (2016). Just A Better Taxi? A Survey-Based Comparison of Taxis, Transit, and Ridesourcing Services in San Francisco. *Transport Policy*. 45. 168-178. 10.1016/j.tranpol.2015.10.004.

Sabar, S., Dzulkalnine, N., Ahmad, S. F. S., & Ahmad, M. F. (2023). Students Satisfaction of Using E-Hailing in UiTM Puncak Alam, Selangor, Malaysia. *Journal of International Business, Economics and Entrepreneurship*, *8*(2), 79-79.

Salim, S., Sanik, M. E., Nor, A. H. M., Salman, M. A. H., Osman, M. H., & Abdullah, M. I. S. (2021). Behaviour of Passengers by E-Hailing Services and Public Transportation in Malaysia. *Journal of Advanced Transportation*, *2*(2), 60-69.

Taber, K. S. (2018). The Use of Cronbach's Alpha When Developing and Reporting Research Instruments in Science Education. Research in Science Education, 1273–1296.

Ubaidillah, N. Z., Yi, C. Y., Hassan, M. K. H., Ali, S. S. S., & Hwang, J. Y. T. (2019). The determinants of Generation Z intention to use the Grab e-hailing services. *Internafional Journal of Academic Research in Business and Social Sciences*, *9*(11), 483-495.

Received: 18th March 2024. Accepted: 17th August 2024

PLANNING MALAYSIA:
Journal of the Malaysian Institute of Planners
VOLUME 22 ISSUE 5 (2024), Page 236 – 247

EVALUATION OF CARBONATED PRODUCT FROM MINERAL CARBONATION OF MINING WASTE FOR CARBON SEQUESTRATION

Umi Rukiah Abdullah[1], Faradiella Mohd Kusin[1,2], Wan Azlina Wan Ab Karim Ghani[3]

[1]*Department of Environmental Sciences, Faculty of Forestry and Environment,*
[2]*Institute of Tropical Forestry and Forest Products (INTROP),*
[3]*Department of Chemical Engineering, Faculty of Engineering,*
UNIVERSITI PUTRA MALAYSIA

Abstract

Mining operations generate significant quantities of waste containing alkaline earth silicates, which are valuable for carbon sequestration. Hence, the goal of this study is to assess the possibility of using mining waste to store carbon through a process of mineral carbonation. The study tested mineral carbonation under low reactivity conditions, including ambient pressure and low temperature, to evaluate the effect of pH levels on process efficiency. The samples were discovered to have an alkaline pH, suggesting that they were suitable for mineral carbonation reactions from the beginning. The carbonation process of the mineral was conducted at different pH levels of 8, 10, and 12. The findings showed that the carbonation efficiency was approximately 3%, with the highest level observed at pH 12. Through thermogravimetric analysis, it was observed that there was a multi stage transformation of minerals, which indicated the formation of carbonates containing iron and magnesium. The process captured approximately 33 and 39 g of CO_2/kg. The process indicates that mine waste can be used as a source material for mineral carbonation, as demonstrated by the formation of iron and calcium carbonate products. This research demonstrates that mine waste has the potential for long-term carbon storage, offering a beneficial method for waste management and carbon capture strategies.

Keywords: Mining Waste, Mineral Carbonation; Gold Mine, Carbon Capture and Storage, Waste Management

[1] Master Candidate Email: umiabdullah7997@gmail.com

INTRODUCTION

Global greenhouse gas emissions have become a critical environmental issue in recent years. This concern arises from a lack of knowledge and understanding about global greenhouse gas emission, their impacts, and the consequences of global warming. The effects will be in terms of physical changes, climate change, weather patterns, and the resulting economic and environmental changes (Wilson et al., 2009; Muhd-Nor et al., 2016; Mendoza et al., 2019). The examples of greenhouse gases include carbon dioxide (CO_2), methane (CH_4), sulfur oxides (SO_2), ozone (O_3), and nitrous oxide (N_2O). Although carbon dioxide (CO_2) has a lower global warming potential compared to other key greenhouse gases, it is responsible for the majority of emissions due to human activities (Kiptarus 2015; Mohammad-Sabri & Ponrahono 2024) The energy sector is the major contributor to carbon emission globally. The energy sector is the largest global contributor to carbon emissions, with other major contributors including the oil, gas, and mining industries. In particular, the mining industry's reliance on fossil fuels is a major factor in global warming, due to the substantial release of CO_2 emissions with its operations (Jorat et al., 2018). CO_2 emissions in the atmosphere negatively affect the planet's weather and climate systems. The impacts of climate change go beyond just higher average temperatures, also encompassing extreme weather events, changes in wildlife populations and habitats, rising sea levels, and various other factors (Manning et al., 2013; Syed-Hasan et al., 2019)

Mining waste is produced as a result of the extraction and processing of mineral resources (Kivinen, 2017). The mining process generates a large quantity of residues that must be strategically treated and managed to combine economic efficiency with demands for environmental long-term stability (Kusin et al., 2020; Mohd-Isha et al., 2021). Anthropogenic gases, including atmospheric carbon, are the most prevalent gases in the air (Misni et al., 2015). To mitigate CO_2 emissions, carbon sequestration methods can be employed. (Jorat et al., 2020). Mineral carbonation is a carbon sequestration method in which gaseous CO_2 can be captured and turned into stable carbonates (Gerdemann et al., 2003; Azdarpour et al., 2018; Kusin et al., 2019; Rahmani et al., 2020). This will avoid CO_2 from being released back to the atmosphere. According to Olajire (2013) and Ibrahim et al. (2019), utilizing carbon sequestration technology can help capture a large quantity of carbon emissions for extended periods of time. A method called carbon sequestration, or carbon capture and storage (CCS), has been suggested as a way to securely store carbon in a stable form for an extended period of time. The process of mineral carbonation involves using carbon-intensive industrial waste, such as mining waste, as the raw material for the process (Li & Hitch, 2018).

The interaction of basic minerals with CO_2 to produce non-toxic solid carbonate is called mineral carbonation (Omale et al., 2019; Lavikko, 2017). This can happen naturally, but a small change to speed up this natural process could

help reduce the amount of additional CO_2 in the atmosphere, thereby reducing global temperatures (Pan et al., 2012; Ohenoja et al., 2020). Equation (1) represents a mineral carbonation reaction, in which CO_2 combines with mineral-containing metal oxides to produce insoluble carbon (Lechat et al., 2016). Magnesium silicate minerals (e.g. Mg_2SiO_4, $Mg_3Si_2O_5(OH)_4$) and silicates rich in Fe or Ca are examples of raw materials for mineral carbonation (e.g. Fe_2SiO_4, $CaSiO_3$). Basically, these minerals can be found in large quantities in many different wastes.

$$\text{Metal oxide} + CO_2 \rightarrow \text{Metal Carbonate} + \text{Heat} \quad (1)$$

Previous research on mineral carbonation for carbon sequestration has mainly relied on the process of carbonation and the potential of different mining waste materials. However, there are still some unresolved issues that require attention. The carbonated products have not been thoroughly characterized in terms of their mineralogical and structural properties, which is crucial for evaluating their long-term stability (Nowak et al., 2013). In addition, there has been a lack of detailed and controlled optimization of process parameters, such as temperature, pressure, and additives, resulting in inconsistent result (O'Connor et al., 2005). Moreover, it is necessary to investigate the implementation of these procedures into current industrial activities in order to improve effectiveness and decrease expenses (Wang & Maroto-Valer, 2011). There is a lack of specific case studies or practical applications in the existing studies, which makes it difficult to demonstrate the real-world practicality of mineral carbonation (Wilson et al., 2009). Apart from that, the potential for carbon sequestration in mine waste has yet to be investigated.

Therefore, this research investigates an innovative application of gold mine waste by utilizing mineral carbonation at varying pH levels for CO_2 sequestration. The primary objectives of this study are to evaluate the potential of mining waste for capturing and storing carbon dioxide by mineral carbonation, as well as to determine the effect of varying pH on mineral carbonation process under ambient CO_2 pressure and temperature (Olajire, 2013). This will provide an insight into the management and utilization of waste material in tackling the global carbon emission issue from the perspective of a technological application.

MATERIALS AND METHODS

Materials Preparation

Gold mining waste was collected from a gold mine in the state of Pahang, Malaysia. Collected samples consist of mine tailing samples in the form of sediment and sludge. As sample analysis and mineral carbonation experiment requires samples of size smaller than 1mm, the sediment samples were pre-treated to prepare for uniform-sized particles. The materials were dried for 24 hours at

room temperature, grounded into fine particles, and homogenized with a <63 µm sieve. The pH of the gold mine waste was tested using British Standard (BS) 1377, to ascertain its natural pH.

pH Analysis

A soil testing method developed from British Standard (BS) 1377 was used to evaluate the pH of the samples (Syed Hasan et al., 2018). 30 g of raw sample and 75 ml of distilled water were combined in a 1: 2.5 ratio, with 30 g of raw sample and 75 ml of distilled water used. The pH of the liquids was then tested using a pH meter after 24 hours.

Mineral Carbonation Experiment

Carbonation experiment was conducted using a customized 250 ml closed stainless steel reactor. For this experiment, the manipulated variables were pH (as shown in Table 1) while constant variables were particle size (63 µm) and temperature (80°C). The pH of the sample mixture was measured using a pH meter as the manipulated variable. For each sample, three levels of pH were used, which are pH 8, 10, and 12. A 1M NaOH solution was added to the solution to raise the pH of the sample. 50 ml of 1 M sodium chloride (NaCl) and 50 ml of 0.64 M sodium bicarbonate ($NaHCO_3$) solution were mixed with the samples and put into the Teflon cup. To alter the pH to the appropriate value, 1 M sodium hydroxide (NaOH) or 1 M hydrochloric acid (HCl) was added to the solution in the experiment (Azdarpour et al., 2018). In mineral carbonation experiments, the use of various additives and solvents has been examined to improve Ca, Mg, and Fe solubility (Muwanguzi et al., 2012). The experimental set-up is shown in Figure 1, while the working parameters and constant parameters are summarized in Table 1.

To change the pH to the appropriate value, 1 M sodium hydroxide (NaOH) or 1 M hydrochloric acid (HCl) was added to the solution in the experiment (Azdarpour et al., 2018). In mineral carbonate experiments, the use of different additives and solvents was examined to improve the solubility of Ca, Mg and Fe (Muwanguzi et al., 2012). The experimental setup is shown in Figure 1, while the working parameters and constants are summarized in Table 1.

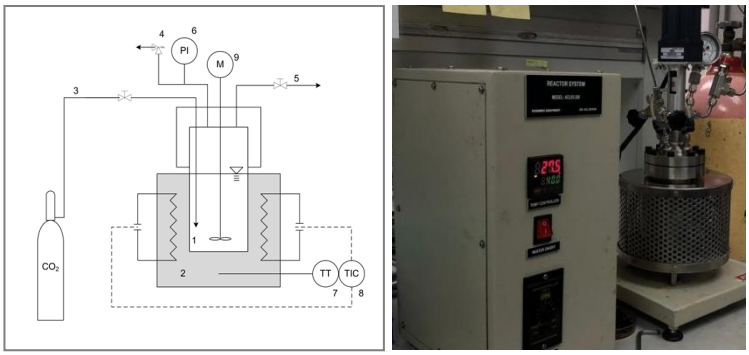


Figure 1: Mineral carbonation experimental set-up as shown in (a) schematic diagram and (b) actual stainless-steel reactor used.

Table 1: Parameters used in mineral carbonation experiment

Adjusted Parameter	pH 8,10,12
Constant Variables	Particle size = 63 µm, Temperature = 80°C CO_2 pressure = 1 bar Reaction time = 1 hour Stirring speed = 300 rpm Solution = 1 M NaCl & 0.64 M $NaHCO_3$

The Teflon cup filled with the mixture was placed into the carbonation reactor, sealed airtight, and heated to a constant temperature of 80°C. The solution was swirled continuously at 300 rpm while 1 bar of CO_2 pressure was introduced. For each experiment, the reaction was allowed to run for around an hour. The carbonation product was filtered and dried at 105°C overnight before being evaluated using a thermogravimetric analyzer (TGA).

Thermogravimetric Analysis

Thermogravimetric analysis (TGA) was carried out to determine the carbonate conversion rate of the mining waste samples (Goldstein, 2003). TGA was used to measure the weight loss of a sample as it is heated continuously from room temperature 25°C to 1200°C. TGA was chosen because it is a reliable method for determining carbonate concentration in solids and is applicable to a wide range of industries. The procedure of this analysis was to expose the samples to high temperatures ranging from 0 to 950 degrees Celsius and the formation of carbonates were observed at certain temperature range. Equations (2) to (4) below were used to compute the carbonation efficiency.

$$\text{Purity } FeCO_3/MgCO_3 = \%\ weight\ loss\ x\ \frac{Molecular\ weight\ of Fe/Mg}{Molecular\ weight\ of\ CO_2} \quad (2)$$

$$\text{Fe/Mg mass in } FeCO_3/MgCO_3 \quad (3)$$

$$= \%\ weight\ loss\ x\ \frac{molecular\ weight\ of Fe/Mg}{Molecular\ weight\ of\ CO_2}\ x\ mass\ of\ solid\ residue$$

$$\text{Carbonation efficiency (\%)} = \frac{Fe/Mg\ mass\ in\ FeCO_3/MgCO_3}{Fe/Ca\ total\ mass\ in\ feeding\ material} \times 100 \quad (4)$$

RESULTS AND DISCUSSION

Characterization of Mining Waste

The mineralogical composition of gold mining waste consists of silicate minerals such as quartz, graphite, muscovite, kaolinite, chlorite, chlorite-serpentine, illite, aerinite, stilpnomelane and sepiolite. Specifically, illite and chlorite-serpentine are the major minerals present in the sludge and sediment of the gold mining waste, with minor amount of quartz (Figure 2). These minerals are typically produced from the chemical weathering of alumino-silicates existing under tropical environment.

Consistent with mineralogical analysis, the chemical composition of the gold mine waste was determined as having iron oxide, Fe_2O_3 of about 3-12% wt. and magnesium oxide, MgO of 2-6% wt. Other oxide elements include SiO_2, Al_2O_3, K_2O and SO_3. The Al_2O_3 compound was associated with kaolinite, while K_2O originated from illite minerals. These alumino-silicate minerals have a high affinity for CO_2, which can be utilized in a process where CO_2 is converted into stable carbonates. The presence of iron oxide (Fe_2O_3) and magnesium oxide (MgO) further supports this, as both iron and magnesium carbonates can form stable, long-term carbon sequestration compounds.

The microstructure of the mine waste sample was evidenced by the hexagonal shape crystals as observed in the SEM micrographs (Figure 3). This is believed to be associated with minerals kaolinite (Figure 3a) and presence of chlorite-serpentine (Figure 3b) in the mine tailings which was depicted by their tabular shape as seen in the SEM micrographs.

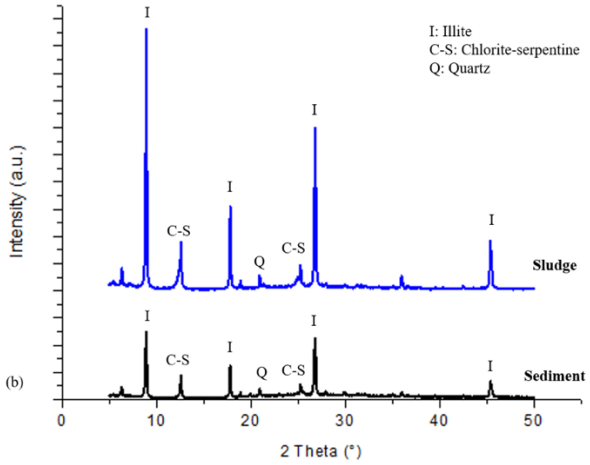
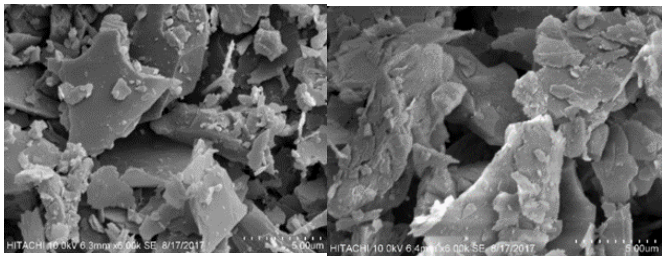


Figure 2: X-ray diffractograms of sludge and sediment from gold mine tailings.



(b)

Figure 3: Microstructure images of mining waste sample for mineral carbonation

Overall, characterizing gold mining waste is necessary in order for it to be used as a feedstock for mineral carbonation and to improve carbonation efficiency in sequestering CO_2.

Carbonation Efficiency as a Function of pH

The Fe/Mg carbonation efficiency of the gold mine waste as influenced by pH are given in Table 2. An increase in pH from 8 to 12 resulted in higher Fe/Mg carbonation efficiency, with values ranging from 2.19% - 2.78% for Fe and 1.86% - 2.41% for Mg. From TGA analysis, the carbonation efficiency corresponds to the $FeCO_3$ purity (12.15-14.43%) and $MgCO_3$ purity (8.73-10.06%), respectively. The corresponding TGA mass loss owing to Fe carbonate decomposition was 5.11-6.22%, and the TGA mass loss due to Mg carbonate decomposition was 3.84-4.43%. From the results, a higher Fe/Mg carbonation efficiency can be seen as pH increases from 8 to 12, indicating that pH plays important role in the mineral carbonation process. The mining waste Fe/Mg

carbonation efficiencies are seen to be influenced by the varied pH employed in the mineral carbonation process where a higher pH, i.e. pH 12 might increase the process efficiency (Syed-Hassan et al., 2018).

The Fe/Mg carbonation conversion efficiency was enhanced as pH were raised to a more alkaline state from 8 to 12. Clearly, pH is an important factor in the conversion of Fe and Mg to carbonates, with a higher pH of 12 achieving a higher carbonation efficiency. This was also reflected by the purity of the carbonate products. It can be seen that the $FeCO_3$ purity and $MgCO_3$ purity of the samples correspond with the trend of the increasing pH. Thus, a greater efficiency process might produce a carbonate product with a higher purity.

Therefore, the presence of potential divalent cations in the mining waste, such as in this case Fe and Mg may aid in the sequestration of CO_2 into carbonate form by mineral carbonation process in this case. The process preferably occurs with a higher alkaline pH, thus enhancing the Fe/Mg carbonation efficiency. However, this process takes place at an ambient CO_2 pressure and at a low reaction temperature of 80ºC.

Table 2: Average Fe and Mg carbonation efficiency of mine waste as influenced by pH.

Parameter	Operating variable	Average Fe carbonation efficiency, %	Average Mg carbonation efficiency, %	Average $FeCO_3$ purity, %	Average $MgCO_3$ purity, %	Mass loss in TGA[a], %	Mass loss in TGA[b], %
pH	8	2.19	1.86	12.15	8.73	5.11	3.84
	10	2.44	2.39	12.59	9.61	5.43	4.23
	12	2.78	2.41	14.43	10.06	6.22	4.43

[a]Average mass loss related to Fe carbonate decomposition
[b]Average mass loss related to Mg carbonate decomposition

It has been examined that mineralization of Fe and Mg carbonate depends on the pH, where the increase of pH favors for the increasing carbonation efficiency. A higher Fe and Mg carbonation efficiency was achieved when mining waste with pH 12 was used in the carbonation experiment. Generally, a higher carbonation efficiency was observed at pH 12 under the low operating conditions (ambient pressure-temperature).

Sequestered CO_2 in Carbonated Product

The TGA mass loss due to carbonate breakdown, which releases carbon dioxide, used to calculate the amount of carbonates ($FeCO_3$ and $MgCO_3$) produced, and the amount of CO_2 sequestered (Hitch et al., 2009). Based on the product mass

loss from the TGA analysis and the following reactions, the stoichiometric CO_2 sequestration uptake was calculated.

TGA analysis assuming the following reactions:

$$CaCO_3 \rightarrow CO_2 + CaO \quad (5)$$

$$FeCO_3 \rightarrow CO_2 + FeO \quad (6)$$

$$MgCO_3 \rightarrow CO_2 + MgO \quad (7)$$

Overall, the production of $FeCO_3$ and $MgCO_3$ in the final carbonation products are given in Table 3. This is based on the chemical reactions between Mg-Fe-silicate minerals in the mine waste samples with the presence of CO_2, which is capable of sequestering CO_2 in the form of carbonate in stable form.

Table 3: Carbonated product from mine waste utilization in mineral carbonation (amount of $FeCO_3$ and $MgCO_3$ formed and sequestered CO_2).

Parameter	Operating variable	$FeCO_3$, g/kg sample	$MgCO_3$, g/kg sample	% $FeCO_3$	% $MgCO_3$
pH	8	154.39	57.76	72.77	27.23
	10	151.42	51.34	74.68	25.32
	12	162.76	65.45	71.32	28.68
	Operating variable	[a]CO_2 uptake, g/kg sample	[b]CO_2 uptake, g/kg sample	Total CO_2 uptake, g/kg sample	Theoretical CO_2 uptake, g/kg sample
pH	8	30.34	3.66	34.00	212.15
	10	30.14	2.99	33.13	202.76
	12	34.65	4.83	39.48	228.21

[a]CO_2 uptake from $FeCO_3$ conversion
[b]CO_2 uptake from $MgCO_3$ conversion

It can be seen that the amount of $FeCO_3$ sequestered are in the range of 151.42-162.76 g/kg mine waste. While the sequestered $MgCO_3$ ranges from 51.34-65.45 g/kg mine waste. The composition of the final carbonated products was composed of around 71-74% $FeCO_3$ and 25-28% $MgCO_3$, with other minerals also present. In terms of the CO_2 sequestration uptake, it can be observed that varying the pH from 8-12 resulted in 30-34 g CO_2 uptake/kg sample from $FeCO_3$ conversion. While about 3-4.8 g CO_2 /kg sample was captured from the conversion of $MgCO_3$. The amount captured follows the theoretical CO_2 uptake from stoichiometric conversion, although in much lower amount. This can be anticipated when using waste material for carbonate conversion as opposed to using natural minerals.

CONCLUSION

This study demonstrates the potential of utilizing mining waste as a valuable resource for mineral carbonation, which could be an effective method for capturing carbon dioxide from the air. The waste samples need to contain minerals such as iron and magnesium in order to improve the carbonation process. According to researchers, using particles smaller than 63µm and adjusting pH levels between 8 to 12 greatly enhanced carbonation efficiency. Furthermore, the study shows that carbonation efficiency increases with higher pH levels, emphasizing the importance of pH control in optimizing CO_2 efficiency. This study demonstrated a CO_2 capture potential ranging from 33 to 39 g CO_2/kg of mine waste, predominantly through the formation of $FeCO_3$ and $MgCO_3$ compounds during mineral carbonation processes. These findings shown the potential of mine waste as a valuable feedstock for carbon sequestration via mineral carbonation under varying conditions. Therefore, it is recommended that future research focus on optimizing the carbonation process to improve the efficiency of CO_2 sequestration. Furthermore, research should explore practical applications and opportunities for utilizing mining waste as a sustainable solution for reducing greenhouse gas emissions.

ACKNOWLEDGMENTS

This research was funded by the Ministry of Higher Education Malaysia, grant number FRGS/1/2023/TK08/UPM/02/9 (FRGS 5540604) and Universiti Putra Malaysia, grant number IPS 9709500.

REFERENCES

Azdarpour, A., Karaei, M. A., Hamidi, H., Mohammadian, E., & Honarvar, B. (2018). CO_2 sequestration through direct aqueous mineral carbonation of red gypsum. *Petroleum*, 4(4), 398-407. https://doi.org/10.1016/j.petlm.2017.10.002

Gerdemann, S. J., Dahlin, D. C., & O'Connor, W. K. (2002). Carbon dioxide sequestration by aqueous mineral carbonation of magnesium silicate minerals. In *Greenhouse Gas Control Technologies – 6th International Conference* (Vol. 1, pp. 677-682). https://doi.org/10.1016/B978-008044276-1/50108-2

Goldstein, J., Newbury, D. E., Joy, D. C., Layman, C. E., Echlin, P., Lifshin, E., Sawyer, L., & Micheal, J. R. (2003). *Scanning electron microscopy and X-ray microanalysis* (3rd ed.). *Kluwer Academic/Plenum Publisher*.

Hitch, M., Ballantyne, S. M., & Sarah, R. (2009). Revaluing mine waste rock for carbon capture and storage. *International Journal of Mining, Reclamation and Environment*, 24(1), 64-79. https://doi.org/10.1080/17480930902843102

Ibrahim, M. H., El-Naas, M. H., Benamor, A., Al-Sobhi, S. S., & Zhang, Z. (2019). Carbon mineralization by reaction with steel-making waste: A review. *Processes*, 7, 115.

Jorat, M. E., Goddard, M. A., Manning, P., Lau, H. K., Ngeow, S., Sohi, S. P., & Manning, D. A. C. (2020). Passive CO_2 removal in urban soils: Evidence from brownfield sites. *Science of the Total Environment*, 703, 135573.

Kawigraha, A., Soedarsono, J. W., Harjanto, S., & Pramusanto. (2013). Thermogravimetric analysis of the reduction of iron ore with hydroxyl content. *Advanced Materials Research*, 774–776(July), 682–686.

Kiew, R., & Rahman, R. A. (2021). Plant diversity assessment of karst limestone: A case study of Malaysia's Batu Caves. *Nature Conservation, 44*, 21-49. https://doi.org/10.3897/natureconservation.44.60175

Kiptarus, J. J., Muumbo, A. M., Makokha, A. B., & Kimutai, S. K. (2015). Characterization of selected mineral ores in the eastern zone of Kenya: Case study of Mwingi North Constituency in Kitui County. *International Journal of Mining Engineering and Mineral Processing, 4(1)*, 8–17.

Kivinen, S. (2017). Sustainable post-mining land use: Are closed metal mines abandoned or re-used space? *Sustainability, 9,* 1705.

Kusin, F. M., Che-Awang, N. H., Syed-Hasan, S. N. M., Abdul-Rahim, H. A., Azmin, N., Jusop, S., & Kyoung-Woong, K. (2019). Geo-ecological evaluation of mineral, major and trace elemental composition in waste rocks, soils, and sediments of a gold mining area and potential associated risks. *Catena*, *183*, 104229.

Kusin, F. M., Syed-Hasan, S. N. M., Hassim, M. A., & Molahid, V. L. M. (2020). Mineral carbonation of sedimentary mine waste for carbon sequestration and potential reutilization as cementitious material. *Environmental Science and Pollution Research*, *27(11)*, 12767–12780.

Lackner, K. S., Wendt, C. H., Butt, D. P., Joyce, E. L., & Sharps, D. H. (1995). Carbon dioxide disposal in carbonate minerals. *Energy, 20*, 1153–1170.

Lavikko, S. (2017). Geological and mineralogical aspects on mineral carbonation (Ph.D. thesis). *Åbo Akademi University*.

Lechat, K., Jean-Michel, L., Molson, J., Beaudoin, G., & Hébert, R. (2016). Field evidence of CO_2 sequestration by mineral carbonation in ultramafic milling wastes, Thetford Mines, Canada. I*nternational Journal of Greenhouse Gas Control*, *47*, 110–121.

Manning, D. A. C., Renforth, P., Lopez-Capel, E., Robertson, S., & Ghazireh, N. (2013). Carbonate precipitation in artificial soils produced from basaltic quarry fines and composts: An opportunity for passive carbon sequestration. *International Journal of Greenhouse Gas Control*, *17*, 309–317.

Mendoza, E. Y. M., Santos, A. S., López, E. V., Drozd, V., Durygin, A., Chen, J., & Saxena, S. K. (2019). Iron oxides as efficient sorbents for CO_2 capture. *Journal of Materials Research and Technology*, *8(3)*, 2944–2956.

Misni, A., Jamaluddin, S., & Kamaruddin, S. M. (2015). Carbon sequestration through urban green reserve and open space. *Planning Malaysia*, *13(5)*.

Mohammad-Sabri, S. A., & Ponrahono, Z. (2024). Greening the city: Criteria and indicators for evaluating the effectiveness of small urban parks in promoting urban resilience to climate change. *Planning Malaysia*, *22(30)*.

Mohd-Isha, N. S., Kusin, F. M., Kamal, N. M. A., Hasan, S. N. M. S., & Molahid, V. L. M. (2021). Geochemical and mineralogical assessment of sedimentary limestone mine waste and potential for mineral carbonation. *Environmental Geochemistry and Health*. https://doi.org/10.1007/s10653-020-00784-z

Muhd-Nor, N. H., Selamat, S. N., Rashid, M. H. A., Ahmad, M. F., Jamian, S., Kiong, S. C., Hassan, M. F., Mohamad, F., & Yokoyama, S. (2016). Carbon sequestration and carbon capture and storage (CCS) in *Southeast Asia. Journal of Physics: Conference Series*, *725*, 012010.

Muwanguzi, A. J. B., Karasev, A. V., Byaruhanga, J. K., & Jonsson, P. G. (2012). Characterization of chemical composition and microstructure of natural iron ore from Muko deposits. *International Scholarly Research Network ISRN Materials Science*, 1–9.

Nowak, D. J., Greenfield, E. J., Hoehn, R. E., & Lapoint, E. (2013). Carbon storage and sequestration by trees in urban and community areas of the United States. *Environmental Pollution, 178,* 229-236. https://doi.org/10.1016/j.envpol.2013.03.019

O'Connor, W. K., Dahlin, D. C., Rush, G. E., Gerdemann, S. J., Penner, L. R., & Nilsen, D. N. (2005). Aqueous mineral carbonation. *Mineral Processing and Extractive Metallurgy Review, 26(5)*, 227-246.

Ohenoja, K., Rissanen, J., Kinnunen, P., & Illikainen, M. (2020). Direct carbonation of peat-wood fly ash for carbon capture and utilization in construction application. *Journal of CO_2 Utilization*, *40*, 101203.

Olajire, A. A. (2013). A review of mineral carbonation technology in sequestration of CO_2. *Journal of Petroleum Science and Engineering, 109*, 364–392. https://doi.org/10.1016/j.petrol.2013.03.013

Omale, S. O., Choong, T. S. Y., Abdullah, L. C., Siajam, S. I., & Yip, M. W. (2019). Utilization of Malaysia EAF slags for effective application in direct aqueous sequestration of carbon dioxide under ambient temperature. *Heliyon*, *5*, e02602.

Pan, S.-Y., Chang, E. E., & Chiang, P.-C. (2012). CO_2 capture by accelerated carbonation of alkaline wastes: A review on its principles and applications. *Aerosol and Air Quality Research*, 1, 770–791.

Rahmani, O. (2020). An experimental study of accelerated mineral carbonation of industrial waste red gypsum for CO_2 sequestration. *Journal of CO_2 Utilization*, *35*, 265-271.

Syed-Hasan, S. N. M., Mohd Kusin, F., Jusop, S., & Mohamat Yusuff, F. (2019). The mineralogy and chemical properties of sedimentary waste rocks with carbon sequestration potential at the Selinsing gold mine, Pahang. *Pertanika Journal of Science & Technology*, *27(2)*, 1005-1012.

Wang, X., & Maroto-Valer, M. M. (2011). Dissolution of serpentine using recyclable ammonium salts for CO2 mineral carbonation. *Fuel, 90(3)*, 1229-1237. https://doi.org/10.1016/j.fuel.2010.10.040

Wilson, S. A., Dipple, G. M., Power, I. M., Thom, J. M., Anderson, R. G., Raudsepp, M., Gabite, J. E., & Southam, G. (2009). Carbon dioxide fixation within mine wastes of ultramafic-hosted ore deposits: Examples from the Clinton Creek and Cassiar chrysotile deposits, Canada. *Economic Geology, 104*, 95–112.

Received: 19th March 2024. Accepted: 3rd September 2024

PLANNING MALAYSIA:
Journal of the Malaysian Institute of Planners
VOLUME 22 ISSUE 5 (2024), Page 248 – 262

ENHANCED GIS-BASED MULTI-CRITERIA DECISION ANALYSIS FOR OPTIMAL FLOOD SHELTER SITE SELECTION: A CASE STUDY OF KUANTAN, MALAYSIA

Nurul Ashikin Mabahwi[1], Hitoshi Nakamura[2]

[1]*School of Housing, Building and Planning,*
UNIVERSITI SAINS MALAYSIA, MALAYSIA
[2]*Department of Planning, Architecture and Environmental Systems,*
SHIBAURA INSTITUTE OF TECHNOLOGY, JAPAN

Abstract

Floods significantly impact lives, infrastructure, and economies, especially in disaster-prone regions such as Kuantan, Malaysia. This study aims to develop a suitability map for flood shelters in Kuantan, Pahang, by employing the Analytic Hierarchy Process (AHP) and Weighted Overlay Analysis (WOA) within ArcGIS software. Geospatial criteria such as elevation, slope, proximity to disaster-prone areas, landslides, floods, and land use were used as parameters. The results indicated that 21% of flood shelters were in unsuitable locations, 32% were in moderately suitable areas, 39% were in very suitable areas, and 8% were in extremely suitable sites. This study highlighted the critical role of geospatial criteria in selecting flood shelter sites and advocated for continuous reassessment to optimise their effectiveness and safety. The research provides valuable insights for urban planning and disaster risk reduction, emphasising the necessity for strategic, data-driven decision-making to enhance urban resilience against floods.

Keywords: GIS, flood shelters, AHP, evacuation, WOA, flood

[1] Corresponding Author. Email: nurulashikin.mabahwi@gmail.com

INTRODUCTION

Climate change and urban development significantly contribute to the increased damage caused by floods (Mustafa et al., 2018; Poelmans et al., 2011). Additionally, population growth, particularly in urban areas, heightens the likelihood of land overuse in flood-prone regions (Larsen, 2009; Ran & Nedovic-Budic, 2016). As a result, floods have caused substantial destruction worldwide; in the 20th century alone, flood disasters resulted in over 100,000 fatalities and impacted more than 1.4 billion individuals (Jonkman, 2005). These effects stem from the increased exposure of people and infrastructure to natural hazards, driven by population growth, limited available space, and climate change (Sutanta et al., 2010). The rising number of vulnerable cities and populations highlights the need for local governments to establish effective disaster management operations to enhance urban resilience (Zhao et al., 2017).

In Malaysia, flooding is the country's most prevalent natural disaster, affecting 4.92 million people and causing damage worth several million Ringgit Malaysia annually (Keicho, 2020; Mohit & Sellu, 2013). Fluvial and coastal flooding usually occurs during the monsoon season due to heavy rainfall, while flash floods happen numerous times throughout the year because of uncontrolled urbanisation, water runoff, and ineffective drainage systems (Saad et al., 2023). Consequently, thousands of Malaysians are required to evacuate their homes and relocate to safe shelters or designated evacuation areas (Mohamad et al., 2021; NADMA, 2018).

As the frequency and severity of floods have increased in Malaysia, effective disaster management strategies have become crucial. A key element of these strategies is the establishment of flood shelters, which provide safe havens for affected populations during flood events. Ensuring the provision of safe evacuation centres or temporary shelters during floods in Malaysia is a priority and a primary concern of the Government (Padlee et al., 2018). Selecting suitable sites for these shelters is vital to ensure the safety and accessibility of evacuees. However, there have been instances in Malaysia where evacuees had to vacate the flood shelters and seek refuge elsewhere due to the shelters being inundated. For example, evacuees had to relocate to another flood shelter in Pahang after the shelter in SK Sungai Ular, Kuantan, was flooded (Mabahwi, 2021; Mabahwi et al., 2021). This underscores the importance of examining the site suitability of existing shelters, yet insufficient attention has been paid to this issue in Malaysia.

The aim of this study is to create a land suitability map for flood shelters in Kuantan using the Analytic Hierarchy Process (AHP) and Weighted Overlay Analysis (WOA) in ArcGIS software. By integrating these techniques, this research seeks to provide a robust and systematic approach to evaluating existing suitable sites for flood shelters, considering multiple geospatial criteria such as proximity to flood-prone areas and secondary disasters, elevation, slope, and land

use. The use of geospatial criteria as GIS variables is crucial because these factors directly influence the safety, accessibility, and overall effectiveness of flood shelters in disaster scenarios.

LITERATURE REVIEW

Site Suitability of Flood Shelters

A vital aspect of the preparedness phase in urban resilience planning involves identifying emergency locations that serve two primary purposes: offering temporary shelter from secondary damage and facilitating efficient rescue operations (Zhao et al., 2017). Ensuring the evacuation of affected populations to safe areas is crucial, necessitating meticulous planning of evacuation shelters.

A primary consideration in planning evacuation sites is evaluating the spatial distribution and demands of potential evacuees. This factor significantly influences the appropriateness of shelter locations and the efficiency of evacuations. Urban shelters need to provide refuge within a reasonable distance and time frame during a disaster (Chen et al., 2018; Yu et al., 2015). Estimating shelter demand requires an analysis of potential disaster-affected areas and population distribution (Chen et al., 2016, 2020). For example, Chen et al. (2018, 2020) utilised census data to predict street-level population density for future urban planning, conducting a risk analysis to identify disaster-prone areas and using GIS to overlay these results to estimate shelter demand.

Additionally, proximity to residential areas is a crucial factor in determining suitable evacuation sites. Building emergency shelters within a 1 km radius of the residential regions ensure accessibility and reduces evacuation time. Studies by Sanyal and Lu (2009), Anhorn and Khazai (2015), and Kusumo (2016) emphasised the importance of this proximity. Kusumo (2016) discovered that most respondents preferred to evacuate within 1 km of their homes, indicating a strong preference for nearby flood shelters. Analysing the radius of shelters from settlements helps determine the coverage and adequacy for affected populations.

Minimising the distance at-risk populations must travel to reach shelters is also vital. Shelter accessibility is a significant concern in evacuation modelling (Chen et al., 2018; Cova & Church, 1997; Kongsomsaksakul et al., 2005). Populations tend to evacuate to shelters with easy access to evacuation routes (FDEM, 2018). Therefore, proximity to highways and evacuation routes is important (Kar & Hodgson, 2008). Ideally, the time required to walk to emergency shelters should be within 5 to 15 minutes (Unal & Uslu, 2016; Wei et al., 2012).

Flood risk is another crucial factor when selecting evacuation sites. It is imperative to ensure that flood shelters are not constructed in high-risk inundation areas and are situated outside flood-prone zones, including those within a 100-year floodplain. Guidelines from international organisations such as the

American Red Cross (2018), FDEM (2018), FEMA (2013, 2015), and Sphere (2011, 2015) support these precautions. Shelters located in flood-prone areas pose additional risks to evacuees (FEMA, 2013, 2015; Kar & Hodgson, 2008). Additionally, shelters should be located within 1 km outside of flood-prone areas to ensure accessibility and safety during flood events (Kongsomsaksakul et al., 2005; Kusumo, 2016).

Topography and elevation are also essential in determining the suitability of shelter sites due to their impact on risk exposure and vulnerability to hazards (Sabri & Yeganeh, 2014). Chen et al. (2018) suggested that flood level, terrain, and elevation should be the primary criteria for determining the suitability of flood shelter sites, as topography affects flood severity, flow size, and direction (Kia et al., 2012; Sabri & Yeganeh, 2014; Saini & Kaushik, 2012). Low-lying areas are particularly susceptible to flooding; therefore, constructing shelters on higher elevations or elevating them through construction is essential (FEMA, 2015; Gol-UNDP, 2006). The International Federation of Red Cross and Red Crescent Societies (2011) sets the standard for flood shelters to be located above the highest estimated flood level.

Furthermore, the slope is another critical factor. Flood shelters should not be built on land with a slope gradient of 30° or higher to avoid the risk of landslides or mudslides (Melgarejo & Lakes, 2014; Sphere, 2011, 2015). Additionally, shelters should not be situated on or near fault lines, with slopes ideally between 2% and 4%, not exceeding 7% (Geng et al., 2020; Kilci et al., 2015). Kusumo (2016) recommended slopes of less than 5%. Ensuring the slope criterion does not exceed 1:15 is important to maintain accessibility for individuals with disabilities (Handicap International-Nepal Programme, 2009).

Land use surrounding potential shelter sites also plays a significant role in determining their suitability (Kusumo, 2016; Sanyal & Lu, 2009; UNHCR, 2007). Locations at risk of secondary disasters, such as rain-induced landslides, should be avoided (Anhorn & Khazai, 2015; Geng et al., 2020; International Federation of Red Cross and Red Crescent Societies, 2011; Sphere, 2015; Wei et al., 2012). A recommended distance of more than 3 km from landslide-prone areas is advisable (Chen et al., 2018; Liu et al., 2011). Additionally, shelters should be situated away from hazardous facilities, such as industrial areas, to minimise the risk of incidents like fires or explosions and avoid secondary hazards caused by dangerous materials (Anhorn & Khazai, 2015; Kusumo, 2016; Tai et al., 2010; Wei et al., 2012).

In conclusion, multiple criteria must be considered when evaluating the suitability of urban shelter sites. Evaluation indicators should integrate domestic and international experience, current research, and the natural geographical features of the area under consideration. As Wang (2019) pointed out, there is no universal model for shelter site suitability evaluation. However, ensuring

accessibility, safety from floods and secondary disasters, suitable topography, and proximity to residential areas are critical in planning effective and resilient evacuation shelters.

MATERIALS AND METHODS

The Kuantan District in Pahang was selected as the focus of this study due to its designation as a high-risk flood area under the National Physical Plan 3, with Kuantan City identified as particularly susceptible to flooding (PLANMalaysia, 2018). Furthermore, the Kuantan Local Plan 2035 highlights that a majority of residential zones in Kuantan are vulnerable to flooding (Majlis Perbandaran Kuantan, 2019). These aspects underscore the necessity of evaluating the suitability of existing flood shelters in Kuantan to bolster the region's resilience.

The analysis employed a GIS-based approach combined with the Analytic Hierarchy Process to determine the suitability of flood shelter sites. The GIS-based site suitability assessment was executed using a multi-criteria analysis method, which integrates and transforms both spatial and non-spatial input data into a comprehensive decision-making output. Research by Mendoza (2000) and Mighty (2015) emphasised the critical role of GIS in multi-criteria site suitability analysis, given that such evaluations are intrinsically multi-criteria. Land suitability assessment is a complex decision problem involving multiple factors, necessitating rigorous criteria evaluation like AHP for precise and informed decision-making (Malczewski, 2004; Mighty, 2015). AHP provides a structured decision-making hierarchy using a predefined reference scale, considering the factors influencing decisions and the importance of decision points relative to these factors. The variations in value are thus converted into percentage representations of decision points (Şentürk & Erener, 2017).

Initially, the analysis involved mapping all flood shelters. Topographic mapping of the district was derived from a Digital Elevation Model (DEM) to study elevation changes and slopes. Shuttle Radar Topography Mission (SRTM) elevation data were imported into ArcMap at elevation points. These data were processed using the Raster Interpolation analysis tool and Inverse Distance Weighting (IDW) to generate the DEM, which was subsequently converted into a slope map using the 3D Analyst extension – Raster Surface – Contour. Layers indicating flood-prone and landslide areas were sourced from government data. However, the original shapefile was not in raster format and thus unsuitable for GIS reclassification techniques and Weighted Overlay Analysis. The Spatial Analyst Tools- Distance- Euclidean Distance was utilised to determine whether flood shelters are situated within or outside hazard-prone areas. This approach was optimal in the study for converting the layer into the raster format and identifying the location of flood shelters relative to hazard zones. The Proximity

tool was used to ascertain the distance between flood shelters and landslide-prone areas.

The suitability maps in GIS were generated based on criteria weighted according to their significance as derived from the AHP. To construct a GIS-based multi-criteria analysis, WOA was integrated with AHP, a method widely used in GIS-based site suitability, selection, and evaluation studies. In this research, weights were assigned based on flood shelter suitability standards. The variables for this analysis included: (1) shelters located outside flood-prone areas, (2) shelters positioned away from secondary disaster sites, such as landslides, by a minimum distance of 3 km, (3) shelters situated on elevated terrain with slopes preferably between 2% and 5%, not exceeding 7%, and (4) shelters distant from industrial zones.

Figure 1: Location plan of Kuantan
Source: Majlis Perbandaran Kuantan (2019)

Weighted Overlay Site Suitability Analysis

To evaluate the final site's suitability, all variables (criteria) identified in the GIS analysis were converted to raster format, reclassified, and then overlaid using the Spatial Analyst - Weighted Overlay tool (refer to Figures 2 to 7). The weights were determined using the AHP scale to produce the final suitability results. In GIS, the Weighted Overlay Analysis facilitates the ranking of areas where a value of 0 indicates 'not suitable' or 'restricted', thereby excluding certain areas from consideration. In this study, regions prone to landslides, forest reserves, and agricultural land, which collectively comprise 91.23% of Kuantan, were

categorised as 'restricted' and considered highly unsuitable for the placement of flood shelters. Additionally, industrial zones were also classified as restricted, as shelters should not be situated in proximity to them. The influence of each AHP weight in GIS, expressed as a percentage, is equally set, indicating the equal importance of all criteria in the suitability assessment. Table 1 summarises the criteria used in the WOA, integrated with AHP in GIS.

Table 1: Weighted Overlay

Criteria (raster layer)	Influence (%)	Field	Scale value (AHP)	Description scale
Flood prone area	25%	Flood area	1	Less suitable
Secondary disasters	25%	Landslide	Restricted	Restricted
Elevation	25%	<5 m	1	Less suitable
		5.1 m – 10 m	3	Moderately suitable
		10.1 m – 15m	5	More suitable
		15.1 m – 20 m	7	Very suitable
		>20.1 m	9	Extremely suitable
Slope	25%	1%-1.9%	5	More suitable
		2%-4%	9	Extremely suitable
		4.1%-5%	7	Very suitable
		>5%	1	Less suitable
Land use	25%	Residential	9	Extremely suitable
		Industrial	Restricted	Restricted
		Forest reserve	Restricted	Restricted
		Agriculture	Restricted	Restricted
		Water body	Restricted	Restricted

Source: Authors, 2024

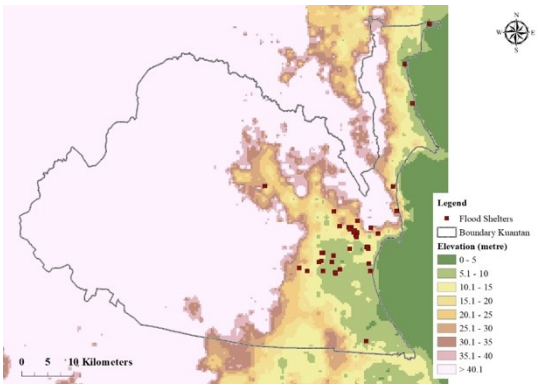


Figure 2: Elevation
Source: Authors, 2024

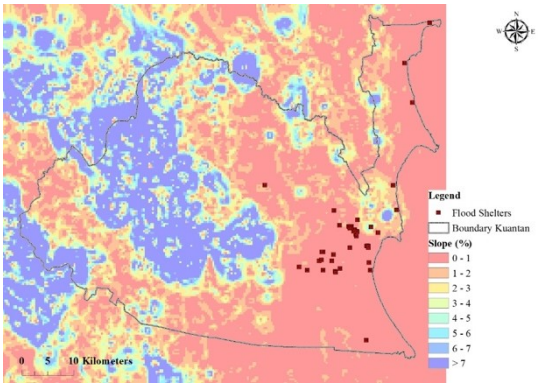


Figure 3: Slope
Source: Authors, 2024

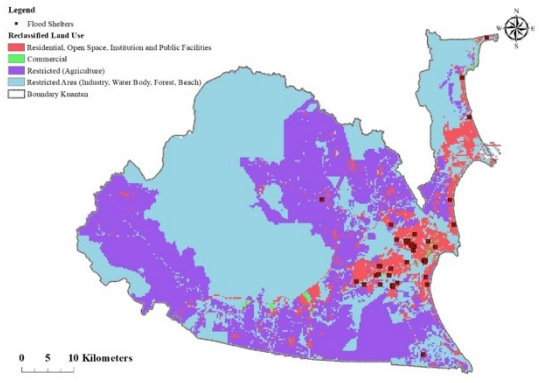


Figure 4: Reclassified Land Use Suitability
Source: Authors, 2024

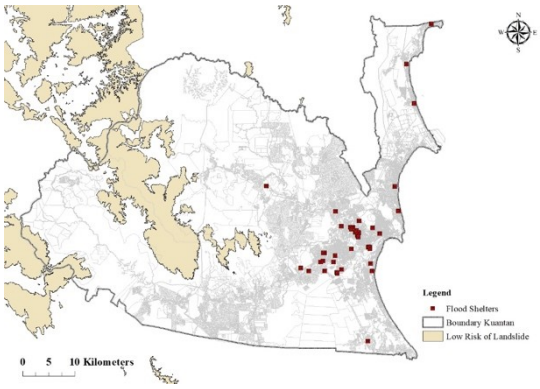


Figure 5: Low Risk of Landslides
Source: Authors, 2024

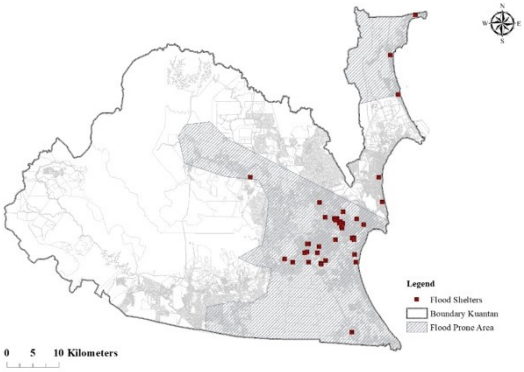


Figure 6: Flood Prone Area
Source: Authors, 2024

RESULTS AND DISCUSSION

The GIS-based multi-criteria Weighted Overlay Analysis forms the foundation of this study. It integrates a land use map with other relevant criteria to evaluate the suitability of flood shelters in Kuantan. This overlay method is crucial for demonstrating the interrelationships between various criteria.

Secondary disasters in Malaysia, most notably landslides, typically occur after heavy rainfall (Chan, 2015a, 2015b). By analysing the landslide risk layer, it was found that some shelters are in proximity to areas with a low risk of landslides. The proximity tool in GIS indicated that 4% of the shelters are situated between 1.4 km and 1.9 km from potential landslide areas, while the remaining 96% are over 9.4 km away. However, since this layer represents a low landslide

risk, the impact on shelters is expected to be minimal. Additionally, elevation and land structure influence the distance travelled by landslide debris.

An analysis of flood-prone areas indicates that 56.8% of Kuantan's total area, amounting to 168,292.9 hectares out of 296,042 hectares, is susceptible to flooding. Notably, 82% of shelters are located in these flood-prone zones, which, according to the initial criteria, would be deemed unacceptable. However, an alternative perspective suggests that placing flood shelters within highly flood-prone residential areas may effectively mitigate flood hazards in developing countries by providing maximum protection and reducing the overall risk for vulnerable communities (Chowdhury et al., 1998; Sanyal & Lu, 2009). This view is corroborated by Kusumo (2016), who found that many residents prefer evacuation centres to be located within their residential areas, even if these areas are prone to flooding. Given that 73.51% of residential settlements in Kuantan are in flood-vulnerable zones, situating flood shelters within these areas could be considered practical and responsive to community preferences.

Topographic characteristics further influence the suitability of flood shelter locations. The analysis shows that 86% of shelters are located on slopes of less than 1.5%, 13% on slopes under 7%, and only 1% on steep slopes. This indicates that most current flood shelter sites are suitable based on elevation and slope criteria. Additionally, proximity to industrial areas poses significant risks, and these locations are deemed unsuitable for shelters due to potential secondary hazards.

The final site suitability map (refer to Figure 7), obtained by analysing the variables collectively in GIS using a Weighted Overlay Analysis, reveals that 21% of flood shelters in Kuantan are situated in unsuitable locations. Meanwhile, 32% are in moderately suitable sites, 39% in highly suitable sites, and 8% in extremely suitable sites. The least suitable sites were identified near industrial areas, regions with a low risk of landslides, or close to rivers or beaches. These findings align with previous research by Kar and Hodgson (2008) and Kusumo (2016), which emphasised the physical unsuitability of emergency shelters near industrial areas, streams, and beaches. Consequently, these unsuitable sites highlight the need for a more strategic approach to flood shelter placement that prioritizes safety, accessibility, and community preferences.

In conclusion, the GIS-based multi-criteria analysis, combined with AHP, provides a robust framework for evaluating the suitability of flood shelter sites in Kuantan. While a significant proportion of current shelters are located in flood-prone areas, considering community preferences and practical constraints can justify their placement. The critical analysis underscores the necessity for a balanced approach that incorporates both risk mitigation and resident preferences to enhance urban resilience effectively.

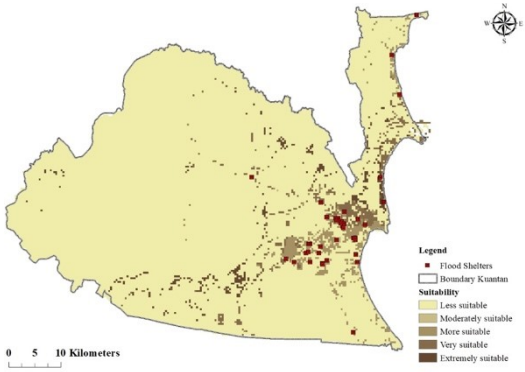


Figure 7: Overall Suitability Map
Source: Authors, 2024

CONCLUSION

This study emphasises the importance of assessing the suitability of flood shelters in flood-prone areas such as Kuantan, Malaysia, through a GIS-based multi-criteria analysis combined with the Weighted Overlay Analysis and the Analytic Hierarchy Process. The results highlight considerable variations: 21% of flood shelters are in unsuitable locations, 32% are in moderately suitable areas, 39% are in very suitable locations, and only 8% are in extremely suitable sites. Unsuitable sites are predominantly located near industrial zones, areas with low landslide risk, steep slopes, and low-lying streams and beaches susceptible to flooding and secondary disasters.

This research underscores the critical role of geospatial criteria, including land use, hazard proximity, and topography, in determining appropriate sites for flood shelters. These factors directly impact the safety, accessibility, and overall effectiveness of evacuation centres during emergencies. The integration of GIS-based WOA and AHP offers a comprehensive framework for site suitability analysis, providing valuable insights for urban planning and disaster risk reduction.

In conclusion, although many current flood shelter locations are unsuitable, there is a practical need to balance accessibility and risk. Future initiatives should focus on the ongoing reassessment of shelter locations, taking into account changing environmental and urban conditions to enhance their effectiveness and safety. This research contributes to the broader discussion on disaster management, highlighting the importance of strategic, data-driven decision-making to strengthen urban resilience against floods.

ACKNOWLEDGEMENTS

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

REFERENCES

American Red Cross. (2018). *Hurricane Evacuation Shelter Selection Standards*. https://nationalmasscarestrategy.org/wp-content/uploads/2019/02/HurricaneEvacuationShelterSelectionStandards.pdf

Anhorn, J., & Khazai, B. (2015). Open space suitability analysis for emergency shelter after an earthquake. *Natural Hazards and Earth System Sciences*, *15*(4), 789–803. https://doi.org/10.5194/nhess-15-789-2015

Chan, N. W. (2015a). Impacts of Disasters and Disaster Risk Management in Malaysia: The Case of Floods. In D. P. Aldrich, S. Oum, & Y. Sawada (Eds.), *Resilience and Recovery in Asian Disasters*. Springer. https://doi.org/10.1007/978-4-431-55022-8

Chan, N. W. (2015b). Impacts of disasters and disaster risk management in malaysia: The case of floods. *Resilience and Recovery in Asian Disasters: Community Ties, Market Mechanisms, and Governance*, 239–265. https://doi.org/10.1007/978-4-431-55022-8

Chen, W., Fang, Y., Zhai, Q., Wang, W., & Zhang, Y. (2020). Assessing emergency shelter demand using POI data and evacuation simulation. *ISPRS International Journal of Geo-Information*, *9*(1). https://doi.org/10.3390/ijgi9010041

Chen, W., Zhai, G., Fan, C., Jin, W., & Xie, Y. (2016). A planning framework based on system theory and GIS for urban emergency shelter system: A case of Guangzhou, China. *Human and Ecological Risk Assessment: An International Journal*. https://doi.org/10.1080/10807039.2016.1185692

Chen, W., Zhai, G., Ren, C., Shi, Y., & Zhang, J. (2018). Urban resources selection and allocation for emergency shelters: In a multi-hazard environment. *International Journal of Environmental Research and Public Health*, *15*(6). https://doi.org/10.3390/ijerph15061261

Chowdhury, J. U., Watkins, D. W., Rahman, M. R., & Karim, M. F. (1998). Models for cyclone shelter planning in bangladesh. *Water International*, *23*(3), 155–163. https://doi.org/10.1080/02508069808686762

Cova, T. J., & Church, R. L. (1997). Modelling community evacuation vulnerability using GIS. *International Journal of Geographical Information Science*, *11*(8), 763–784. https://doi.org/http://dx.doi.org/10.1080/136588197242077

FDEM. (2018). *Statewide Emergency Shelter Plan*. https://www.floridadisaster.org/globalassets/dem/response/sesp/2018/2018-sesp-entire-document.pdf

FEMA. (2013). *Federal Insurance and Mitigation Administration Critical Facilities and Higher Standards*. https://www.fema.gov/media-library-data/1436818953164-4f8f6fc191d26a924f67911c5eaa6848/FPM_1_Page_CriticalFacilities.pdf

FEMA. (2015). *Flood Hazard Elevation and Siting Criteria for Community Safe Rooms*. https://www.fema.gov/national-flood-insurance-program-

Geng, S., Hou, H., & Zhang, S. (2020). Multi-Criteria Location Model of Emergency Shelters in Humanitarian Logistics. *Sustainability*, *12*(5). https://doi.org/10.3390/su12051759

Gol-UNDP. (2006). *Guidelines for Design and Construction of Cyclone/Tsunami Shelters*.

Handicap International-Nepal Programme. (2009). Guidelines for Creating Barrier-free Emergency Shelters. In *Handicap International Nepal*.

International Federation of Red Cross and Red Crescent Societies. (2011). Shelter safety handbook: Some important information on how to build safer. In *International Federation of Red Cross and Red Crescent Societies*. International Federation of Red Cross and Red Crescent Societies.

Jonkman, S. N. (2005). Global perspectives on loss of human life caused by floods. *Natural Hazards*, *34*(2), 151–175. https://doi.org/10.1007/s11069-004-8891-3

Kar, B., & Hodgson, M. E. (2008). A GIS-based model to determine site suitability of emergency evacuation shelters. *Transactions in GIS*, *12*(2), 227–248. https://doi.org/10.1111/j.1467-9671.2008.01097.x

Keicho, T. (2020). *Knowledge Note 3-5 Cluster 3: Emergency Response Evacuation Center Management*. http://wbi.worldbank.org/wbi/Data/wbi/wbicms/files/drupal-acquia/wbi/drm_kn3-5.pdf

Kia, M. B., Pirasteh, S., Pradhan, B., Mahmud, A. R., Sulaiman, W. N. A., & Moradi, A. (2012). An artificial neural network model for flood simulation using GIS: Johor River Basin, Malaysia. *Environmental Earth Sciences*, *67*(1). https://doi.org/10.1007/s12665-011-1504-z

Kilci, F., Kara, B. Y., & Bozkaya, B. (2015). Locating temporary shelter areas after an earthquake: A case for Turkey. *European Journal of Operational Research*, *243*, 323–332. https://doi.org/10.1016/j.ejor.2014.11.035

Kongsomsaksakul, S., Yang, C., & Chen, A. (2005). Shelter location-allocation model for flood evacuation planning. *Journal of the Eastern Asia Society for Transportation Studies*, *6*, 4237–4252.

Kusumo, A. N. L. (2016). *Utilizing Volunteered Geographic Information to Assess Community's Flood Evacuation Shelters* [Master Thesis, University of Twente]. http://www.itc.nl/library/papers_2016/msc/upm/kusumo.pdf

Larsen, J. B. (2009). Forestry between landuse intensification and sustainable development: Improving landscape functions with forests and trees. *Geografisk Tidsskrift-Danish Journal of Geography*, *109*(2), 191–195.

Liu, Q., Ruan, X., & Shi, P. (2011). Selection of emergency shelter sites for seismic disasters in mountainous regions: Lessons from the 2008 Wenchuan Ms 8.0 Earthquake, China. *Journal of Asian Earth Sciences*, *40*(4), 926–934. https://doi.org/10.1016/j.jseaes.2010.07.014

Mabahwi, N. A. (2021). *The Relationship Between Flood Risk Management And Spatial Planning: An Evacuation Area Suitability Perspective In Malaysia*. Shibaura Institute of Technology.

Mabahwi, N. A., Bhattacharya, Y., & Nakamura, H. (2021). GIS-based multi-criteria analysis to identify site suitability of flood shelters in Kuantan, Malaysia. *IOP Conference Series: Earth and Environmental Science*, *799*(1). https://doi.org/10.1088/1755-1315/799/1/012027

Majlis Perbandaran Kuantan. (2019). Rancangan Tempatan Daerah Kuantan 2035. In *Majlis Perbandaran Kuantan: Vol. Jilid 2*.

Malczewski, J. (2004). GIS-based land-use suitability analysis: A critical overview. *Progress in Planning*, *62*(1), 3–65. https://doi.org/10.1016/j.progress.2003.09.002

Melgarejo, L. F., & Lakes, T. (2014). Urban adaptation planning and climate-related disasters: An integrated assessment of public infrastructure serving as temporary shelter during river floods in Colombia. *International Journal of Disaster Risk Reduction*, *9*, 147–158. https://doi.org/10.1016/j.ijdrr.2014.05.002

Mendoza, G. A. (2000). A GIS-based multicriteria approaches to land use suitability assessment and allocation. *SemanticScholar*. https://pdfs.semanticscholar.org/6892/b3acd9c984608da72152a328f2a698dcc25b.pdf

Mighty, M. A. (2015). Site suitability and the analytic hierarchy process: How GIS analysis can improve the competitive advantage of the Jamaican coffee industry. *Applied Geography*, *58*, 84–93. https://doi.org/10.1016/j.apgeog.2015.01.010

Mohamad, M., Bachok, S., Zahari, M., Olabayonle, O., & Zulkifli, N. M. (2021). Agencies' Management Preparations and Proposed Evacuation Routes for Flood Disaster: A Case Study of Melaka. *PLANNING MALAYSIA: Journal of the Malaysian Institute of Planners*, *19*, 199–212.

Mohit, M. A., & Sellu, G. M. (2013). Mitigation of Climate Change Effects through Non-structural Flood Disaster Management in Pekan Town , Malaysia. *Procedia - Social and Behavioral Sciences*, *85*, 564–573. https://doi.org/10.1016/j.sbspro.2013.08.385

Mustafa, A., Bruwier, M., Archambeau, P., Erpicum, S., Pirotton, M., Dewals, B., & Teller, J. (2018). Effects of spatial planning on future flood risks in urban environments. *Journal of Environmental Management*, *225*(July), 193–204. https://doi.org/10.1016/j.jenvman.2018.07.090

NADMA. (2018). *Laporan tahunan nadma 2018*.

Padlee, S. F., Nik Razali, N. N. H., Zulkifli, S. N. 'Atikah, & Hussin, N. Z. I. (2018). An assessment of the perception and satisfaction with flood evacuation centre service quality in East Coast States of Peninsular Malaysia. *Journal of Sustainability and Management Special Issue*, *Special Issue No. 4*, 65–77.

PLANMalaysia. (2018). *Laporan Pelan Tindakan Pembangunan Bersepadu Guna Tanah Di Lembangan Sungai Pahang*.

Poelmans, L., Rompaey, A. Van, Ntegeka, V., & Willems, P. (2011). The relative impact of climate change and urban expansion on peak flows: A case study in central Belgium. *Hydrological Processes*, *25*(18), 2846–2858. https://doi.org/10.1002/hyp.8047

Ran, J., & Nedovic-Budic, Z. (2016). Integrating spatial planning and flood risk management: A new conceptual framework for the spatially integrated policy infrastructure. *Computers, Environment and Urban Systems*, *57*, 68–79. https://doi.org/10.1016/j.compenvurbsys.2016.01.008

Saad, M., Kamarudin, M., Toriman, M., Wahab, N., Ata, F., Samah, M., Saudi, A., & Manoktong, S. (2023). Analysis of the Flash Flood Event and Rainfall Distribution Pattern on Relau River Basin Development, Penang, Malaysia. *PLANNING MALAYSIA: Journal of the Malaysia Institute of Planners*, *21*, 58–71.

Sabri, S., & Yeganeh, N. (2014). Flood Vulnerability Assessment in Iskandar Malaysia Using Multi-criteria Evaluation and Fuzzy Logic. *Research Journal of Applied Sciences, Engineering and Technology*, *8*(16), 1794–1806.

Saini, S. S., & Kaushik, S. P. (2012). Risk and vulnerability assessment of flood hazard in part of Ghaggar Basin: A case study of Guhla block, Kaithal, Haryana, India. *International Journal of Geomatics and Geosciences*, *3*(1).

Sanyal, J., & Lu, X. X. (2009). Ideal location for flood shelter: A geographic information system approach. *Journal of Flood Risk Management*, *2*(4), 262–271. https://doi.org/10.1111/j.1753-318X.2009.01043.x

Şentürk, E., & Erener, A. (2017). Determination of Temporary Shelter Areas in Natural Disasters by Gis a Case Study for Gölcük/Turkey. *International Journal of Engineering and Geosciences*, *2*(3), 84–90. https://doi.org/10.26833/ijeg.317314

Sphere. (2011). Humanitarian Charter and Minimum Standards in Humanitarian Response. In *Humanitarian Charter and Minimum Standards in Humanitarian Response* (2011 Editi). The Sphere Project. https://doi.org/10.3362/9781908176202

Sphere. (2015). Minimum Standards in Shelter, Settlement and Non-Food Items. In *Humanitarian Charter and Minimum Standards*. The Sphere Project.

Sutanta, H., Bishop, I. D., & Rajabifard, A. (2010). Integrating Spatial Planning and Disaster Risk Reduction at the Local Level in The Context of Spatially Enabled Government. *Spatially Enabling Society: Research, Emerging Trends and Critical Assessment*, *1*(December 2014), 55–68. http://services.land.vic.gov.au/landchannel/jsp/map/PlanningMapsIntro.jsp%0Ahttps://minerva-access.unimelb.edu.au/bitstream/handle/11343/28949/265594_Integrating Spatial Planning and Disaster Risk Reduction at the Local Level in the Context of Spatially E

Tai, C. A., Lee, Y. L., & Lin, C. Y. (2010). Urban disaster prevention shelter location and evacuation behavior analysis. *Journal of Asian Architecture and Building Engineering*, *9*(1), 215–220. https://doi.org/10.3130/jaabe.9.215

Unal, M., & Uslu, C. (2016). GIS-based accessibility analysis of urban emergency shelters: The case of Adana City. *International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences*, *42*(2W1), 95–101. https://doi.org/10.5194/isprs-archives-XLII-2-W1-95-2016

UNHCR. (2007). *UNHCR Handbook for Emergencies*. UNHCR.

Wang, X. (2019). Research on the Suitability of the Emergency Shelter in Tianjin. *Advances in Social Science, Education and Humanities Research*, 225–230. https://doi.org/10.2991/sschd-19.2019.40

Wei, L., Li, W., Li, K., Liu, H., & Cheng, L. (2012). Decision support for urban shelter locations based on covering model. *Procedia Engineering*, *43*, 59–64. https://doi.org/10.1016/j.proeng.2012.08.011

Zhao, L., Li, H., Sun, Y., Huang, R., Hu, Q., Wang, J., & Gao, F. (2017). Planning emergency shelters for urban disaster resilience: An integrated location-allocation modeling approach. *Sustainability (Switzerland)*, *9*(11), 1–20. https://doi.org/10.3390/su9112098

Received: 18th March 2024. Accepted: 17th August 2024

PLANNING MALAYSIA:
Journal of the Malaysian Institute of Planners
VOLUME 22 ISSUE 5 (2024), Page 263 – 277

ASSESSMENT OF WASTE GENERATION, COMPOSITION AND REVENUE LOSS ESTIMATION DUE TO FLOATABLE RIVERINE LITTER AT LOG BOOM SUNGAI PINANG, KLANG, MALAYSIA

Noor Azwani Azmar[1], Latifah Abd Manaf[2]

[1,2]*Faculty of Forestry and Environment,*
UNIVERSITI PUTRA MALAYSIA

Abstract

The presence of floatable riverine litter poses a significant environmental challenge, impacting both aquatic ecosystems and local economies. The purpose of this study is to quantify waste generation and composition based on two different seasons and estimate revenue loss from floatable litter at the log boom in Sungai Pinang. Using systematic waste sampling and analysis techniques, we categorised and measured the types and volumes of waste collected over a specified period. The data revealed substantial quantities of plastic, organic matter, and miscellaneous debris. To estimate the economic impact, we employed a revenue loss model that considers cleanup costs, damage to local fisheries, and the tourism sector. Our findings indicate that the accumulation of floatable riverine litter results in considerable economic losses annually. The study highlights the urgent need for effective waste management strategies and policies to mitigate the negative impacts of riverine litter on both the environment and the local economy.

Keywords: Waste, Environmental, Revenue Loss, Floatable Riverine Litter, Log Boom

[1] Master Candidate Email: noorazwaniazmar@gmail.com

INTRODUCTION

The issue of floatable riverine litter has become an increasingly pressing environmental concern. Along with seriously endangering aquatic life, water quality, and human health, this floatable riverine litter affects the aesthetic value of riverine habitats (Ahmad et al, 2022). In the context of Sungai Pinang, a key waterway in the region, one of the biggest challenges facing local government and communities is the build-up of floatable riverine litter at the log boom (Eusoff et al, 2011).

Floatable riverine litter typically comprises a variety of waste materials, including plastics, organic matter, and other debris. These materials are often carried into rivers through stormwater runoff, improper waste disposal, and other human activities. Once in the river, they can travel considerable distances, eventually accumulating at structures like log booms designed to trap and remove such debris. The environmental implications of riverine litter are well-documented (Ahmad et al, 2022). Plastics, in particular, can persist in the environment for extended periods, fragmenting into microplastics that are ingested by aquatic organisms, thereby entering the food chain. Organic waste, while biodegradable, can contribute to oxygen depletion in water bodies, adversely affecting fish and other aquatic species.

Beyond the environmental impact, floatable riverine litter also has significant economic repercussions. The costs associated with cleaning up and managing this waste are substantial (Malik et al., 2020). Additionally, the presence of floatable riverine litter can detract from the natural beauty of riverine areas, negatively affecting tourism and recreational activities (Malik et al., 2020). Furthermore, local fisheries can suffer due to polluted waters, leading to a decline in fish populations and affecting the livelihoods of those dependent on fishing (Ahmad et al, 2022). With a systematic waste generation assessment and an estimation of the related revenue loss, this study seeks to solve these concerns at the Sungai Pinang log boom. In additions, it aims to provide an extensive overview of the kinds and quantities of litter collected by means of thorough waste sampling and analysis (Burillo et al, 2002). Futhermore, the financial impact of this riverine litter can be determined by using revenue loss model, taking into account factors like cleanup expenses, harm to nearby fisheries and the impact on tourists (Kim et al., 2009)

This study highlights the critical need for efficient waste management methods and regulations by illuminating the extent and consequences of floatable riverine litter (Galgani et al, 2024). It is envisaged that the results would guide the creation of focused actions to lessen the negative effects that riverine trash at Sungai Pinang is having on the environment and the local economy.

SIGNIFICANCE OF THE STUDY

The study of waste generation and revenue loss estimation due to floatable riverine litter at the log boom in Sungai Pinang holds critical significance for several reasons. Firstly, it addresses a pressing environmental issue that affects water quality, aquatic ecosystems, and public health. By systematically quantifying the types and volumes of waste collected, the study provides essential data that can be used to understand the extent of pollution and its sources. This information is crucial for designing effective waste management strategies and policies that target the reduction of litter at its origin, thereby improving the overall health of the riverine ecosystem.

Secondly, the economic dimension of this study is of paramount importance. The estimation of revenue losses associated with riverine litter highlights the financial burden borne by local communities and authorities. Costs related to the cleanup and management of floatable litter, as well as the negative impact on tourism, fisheries, and recreational activities, are significant. By quantifying these economic impacts, the study underscores the need for investments in preventive measures and infrastructure that can mitigate these costs in the long term. This economic analysis can also serve as a compelling argument for policymakers and stakeholders to prioritise and allocate resources for riverine litter management.

Finally, this study has broader implications for environmental sustainability and community engagement. By drawing attention to the tangible and intangible costs of riverine litter, it fosters greater public awareness and involvement in waste reduction initiatives. Educating the community about the environmental and economic impacts of litter can lead to more responsible behaviour and increased participation in local clean-up efforts. Moreover, the study's findings can contribute to global discussions on sustainable waste management practices, offering insights that can be adapted and applied in other regions facing similar challenges. In essence, this study not only aims to address immediate local concerns but also aspires to contribute to the global movement towards more sustainable and resilient environmental practices.

METHODOLOGY

Study Area

This study employs a comprehensive approach to quantify the waste generation and estimate revenue losses due to floatable riverine litter at the log boom in Sungai Pinang. The methodology is divided into several key components: site selection and sampling, waste categorization and analysis, revenue loss estimation, and data analysis. The log boom is located at Sungai Pinang, which is at the bottom of Sungai Klang, about twenty-five kilometres from the coast. Situated downstream along the Sungai Klang, the log boom is a considerable

distance from the river mouth and the coast. The purpose of the log boom is to capture or control logs and debris that may be transported downstream by the river's flow, preventing them from reaching the sea and potentially causing navigational hazards or environmental issues. Figure 1 below, - shows the location of the log boom at Sungai Pinang

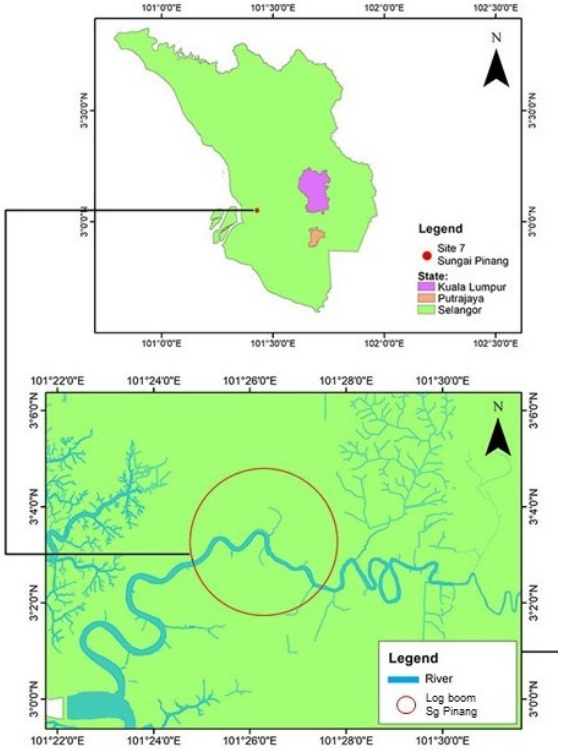


Figure 1: Study Area of Log Boom Sungai Pinang

Sampling Procedure

The waste generation study of floatable riverine litter was carried out during two different seasons: the dry season from March to the end of April 2020 and the wet season from September to October 2021. During the dry and wet seasons, 28 days of sampling were conducted to collect data on floatable riverine litter whereas 14 days during the dry season and another 14 days respectively during wet season. The collection took place at the log boom located at Sungai Pinang. The log boom serves as a barrier to capture and collect the litter that floats on the river's surface. The floatable riverine litter that gets accumulated at the log boom is then

manually pushed into the river to be transported to a facility for further analysis. By conducting these data collection efforts, the study aimed to gather information on the seasonal variations in floatable riverine litter and gain insights into the effectiveness of litter management strategies in the studied area. However, during the data collection process, there were some technical problems encountered. The excavator arm breakdown and the time required to physically push the collected litter into the river caused variations in the rate at which the excavator transported the waste throughout the operating day. To address this issue, the researchers modified the equation used to measure the conveyor's rate. They weighed each of the n conveyors that brought the waste to the facility within a range of 30 minutes. This modification aimed to record the fluctuations in the conveyer's performance and provide a more accurate assessment of the litter collection process. The floatable riverine litter was weighed and documented when it arrived at the facility. This is a critical stage in determining the quantity of waste collected and the scope of the litter problem in Sungai Pinang, both in the rainy and dry seasons. The following equation has been used to determine the total amount of floatable riverine litter generated.

$$W = T1\ (w1/t1) + T2\ (w2/t2) + T3\ (w3/t3) + \ldots\ldots + Tn\ (wn/tn) \text{ ----- (equation 1)}$$

Where;

W = the total weight of waste transported by the excavator
T = the total number of excavators that transported waste
W = the total weight of the excavator that was weighed
T= the number of the excavators that were weighed

Floatable riverine litter composition describes the kinds of components that make up litter that can float on the water's surface, such as in rivers. Several factors, including geographic location, human activity in the area, and environmental features, might affect the composition of floatable riverine litter. The composition of unprocessed municipal solid garbage was examined using the ASTM D5231 standard test method, which is a tool used by the American Society for Testing and Materials, to determine the composition of floatable riverine litter. The ideal sample size, ranging from 200–300 pounds (91–136 kg), was manually selected at random from the waste samples.

$$n= (t * s/ex)^2 \quad \text{…….. (Equation 2)}$$

Where:
n = the required sample size,
t* = the confidence level and an estimate of the sample size needed,
s = the estimated standard deviation,
e = the level of precision, and
x = the estimated mean.

Once a sufficient number of samples had been collected for that categorization, the floatable riverine litter classification technique required basic sorting sequences for sample sampling. Following the sorting process, the following descriptions of floatable riverine litter were produced:

a) The sample of floatable riverine litter generated from the excavator was lifted onto the surface of the sorting area.
b) The floatable riverine litter was segregated manually and classified into 11 different types of floatable riverine litter compositions such as plastics, organic waste, metal, cardboard/paper/tetrapak (CPT), glass, polystyrene, bulky waste, aluminium, rubber, medical waste, and others.
c) Then, by using a 50 kg non-automatic weighing scale, each type of floatable riverine litter was sorted, weighed and recorded. Repeatability measurement for quality testing were used to calibrate non-automatic weighing scales. In order to determine repeatability, the same load was replaced on the load receptor at the same location under the same circumstances.

Rainfall Data

From March to April 2020 and September to October 2021, the Department of Irrigation and Drainage Malaysia (DID) provided a secondary dataset of total rainfall for 28 days of operation during the dry and wet seasons. In order to comprehend its impact on the creation and accumulation of floatable riverine litter at the log boom in Sungai Pinang, rainfall data was used as secondary data in this study. Debris from both urban and rural areas is transported into the river system by precipitation patterns, especially during heavy rain events that enhance surface runoff. The local meteorological department provided historical rainfall data for the study period, including daily precipitation amounts and the frequency of major storm events. The study sought to determine patterns and peaks in the buildup of litter by comparing rainfall data with rubbish collection records. This would provide further insight into the connection between environmental variables and riverine pollution. This analysis helped in determining the extent to

which rainfall contributes to the influx of floatable litter, informing more targeted and timely waste management interventions.

Revenue Loss from the Potential Recyclables

Understanding the revenue loss of recyclable materials requires knowledge about the price list. The total weight of each possible recyclable material is multiplied by its corresponding market price per unit (e.g., per kilogramme or tonne) to determine the value of the recyclable materials. The price list for recyclable materials based on Alam Flora's current market price is displayed in Table 3.1. The entire weight of possible recyclable material is converted into Malaysian Ringgit (RM) to determine the projected value for recyclable material.

The calculation is done by using the following equation:

$$E_r = T_w \, x W_p$$

where
E_r = Estimated revenue
T_w = Total weight
W_p = Price of waste material

Table 1: Types of Waste that can be calculate as potential recyclables.

TYPE OF WASTE	PRICE PER KG (RM)
Plastic	0.40
Glass	0.10
Metal	0.20
Aluminum	2.00

Source: Alam Flora (2023)

ANALYSIS & DISCUSSION

Floatable Litter Generation and Composition

Analyses have been conducted on the observed data sampling at the log boom structure during two different seasons. The findings on the amount of floatable riverine litter collected at the log boom structure during the cleaning operation day are shown in Figure 4.1. The summary of the graphical presentation on the amount of floatable riverine litter collected at the log boom structure for each cleaning operation day revealed that the sixth cleaning operation for the wet sampling and the third cleaning operation for the dry sampling contributed the highest amounts of floatable litter generation, with 1140.00 kg/day and 1123.00 kg/day, respectively, because of the highly heterogeneous waste condition

resulting from land-based source activities. On the eighth and fourth days of the cleaning operation, respectively, for the wet and dry season samples, the lowest floatable riverine litter weight was recorded, at 801.00 kg/day for the wet season and 889.00 kg/day for the dry season. This result has demonstrates the intricate relationship between environmental factors—such as high and low moisture content—and the creation of litter. High moisture conditions tend to accelerate the decomposition of organic matter and, consequently, the breakdown of waste products. Waste production may rise as a result of the decomposition of organic materials and the release of gases like methane. Excessive moisture levels might also make waste heavier, which could affect logistics and transportation expenses (Kasavan et.al, 2017). Conversely, low moisture levels can potentially reduce the amount of litter created by slowing down the breakdown process. On the other hand, low moisture content can also prevent some materials from breaking down, which can lead to an accumulation of non-biodegradable waste (Eusuff et al, 2011).

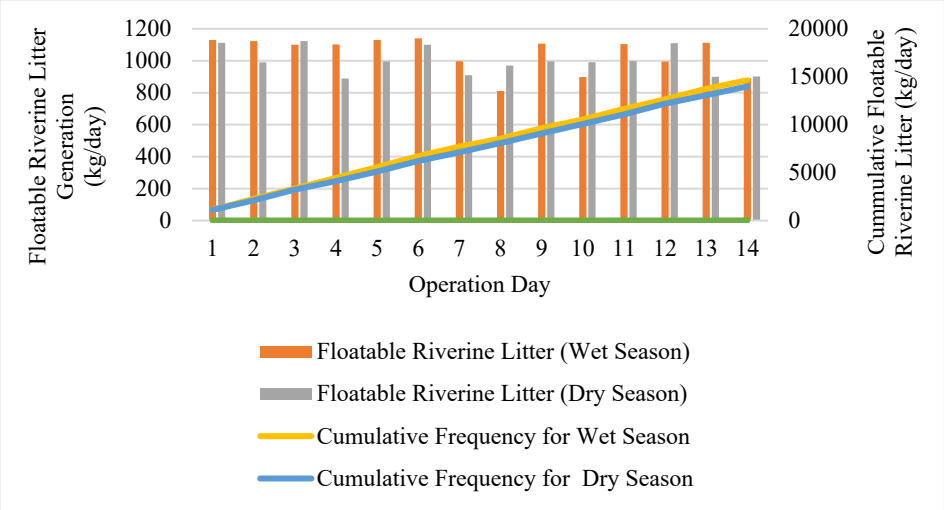


Figure 2: Floatable Riverine Litter Generation

It is important to conduct a systematic analysis of the formation of floatable riverine litter and its composition at log boom structures in order to ascertain the amount and composition of waste that is gathered in this manner. According to Crosti et al. (2018), there was a lack of monitoring data on the formation of floatable litter and its composition in river systems. The amount and composition of floatable riverine litter provided essential information for the planning and operation of the waste management systems (Beigl et al., 2008).

The wet sampling produced the highest cumulative amount of floatable riverine litter creation (15555.00 kg/day) compared to the dry sampling's 13628.00 kg/day of generated cumulative amount. Based on the actual conditions at the sample site, where the data was divided between dry and wet seasons, the study's overall conclusions about the formation of floatable riverine litter and its cumulative burden were made. Studies on hydrology and climate frequently deal with this since rainfall can fluctuate seasonally.

Additionally, changes in the amount of floatable riverine litter generated at the log boom structure were sometimes caused by technical issues with the excavator equipment that was employed to raise and move the litter to a facility. Consequently, the inability of the bucket conveyor machine to operate properly has affected time management, the frequency of bucket conveyors, and the amount of labour needed to manually transfer the floatable riverine litter. Due to the inability to elevate and transfer the floatable riverine litter from the log boom structure to the waste sample area, this has an indirect impact on the formation of floatable riverine litter and its cumulative weight.

An investigation and analysis have been conducted regarding the make-up of the floatable riverine litter that was gathered at the log boom structure within the river system. Floatable riverine trash, including plastic, organic, glass, metal, bulky, rubber, polystyrene, aluminium, and CPT (cardboard/paper/tetrapak), together with other materials, makes up the majority of the litter collected at log boom structures. Better results for each kind of floatable riverine litter composition load are shown in Figure 3.

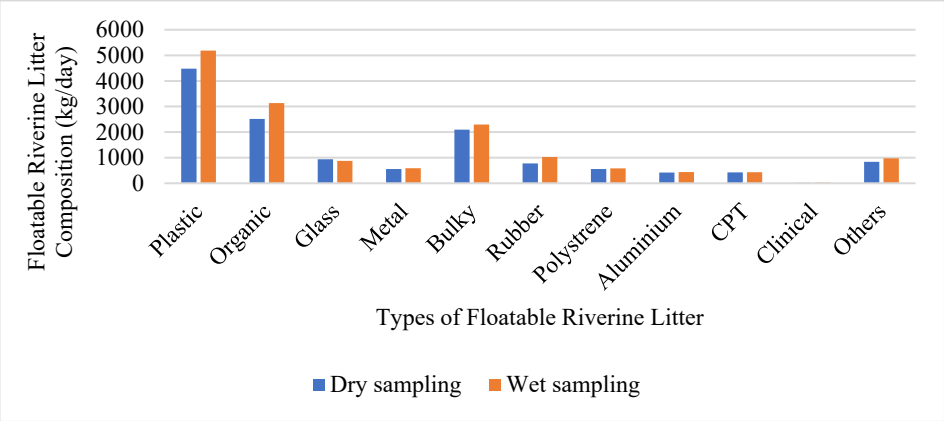


Figure 3: Floatable Riverine Litter Composition

Figure 3 illustrates that the majority of the different types of floatable riverine litter composition that was collected at the log boom structure was composed of household garbage from the residential and commercial regions

along Sungai Pinang. The results unequivocally show that, during the wet season sampling, the plastic load at the log boom structure was reported to be 5684.20 kg/day, which is higher than the plastic weight during the dry sampling, which was 5596.00 kg/day. This indicates that the volume of garbage by composition varies significantly between the rainy and dry seasons. This is due to the fact that a number of variables, including consumption patterns, are reaponsible for the variation in waste volume between the dry and wet seasons (Sadri and Thompson, 2014). Plastic waste is a diverse range of materials that includes food packaging, water bottles, plastic bags, and other items. It is evident that illegal dumping and littering operations are the primary cause of much of this waste. The physical characteristics of plastic waste, such as its strength, light weight, electrical insulation, resistance to corrosion, and ability to float on the water's surface (Thompson et al., 2009); low cost, durability, and versatility (Sadri and Thompson, 2014); and disposable nature, make it an obvious source of pollution, particularly in the river system. Consumers can simply dispose of their waste in a number of situations and utilise it often as a result. Previous studies have concentrated on quantifying plastic debris in water bodies, such as rivers, because of the large volume of plastic garbage that has been disposed of in these studies (Gasperi et al., 2014; Sadri and Thompson, 2014; Di-Méglio and Campana, 2017; Tramoy et al., 2019). The majority of plastic waste in river systems has also been detected in different regions, according to Riverine and Marine Floating Macro-Litter Monitoring and Modelling of Environmental Loading (RIMMEL) from the European Commission-Joint Research Centre (2018). These include the Rhone River (77%), Tiber River (82%; Crosti et al., 2018), and Esperana Stream (8.7% to 17.3%) (Salles et al., 2012).

Furthermore, the term "polystyrene" in this study refers to polystyrene, which is easily accessible at log boom constructions in a range of forms, such as food packages and cups. It is widely used in a wide range of consumer product applications and is particularly useful for commercial packaging. Rigid foam and regular solid plastics are two forms of Polystyrene (PS), a naturally transparent thermoplastic. According to this study, it is evident that 569.23 kg of polystyrene were collected per day during the first sampling and 539.11 kg per day during the second sampling. This characteristic allows polystyrene to survive a long period in the natural environment and contributes to the litter problem because the material is typically discarded after a very short usable lifespan (Tony et al, 2015).

In addition, the elements most likely to be recyclable in the composition of floatable riverine litter gathered at the log boom structure were found to be plastic, aluminium, glass, and metal. Moreover, it supports environmental preservation and sustainability even in the event that the market value of some resources changes. Among the floatable riverine litter compositions collected at the log boom structure during both periods of floatable litter sampling on the

cleaning operation day, these four types of materials were found to be the least abundant in numbers (Figure 3). Next, the quantity of organic waste collected at the log boom structure during the first sampling, which weighed 4437.66 kg per day, was compared to the second sampling's organic waste load of 12222.48 kg per day. Different cleaning operations were scheduled to correspond with different levels of rainfall and river water flow, which led to different volumes of organic waste being recorded during the floatable litter sampling at the log boom structure. The log boom structure's abundant organic waste, which included fruits, vegetables, and food items, was consistently in line with the findings of Saidan et al's (2017) investigation. According to Figure 3, medical waste contributes 25 kg of weight per day during the wet season and 20 kg per day during the dry season. The higher frequency of COVID-19 infections has been linked to an increase in the amount of medical waste. This is due to the fact that more disposable medical products, such as masks, coveralls, gloves, and other items, are being utilised to treat COVID-19 patients. The growing use of cleansers and disinfectants by hospitals and clinics has also resulted in an increase in the quantity of medical waste.

The Relationships between Floatable Riverine Litter Generation, Composition and Rainfall

There are consequences for environmental science and sustainable waste management techniques from the complex and ecologically significant relationship that exists between the production of floatable riverine waste and rainfall data. This complex relationship highlights the significance of comprehending, tracking, and reducing the effects of litter on our aquatic ecosystems in the context of shifting precipitation and weather patterns. It also reflects the complex interactions between natural processes, human activity, and climate variables.

Figure 4 illustrates the relationship between the development of cumulative rainfall data and the generation of cumulative floatable litter during a 14-day cleaning operation at the log boom for two distinct sampling seasons. The findings indicate a strong correlation between the two variables: cumulative rainfall data and floatable litter generation during dry sampling, with $R^2 = 0.9673$, $r = 0.9881$ ($p < 0.01$); and cumulative floatable litter generation and wet sampling, with $R^2 = 0.9816$, $r = 0.992$ ($p < 0.01$).

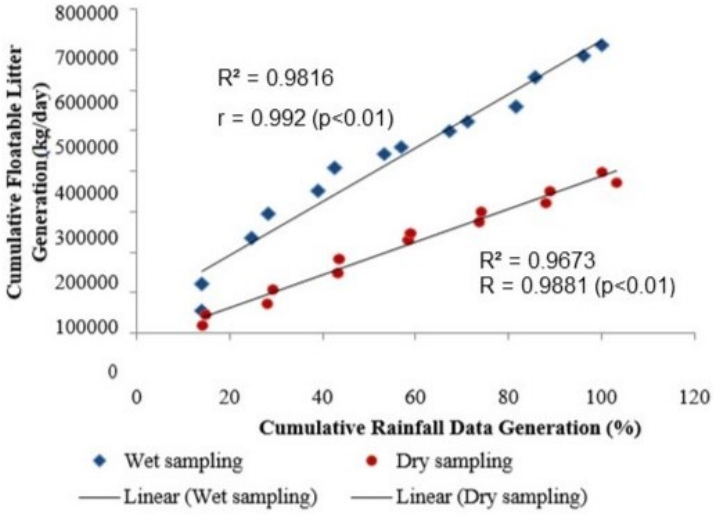


Figure 4: The Relationships Between Floatable Riverine Litter Generation, Composition and Rainfall Data Generation

Rainfall data can be presented as a percentage to indicate the likelihood of precipitation in a specific location or period of time. This percentage represents the probability that measurable rainfall will occur at a given place over a given time frame, usually one or more days. Because rainfall events generated runoff, which in turn readily carried and washed out the floatable trash from land-based sources into the main river system, they played a crucial role in the hydrology of this study. Furthermore, rainfall events have the ability to transport and introduce new floatable litter materials into the waterways system as well as reassemble the floatable litter that has been deposited along riverbanks, as Castro-Jimenez et al. (2019) have convincingly shown.

Estimation Revenue Loss from the Potential Recyclables

The materials that can be recycled the most from riverine litter are aluminium, glass, metal, and tetrapak (CPT), as well as plastic, cardboard, and paper. Observations made during data collection indicated that metals were mostly obtained from aluminium cans, while food packaging, such as drink and pizza boxes, accounted for the bulk of CPT. Aluminium cans are highly desirable materials because of their high cost and large recycling potential. The weight of all possible recyclables from the Sungai Pinang log boom that can be recycled is shown in the following statistics.

Table 2: Estimation Revenue from Potential Recyclables Floatable Riverine Litter

Types of Potential Recyclables	*Total Quantity (kg)*	*Unit price/kg (RM)*	*Revenue Loss Value (RM)*
Plastic	9663.00	0.40	3865.20
Glass	1817.00	0.10	181.70
Metal	1142.00	0.20	228.40
CPT	855.00	0.45	384.75
Aluminum can	858.00	2.00	1716.00

The entire amount of floatable riverine litter generated throughout both the wet and dry seasons has been used to calculate and summarise the weight of potential recyclables. Evaluating the number of recyclable materials in riverine trash can also be used to calculate the possible economic and environmental gains from recycling initiatives. It can also be used as a starting point to track changes in plastic pollution over time and assess how well conservation efforts are working. The estimated revenue was calculated using the most current litter collection prices from Alam Flora Sdn Bhd. Consequently, in light of the anticipated revenue mentioned above, the local government ought to support recycling initiatives. The community may reduce waste while earning money with these efforts. Trash minimization should be promoted because Malaysia's landfills are unable to handle the increasing amount of trash produced annually. To sum up, in order to tackle the issue of increasing waste generation and promote a sustainable and eco-friendly community, local authorities in Malaysia need to prioritise the promotion of responsible waste management practices, recycling initiatives, and waste reduction incentives. These initiatives have the power to promote social interaction and economic advancement in addition to improving the environment.

CONCLUSION

Overall, a comprehensive assessment of waste generation and its economic impacts was conducted at the log boom in Sungai Pinang. Through systematic sampling and categorization, we have identified significant quantities of plastic, organic matter, and other debris that contribute to the environmental degradation of the river. The correlation with rainfall data highlighted the influence of precipitation on the influx of litter, underscoring the need for targeted interventions during heavy rain events.

The economic analysis revealed substantial revenue losses attributable to the management of riverine litter. Cleanup costs, negative impacts on local fisheries, and reduced tourism revenue collectively illustrate the financial burden imposed by this environmental challenge. These findings underscore the

importance of investing in effective waste management strategies, such as improved waste collection infrastructure, public education campaigns, and policies aimed at reducing litter at the source.

In the end, this study emphasises how critical it is to take a multipronged strategy to solving the problem of floatable riverine litter. Educating the public, policymakers, and local authorities about the scope and financial implications of this issue is intended to promote increased cooperation and dedication to long-term solutions. The knowledge acquired from this study can also be a useful guide for other areas dealing with comparable issues, supporting more extensive initiatives in environmental preservation and economic resilience.

REFERENCES

Alwi, S. N. N. S., Abd Manaf, L., Kpalo, S. Y., & Nazibudin, N. A. (2023). Riverine Litter Assessment and Recycling Potential Along Sungai Kelantan at Kampung Pasir Era, Kelantan, Malaysia. *Planning Malaysia*, *21*.

American Society for Testing and Materials (ASTM) (2008) Standard test method for determination of the composition of unprocessed Municipal Solid Waste, D5231-92

Antonella, A., Léa, D., Alex, A., Fabrizio, A., Asunción, B., Ilaria, C., ... & Morgana, V. (2020). Floating marine macro litter: density reference values and monitoring protocol settings from coast to offshore. Results from the MEDSEALITTER project. *Marine Pollution Bulletin*, *160*, 111647.

Beigl, P., Lebersorger, S., & Salhofer, S. (2008). Modelling municipal solid waste generation: A review. *Waste management*, *28*(1), 200-214.

Cheremisinoff, N. P. (2003). *Handbook of solid waste management and waste minimization technologies*. Butterworth-Heinemann.

de Castro, F. S., & Dantas, J. L. D. COB-2019-1262 Motion Analysis of Scale Truncated Log Boom Structures Tested in a Towing Tank

Eusuf, M. A., Ibrahim, M., Din, S. A. M., & Islam, R. (2011). Solid Waste Generation Characteristics: The Malaysian Local Authorities'outlook. *Planning Malaysia*, *9*.

Ferronato, N., & Torretta, V. (2019). Waste mismanagement in developing countries: A review of global issues. *International journal of environmental research and public health*, *16*(6), 1060.

GES, M. (2016). Riverine Litter Monitoring-Options and Recommendations.

Geraeds, M., van Emmerik, T., de Vries, R., & bin Ab Razak, M. S. (2019). Riverine plastic litter monitoring using unmanned aerial vehicles (UAVs). *Remote Sensing*, *11*(17), 2045.

González-Fernández, D., & Hanke, G. (2017). Toward a harmonized approach for monitoring of riverine floating macro litter inputs to

Hameiri, S. (2012). Mitigating the risk to primitive accumulation: State-building and the logging boom in Solomon Islands. *Journal of Contemporary Asia*, *42*(3), 405-426.

Kasavan, S., Mohamed, A. F., & Halim, S. A. (2017). Sustainable food waste management in hotels: case study Langkawi Unesco Global Geopark. *Planning Malaysia*, *15*.

Malik, N. K. A., & Abd Manaf, L. Solid Waste Composition at Log boom of Diversion Gombak River in Kuala Lumpur during Dry Season. *IPCB 2016*, 183.

Malik, N. K. A., & Manaf, L. A. (2018). Potential recyclable materials derived from riverine litter at log boom Sungai Batu in Kuala Lumpur. *Journal of Material Cycles and Waste Management*, *20*, 1063-1072.

Malik, N. K. A., Jamil, N. R., Abd Manaf, L., Rosli, M. H., Ash'aari, Z. H., & Yusof, F. M. (2019). Application of frequency analysis on peak river discharge toward the cumulative floatable litter load at log boom Sungai Batu. In *MATEC Web of Conferences* (Vol. 266, p. 02002). EDP Sciences.

Malik, N. K. A., Manaf, L. A., Jamil, N. R., Rosli, M. H., Ash'aari, Z. H., & Adhar, A. S. M. (2020). Variation of floatable litter load and its compositions captured at floating debris boom (FDB) structure. *Journal of Material Cycles and Waste Management*, *22*, 1744-1767

Miliute-Plepiene, J., Fråne, A., Haikonen, K., & Youhanan, L. (2018). Overview of available methods to monitor marine plastic litter Incl. method for riverine litter monitoring developed within BLASTIC.

Mikusheva, M., Pogojeva, M., Kotova, E., Kozhevnikov, A., Danilova, E., Berezina, A., & Yakushev, E. (2023). Floating Riverine Litter Flux to the White Sea: Seasonal Changes in Abundance and Composition. *Journal of Marine Science and Engineering*, *11*(2), 293.

Nabilah Adzhar, N. F., Abd Manaf, L., Azmar, N. A., Nadhirah Roslan, A., Bagheri, M., Yusuf Kpalo, S., ... & Beiranvand Pour, A. (2023). The Travel Time of Floatable Litter of Different Densities Influenced by River Flow Velocity. *Applied Sciences*, *13*(6), 3450

Ryan, P. G., & Perold, V. (2021). Limited dispersal of riverine litter onto nearby beaches during rainfall events. *Estuarine, Coastal and Shelf Science*, *251*, 107186

Rech, S., Macaya-Caquilpán, V., Pantoja, J. F., Rivadeneira, M. M., Campodónico, C. K., & Thiel, M. (2015). Sampling of riverine litter with citizen scientists—findings and recommendations. *Environmental monitoring and assessment*, *187*, 1-18.

Sadri, S. S., & Thompson, R. C. (2014). On the quantity and composition of floating plastic debris entering and leaving the Tamar Estuary, Southwest England. *Marine pollution bulletin*, *81*(1), 55-60.

Sari, M. M., Andarani, P., Notodarmojo, S., Harryes, R. K., Nguyen, M. N., Yokota, K., & Inoue, T. (2022). Plastic pollution in the surface water in Jakarta, Indonesia. *Marine Pollution Bulletin*, *182*, 114023

Sarker, A., Poon, W. C., & Herath, G. (2018). Natural resource use, institutions, and green ergonomics. *Ergonomics and Human Factors for a Sustainable Future: Current Research and Future Possibilities*, 271-297

Schirinzi, G. F., Köck-Schulmeyer, M., Cabrera, M., González-Fernández, D., Hanke, G., Farré, M., & Barceló, D. (2020). Riverine anthropogenic litter load to the Mediterranean Sea near the metropolitan area of Barcelona, Spain. *Science of the Total Environment*, *714*, 136807.

Received: 19th Mar 2024. Accepted: 3rd September 2024

PLANNING MALAYSIA:
Journal of the Malaysian Institute of Planners
VOLUME 22 ISSUE 5 (2024), Page 278 – 292

THE ROLE OF GEOSPATIAL ARTIFICIAL INTELLIGENCE (GEOAI) IN SMART BUILT ENVIRONMENT MAPPING: AUTOMATIC OBJECT DETECTION OF RASTER TOPOGRAPHIC MAPS IN MALAYSIA

Saiful Anuar Jaafar[1], Abdul Rauf Abdul Rasam[2], Eran Sadek Said Md Sadek[3], Norizan Mat Diah[4]

[1,2,3]*School of Geomatics Science and Natural Resources, College of Built Environment,*
UNIVERSITI TEKNOLOGI MARA SELANGOR, MALAYSIA
[2]*Malaysia Institute of Transport (MITRANS),*
UNIVERSITI TEKNOLOGI MARA SELANGOR, MALAYSIA
[4]*School of Computing Sciences, College of Computing, Informatics and Media,*
UNIVERSITI TEKNOLOGI MARA SELANGOR, MALAYSIA

Abstract

Smart built environment mapping is integrating Geospatial Artificial Intelligence (GeoAI) to enable advanced analysis, pattern recognition, and decision-making processes. This shift in understanding, planning, designing, and managing the built environment is paving the way for a smarter, more sustainable future. This commentary explores the current role of AI in enhancing technology use within the geospatial field, focusing specifically on the application of GeoAI in mapping the built environment. Additionally, the paper presents a selection of case studies related to the implementation of AI in developing automatic vectorization, particularly for geospatial mapping in built environments. This research demonstrates the effectiveness of using Convolutional Neural Network (CNN) models for sorting objects in scanned, old topographic maps of the built environment. The findings of this study are valuable for making informed decisions, devising effective strategies, and identifying opportunities for further research and exploration within the dynamic field of GeoAI in smart built environment mapping and applications.

***Keywords*:** Built Environment, Convolutional Neural Network (CNN), Deep Learning, Geospatial Artificial Intelligence (GeoAI), Smart Mapping

[2] Senior Lecturer at Universiti Teknologi MARA Selangor. Email: rauf@uitm.edu.my

INTRODUCTION

For the past few years, geospatial technology and AI have made considerable strides together. By enabling AI models to automatically extract complex features and patterns from geographical data, deep learning techniques have transformed the industry. Automated analysis of satellite imagery and geospatial datasets is possible because of computer vision algorithms that can recognise and comprehend objects and structures in pictures and movies (Sun et al., 2020). With the integration of machine learning, computer vision, and deep learning algorithms, GeoAI combines AI methods with geospatial data to glean insightful information from vast amounts of geospatial data (Zhu et al., 2019). Gartner defines GeoAI as the application of AI techniques, such as machine learning (ML) and deep learning (DL), to generate knowledge through the analysis of spatial data and imagery.

The significance and possibilities of GeoAI are growing as a result of the expansion of geographic data availability, AI developments, and the accessibility of vast computing capacity. By automating analysis, interpretation, and decision-making, GeoAI can revolutionise conventional geospatial technology and take it to new levels of accuracy, effectiveness, and innovation. The incorporation of AI algorithms and geospatial data has facilitated the mapping and analysis of complex urban landscapes, leading to the emergence of smart built environment mapping (Jiang et al., 2020). In the context of intelligent mapping of the built environment, geospatial AI facilitates several essential functions. It automates the mapping procedure by eliminating the need for manual data collection and interpretation.

This not only saves time and resources but also allows for more consistent and frequent mapping updates. GeoAI also improves the precision and accuracy of mapping outputs by reducing human errors and biases. As the significance of AI in geospatial technology becomes evident, this study aims to explore the current role of AI in advancing technology utilisation within the geospatial field. Then the objective continued to analyse the performance of AI in object detection for historical topographic maps, using a case study as a sample. Consequently, the research presented herein sheds light on the potential of GeoAI for mapping the built environment, demonstrated through an automatic object detection case study of topographic maps in Malaysia.

LITERATURE REVIEW

Geospatial Artificial Intelligence (GeoAI)

Artificial intelligence, which involves the development of machines or computational methods, encompasses the ability to perform tasks that typically necessitate human intelligence. These tasks include reasoning, learning, and foresight, enabling the machines to operate effectively within their environment.

The first is GeoAI, which is a rapidly developing field of study that merges advancements in spatial science, artificial intelligence, and machine learning such as deep learning, data mining, and high-performance computing. Its primary objective is to extract valuable insights and knowledge from large-scale spatial data sets, often referred to as spatial big data (Boulos et al., 2019; Yakub et al., 2021).

Next is ML. This AI approach consists of a specific branch within the field of AI that relies on statistical techniques or numerical optimisation methods to construct models from data, eliminating the need for manual programming of each model parameter or computational step (Ja'afar et al., 2021). The last is DL, which refers to a particular form of machine learning that involves the utilisation of artificial neural networks and algorithms inspired by the functioning of the human brain. In this approach, large volumes of data are used to train the neural networks, enabling them to learn intricate patterns and prediction rules.

Through this topic, leveraging the advancements in geospatial data and AI capabilities, GeoAI offers substantial advantages for urban planning, enabling more effective environmental administration and management in the built environment. Integration of technologies in various fields can benefit from revolutionised planning, design, and management processes, leading to the development of more sustainable and efficient mapping. With automated object detection on topographic maps, GeoAI contributes significantly to enhancing the accuracy and speed of mapping initiatives, facilitating better-informed decisions and smarter urban development strategies in the country.

Smart Built Environment: Enhancing Decision-Making, Efficiency, and Sustainability

In the built environment, GeoAI has become a potent technology that offers revolutionary capabilities in several planning, design, and management-related areas. The built environment encompasses several key concepts, each vital to shaping and managing urban areas effectively. Urban planning involves the design and organisation of cities, towns, and other urban spaces to optimise their liveability, functionality, and sustainability. Its architecture combines the art and science of planning and constructing buildings and structures while adhering to standards for usability, aesthetics, and environmental impact. Additionally, the infrastructure is the backbone of its civilisation, encompassing essential transportation networks, water supply systems, energy systems, and communication networks.

Sustainable development focuses on addressing present needs without compromising the ability of future generations to meet their own needs, necessitating consideration of economic, social, and environmental factors in built environment planning and design. Land use planning in the development

process entails selecting the most suitable use for a piece of land, taking into account zoning laws, environmental concerns, and local requirements. The term "environmental impact" refers to how human actions influence the environment, such as pollution, resource depletion, and climate change. The built environment has a significant impact on adverse environmental effects, which are what sustainable design concepts aim to mitigate. Lastly, community development involves enhancing the well-being of a community through various efforts, including the construction of public spaces, housing, and infrastructure, thereby fostering social, economic, and cultural growth.

All these key concepts provide a foundation for understanding the various aspects and considerations involved in planning, designing, and managing the built environment. The built environment could also be understood to study the potential for enhancing numerous aspects of the built environment that surround humans. To make decisions that contribute to the overall growth and management of the built environment, it focuses on improving decision-making processes linked to urban planning, resource allocation, and policy creation. In addition, it looks at how to use resources more effectively, create less waste, and produce more with fewer negative environmental effects.

GeoAI integration in smart-built settings improves urban life quality by enhancing infrastructure effectiveness and productivity, promoting sustainable development, and enhancing spatial understanding. It aids in informed decision-making, resulting in more flexible, resilient, and sustainable cities. This technology uses AI to analyse geospatial data, leading to intelligent urban planning, improved infrastructure management, environmental sustainability, and increased catastrophe resilience as applied in built environment studies (Mustapha et al., 2023; Mohd Rasu et al., 2023; Adnan et al., 2023; Mohd Zubir et al., 2022; Ridzuan et al., 2021; Omar et al., 2021; Rasam et al., 2017; Abdul Rasam et al., 2016).

Smart Mapping: Transforming GeoAI Automation in Built Environment Applications

In the context of GeoAI and the built environment, smart mapping extends traditional mapping techniques by leveraging the capabilities of AI and geospatial technology to generate interactive, dynamic, and insightful visualisations of spatial data. With the exponential development of available data, smart mapping techniques facilitate the management, analysis, and visualisation of data (Sun et al., 2020). AI algorithms can be used to autonomously extract complex features and patterns from geospatial data, enabling more accurate and comprehensive representations of the built environment (Yuan et al., 2021).

In addition, smart mapping facilitates the integration of diverse data sources and formats, such as satellite imagery, sensor data, social media feeds,

and textual reports. By combining diverse datasets, smart mapping enables decision-makers to obtain valuable insights for urban planning, infrastructure management, and environmental monitoring (Zhu et al., 2019). Other than that, smart mapping's dynamic nature allows real-time updates and interactive exploration of geospatial data. It facilitates the visualisation of changes and trends over time, thereby facilitating proactive decision-making and prompt responses to emergent challenges or opportunities. For instance, smart mapping's real-time monitoring of infrastructure assets can detect anomalies and initiate immediate actions to prevent failures or ensure prompt maintenance (Banihashemi et al., 2021). Moreover, smart planning improves communication and collaboration among built environment stakeholders. It provides user-friendly and intuitive interfaces that facilitate effective knowledge exchange, data interpretation, and collaborative decision-making. Hence, various disciplines, including urban planning, architecture, and environmental management, can interact with the mapped data, nurturing interdisciplinary collaborations and promoting holistic approaches to addressing complex challenges (Lu et al., 2021).

Specifically, smart mapping enables decision-makers in the built environment to obtain meaningful insights, make informed decisions, and promote sustainable development through these developments. To help urban planners make well-informed decisions, AI systems can process and evaluate enormous amounts of geographical data. By anticipating patterns of urban development and enhancing transit networks, GeoAI enables planners to create more liveable, sustainable cities (Kopec et al., 2018).

METHODOLOGY

Case Study of GeoAI Implementation: Automatic Object Detection and Classification of an Archived Topographic Map

This section showcases a sample of a case study and the practical application of GeoAI in the context of smart built environment mapping. It demonstrates the potential to revolutionise how geospatial data is analysed, interpreted, and utilised for creating more intelligent and efficient urban landscapes. The case study aims to automate the process of vectorization to achieve smart mapping, realising the immediate benefits in time and cost savings as well as improving the accuracy of the data. This study uses the Historical Topographic Hardcopy Map as the domain of datasets. Figure 1 below shows an example of the dataset.

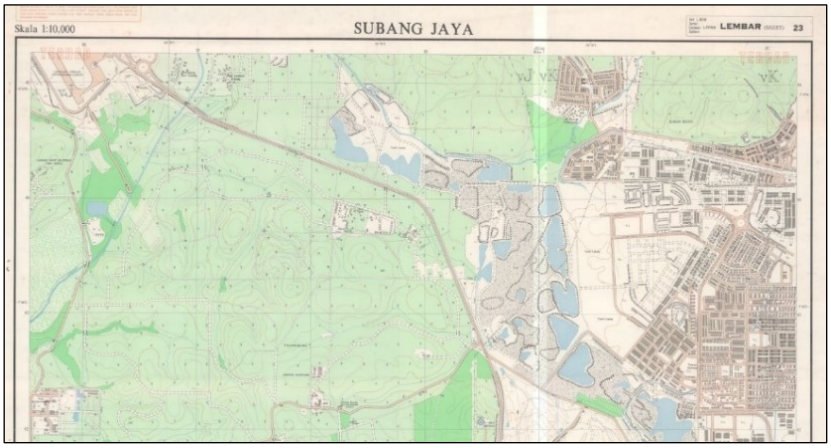


Figure 1: Sample of Historic Topographic Scanned Hardcopy Map
Source: Mapping Section, PTAR 1 UiTM Shah Alam (Yusof, 2021)

In the context of geospatial data processing, an automatic vectorization model provides several important benefits. Utilising a GeoAI deep learning model enables the completely digitised vectorization process to be carried out using automated procedures. This digitalisation process not only saves considerable time but also improves accuracy, providing direct benefits to library institutions, particularly their cartography departments. A specific application of vectorization is used to prepare maps for smart mapping by transforming geospatial views into vectorized data that is ready for use. Library institutions normally deal with numerous obstacles, such as a lack of mapping expertise, limited human resources, and digitization time constraints. To overcome these obstacles, a geospatial domain-specific automated system is devised using artificial intelligence. Using AI techniques, this system seeks to streamline the digitization process and increase productivity (Anuar, 2021).

Research Framework

The method of this study is described in Figure 2 below. A general review of selected papers was conducted to examine the roles of GeoAI for smart built environment applications. The data collection process then involved obtaining scanned historical topographic hardcopy maps from the mapping section of Perpustakkan Tun Abdul Razak (PTAR) UiTM Shah Alam. The collected images were in pdf format.

Images from scanned maps were then cropped using Adobe Photoshop to a size of 244 x 244 inches. From the cropped images, four objects were classified in the study: buildings, water bodies, land use, and roads. These objects were then subjected to data preprocessing, which included image enhancement of colour, clarity, and augmentation. The procedure then continued with the

implementation of CNN through training and testing for two methods: CNN standard architecture and lightweight. During the data training and validation stage, several software tools and libraries were utilised to facilitate the processing.

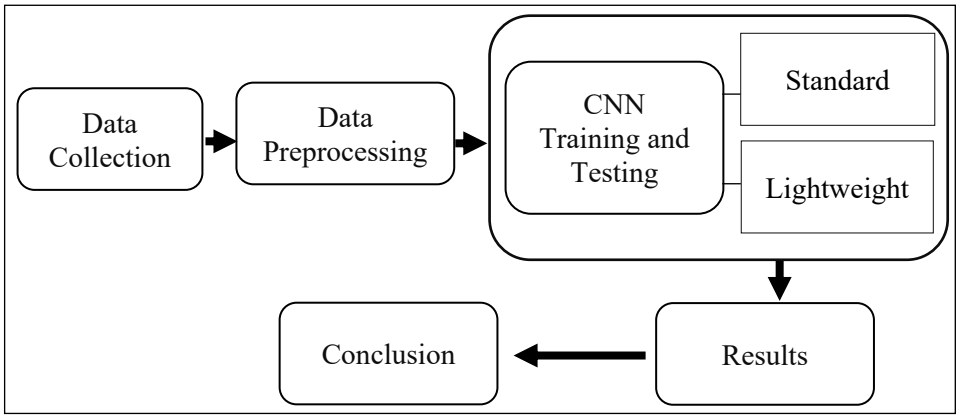


Figure 2: Methodology of Study

These include Anaconda, Jupyter Notebook, and a variety of deep learning packages and libraries such as Keras, TensorFlow, and PyTorch. Additionally, Python served as the primary programming language for implementation, while Matplotlib was used for visualisation purposes to analyse the model's performance and results effectively. Finally, a conclusion was highlighted at the end of the results comparison, highlighting the significance of the technique and its future potential in further developing this method. The methodological approach combined qualitative and quantitative methods.

Multiple criteria were used to assess the accuracy of the model's performance. First, using graph interpretation, the accuracy of training and validation was examined. It was possible to see how the model was learning, how well it could generalise, and whether it was overfitting or underfitting by plotting the accuracy over epochs. Second, the shape of the loss graph for the model was looked at. Plotting the loss function over time allowed researchers to track learning progress, identify over- or underfitting, and evaluate convergence. The loss function quantifies the difference between predicted and expected outputs. Thirdly, to identify prediction mistakes and evaluate accuracy, the confusion matrix was used to compile the model's predictions and actual labels. Lastly, the classification report used assessment measures to assess how well the model predicted accurate class labels, including accuracy, precision, recall, and F1 score.

RESULT AND DISCUSSION

The Roles of GeoAI for Smart Built Environments: A Review

The function of AI in the built environment and its possible benefits are examined in this article. It investigates how AI approaches and GIS technology improves decision-making processes, increase efficiency, enable predictive analytics, support infrastructure management, build catastrophe resilience, and promote sustainable development by analysing pertinent literature and case studies. Consequently, urban planning, infrastructure development, and environmental management can all benefit from better decision-making thanks to the integration of AI with GIS technologies (Chen et al., 2020). Huge amounts of geographical data can be processed and analysed by AI algorithms to yield valuable insights that aid professionals in making data-driven decisions (Li et al., 2019).

Particularly, AI improves efficiency and resource allocation by automating the analysis and interpretation of geographical data (Bao et al., 2019). AI increases consistency and precision in decision-making and resource allocation by minimising manual labour and time-consuming procedures (Zhang et al., 2021). Another important addition of AI to the built environment is predictive analytics. AI can predict future trends, patterns, and repercussions by using historical geographical data and machine learning algorithms (Wang et al., 2020). This skill facilitates proactive decision-making and increases readiness for upcoming difficulties (Zhang et al., 2021). Without a doubt, AI is extremely important for managing and maintaining infrastructure.

Next, by combining AI algorithms with geographical data, real-time monitoring, evaluation, and proactive maintenance of infrastructure assets are made possible (Li et al., 2020). It enhances the lifecycle management of assets by identifying maintenance needs, spotting anomalies, and forecasting possible breakdowns (Wang et al., 2019). AI also helps the built environment be more resilient and disaster-ready, as well as assists in assessing damage, identifying affected locations, and coordinating emergency response operations by analysing real-time geospatial data from a variety of sources (Chen et al., 2020). It makes planning for evacuations, resource mobilisation, and recovery measures easier (Wang et al., 2020).

AI also aids in sustainable development by integrating AI methods with geospatial data (Zhang et al., 2021). It makes it possible to plan for land use, evaluate environmental effects, and find potential for green infrastructure (Li et al., 2019). AI improves sustainable urban planning and development, lowers environmental footprints, and optimises energy use (Bao et al., 2019). The application of geospatial and AI in the built environment has broad ramifications. AI boosts infrastructure management, raises catastrophe resilience, increases efficiency, enables predictive analytics, and encourages sustainable growth. As a result, the built environment is now understood, planned, designed, and managed

differently as a result of these developments, opening the door to a smarter, more sustainable future.

AI-Based Automatic Object Detection and Classification: Result of Testing Using the Standard Architecture of CNN

Based on Figure 3 below, the study observed a consistent increase in training accuracy, which suggests that the model was capturing the patterns and features presented in the training dataset, allowing it to make better predictions based on the data it had seen during training. On the other hand, the validation accuracy, which measures the model's performance on unseen data, followed a similar trend of improvement but with some fluctuations. Through observation, the loss function quantified the disparity between the model's predicted output and the expected output, intending to minimise this difference during training. Plotting the loss over epochs provided valuable information about the model's learning progress and convergence. The significance of the loss graph and its interpretation monitored the model's learning progress, with decreasing or plateauing losses indicating effective learning.

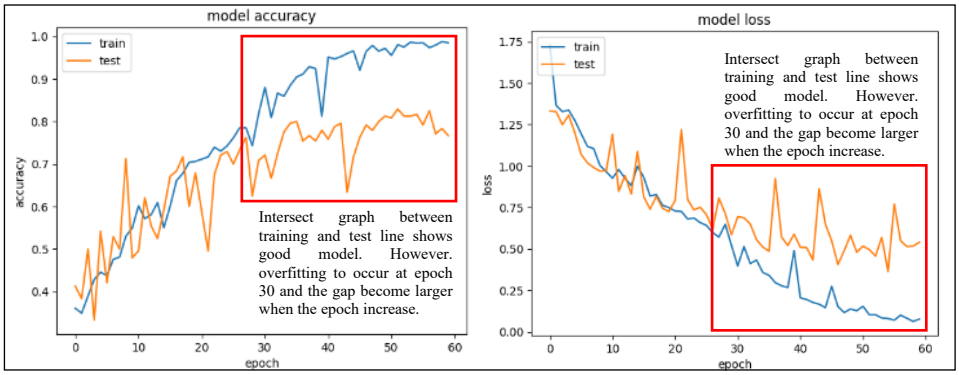


Figure 3: Graph of Model Accuracy-Loss for Training and Validation

The analysis of the training then continued with the classification report. Based on the results in Figure 4 below, the F1 scores reflected a balance between precision and recall for each class. Classes 0, 2, and 3 demonstrated relatively high F1 scores, indicating a harmonious trade-off between precision and recall, while class 1 has a slightly lower F1 score of 0.73. This implies that the model might encounter challenges in achieving a balanced performance for class 1. Considering the overall performance, the model exhibited an accuracy of 82%, indicating its ability to correctly predict the class labels for a majority of instances. The macro averages for precision, recall, and F1-score were 0.86, 0.83, and 0.83, respectively, indicating an acceptable overall performance across all

classes. The weighted averages, which were considered the support for each class, yielded similar values, with precision at 0.86, recall at 0.82, and F1-score at 0.83.

Classification report :

	precision	recall	f1-score	support
0	0.96	0.83	0.89	30
1	0.61	0.90	0.73	30
2	0.93	0.83	0.88	30
3	0.96	0.73	0.83	30
accuracy			0.82	120
macro avg	0.86	0.83	0.83	120
weighted avg	0.86	0.82	0.83	120

Figure 4: Classification Report for Dataset Training and Validation

Result of Testing Using an Advanced Lightweight Model

Lightweight Convolutional Neural Networks (CNNs) have gained significant attention in the field of computer vision. It is specifically designed to provide efficient and accurate feature recognition on resource-constrained devices, such as mobile phones or embedded systems.

The lightweight CNN architecture incorporates depth-wise separable convolutions, which decompose the standard convolution operation into depth-wise convolutions and point-wise convolutions. This factor significantly reduces the computational complexity of the network while maintaining a good level of recognition accuracy (Howard et al., 2017). By utilising MobileNet, lightweight models based on MobileNet have demonstrated their effectiveness in automating feature extraction, aiding applications such as road extraction (Wang et al., 2019) and building footprint recognition (Zhang et al., 2022) on hardcopy maps. The relationship between MobileNet and lightweight CNNs highlights the impact and versatility of MobileNet's design principles in addressing the challenges of resource-constrained environments and specific application domains like hardcopy map feature recognition.

Through the results in Figure 5 below, the accuracy metric measured the model's performance in terms of correctly classified samples, with higher values indicating better accuracy. Looking at the accuracy values, there was an increasing trend over the epochs. The model's accuracy started at 0.4800 and reached a peak of 0.9974 at almost every epoch. Similarly, the validation accuracy started at 0.2500 and reached a peak of 0.990 at epoch 185.

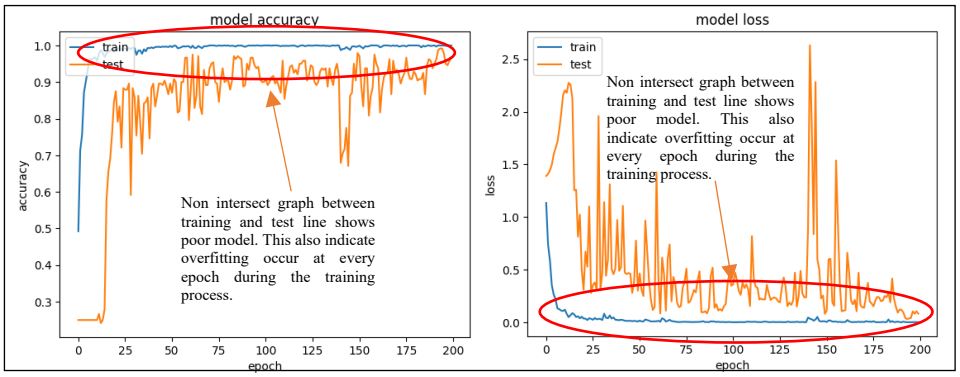


Figure 5: Graph of Model Accuracy-Loss for Training and Validation

This improvement in accuracy suggests that the model is learning and making better predictions as the training progresses. Based on the model loss graph, the loss metric represented the model's error during training, where lower values indicated better performance. The accuracy metric measured the model's performance in terms of correctly classified samples, with higher values indicating better accuracy. The loss on the training data decreased from 1.2365 to almost 0 throughout the training data. As well as the testing, the graph pattern shows a uniform decrease of almost 0 loss over the epoch, indicating that the model is learning and improving its predictions.

Classification report :

	precision	recall	f1-score	support
0	1.00	1.00	1.00	30
1	0.83	0.97	0.89	30
2	1.00	0.87	0.93	30
3	0.97	0.94	0.95	31
accuracy			0.94	121
macro avg	0.95	0.94	0.94	121
weighted avg	0.95	0.94	0.94	121

Figure 6: Classification Report for Dataset Training and Validation

Based on the above Figure 6 experiment results, the classification report shows classes 0, 1, 2, and 3 demonstrated relatively high F1-scores, indicating a high prediction percentage with an average of 90% successful prediction. This indicates that a significant proportion of instances predicted by these classes are correct. The results also achieved a training accuracy of almost perfectly 99.99% and a validation accuracy above 90% on epoch 200 with several trained datasets

of 1320 images. Overall, the lightweight CNN model demonstrated successful performance in accurately identifying objects in topographic hardcopy map datasets, exhibiting high accuracy levels on both training and validation data.

CONCLUSION

This paper has demonstrated the effectiveness of employing Convolutional Neural Network (CNN) models for object classification in scanned historical topographic maps. The use of AI has revolutionised the way geospatial data is collected, analysed, and interpreted. Moreover, the study underscores the significance of leveraging Geospatial AI technologies to facilitate informed decision-making and foster responsible urban development. By adopting innovative methods such as automated object detection in topographic maps, planners and policymakers are better equipped to tackle critical issues related to land use management, infrastructure planning, and environmental conservation. This, in turn, promotes the development of a more resilient and sustainable built environment for future generations. Looking ahead, this paper outlines several recommendations for future research and potential industry applications. A key area for further investigation involves the integration of advanced deep learning techniques, such as transfer learning or ensemble methods, to improve the accuracy and efficiency of object classification. Additionally, examining the scalability of the developed methodology to larger datasets or different geographical regions could offer valuable insights into its broader applicability.

ACKNOWLEDGEMENT

The authors would like to sincerely thank Universiti Teknologi MARA Selangor for providing Geran Intensif Penyelidikan (GIP) Research Fund 600-RMC/GIP 5/3 (074/2022) and Geran Kolaborasi Entiti Penyelidikan (KEPU) 600-RMC/KEPU 5/3 (015/2021) for conference sponsoring.

REFERENCES

Abdul Rasam, A. R., Shariff, N. M., & Dony, J. F. (2016). Identifying high-risk populations of tuberculosis using environmental factors and GIS-based multi-criteria decision-making method. *The International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences*, XLII-4/W1, 9–13. https://doi.org/10.5194/isprs-archives-xlii-4-w1-9-2016

Adnan, N. A., Mahadzir, Z. 'Aqilah, Hashim, H., Mohd Yusoff, Z., Abdul Rasam, A. R., & Mokhtar, E. S. (2023). Road Accessibility and Safety Analysis in Gated and Non-Gated Housing Communities. *Planning Malaysia, 21*(28). https://doi.org/10.21837/pm.v21i28.1318

Anuar, S., & Rauf, A.R.A (2021). Towards Automated Digitization of Cartographic Hardcopy Maps: Reviews of Issues, Challenges and Potentials in Malaysia Library

Archives. *Malaysian Journal of Remote Sensing and Geographical Information System, 10*(1), 43–51.

Anuar, S., & Rauf, A.R.A (2022). Smart Hardcopy Mapping Products Practices in University Records Management Program: The Ideal Criteria and Procedures for UiTM Library Archive. Global Business and Management Research: *An International Journal, 14*(1), 108–118.

Batty, M., & Axhausen, K. W. (Eds.). (2013). Smart cities of the future. *European Physical Journal-Special Topics*, 214(1), 481-518.

Boulos, M. N. K., Yang, S. P., & Burden, D. (2019). Towards intelligent geospatial analytics: conventional GIS versus cognitive GIS. *International Journal of Health Geographics, 18*(1), 4. https://doi.org/10.1186/s12942-019-0178-3

Chen, X., Wang, L., Xie, X., & Meng, L. (2016). Automatic vectorization of building footprints from remote sensing imagery using hierarchical geometric features. *International Journal of Geographical Information Science, 30*(9), 1704-1721.

Chen, Y., Carlinet, E., Chazalon, J., Mallet, C., Chen, Y., Carlinet, E., Chazalon, J., Mallet, C., & Dumenieu, B. (2021). Vectorization of historical maps using deep edge filtering and closed shape extraction to cite this version: HAL Id: hal-03256073 Vectorization of Historical Maps Using Deep Edge Filtering.

Commission, I. C. A., & Heritage, C. (2020). Automatic Vectorisation of Historical Maps International workshop organized by the ICA Commission on Carto-graphic Heritage into the Digital.

Courtial, A., Ayedi, A. El, Touya, G., & Zhang, X. (2020). Exploring the potential of deep learning segmentation for mountain roads generalisation. *ISPRS International Journal of Geo-Information, 9*(5). https://doi.org/10.3390/ijgi9050338

Cubuk, E. D., Zoph, B., Mane, D., Vasudevan, V., & Le, Q. V. (2019). AutoAugment: Learning augmentation policies from data. In Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition (CVPR) (pp. 113-123).

Delhi, N., & Learning, D. (2019). Vector map generation from aerial imagery using deep learning. IV(June), 10–14.

Dwivedi, D. N., & Patil, G. (2022). View of Lightweight Convolutional Neural Network for Land Use Image Classification.pdf. 1(1), 31–48.

Egiazarian, V., Voynov, O., Artemov, A., Volkhonskiy, D., Safin, A., Taktasheva, M., Zorin, D., & Burnaev, E. (2020). Deep Vectorization of Technical Drawings. 1–17.

Goodfellow, I., Bengio, Y., & Courville, A. (2016). Deep learning. Cambridge, MA: MIT Press.

Gong, J., Zeng, H., Wei, Y., Yu, W., & Ma, Y. (2017). Segmentation and vectorization of building footprints from high-resolution aerial images using multi-directional local gradient patterns. *Remote Sensing, 9*(9), 869.

Gan, J., Li, X., & He, Y. (2021). Fast and lightweight building extraction from aerial images with multi-scale feature fusion. *Remote Sensing, 13*(4), 705.

Howard, A. G., Zhu, M., Chen, B., Kalenichenko, D., Wang, W., Weyand, T., ... & Adam, H. (2017). MobileNets: Efficient convolutional neural networks for mobile vision applications. arXiv preprint arXiv:1704.04861.

Ja'afar, N. S., Mohamad, J., & Ismail, S. (2021). Machine Learning for Property Price Prediction and Price Valuation: A Systematic Literature Review. *Planning Malaysia, 19*(17). https://doi.org/10.21837/pm.v19i17.1018

Kotsiantis, S. B. (2007). Supervised machine learning: A review of classification techniques. *Informatica, 31*(3), 249-268.

Li, X., Fang, T., Xu, H., Zhang, L., & Wang, X. (2018). Deep learning for remote sensing data: A technical tutorial on the state of the art. *IEEE Geoscience and Remote Sensing Magazine, 6*(2), 22-40.

Liu, X., Zhu, Q., Tang, L., & Li, J. (2021). Convolutional neural networks for large-scale remote sensing image classification: A comprehensive review. *Remote Sensing, 13*(4), 616.

Liu, X., Yan, H., Liu, L., Li, L., Zhu, F., & Ding, W. (2020). Lightweight deep learning for road extraction from aerial imagery using an improved U-Net. *Remote Sensing, 12*(6), 982.

Liu, Y., et al. (2021). Artificial intelligence in urban geoinformatics: State-of-the-art and future

Li, Z., Xin, Q., Sun, Y., & Cao, M. (2021). A deep learning-based framework for automated extraction of building footprint polygons from very high-resolution aerial imagery. *Remote Sensing, 13*(18). https://doi.org/10.3390/rs13183630

Mustapha, N. I., Rasam, A. R., Saraf, N. M., Idris, R., & Wakijan, A. (2023). Cycling route mapping via cartography and GIS techniques. *IOP Conference Series: Earth and Environmental Science,* 1240(1), 012008. https://doi.org/10.1088/1755-1315/1240/1/012008

Omar, M. B., Mamat, R. C., Rasam, A. R., Ramli, A., & Samad, A. M. (2021). Artificial intelligence application for predicting slope stability on soft ground: A comparative study. *International Journal of Advanced Technology and Engineering Exploration*, 8(75), 362–370. https://doi.org/10.19101/ijatee.2020.762139

Radne, A., & Forsberg, E. (2021). Vectorization of architectural floor plans.

Rasam, A.R.A., Mohd Shariff, N., Dony., J.F, & Maheswaran, P. (2017). Mapping risk areas of tuberculosis using knowledge-driven GIS model in Shah Alam Malaysia. *Pertanika J Soc Sci HumIties*. 2, 135-144.

Ridzuan, N., Abdul Rasam, A., Isa, M., & Shafie, F. (2021). Spatial Interaction between Lifestyles and Tuberculosis: An Expert and Public Participatory GIS in Malaysia. *International Journal of Geoinformatics, 17*(5), 178–192. https://doi.org/10.52939/ijg.v17i5.2033

Lu, X., Weng, Q., & Tong, C. (2019). An object-based convolutional neural network approach for urban land use and land cover classification. *ISPRS Journal of Photogrammetry and Remote Sensing*, 147, 245-259.

Yusof, S. R. (2021). Historic Topographic Scanned Hardcopy Map Perpustakaan Tun Abdul Razak UiTM Shah Alam. (S. Anuar, Interviewer)

Mohd Rasu, M. S., Suhandri, H. F., Khalifa, N. A., Abdul Rasam, A. R. & Hamid, A. (2023) Evaluation of Flood Risk Map Development through GIS-Based Multi-Criteria Decision Analysis in Maran District, Pahang - Malaysia. (2023). *International Journal of Geoinformatics*, 1–16. https://doi.org/10.52939/ijg.v19i9.2873

Mohd Zubir, M. A., Jaafar@Ibrahim, S. A., Abdul Rasam, A. R., Mohd Yusoff, Z., & Che Hashim, I. (2022). Identifying the optimal placement of spatial wind energy farms in Selangor, Malaysia. *Planning Malaysia*, 20. https://doi.org/10.21837/pm.v20i21.1109

Ridzuan, N., Abdul Rasam, A., Isa, M., & Shafie, F. (2021). Spatial Interaction between Lifestyles and Tuberculosis: An Expert and Public Participatory GIS in Malaysia. *International Journal of Geoinformatics*, *17*(5), 178–192. https://doi.org/10.52939/ijg.v17i5.2033

Sculley, D., Snoek, J., & Wiltschko, A. (2015). Hidden technical debt in machine learning systems. In Advances in neural information processing systems (pp. 2503-2511).

Schlegel, I. (2021). Automated Extraction of Labels from Large-Scale Historical Maps. 1–14.

Shorten, C., & Khoshgoftaar, T. M. (2019). A survey on image data augmentation for deep learning. *Journal of Big Data, 6*(1), 60.

Sarker, I. H. (2021). Deep Learning: A Comprehensive Overview on Techniques, Taxonomy, Applications and Research Directions. *SN Computer Science, 2*(6), 1–20. https://doi.org/10.1007/s42979-021-00815-1

Smith, J., Johnson, A., & Lee, K. (2022). The Role of Geospatial Artificial Intelligence in Smart Built Environment Mapping. *Journal of Urban Planning and Development, 49*(3), 150-165.

Vassányi, G., & Gede, M. (2021). Automatic vectorization of point symbols on archive maps using deep convolutional neural network. Proceedings of the ICA, 4(December), 1–5. https://doi.org/10.5194/ica-proc-4-109-2021

Wang, R., Wu, X., Fu, K., Tao, Y., Lu, L., Xu, M., & Xiao, J. (2019). RoadNet: A lightweight deep network for road extraction from aerial imagery. *Remote Sensing, 11*(16), 1897.

Wu, X., Fu, K., Tao, Y., Tao, C., & Gong, H. (2020). Lightweight deep learning networks for building extraction from aerial imagery. *Remote Sensing, 12*(3), 441.

Yakub, A. A., Hishamuddin, M. A., Kamalahasan, A., Abdul Jalil, R. binti, & Salawu, A. O. (2021). An Integrated Approach Based on Artificial Intelligence Using ANFIS and ANN for Multiple Criteria Real Estate Price Prediction. Planning Malaysia, 19(3), 270–282. https://doi.org/10.21837/PM.V19I17.1005

Zhang, L., Li, Z., Tao, D., & Gu, L. (2022). Lightweight building footprint recognition on topographic hardcopy maps using deep learning. IEEE Transactions on Geoscience and Remote Sensing, *60*(1), 88-99.

Received: 30th June 2024. Accepted: 10th September 2024

PLANNING MALAYSIA:
Journal of the Malaysian Institute of Planners
VOLUME 22 ISSUE 5 (2024), Page 293 – 306

POLICY ON THE IMPLEMENTATION OF SMART MOBILITY IN THE SOUTH TANGERANG CITY, INDONESIA BASED ON PUBLIC TRANSPORTATION USING THE PROMETHEE METHOD

Syafieq Fahlevi Almassawa[1], Ernan Rustiadi [2], Akhmad Fauzi[3], Ridwan Sutriadi[4]

[1]UNIVERSITAS PAMULANG
[2,3]INSTITUT PERTANIAN BOGOR
[4]INSTITUT TEKNOLOGI BANDUNG

Abstract

The increase in population density and mobility in certain urban areas has underscored the need for a smart mobility concept. As a component of the broader smart city framework, smart mobility aims to enhance transportation services, making them more accessible, safe, comfortable, efficient, and affordable for the public. This research assesses the readiness for implementing public transportation-based smart mobility in South Tangerang and develops a policy strategy model for its transportation planning and development. The study employed a mixed-method approach, incorporating multivariate analysis and Multi-Criteria Decision Analysis. The findings reveal that South Tangerang is currently unprepared to implement smart mobility, as indicated by low scores on its assessment indicators. Recommended policies include improving the availability, security, and comfort of public transportation, reorganizing transit routes, providing real-time information access, adjusting schedules, and promoting bicycle use by adding bicycle lanes. This research highlights the current state of transportation systems in developing countries and emphasizes the importance of implementing policies that benefit a wide segment of the population.

Keywords: Smart Mobility, Smart City, Public Transportation, Policy, South Tangerang

[1] Corresponding Author. Email: dosen01855@unpam.ac.id

INTRODUCTION

According to the World Urbanization Prospects (WUP) report, the number of people living in urban areas surpassed those in rural areas in 2007. The most recent revision in 2018 indicated that over half of the world's population, specifically 55%, resides in urban areas, with this figure expected to rise to 66% by 2050 (Alanazi, 2023; Ribeiro et al., 2021a, 2021b). While the growth of the urban population might appear random, it highlights the critical need for effective urban space management to enhance the performance of urban services such as energy, transportation, health, and housing. As the urban population continues to grow, meeting the increasing demands for these services becomes increasingly vital (Tariq et al., 2020).

Cities are often viewed as powerful engines of growth, but the movement of populations to suburban areas can create functional centers with bustling urban activities. Over time, peri-urban areas can evolve into densely populated urban centers, while rural areas can develop urban cores with high levels of centrality and service quality (Gerten et al., 2019). Rapid urban growth and expansion impact other urban systems (Aljoufie, 2021). Suburbanization refers to the creation of new settlements and industrial zones on the outskirts of urban areas as city dwellers seek new places to live and work (Rustiadi et al., 1999).

Furthermore, the Smart City concept is the result of knowledge development and community engagement aimed at creating a better environment with high enthusiasm. Its main goal is to enhance citizens' quality of life by effectively using information and communication technology to mitigate the negative effects of urbanization through the development of infrastructure networks that improve social and business activities (Sutriadi, 2018). A heterogeneous traffic environment is characterized by a mix of different types of road users, including vehicles, bicycles, and pedestrians. This heterogeneity distinguishes traffic conditions in developing countries from those in developed countries (Karwad et al., 2024).

A Smart City can be defined as a modern urban area that seeks to improve citizens' quality of life by integrating information and communication technology. This involves evaluating infrastructure and technology across various sectors, including health, safety, mobility, recreation, employment, education, and governance. Investment in advanced human, social, transportation, and communication infrastructure is crucial for driving sustainable economic growth and enhancing the quality of life in Smart Cities. It also involves prudent natural resource management and governance with community participation (Billones et al., 2021). The Smart City concept has sparked considerable debate among city planners, investors, and local governments, attracting more affluent residents, law-abiding citizens, and

potential investors. Efficient resource use in everyday life is another important topic. The availability of facilities, job growth, and higher income opportunities contribute to the expansion of urban populations compared to rural areas (Azmi et al., 2024).

Smart mobility, a key component of the Smart City concept, involves developing technology-based transportation systems using information and communication technology. Its goal is to make public transportation easy, safe, convenient, fast, and affordable through technological advancements. Smart cities with smart transportation systems will facilitate easier travel for citizens by providing innovative and sustainable public transportation with minimal environmental impact. According to identified variables (Billones et al., 2021), smart mobility includes three main components: Accessibility, Information Technology System (ITS) Availability, and Integration (between modes and ITS). Smart mobility aims to reduce car travel and its environmental impact while encouraging alternative travel modes (Müller-Eie & Kosmidis, 2023). However, the introduction of smart mobility raises concerns about the sustainability of urban mobility systems if these new solutions are expected to function alongside existing public transportation options such as buses and metros (So et al., 2023).

Smart mobility involves using technology and data to enhance the efficiency, sustainability, and accessibility of transportation systems. It encompasses various modes of transport, including cars, bikes, buses, and trains. Transportation systems play a strategic role for several reasons: they foster social cohesion, promote economic and employment development, and help balance accessibility across different areas (Labri & Baziz, 2022). Smart mobility solutions aim to optimize existing transportation infrastructure, reduce congestion and emissions, improve safety and accessibility, and enhance the overall mobility experience for users (Wolniak, 2023). This optimization can be achieved by introducing innovative solutions through information and communication technologies (Savastano et al., 2023).

Smart mobility encompasses actions that improve users' mobility by various means of transport, leading to reduced economic and environmental costs (Bıyık et al., 2021). Implementing or supporting policies that increase the use of public transportation and address negative perceptions is crucial. Public transportation services should be more competitive and meet passenger needs and demands. Understanding the factors influencing people's choice of transportation and their attitudes is essential for these improvements. Evaluating passenger perceptions and attitudes towards different modes of transportation is necessary (Burian et al., 2018). Public transportation (PT) plays a significant role in providing mobility and contributing to sustainability by reducing traffic congestion and air pollution. For PT to be effective, it must ensure continuous accessibility and connectivity.

Service reliability is also crucial in encouraging people to switch from cars to PT. The reliability of PT affects user perceptions and their willingness to use these services (Hadas et al., 2023). Improving public transportation positively impacts both public transport passengers and private car users by saving time and costs through enhanced transit services and increased business productivity. Key factors in bus service quality include service mobility and accessibility, the number of bus lines and service frequency, hours of operation, and service reliability.

Designing effective improvements requires modeling user attitudes and satisfaction, considering perceived quality from personal experience and expected changes, which influences user desires for efficient public transport service and impacts the city and country's economy (Alkharabsheh et al., 2021). Compared to cars, public transportation offers clear advantages in terms of road resource use and energy consumption. Prioritizing public transportation development is crucial for addressing urban transportation challenges and supporting sustainable urban growth (Xue et al., 2020). However, in many developing countries, existing public transportation services often fail to attract users because land use characteristics are not adequately considered in planning and designing public transit systems (Motieyan & Mesgari, 2017).

Given this context, a more in-depth study of smart mobility is needed to address mobility issues in South Tangerang. This research aims to tackle problems related to public transportation accessibility, information and communication systems, and infrastructure in South Tangerang. The study is crucial due to the severe mobility challenges in the city, such as congestion, ineffective transportation routes, outdated city vehicles, and misaligned route systems. It will also explore the relationship between mobility problems and regional planning and development, offering broader insights into urban planning for South Tangerang.

The study's objective is to assess the level of smart mobility implementation in South Tangerang City using multivariate analysis with SPSS and to design a policy model for the city's transportation planning and development using Multi-Criteria Decision Analysis (MCDA) with PROMETHEE. PROMETHEE was chosen for its low level of uncertainty in available data, its effectiveness in communicating decision problems and objectives to decision-makers, and its ability to evaluate a balanced sustainability approach while presenting results in an understandable manner (Melkonyan et al., 2022).

METHOD

The research design used in this study was observational. The observational design uses various combinations of quantitative and qualitative analysis. This research is planned to be carried out from October 2021 to November 2022. Location The research was conducted in the southern Tangerang City Area

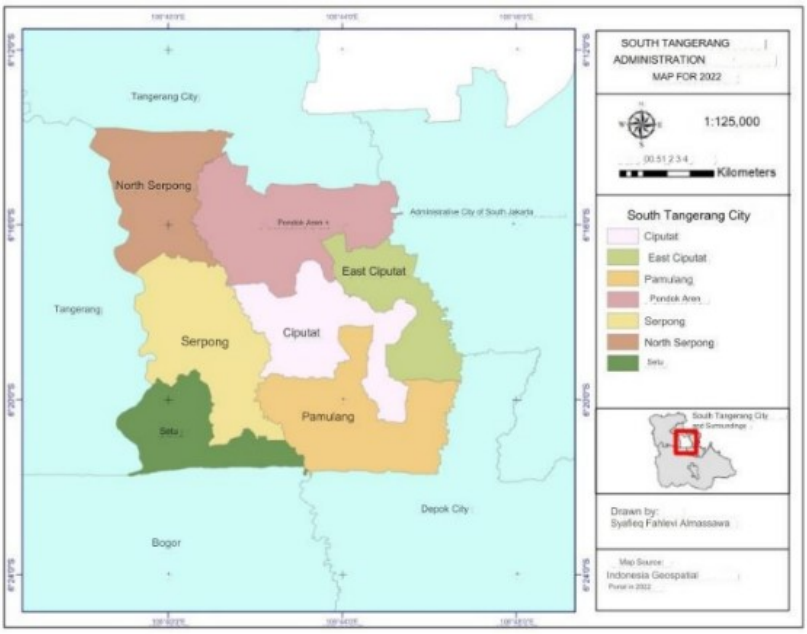


Figure 1: Map of South Tangerang City Area

Figure 1 is a South Tangerang map. South Tangerang City was established based on No. 51/2008 concerning the Establishment of South Tangerang City on September 29, 2008. Located in the eastern part of Banten Province and administratively consists of 7 (seven) sub-districts, 54 (fifty-four) wards with an area of 147.19 km2. The figure used is 147.19 km2 because it is by Law. No. 51/2008 concerning the Establishment of South Tangerang City in Banten Province

Tools and Materials

Table 1 outlines the methodology for assessing and strategizing smart mobility in South Tangerang. The first objective is to evaluate the current implementation of smart mobility by collecting primary data through a structured questionnaire distributed to 100 purposively selected respondents. This data will be analyzed using multivariate techniques and weighting to assess the value and effectiveness

of smart mobility applications in the city. The findings will offer insights into the current status and impact of smart mobility initiatives in South Tangerang. The second objective focuses on analyzing and designing a policy strategy for smart mobility planning and development in the city. Primary data from interviews and Focus Group Discussions (FGDs) will be used, with Multicriteria Decision-Making Analysis (MCDA) applied to evaluate and prioritize different policy options. The result will be a comprehensive policy model to guide the future development of smart mobility in South Tangerang.

Table 1: Objective Matrix, Data Type, Analysis Techniques and Results Output

Research Objectives	Data Type	Analysis Methods & Techniques	Output (Output)
Assessing the level of smart mobility implementation in South Tangerang..	Primary (Results of answers from questionnaires)	1. Instrument: Questionnaire 2. Purposive sampling (100 respondents) 10x 10 independent variables 3. Analysis Techniques a. Analyzes Multivariate b. Weighting	1. The Value of Smart Mobility Application in South Tangerang City
Analyze and design a policy strategy model for the planning and development of smart mobility in South Tangerang.	Primary (FGD Results)	1. Interview 2. FGD 3. Analysis techniques: Multicriteria Decision making analysis (MCDA),	Policy Model Planning and development of South Tangerang city with smart mobility

Table 2 presents a comprehensive framework for evaluating smart mobility through various dimensions and indicators. The primary dimension, Local Access, includes several indicators related to public transportation. These indicators cover the availability and ease of access to buses and urban transport, the presence of terminals or stations, the reliability of schedules, the extent of transportation routes, the overall convenience, and the safety of public transportation options

Table 2: Operational Definitions of Smart Mobility Variables

Variable	Dimension	Indicator
Smart Mobility	**Local Access**	Public Transportation Availability 1. Bus 2. Urban Transport
		Ease of Getting Public Transportation 1. Bus 2. Urban Transport
		Terminal/Station Presence 1. Bus 2. Urban Transport
		Public Transport Schedule 1. Bus 2. Urban Transport
		Public Transportation Routes 1. Bus 2. Urban Transport
		Convenience of Public Transportation 1. Bus 2. Urban Transport
		Public Transportation Safety 1. Bus 2. Urban Transport
	Multimodal Access	Integrated mode availability
	Information and Communication Technology Supporter Mobility	Availability of access to realtime bus information
		Availability of access to realtime information City transport
	Sustainability	Use of Non-Motorized Vehicles 1. Bicycle 2. Walkers
		Traffic Safety
		Exhaust emissions of Public Transportation

Source: Author 2023

The method used in the first goal for measuring the level of smart mobility application involves multivariate analysis, which includes calculating the weight of indicators deemed valid and reliable based on respondents' questionnaire answers. The criteria for determining the validity and reliability of the data are as follows:

Validity Test: Data is considered valid if the calculated r value exceeds the r table value.

Reliability: According to Ghozali (2018: 46), the reliability of an instrument is assessed using Cronbach's Alpha with a single measurement. The classification is as follows:

- If Cronbach's Alpha value > 0.70, the instrument is considered reliable.
- If Cronbach's Alpha value < 0.70, the instrument is considered unreliable

In the second objective, the method used is ranking through Multicriteria Decision-Making Analysis (MCDA). This method is employed to determine the priority of each policy option. The MCDA process involves consolidating data from Focus Group Discussions (FGDs) with informants and inputting this data into a system to generate a ranking of policies based on their relative importance

RESULTS AND DISCUSSION

Instrument Data Test Results

The validity test results for the smart mobility variable indicate that all statements are valid, as the average value of r is greater than the critical value (0.643 > 0.196). Data analysis further shows that the Smart Mobility variable has a Cronbach's Alpha value of 0.953, which exceeds the reliability threshold of 0.70, indicating that the variable is classified as reliable.

Analysis of the questionnaire responses from civil servants, community leaders, private entrepreneurs, and academics reveals several indicators with low or suboptimal weights. The lowest-weight indicator is the availability of city transportation, which received a score of 3.00. This suggests a preference for city transportation with fixed schedules, as predictable timings would facilitate better planning of daily travel. A consistent schedule would help users know when city transportation services are available.

Another low-scoring indicator is the availability of real-time public transportation information, which received a score of 3.05. This reflects a lack of timely and accurate information from relevant agencies, resulting in long waiting times for public transportation. This issue also affects bus services, as indicated by the low score of 3.10 for the availability of bus public transport information.

Additional indicators reveal the suboptimal state of smart mobility in South Tangerang, including inadequate bus routes that fail to cover all areas of the city, low safety and accessibility of city transportation, insufficient cycling infrastructure, and high pollution levels due to poor exhaust emission controls.

South Tangerang City Policy Strategy Model to Implementing Smart Mobility

Following the interviews shows in Table 3, a Focus Group Discussion (FGD) was conducted, involving all informants representing various agencies and community groups. The results of the FGD are included in the table and will subsequently be processed using PROMETHEE software.

Table 3: Focus Group Discussion Results

Criteria / Evaluation	ECO	T&I	PD	S&CA	I&A	GP	MP
Availability of Public Transportation	85%	3	75%	VG	VG	3	3
Public transportation Schedule	70%	2	65%	G	G	1	2
Convenience of Public Transportation	75%	2	70%	VG	G	3	3
Public Transportation Security	80%	3	73%	VG	G	3	3
Use of Non-Motorized Bicycles	55%	1	60%	AV	AV	1	1
Public Transportation Routes	60%	2	55%	G	G	2	2
Availability of Access to Realtime Information	85%	3	70%	AV	AV	3	3

Table 3 categorizes the criteria into three main groups: economic (ECO), population density (PD), and social and cultural aspects (S&CA), which includes social groups. It also encompasses technology and innovation (T&I), infrastructure and accessibility (I&A), and movement patterns (PP), which relate to technical aspects, and government policies (GP), which pertain to institutional aspects.

In Table 4 shows the evaluations are divided into two categories. The first category, technical, includes factors such as the availability of public transportation, public transportation safety, public transportation comfort, and bicycle use. The second category, non-technical, consists of public transportation schedules, public transportation routes, and the availability of real-time information

Table 4: Criteria weighting

Criterion	I(1)	I(2)	I(3)	I(4)	I(5)	I(6)	I(7)	total	Rata2x
Perekonomian	15	14	11	14	12	14	10	90	13%
Technology & Innovation	10	10	10	10	10	10	10	70	10%
Population Density	10	10	10	10	10	10	10	70	10%
Social & Cultural Aspects	17	15	20	17	18	16	20	123	17%
Government Policy	20	20	20	20	20	20	20	140	20%
Infrastructure & Accessibility	17	20	18	18	19	19	19	130	19%
Movement Patterns	11	11	11	11	11	11	11	77	11%

Source: FGD Results 2023

Promethee II Complete Ranking

Table 5: Phi, Phi+, and Phi- values

Rank	Action	Phi	Phi+	Phi-
1	Public Transport Availability	0.2300	0.2300	0.0000
2	Public Transport Safety	0.1967	0.1967	0.0000
3	Convenience of Public Transportation	0.1800	0.1800	0.0000
4	Public Transportation Routes	-0.0300	0.0600	0.0900
5	Real-time Information Access Availability	-0.0733	0.0767	0.1500
6	Public Transport Schedule	-0.1500	0.0600	0.2100
7	Bicycle Usage	-0.3533	0.0000	0.3533

Table 5 displays the ratings and scores for four smart mobility action options. The highest rating was given to improving public transportation availability, which received a score of 0.2300. This was followed by measures to enhance public transportation safety, with a score of 0.1967. The next highest score was for improving equality in public transportation, which received -0.1800.

Route optimization scored -0.0300, while the action to enhance real-time information access received -0.0773. Public transportation scheduling earned a score of -0.1500. The action to promote bicycle use had the lowest score at -0.3533.

Promethee Rainbow

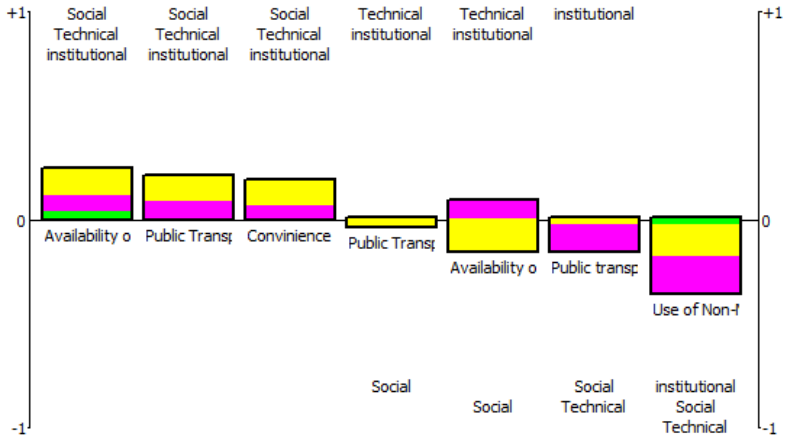


Figure 3: Promethee Rainbow

Figure 3 illustrates that the evaluations for alternatives regarding the availability of public transportation, public transportation safety, and the equality of public transportation fall under social, institutional, and technical groups, indicating that all criteria contribute to these alternatives.

In contrast, public transportation routes and the availability of real-time information access are categorized under technical and institutional groups in Phi+ and under social groups in Phi-. Transportation schedules are included in institutional groups for Phi+ and social groups for Phi-. Finally, the use of bicycles is classified under institutional, social, and technical groups in Phi-.

Promethee GAIA

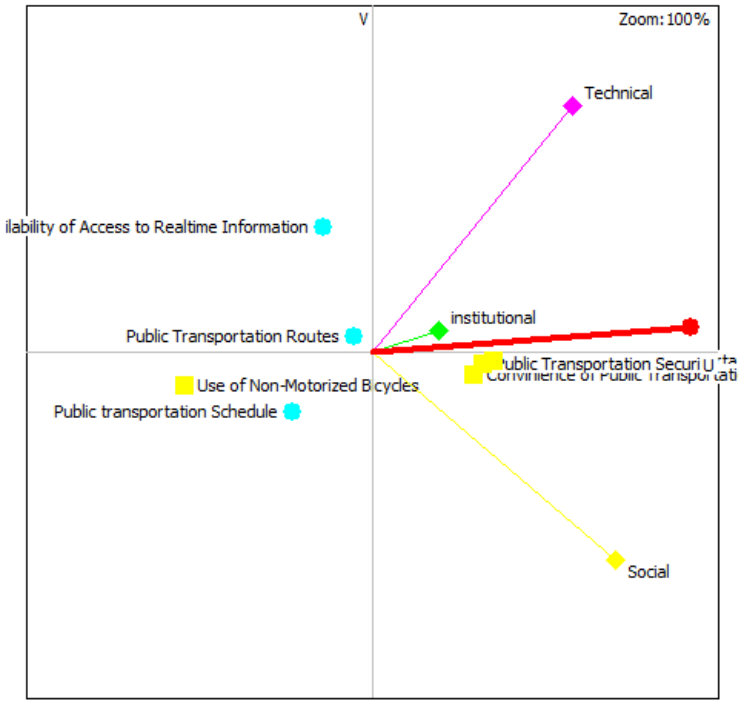


Figure 4: Promethee GAIA

In figure 4 there are three color axes, namely the red axis of the decision axis, the yellow axis for social groups, the green axis for institutional groups and the magenta color axis for technical groups. The best alternative course of action is on the yellow criterion axis on social groups, namely the safety and comfort of public transport

CONCLUSION

In implementing smart mobility in South Tangerang, several indicators reveal significant shortcomings. The lack of a fixed city transportation schedule means residents cannot rely on timely urban transport for daily activities. Furthermore, the absence of dedicated inner-city bus routes forces people to use buses from Jakarta or other areas. The city's public transportation, including Urban Transport, is inconvenient due to an outdated fleet and unprofessional crews, compromising both comfort and safety. Additionally, there is a lack of real-time information on public transportation, leaving arrival and departure times unknown. Bicycle lane facilities are also insufficient, discouraging cycling and leading people to use private vehicles instead. Finally, high exhaust emissions from public transportation contribute to poor air quality. These issues underscore the need for comprehensive improvements to enhance smart mobility readiness in South Tangerang.

Based on the research results, several policy strategies are necessary to transform South Tangerang into a smart mobility city. First, improving the availability of public transportation is crucial, which may involve rejuvenating the city's fleet or upgrading older vehicles that are still in good condition. Second, ensuring the security of public transportation is essential, requiring fixed and reliable safety measures. Third, enhancing the comfort of public transportation is necessary so that passengers have a pleasant experience. Fourth, adapting public transportation routes is important to accommodate the growing population and new developments by establishing new routes. Fifth, providing accessible real-time information on public transportation will allow residents to easily access schedule and route details. Sixth, establishing fixed public transportation schedules is crucial for reliability, enabling people to depend on public transport for their daily activities. Lastly, promoting bicycle use can be achieved by expanding bicycle lanes and implementing safety measures to protect cyclists. These policies collectively aim to improve smart mobility and address existing transportation challenges in South Tangerang.

SUGGESTIONS

To effectively implement smart mobility in South Tangerang, it is crucial for all stakeholders—including the government, parliament, the community, and the private sector—to be actively involved. Achieving the goal of transforming South Tangerang into a smart mobility city will be challenging without the collaboration of all these parties. The government must enhance the transportation system by improving city transportation schedules, optimizing bus routes to meet current demands, and upgrading transportation facilities to ensure safety and comfort. Additionally, real-time information about public transportation should be made available to provide residents with accurate updates. To encourage bicycle use,

efforts should be made to increase bicycle sales and expand bicycle infrastructure. To reduce exhaust emissions, the government should promote the use of public transportation and bicycles. These strategies reflect smart mobility policies already implemented in Jakarta, where public transportation has been integrated with modern information technology systems, enabling residents to access online information about schedules, routes, and other public transport services.

REFERENCES

Alanazi, F. (2023). Development of Smart Mobility Infrastructure in Saudi Arabia: A Benchmarking Approach. *Sustainability (Switzerland), 15*(4). https://doi.org/10.3390/su15043158

Aljoufie, M. (2021). The impact assessment of increasing population density on jeddah road transportation using spatial-temporal analysis. *Sustainability (Switzerland), 13*(3), 1–17. https://doi.org/10.3390/su13031455

Alkharabsheh, A., Moslem, S., Oubahman, L., & Duleba, S. (2021). An integrated approach of multi-criteria decision-making and grey theory for evaluating urban public transportation systems. *Sustainability (Switzerland), 13*(5), 1–15. https://doi.org/10.3390/su13052740

Azmi, N.A., Rozman, A.T., Sukereman, A., S., Wijayaningtyas, M (2024). Requisite Of Sub-Attributes For Smart City Conceptual Framework. *Journal of the Malaysian Institute of Planners*. http://dx.doi.org/10.21837/pm.v22i31.1464

Billones, R. K. C., Guillermo, M. A., Lucas, K. C., Era, M. D., Dadios, E. P., & Fillone, A. M. (2021). Smart region mobility framework. *Sustainability (Switzerland), 13*(11). https://doi.org/10.3390/su13116366

Bıyık, C., Abareshi, A., Paz, A., Ruiz, R. A., Battarra, R., Rogers, C. D. F., & Lizarraga, C. (2021). Smart mobility adoption: A review of the literature. *Journal of Open Innovation: Technology, Market, and Complexity, 7*(2). https://doi.org/10.3390/joitmc7020146

Burian, J., Zajíčková, L., Ivan, I., & Macků, K. (2018). Attitudes and motivation to use public or individual transport: A case study of two middle-sized cities. *Social Sciences, 7*(6). https://doi.org/10.3390/socsci7060083

Gerten, C., Fina, S., & Rusche, K. (2019). The Sprawling Planet: Simplifying the Measurement of Global Urbanization Trends. Frontiers in Environmental Science, 7. https://doi.org/10.3389/fenvs.2019.00140

Hadas, Y., Tillman, A., Tsadikovich, D., & Ozalvo, A. (2023). Assessing public transport passenger attitudes towards a dynamic fare model based on in-vehicle crowdedness levels and additional waiting time. *International Journal of Transportation Science and Technology, 12*(3), 836–847. https://doi.org/10.1016/j.ijtst.2022.08.003

Karwad, Z., Mokhtar, S., Hustim, M., Shimizu, T. (2024) Evaluating Pedestrian Crossing Attributesat Intersections In Kabul City, Afghanistan: A Computer Vision Approach. *Journal of the Malaysian Institute of Planners*. http://dx.doi.org/10.21837/pm.v22i33.1545

Labri, N., & Baziz, A. (2022). A Methodological Framework For Evaluating Smart Transport Applicability In Algiers. Communications - Scientific Letters of the

University of Žilina, 24(4), A160–A171. https://doi.org/10.26552/com.C.2022.4.A160-A171

Melkonyan, A., Gruchmann, T., Lohmar, F., & Bleischwitz, R. (2022). Decision support for sustainable urban mobility: A case study of the Rhine-Ruhr area. *Sustainable Cities and Society*, 80. https://doi.org/10.1016/j.scs.2022.103806

Motieyan, H., & Mesgari, M. S. (2017). Towards sustainable urban planning through transit-oriented development (A case study: Tehran). *ISPRS International Journal of Geo-Information, 6*(12). https://doi.org/10.3390/ijgi6120402

Müller-Eie, D., & Kosmidis, I. (2023). Sustainable mobility in smart cities: a document study of mobility initiatives of mid-sized Nordic smart cities. *European Transport Research Review, 15*(1). https://doi.org/10.1186/s12544-023-00610-4

Ribeiro, P., Dias, G., & Pereira, P. (2021a). Transport systems and mobility for smart cities. *Applied System Innovation, 4*(3). https://doi.org/10.3390/asi4030061

Ribeiro, P., Dias, G., & Pereira, P. (2021b). Transport systems and mobility for smart cities. *Applied System Innovation, 4*(3). https://doi.org/10.3390/asi4030061

Ridwan Sutriadi. (2018). 10 langkah mencerdaskan kota (Warsidi Edi & Safira Maya, Eds.). ITB Press.

Rustiadi, E., Dyah, D., & Panuju, R. (n.d.). SUBURBANISASI KOTA JAKARTA 1.

Savastano, M., Suciu, M.-C., Gorelova, I., & Stativă, G.-A. (2023). How smart is mobility in smart cities? An analysis of citizens' value perceptions through ICT applications. *Cities*, 132. https://doi.org/10.1016/j.cities.2022.104071

So, J. J., Chae, M., Hong, J., Youm, J., Kim, S. H., & Kim, J. (2023). Integrated Mobility Hub Location Selection for Sustainable Urban Mobility. *Sustainable Cities and Society*, 99. https://doi.org/10.1016/j.scs.2023.104950

Tariq, M. A., Faumatu, A., Hussein, M., Ur Rahman Shahid, M. L., & Muttil, N. (2020). Smart city-ranking of major australian cities to achieve a smarter future. *Sustainability (Switzerland), 12*(7), 1–19. https://doi.org/10.3390/su12072797

Wolniak, R. (2023). European Union Smart Mobility–Aspects Connected with Bike Road System's Extension and Dissemination. *Smart Cities, 6*(2), 1009–1042. https://doi.org/10.3390/smartcities6020049

Xue, Y., Cheng, L., Wang, K., An, J., & Guan, H. (2020). System dynamics analysis of the relationship between transit metropolis construction and sustainable development of urban transportation-case study of nanchang city, China. *Sustainability (Switzerland), 12*(7). https://doi.org/10.3390/su12073028

Received: 28th April 2024. Accepted: 29th August 2024

PLANNING MALAYSIA:
Journal of the Malaysian Institute of Planners
VOLUME 22 ISSUE 5 (2024), Page 307 – 320

DEVELOPING URBAN WALKABILITY MEASURES GROUNDED IN GREEN URBANISM PRINCIPLES USING THE DELPHI SURVEY STUDY

Zulkefle Ayob[1], Atikah Raihanah Amir[2]

[1,2]*Department of Built Environment Studies and Technology,*
College of Built Environment,
UNIVERSITI TEKNOLOGI MARA PERAK BRANCH, MALAYSIA

Abstract

This paper investigates the correlation between Green Urbanism Principles (GUP) and urban walkability. It begins with a Literature Investigation to identify green urbanism components and principles by utilising the Green Urbanism concept by Beatley and Lehmann's Principles of Green Urbanism as a framework. Three-stage Delphi Surveys were conducted to conclude the associated GUP, parameters, potential indicators, and themes of Green Urbanism Quality with urban walkability. The study addresses a literature gap, which is found by linking green urbanism principles to walkability indices and fills it effectively. The outcome is the validated Green Urbanism Walkability Index (GUWI). Moreover, the research emphasises the need for a quality urban environment that stimulates walking in Malaysia. Four main themes of Green Urbanism Quality, namely Nature, Urbanism, Liveability, and Culture and Identity, significantly promote urban walkability. A walkable city triggers positive effects, including lively street-level activities, increased security, and economic stability. Landscapes, greeneries, and well-integrated pedestrian networks further enhance walkability. The results emphasise the crucial link between green urbanism principles and the walkability index, allowing for better identification and measurement of walkability. Implementing the system requires enhancing technical and cultural aspects through training, education, and regulation. This research contributes significantly to the body of walkability studies, particularly in the Malaysian context.

Keywords: Green Urbanism, Urban Walkability, Walkability Index, Delphi Survey

[1] Senior Lecturer at Universiti Teknologi MARA Perak Branch. Email: zulke191@uitm.edu.my

INTRODUCTION

The speed of urbanisation in developing countries is a major spatial outcome of global capitalism (World Economic Forum, 2023). This uneven process leads to rural-urban imbalance, lopsided city hierarchy and housing segregation, as well as degenerating social and economic inequalities across cities and towns (Lomoro et al., 2017; Todaro, 1997). According to Cardoso (2022), lopsided development can be interpreted as uneven development, uncontrolled urbanisation, and degradation of both the environment and the quality of urban life.

In the Malaysian context, Alor Setar could be referred to in discussing this matter. As a capital city, Alor Setar is a prominent example of a secondary city in Malaysia, historically known for its accessibility to goods and services within walking distance (Jamin, Mohmad Shukri, Taib, & A M R, 2021; Mel'nikova, 2020). However, the city's recent expansions and developments have shifted its focus towards motorised transportation, diminishing its walkability (Ayob, 2020). Studies indicate a decline in active mobility among city dwellers due to a lack of street-level activities and a decrease in dynamic pedestrians (Abdul Latif et al., 2014; Ayob, 2020; Cardoso, 2022). This apparent decline might be associated with population growth, as observed in Kota Setar (Alor Setar city), where the population decreased from 3.25% in 2000 to 2.70% in 2020. Furthermore, the 2020 census revealed that the ageing society in the region reached 8.5% (Department of Statistics Malaysia-Kedah, 2020).

To attract both inhabitants and visitors alike, towns and cities must ensure safety, comfort, and pleasantness in their street environments to experience the town's unique attributes, values, and assets; these are crucial considerations in walkability indices (Samsudin et al., 2022; Rhodes et al., 2022). These factors encompass the three parameters of a walkability index: 1) Safety and Security, 2) Convenience and Attractiveness, and 3) Policy Support. The significance of proximity to goods and services, population dynamics, and street intersection concentration (i.e., connectivity) has become the key factor in typical walkability indices. Further study is needed to understand the magnitude of accessibility and the application of Green Urbanism principles to create a sustainable, safe, comfortable, and high-quality urban life for inhabitants in small towns (Rhodes et al., 2022).

SUSTAINABLE DEVELOPMENT – GREEN URBANISM PRINCIPLES

Malaysia's physical, conceptual and ideologies towards fully sustainable development are still at an initial stage and has yet to be as extensive as other developed countries. However, the visions and missions in that direction are echoed in the policies of both the Federal and Kedah State Governments (MBAS, 2020; Ministry of Science Technology & Environment, 2020). These endeavours

are possible with the application of the Green Urbanism Principles (Beatley, 2001; Lehmann, 2015) and should be applied consecutively to ensure the utmost success. Even so, at this stage, applying all the principles in Malaysia, where urban sustainability is still in its infancy, is unviable. For this research, selective principles (resulting from the three stages of the Delphi Survey) for a specific purpose (measuring urban walkability in the Secondary City in Malaysia) are proposed and tested.

The Definition of Green Urbanism

The term "Green Urbanism" has become prevalent in various media platforms, including newspapers, conferences, and social media, but its exact meaning remains elusive and vague. Despite this ambiguity, there is an inherent and instinctual understanding of its significance. However, the definition of Green Urbanism varies between authors and professionals in the field. Interestingly, most green urbanism definitions by scholars, researchers and professional practitioners revolve around the three (3) pivotal qualities of sustainability (as detailed in Table 1.0 below). Hence, the working definition of Green Urbanism for this research.

i. Natural Qualities - Qualities of the environment with great concern for synergetic co-existence between people and nature (and the management of energy and materials).
ii. Urbanism Qualities – The imprint of geographic, economic, political, social, and cultural environment forces on the built environment.
iii. Liveability Qualities – The Community's quality of life, including the built and natural environments, accessibility, connectivity and walkability, economic prosperity, social stability and equity, educational opportunity, and cultural, entertainment and recreation possibilities.

Table 1: Classification of Green Urbanism Definition Worldwide

No of Author	Years Range	Research Approach	Location	Definition of Green Urbanism		
				Nature	*Urbanism*	*Liveability*
38	2002 – 2017	Sustainability, Urbanism, Landscape,	Global, Asia and Malaysia	34	35	35

Source: Ayob (2020)

Site context

The study was conducted in a medium size city or secondary city of Alor Setar, the capital state of Kedah in Malaysia. The 2010 national census indicated that Alor Setar has a total land area of 666 km^2 with an estimated population of 405,523. The majority of its population dwells at the fringe of the city's boundary,

leaving a very small number of residents residing within the city centre (Jamin et al., 2021; Department of Statistics Malaysia-Kedah, 2020). Alor Setar is known as a secondary city due to its smaller population and medium economic growth, as well as its moderate infrastructure, facilities, and city income (Department of Statistics Malaysia, 2022; The Economic Planning Unit (Malaysia), 2023). Alor Setar City Council is pursuing sustainable development, a healthy lifestyle, and a walkable town, as it aims for a Liveable Township by 2035 (MBAS, 2018).

RESEARCH METHODOLOGY

Identifying Green Urbanism Principles associated with urban walkability in the Secondary city involved two phases of investigation. The first (1) phase was examining extensive literature on both domains of Green Urbanism and Walkability to understand the key concepts and principles. Phase two (2) employed the three-stage Delphi Survey, involving nineteen built environment experts and academicians in Malaysia.

In the first stage - Identification of Green Urbanism Principles that are related to urban walkability - each panel of experts was asked to individually select the most relevant principles associated with urban walkability among the fifteen (15) Green Urbanism Principles.

The second stage of the survey - Examining and discussing the selected principles (from Stage 1) and their detailed content for relevance to walkability**.** To extract and list as many indicators as possible from the detailed content of the selected principles, all panels of experts were asked to deliberate and review the pivotal issues of each principle and to work out the parameters and key attributes of Green Urbanism's association with walkability.

The third stage of the survey - Assessing the selected indicators (from Stage 2) to finally determine a list of Key Indicators that associate Green Urbanism with urban walkability**.** The panel of experts were asked to deliberate and work out the details of indicators based on their knowledge and understanding of Green Urbanism Principles and urban walkability. At the end of stage three, a Green Urbanism Index (ASGUI) set was established to measure urban walkability.

DISCUSSION OF DELPHI SURVEY FINDINGS

i. Delphi Survey-Stage 1- Associated Green Urbanism Principles (GUP) with Urban Walkability

Literature Investigations concluded that 15 GUP were involved in developing a sustainable-zero carbon city. However, not all fifteen principles can be used in measuring urban walkability. Table 2 below showcases the findings. Stage 1 of the Delphi Survey indicated that **Five** principles were selected by the panel of experts during Stage 1.

Table 2: Selection of FIVE GUPs after Stage 1 Delphi Survey by Experts.

Principles (GUP)	% (PCA)
1: Climate and context	68.4
5: Landscape, gardens and urban biodiversity	100.0
6: Sustainable transport & good public space: compact & polycentric cities	100.0
10: Liveability, healthy communities and mixed-use programs	100.0
12: Cultural heritages, identity and sense of place	100.0

Note: PCA = Percentage of Consensus of Agreement

Stage 1 of the survey adopts 66.7% as the cut-off point for the Consensus of Agreement percentage; the calculation for the Percentage of Consensus of Agreement (PCA) is done by a simple percentage formula below;

$$Percentage\ of\ Consensus\ of\ Agreement = \frac{Accumulated\ Given\ rating}{Total\ of\ Maximum\ Rating}\ x\ 100$$

ii. Delphi Survey-Stage 2- Identification of Themes, Parameters and Key Attributes from Identified Associated Principles

Stage 2 was divided into two parts; Part 1 consists of identifying Themes, Parameters and Key Attributes from the five selected principles (from Stage 1). The outcome of the first part is a list of parameters and key attributes based on each selected principle. Part 2 determines the relevancy of all parameters and key attributes for the research and its suitability for Malaysian SC, particularly Alor Setar.

At the end of the Stage 2 session, the panel of experts, upon detailed deliberation of the site context and the nature of research, all agreed to discard GUP 1, citing that GUP 1 was focused on the city's architectural development as the primary reason. This is evident in GUP 1 detail description: "… all buildings will have climate-adapted envelope technologies, with fully climate-responsive facades" (Lehmann, 2010, 2015). The testing on the relevancy of Principle 1 using the four parameters employing Intraclass Correlation Coefficient (ICC) analysis, as in Table 3, indicated 75.5% of participants opted for 'NO' on the relevancy of Principle 1, which is very significant.

Table 3: Intraclass Correlation Coefficient: Principle 1 Relevancy for the Research

Intraclass Correlation Coefficient							
Principle 1: Climate and Context – The Parameters and Key Attributes							
	Intraclass Correlation [b]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.436[a]	.207	.681	4.074	18	54	.000
Average Measures	.755	.511	.895	4.074	18	54	.000

Two-way random effects model where both people effects, and measures effects are random.
a. The estimator is the same whether the interaction effect is present or not.
b. Type A interclass correlation coefficient using an absolute agreement definition.

The exclusion of Principle 1 and its parameters was based on three grounds: 1) Redundancy of Parameters and Key Attributes with other Principles; 2) Limitation of information and records on-site/local authority; 3) Not relevant to the local context (especially in Malaysia's small towns and Medium-sized City).

Next, the Frequency Analysis on Principles 5,6,10, and 12 indicated that the majority of the participants opted for 'Yes' on the relevancy of Key Attributes to their Parameters with the Percentage of Consensus of Agreement of above 66.7% cut-off point; thus, validated all Key Attributes to their Parameters. The Intraclass Correlation Coefficient (ICC) calculation of Principles 5, 6, 10 and 12 Key Attributes to its Parameters indicated Sig. Values of 0.002, thus indicating a highly significant, as indicated in Table 4 below.

Table 4: Intraclass Correlation Coefficient: The Relevancy of Principles 5, 6, 10 and 12 for the Research

Intraclass Correlation Coefficient							
Principle 5: Landscape, Gardens and Biodiversity – The Parameters and Key Attributes, **Principle 6: Sustainable Transport and Good Public Space; Compact and Poly- Centric Cities – The Parameters and Key Attributes,** **Principle 10: Liveability, Healthy Communities and Mixed-Use Programmes – The Parameters and Key Attributes,** **Principle 12: Cultural Heritage, Identity and Sense of Place – The Parameters and Key Attributes.**							
	Intraclass Correlation [b]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.412[a]	.130	.682	3.077	18	54	.002
Average Measures	.677	.310	.866	3.077	18	54	.002

Two-way random effects model where both people effects, and measures effects are random.
c. The estimator is the same whether the interaction effect is present or not.
d. Type A interclass correlation coefficient using an absolute agreement definition.

Hence, the Stage 2 outcome (Table 5) was a list of Four Principles, 11 Parameters and 28 Key Attributes as follows:

Table 5: Result from Stage 2 Delphi Survey: The identified Themes, Parameters and Key Attributes extracted Green Urbanism Principles associated with Urban Walkability.

GUP	PRINCIPLE	THEME	PARAMETERS	KEY ATTRIBUTES
5	**Principle 5: Landscape, Gardens and Urban Biodiversity**	Nature and Biodiversity	1. Urban Cooling	a) Presence of Urban Vegetation; b) Inner city garden; c) Urban farming; d) Building greenery
			2. Integrated Urban Landscape	a) Urban landscape; b) Accessibility to parks, gardens & public spaces; c) Leisure & recreation
			3. Local Biodiversity	a) Habitat; b) Ecology; c) Wildlife Rehabilitation; d) Forest Conservation
			4. Conserving Natural Resources	a) Restoring Streams; b) Re-establishing Riverbanks
6	**Principle 6: Sustainable Transport and Good Public Space: Compact and Poly-centric Cities**	Sustainable Urbanism	5. Sustainable Transport System	a) Integrated non-motorized transport (cycling/walking); b) Integrated motorised transport (private/public)
			6. Good Public Space Network	a) Pleasant public spaces; b) Pedestrian network and connectivity
			7. Compact And Polycentric City	a) Land uses; b) Diversity
10	**Principle 10: Liveability, Healthy Communities and Mixed-use Programs**	Liveability	8. Liveability	a) Housing range and users; b) Sense of community
			9. Healthy Community And Mixed-Used Programmes	a) Amenities and facilities b) Healthy communities
12	**Principle 12: Cultural Heritages, Identity And Sense of Place**	Culture, Heritage & Identity	10. Cultural Heritage	a) Local culture b) Heritage
			11. Identity And Sense Of Place	a) Historical elements b) Historical dominance c) Spiritual presence

iii. Delphi Survey-Stage 3 – Identification of Indicators

The Stage 3 objective is to develop a list of indicators for fieldwork. Stage 3 started with the weighing of the definition of Green Urbanism, a detailed description of each Principle, the traverse of key attributes, and finally, arriving at the detailed, measurable indicators for urban walkability established from Green Urbanism principles. The identified indicators were then tabulated for detailed discussion, where the process of addition and omission took place based on mutual and majority agreement for the final register of the Green Urbanism Indicators list.

Delphi Survey-Stage 3 (a) -The Preliminary Listing of Indicators

Apart from their experiences and knowledge on the topic, the participants referred to four publications and a set of current journal articles, namely: 1) Green

Urbanism – Learning from European Cities by Timothy Beatley (2000); 2) Green Urbanism Down Under – Learning from Sustainable Communities in Australia (2009); 3) The Principle of Green Urbanism – Transforming the City for Sustainability by Stephan Lehmann (2010, 2015); 4) Green Urbanism in Asia – The Emerging Green Tigers by Peter Newman and Ann Matan (2013); 5) The currently published journals provided by the author in the form of softcopy. Subsequently, the preliminary listing of Indicators after the first round of discussion has identified 72 indicators, as shown in Table 6 for all Key Attributes.

Table 6: Total Number of Parameters, Key Attributes and Indicators for Each Principle

Principle	Parameters	Key Attributes	Preliminary Indicator
Principle 5	4	13	37
Principle 6	3	6	17
Principle 10	2	4	9
Principle 12	2	5	9
Total	11	28	72

Delphi Survey-Stage 3 (b) -Refining the List of Green Urbanism Indicators

Refining the preliminary list of indicators involved a process of 'omission and addition' to identify the best-suited indicators fit for the research and site context. The second round of rigorous discussion and rationalisation has identified 14 overlapping and redundant indicators that can be merged and will not jeopardise the inclusivity and entirety of the final index. Three indicators were amended by re-wording them for easy understanding. The Key Attribute of Historical Dominance was omitted and merged with the Historical Element, and one Key Attribute (Identity) with Indicator (Showcase Distinct Image and Identity) was added.

Delphi Survey-Stage 3 (c) -The Final List of Green Urbanism Indicators

All participants have reached a consensus on the agreement for an amended list of 58 Indicators. Table 7 below displays the list of indicators for each key attribute, such as the Stage 3 Delphi Survey outcome.

Table 7: The Final List of Principles, Parameters, Key Attributes and Indicators

PRINCIPLE 5: LANDSCAPE, GARDENS AND BIODIVERSITY		
Parameter	**Key Attribute**	**Indicator**
1- Urban Cooling	a) Presence of urban vegetation	1) Functional trees -street planting
		2) Aesthetic & display– palms/shrubberies
	b) Inner-city Garden	3) Pocket park/vertical garden/linear garden/display garden
		4) Mix users and activities
		5) Social interaction and community activities
	c) Urban farming	6) Plot land/bedded/potted
	d) Building greenery	7) Green roof and balcony
2- Integrated urban landscape	a) Urban landscape	8) Image/identity creation
		9) Coverage (continuous throughout the city)
	b) Accessibility to parks, gardens & public spaces	10) Access legibility
		11) Sense of direction (notice board, direction signs, visual linkage)
		12) Connection to public transport
		13) Easy access for pedestrian (connection with primary/secondary roads)
		14) Easy access vehicle (connection with primary/secondary roads/parking)
	c) Leisure & recreation	15) Recreational park -Relaxation/Strolling -Exercise and Jogging
3- Local Biodiversity	a) Habitat	16) Presence of wildlife
		17) Presence of urban wildlife (crows, pigeon, stray cats & dogs)
	b) Ecology	18) Presence of urban peri-landscape
		19) Presence of native vegetation
		20) Inclusion of natural resources in urban development (trees, rivers and wildlife)
	c) Forest Conservation	21) Presence of urban forest
4- Conserving Natural Resources	a) Restoring Streams	22) Reintroducing streams and rivers in the city
		23) Maintenance and management of streams and rivers
	b) Re-establishing Riverbanks	24) Reinstating uses and function of riverbanks
		25) Presence of recreational activities along the river
		26) Presence of community involvement/activities along the riverbanks

.

PRINCIPLE 6: SUSTAINABLE TRANSPORT AND GOOD PUBLIC SPACE COMPACT AND POLY - CENTRIC CITIES		
Parameter	**Key Attribute**	**Indicator**
5- Sustainable Transport System	a) Integrated non-motorised transport (cycling/walking)	27) Presence of pedestrian walkways network
		28) Assigned walkways/Paved or Unpaved path
		29) Availability of cycling lanes and Facilities
		30) Safe pedestrian ways
		31) Safe bicycle ways
	b) Pedestrian Network and Connectivity	32) Integrated public and private transport system
		33) Centralised parking spaces (park and ride)
		34) Availability & close proximity of public transport stations/stops along pedestrian routes
6- Good Public Space Network	a) Pleasant public spaces	35) Good legibility and accessibility
		36) Presence of social interaction and community activities
	b) Pedestrian Network and Connectivity	37) Connected pedestrian network
		38) Streetscape that encourage healthy and active life
7- Compact and polycentric city	c) Land uses	39) Close proximity to residential areas
		40) Mix development / land use (residential and business)
	d) Diversity	41) Diverse business types

.

PRINCIPLE 10: LIVEABILITY, HEALTHY COMMUNITIES AND MIXED-USE PROGRAMMES		
Parameter	**Key Attribute**	**Indicator**
8- Liveability	a) Housing range and users	42) Mixed users - social status (based on housing type)
		43) Mixed users – age, race, workers/students (city campus)
	b) Sense of community	44) Compact housing and communities
		45) Connected housing areas
9- Healthy community & Mixed-use programmes	a) Amenities and facilities	46) Integrated housing amenities and facilities
		47) Community centres
	b) Healthy communities	48) Facilities for healthy lifestyles
		49) Recreational areas and facilities
		50) Social spaces

.

PRINCIPLE 12: CULTURAL HERITAGES, IDENTITY AND SENSE OF PLACE		
Parameter	**Key Attribute**	**Indicator**
10- Cultural Heritage	a) Local culture	51) Cultural significant/values (day to day activity/story)
	b) Heritage	52) Heritage values (areas/buildings/structures/activity)
11- Identity & Sense of place	a) Historical elements	53) Local based history
		54) Foreign influences history
		55) Historical significant structures/artefacts)
	b) Identity	56) Showcase distant image and identity
	c) Spiritual presence	57) Religious based
		58) Cultural and race based

Validation of the Final List of Indicators

Two validators, who were senior academics from distinct local public universities, were assigned to assess and validate the finalised set of indicators. Each validator independently reviewed the completed list and then ranked them based on their relevancy. The ranking ranges from '1' = very low to '5' = very high. The results of the relevancy ranking were then calculated and analysed using the Cohen Kappa Coefficient (k) in SPSS to measure inter-rater agreement between the two validators. Cohen Kappa's analysis is very comprehensive in analysing the inter-rater coefficient or agreement between two raters (Koo, Guhathakurta, & Botchwey, 2022) as it omitted chances (Li, Gao, & Yu, 2023). Table 8 below displays the Level of Agreement between the two validators, which indicates a very high level of agreement.

Table 8: Level of Agreement Between Two Validators

Validator 2 * Validator 1 Crosstabulation						
			Validator 1			*Total*
			Moderate	*High*	*Very High*	
Validator 2	*Moderate*	*Count*	2	0	0	2
		Expected Count	.1	.3	1.7	2.0
		% within Validator 2	100.0%	0.0%	0.0%	100.0%
		% within Validator 1	100.0%	0.0%	0.0%	3.4%
		% of Total	3.4%	0.0%	0.0%	3.4%
	High	*Count*	0	8	3	11
		Expected Count	.4	1.5	9.1	11.0
		% within Validator 2	0.0%	72.7%	27.3%	100.0%
		% within Validator 1	0.0%	100.0%	6.3%	19.0%
		% of Total	0.0%	13.8%	5.2%	19.0%
	Ver	*Count*	0	0	45	45
		Expected Count	1.6	6.2	37.2	45.0
		% within Validator 2	0.0%	0.0%	100.0%	100.0%

Validator 2 * Validator 1 Crosstabulation					
		Validator 1			*Total*
		Moderate	*High*	*Very High*	
y H i g h	*% within Validator 1*	0.0%	0.0%	93.8%	77.6%
	% of Total	0.0%	0.0%	77.6%	77.6%
Total	*Count*	2	8	48	58
	Expected Count	2.0	8.0	48.0	58.0
	% within Validator 2	3.4%	13.8%	82.8%	100.0%
	% within Validator 1	100.0%	100.0%	100.0%	100.0%
	% of Total	3.4%	13.8%	82.8%	100.0%

Both validators agreed that 45 out of 58 indicators as very high relevancy, which is higher than the expected count value (by change value) of 37.2; eight indicators were found to have high relevancy, and two were moderate, higher than the expected count of 1.5 and 0.1, respectively.

Table 9: The Kappa Value for the Level of Agreement Between the Two Validators

Symmetric Measures					
		Value	*Asymptotic Standard Error* [a]	*Approximate T* [b]	*Approximate Significance*
Measure of Agreement	*Kappa*	.844	.088	7.537	.000
N of Valid Cases		58			

[a]. Not assuming the null hypothesis.
[b]. Using the asymptotic standard error assuming the null hypothesis.

The Kappa value is 0.844 or (84.4%) with a standard error of 0.088. Table 9 above, indicates the Level of Agreement beyond chance is **Almost Perfect Agreement** with a statistical significance value of 0.000, indicating that it is highly significant (as the interpretation of the Kappa value).

Accordingly, the list of indicators as selected by the participants has been validated with Kappa Value of 'Almost Perfect Agreement' and with a high significance Level of Relevancy related to i) the purpose of the research, ii) the validity of the list of indicators, and iii) the site context. Therefore, as in Table 7 above, the list of indicators was validated and accepted as the Green Urbanism Walkability Index (GUWI) as a tool to measure urban walkability in secondary cities.

CONCLUSION

The study highlights the correlation between Green Urbanism Principles (GUP) and urban walkability. It begins with a Literature Investigation to identify green

urbanism components and principles. Three-stage Delphi Surveys were conducted to conclude the associated GUP, parameters, potential indicators, and themes of Green Urbanism Quality with urban walkability. The outcome is the validated Green Urbanism Walkability Index (GUWI). Thus, the research emphasises the need for a quality urban environment that stimulates walking in Malaysia. Four main themes of Green Urbanism Quality, namely Nature, Urbanism, Liveability, and Culture and Identity, significantly promote urban walkability. A walkable city triggers positive effects such as lively street-level activities, increased security, and economic stability. Landscapes, greeneries, and well-integrated pedestrian networks further enhance walkability. This research contributes significantly to the body of walkability studies, particularly in the Malaysian context.

ACKNOWLEDGEMENT

This research has been made possible with funding from the Ministry of Malaysian Higher Education and Universiti Teknologi MARA (UiTM).

REFERENCES

Beatley, T. (2001). Green Urbanism: Learning from European Cities. Canada: Island press.

Beatley, T., & Newman, P. (2009). *Green Urbanism Down Under: Learning from Sustainable Communities in Australia*. Washington DC: Island Press.

Beatley, T., & Newman, P. (2013). Biophilic cities are sustainable, resilient cities. *Sustainability (Switzerland)*, *5*(8), 3328–3345.

Department of Statistics Malaysia-Kedah. (2020). *Statistik kedah 2020*. Alor Setar.

Department of Statistics Malaysia. (2018). *Malaysia at a Glance*. Retrieved from https://www.dosm.gov.my

Jamin, T. I. A. T. M., Mohmad Shukri, S., Taib, I., & A M R, A. (2021). Revitalizing Malay Royal Town: A Case Study in Alor Setar Kedah. *Malaysia Architectural Journal*, *3*(3), 1–8. Retrieved from https://www.researchgate.net/publication/357912409

Koo, B. W., Guhathakurta, S., & Botchwey, N. (2022). Development and validation of automated microscale walkability audit method. *Health & Place*, *73*(January).

Lehmann, S. (2010). *The principles of green urbanism: Transforming the city for sustainability* (1st ed.). London: Earthscan.

Lehmann, S. (2013). Transforming the city with sustainable design | Opinion | Eco-Business | Asia Pacific. Retrieved February 18, 2016, from http://www.eco-business.com/opinion/transforming-city-sustainable-design/

Li, M., Gao, Q., & Yu, T. (2023). Kappa statistic considerations in evaluating inter-rater reliability between two raters: which, when and context matters. *BMC Cancer*, *23*(1), 1–5. https://doi.org/10.1186/s12885-023-11325-z

MBAS. (2022). Misi dan Visi Alor Setar. Retrieved May 10, 2024, from http://www.mbas.gov.my/ms/mas/profil/misi-visi

Moses Lomoro, A. B., Guogping, X., & John Ladu, L. C. (2017). Causes and

consequences of rural-urban migration: The case of Juba Metropolitan, Republic of South Sudan C. *IOP Conference Series: Earth and Environmental Science*, *81*(102130), 9.

Rhodes, R. E., Cox, A., & Sayar, R. (2022). What Predicts the Physical Activity Intention-Behavior Gap a Systematic Review. *Annals of Behavioral Medicine*, *56*(1), pp1–20. https://doi.org/10.1093/abm/kaab044

Samsudin, N. A., Rosley, M. S. F., Lai L. Y., Omar, S. R., Rashid, M. F., Mohd Hanifi, N. N. & Bakhtiar, I. S. (2022). A Comparative Study of Smart City Initiatives in Malaysia: Puterajaya and Iskandar Puteri. *Planning Malaysia Journal.* 20(5), pp14-28

The Economic Planning Unit (Malaysia). (2023). *Rancangan Malaysia Kesebelas (Eleventh Malaysia Plan) : 2016-2020*. *Economic Planning Unit, Prime Minister's Department*. Kuala Lumpur, Malaysia. Retrieved from http://rmk11.epu.gov.my/book/eng/Elevent-Malaysia-Plan/RMKe-11 Book.pdf

World Economic Forum. (2023). *The Global Risks Report 2023* (18th Editi). Geneva: World Economic Forum.

Received: 30th June 2024. Accepted: 10th September 2024

PLANNING MALAYSIA:
Journal of the Malaysian Institute of Planners
VOLUME 22 ISSUE 5 (2024), Page 321 – 331

ASSESSING FEDERAL ROAD SAFETY CORPS (FRSC) IMPACT ON EASING TRAFFIC CONGESTION ALONG THE ILESA-BENIN HIGHWAY AT AKURE, ONDO STATE, NIGERIA: EDUCATION, ENFORCEMENT, AND PATROL EFFICIENCY

Omotayo Fatai Ogunyemi[1], Diana Binti Mohamad[2], Nurwati Badarulzaman[3], Abdul Ghapar Othman[4]

[1,2,3,4]*School of Housing, Building, and Planning,*
UNIVERSITI SAINS MALAYSIA

Abstract

This study evaluates the efficacy of the Federal Road Safety Corps (FRSC) in mitigating traffic congestion along the Ilesa-Benin Highway in Akure, Ondo State, Nigeria. It scrutinizes the efficiency of FRSC's education, patrol, and enforcement strategies to discern their impact on traffic congestion levels. The data were collected from primary sources via questionnaires and activity-based trip surveys, supplemented by secondary sources including satellite imagery and literature. The results revealed high internal consistency in the respondents' perceptions and no evidence of multicollinearity in the dataset. It also indicates the significant contributions of education and enforcement in reducing traffic congestion, contrary to the limited effectiveness of patrols. Among the recommendations include prioritizing improvements in education and enforcement efforts through enhanced training programs and community collaborations as well as re-evaluating and potentially restructuring patrol activities. These insights offer valuable guidance for policymakers and stakeholders in devising strategies to alleviate traffic congestion and enhance road safety on critical highway routes like the Ilesa-Benin Highway.

Keywords: Education, Enforcement, Patrol, Highways, Traffic Congestion, Federal Road Safety Corps

[2] Lecturer at USM. Email: diana_mohamad@usm.my

INTRODUCTION

The establishment of the Federal Road Safety Corps (FRSC) through Decree No. 45 of 1988—later amended by Decree 35 in 1992, codified under the FRSC Act (CAP 141) of the Laws of the Federation of Nigeria 1990, and reenacted as the FRSC (Establishment) Act 2007—epitomizes an initiative aligned with the principles of good governance. This legislative action was pivotal given the severe issues of traffic law violations and congestion on Nigerian roads before 1988, a situation underscored by various historical accounts. For example, Maduagwu (1998) reported widespread disregard for traffic laws among Nigerian drivers, including ignoring speed limits and traffic signals, reckless overtaking, and haphazard parking, often compromising the safety of other road users. These behaviors contribute to a general state of disorder and unpredictability on the roads, coupled with a public disinterest in road safety and inconsistent policy approaches to managing road safety concerns (FRSC, 2020).

This study assesses the effectiveness of the Federal Road Safety Corps (FRSC) in reducing traffic congestion on the Ilesa-Benin Highway in Akure, Ondo State, Nigeria. It focuses on FRSC's education, patrol, and enforcement (which involves the power to arrest and prosecute) efficiency. The main objectives are (i) to assess the effectiveness of FRSC in reducing traffic congestion on the Ilesa-Benin Highway and (ii) to identify the relationship between FRSC's operational activities (education, enforcement, and patrol) efficiency on traffic congestion levels. The outcome of this paper will determine how FRSC's operational activities relate to traffic congestion levels and which operational characteristics significantly impact congestion on the highway.

LITERATURE REVIEW

Federal Road Safety Corps (FRSC)

The FRSC (Establishment) Act of 2007 grants power and responsibility to FRSC for enforcing traffic laws, promoting road safety education, and ensuring vehicle compliance. Traffic congestion along the Ilesa-Benin Highway in Akure, Ondo State, is symptomatic of multiple underlying issues, including poor traffic management, unsafe road infrastructure, human errors, deteriorating vehicle conditions, and a general non-adherence to traffic laws. These issues are further exacerbated by inadequate enforcement measures (Filibus, 2012; Alade, 2012; Raji, 2014; Stephens et al., 2015; Agyapong & Ojo, 2018; Ajiboye et al., 2020). It subsequently questions the effectiveness of FRSC in alleviating traffic congestion, particularly considering the continued traffic bottlenecks along the Ilesa-Benin Highway.

The literature also suggests that enhancements in traffic management might require a fortified legislative framework, better harmonization of traffic laws across various states, the establishment of stringent penalties for traffic

violations, and more rigorous enforcement protocols. Atubi (2012) postulates that the enhancement of traffic patrols, alongside the development of well-planned road networks and effective transport strategies, could significantly diminish road traffic congestion. A pertinent role of FRSC is to educate road users, especially drivers, on the importance of road discipline and the correct use of roads and highways. Purwoko et al. (2022) reported that the most common modes of transportation for round-trip commutes are private vehicles (73%) and public transit (27%). Considering the crucial role of mass public transportation in alleviating congestion and promoting eco-friendly transit, it is crucial to examine the FRSC's public enlightenment unit, which is primarily responsible for conducting this educational mandate under the authority granted by the 2007 Act.

Theoretical Framework (Social Judgment Theory)

This study is grounded on the Social Judgment Theory, which was first proposed by Muzafer Sherif, Carolyn Sherif, and Carl Hovland in 1961. The theory suggests that the effectiveness of a persuasive message on a specific issue depends on how the recipient evaluates the message's position (Smith et al., 2006, as cited in Asemah & Nkwam-Uwaoma, 2017). It asserts that individuals gauge message content based on their existing attitudes or viewpoints (Sherif & Hovland, 1961; Sherif, 1965, as cited in Yaroson & Asemah, 2008; Asemah, 2011; Asemah et al., 2017). As the primary objective of persuasive communication is to induce attitude change, the Social Judgment Theory aims to identify the conditions that facilitate this change while predicting its direction and extent (Asemah, Nwammuo, & Nkwam-Uwaoma, 2017, as cited in Amah, Oladele, & Asemah 2022).

According to the Social Judgment Theory, audience members often interpret and evaluate a message before forming their positions. It delves into the internal cognitive processes guiding an individual's judgment in response to a communicated message (Amah, Oladele, & Asemah 2022). The relevance of this theory to the present study lies in its ability to elucidate the impact of educational campaigns on the extent of attitudinal shifts among motorists along the Ilesa-Benin Highway in Akure, Ondo State, which is contingent upon consumers' perceived judgments.

RESEARCH METHODOLOGY

The data for this study were collected from both primary and secondary sources. Primary data involved administering 203 questionnaires to gauge the respondents' perceptions of FRSC's efficiency in reducing traffic congestion on the Ilesa-Benin Highway and analyzed through regression analysis. Cronbach’s Alpha was used to assess internal consistency reliabilities, yielding high scores: 0.86 for Education, 0.88 for Enforcement, 0.78 for Patrol, and 0.72 for traffic congestion,

indicating strong internal consistency. Multicollinearity was absent in the dataset as indicated by the value inflation factors (VIF). Additionally, an activity-based trip survey of the study area provided on-site road traffic congestion data. Secondary data included Google Earth satellite imagery of the study area and relevant literature. The results and findings are presented and discussed in the subsequent sections.

STUDY AREA LOCATION AND SIZE

Since assuming the role of the administrative capital of Ondo State, Akure's population has increased substantially from around 71,106 in 1963 to 691,000 as of 2021, marking a 3.75% rise from the previous year (Owoeye et al., 2021; UN et al., 2022). Land use in the study area comprises built-up areas, dense and sparse vegetation, alongside aquatic bodies. The Ilesa-Benin Highway in Akure, Ondo State, Nigeria serves as the focus of this research due to frequent traffic congestion (Ajayi et al., 2019). The highway is a crucial transportation hub for the state and experiences heavy traffic congestion daily, which is attributed to factors such as inadequate road infrastructure and indiscriminate parking by roadside traders, leading to travel delays and reduced road capacity (Ajayi et al., 2019). Figure 1 shows the locational map of Ondo State in Nigeria and its 18 Local Government Areas.

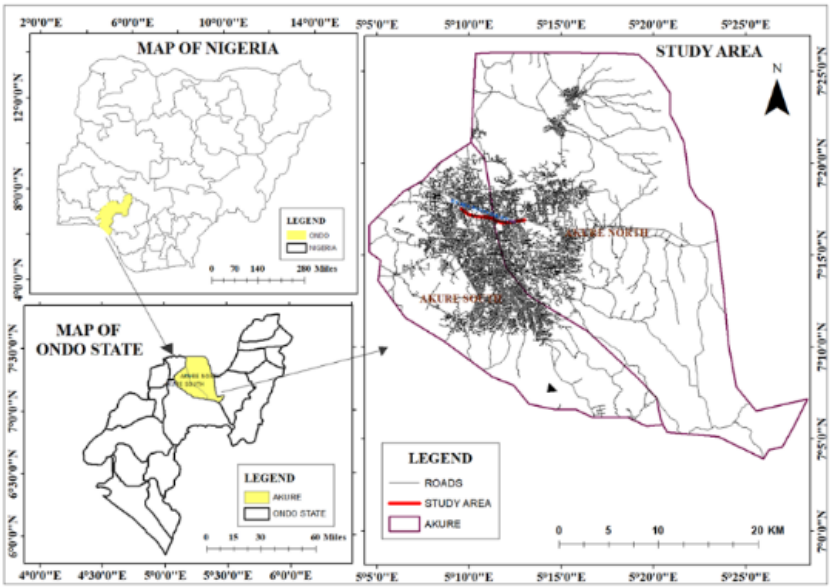


Figure 1: Locational map of the study area in the regional setting and the 18 Local Government Areas.
(Source: - ArcGIS Studio work 2023)

Background Information and Site Visit

Figures 2 and 3 show pictorial evidence of recent traffic congestion situations along the Ilesa-Benin Highway of Akure.

Figure 2: Traffic congestion along the Ilesa-Benin Highway.
(Source: On-site visit, 2023)

Figure 3: Traffic congestion along the Ilesa-Benin Highway.
(Source: On-site visit, 2023)

ANALYSIS AND DISCUSSION

Assessing the effectiveness of FRSC on the Ilesa-Benin Highway in Akure

Table 1 delineates the efficacy levels of FRSC's operational characteristics along the Ilesa-Benin Highway at Akure, Ondo State, Nigeria. The analysis focuses on three distinct variables: Education, Patrol, and Enforcement, with the latter involves the power to arrest and prosecute. Each variable is stratified into five tiers of efficacy, ranging from Very Low to Very High.

Concerning the Education variable, many of the respondents manifested Low (38.9%) and Moderate (34.0%) predominant perceptions, with a

concurrent prevalence of Very Low (21.2%). A minor portion of them perceived the variable as having High (3.4%) or Very High (2.5%) prominence. In terms of Patrols, a substantial portion of the respondents perceived High (28.6%), Moderate (25.1%), and Low (23.6%) efficacy levels. It was followed by smaller contingents of Very Low (8.4%) or Very High (14.3%). Notably, a broader distribution is evident, primarily emphasizing the perceptions of heightened efficacy. This is indicative of a relatively elevated operational efficiency in executing their power over offenders. Regarding Enforcement, the prevalent perceptions centered around Low (30.0%) and Very Low (32.0%), followed by Moderate (24.1%). A limited proportion of the respondents categorized it as High (12.3%) or Very High (1.5%).

Such data implicate potential areas for enhancement across all three operational characteristics of FRSC, particularly in Education and Enforcement. Predominant perceptions depict these aspects operating at Low or Moderate efficacy levels, suggesting a requisite for augmentation to bolster road traffic congestion outcomes.

Moreover, a prevailing sentiment among the respondents underscores perceived inadequacies, especially in Education and Enforcement, for mitigating traffic congestion issues along the highway. This subsequently emphasizes the necessity for remedial actions. However, it is worthy to highlight that Patrols evinced relatively higher perceived efficacy, with a significant number of respondents attributing it to High or Moderate efficacy levels.

Table 1 Level of efficiency of the Federal Road Safety Corps (FRSC) operational characteristics

Variables		Frequency	Percentage	Cumulative Percentage
Education	Very Low	43	21.2	21.2
	Low	79	38.9	60.1
	Moderate	69	34.0	94.1
	High	7	3.4	97.5
	Very High	5	2.5	100.0
Patrols	Very Low	17	8.4	8.4
	Low	48	23.6	32.0
	Moderate	51	25.1	57.1
	High	58	28.6	85.7
	Very High	29	14.3	100.0
Enforcement	Very Low	65	32.0	32.0
	Low	61	30.0	62.1
	Moderate	49	24.1	86.2
	High	25	12.3	98.5
	Very High	3	1.5	100.0

(Source: Author's calculation)

Identifying the relationship between FRSC's operational activities and traffic congestion levels on the Ilesa-Benin Highway

A multiple linear regression analysis was conducted to further investigate the effectiveness of these specific operational activities conducted by FRSC in curbing traffic congestion along the Ilesa-Benin Highway in Akure, Ondo State, Nigeria. The three key strategies employed by FRSC were Education, and Patrols. By examining the relationships between these independent variables and the dependent variable (i.e., traffic congestion), this study hopes to assess the effectiveness of these three key strategies employed by FRSC in managing traffic flow and improving road traffic congestion.

Hypotheses and Results of the Multiple Linear Regression Analysis

Table 2 depicts the multiple linear regression analysis of FRSC's operational activities and traffic congestion levels. The hypotheses suggest that the initiatives undertaken by FRSC have not yielded tangible improvements in traffic flow and congestion levels, thereby validating the efficacy of their interventions. These hypotheses were analyzed at 95% confidence intervals. The analysis showed a significant model summary: $F_{(1, 2)} = 8.47$, $P < .000$, Adj $R^2 = 0.16$, and $R^2 = 0.18$.

The hypotheses central to this exploration are as follows:

- Hypothesis 1 (Education)
  H0: There exists no significant reduction in traffic congestion following the implementation of education measures by the Federal Road Safety Corps (FRSC). However, the regression analysis found that Education had a significant effect on reducing traffic congestion along the highway ($\beta = -0.17$, $t = -2.42$, $P < 0.010$). Therefore, H0 is rejected, indicating that education measures implemented by FRSC led to a significant reduction in traffic congestion.
- Hypothesis 2 (Patrols)
  H0: There is no significant decrease in traffic congestion resulting from the execution of patrols by the Federal Road Safety Corps (FRSC). Affirmatively, the regression analysis showed that Patrols had no significant effect on reducing traffic congestion along the highway ($\beta = 0.114$, $t = 1.70$, $P > 0.092$). Therefore, H0 is accepted, indicating that there was no significant decrease in traffic congestion resulting from the execution of patrols by FRSC.
- Hypothesis 3 (Enforcement)
  H0: There is no notable decrease in traffic congestion after the enactment of enforcement measures by the Federal Road Safety Corps (FRSC). The regression analysis revealed that Enforcement had a significant effect on

reducing traffic congestion along the highway (β = -0.246, t = -3.515, P < 0.001). Hence, H0 is rejected, suggesting that enforcement measures implemented by FRSC led to a notable decrease in traffic congestion.

Table 2: Multiple Linear Regression Analysis of FRSC's operational activities and traffic congestion levels

Model Summary

Model	R Square	Adjusted R Square	Change Statistics	
			F Change	Sig. F Change
1	.177	.156	8.467	.000

a. Predictors: (Constant), Education, Patrols, Enforcement, Gender, Age
b. P = 0.05

(Source: Author's calculation)

Coefficients[a]

Model		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		Beta			Tolerance	VIF
1	(Constant)		8.017	.000		
	Age	-.112	-1.655	.099	.910	1.099
	Gender	-.172	-2.602	.010	.961	1.041
	Education	-.170	-2.417	.017	.849	1.178
	Patrols	-.246	-3.515	.001	.850	1.176
	Enforcement	.114	1.692	.092	.927	1.079

a. Dependent Variable: Traffic congestion along the Highway
b. P = 0.05

(Source: Author's calculation)

DISCUSSIONS

The study evaluated FRSC's effectiveness in reducing traffic congestion on the Ilesa-Benin Highway by examining the impact of its operational activities. Previous studies have emphasized on the importance of law enforcement, collaboration, and education campaigns to reduce traffic congestion (Sumaila, 2013) alongside the need for adequate equipment and optimal operations (Gana & Emmanuel, 2014). Our findings highlighted deficiencies in education and enforcement, which are aligned with the Social Judgment Theory. This is also supported by Asemah, Nwammuo, and Nkwam-Uwaoma (2017, as cited in

Amah, Oladele, & Asemah, 2022) who emphasize that persuasive communication aims to alter attitudes.

Hypothesis 1 indicated a notable decrease in congestion due to FRSC's education program. Such result is consistent with earlier studies by Onuka and Akinyemi (2012) and Okafor et al. (2014) whereby enforcement significantly reduces congestion. It also resonates with the study by Hills (2008) on traffic safety regulations. However, the patrols by FRSC did not notably decrease congestion, which echoes the observations of widespread traffic violations by Chidoka (2009) and FRSC (2012). The study's focus on traffic congestion along the Ilesa-Benin Highway in Akure also reflects the experiences and perceptions of individuals in the area.

CONCLUSION

This research sheds light on the effectiveness of the Federal Road Safety Corps (FRSC) in managing traffic congestion along the Ilesa-Benin Highway. It underscores the importance of addressing deficiencies in the FRSC's service delivery to enhance traffic flow. The findings suggest that while education and enforcement measures are proven effective in reducing traffic congestion, patrolling measures yield no significant improvements. These insights offer crucial guidance for policymakers and stakeholders in developing strategies to reduce traffic congestion and enhance road safety on this critical highway, which has long suffered from persistent congestion. Our respondents also denoted poor road infrastructure, commercial activities, the proximity of junctions, and high volume of vehicles as the main contributors to traffic congestion. This aligns with Ogunyemi et al. (2021) who found that delays at road junctions exacerbate extended travel times. Based on the findings, it is recommended for FRSC to prioritize initiatives aimed at improving the effectiveness of education and enforcement efforts. This involves enhancing training programs, fostering collaborations with communities, and implementing comprehensive public awareness campaigns. Additionally, further evaluation and potential restructuring of patrol activities are necessary to better align with traffic management objectives. By addressing these areas of concern, stakeholders can work towards reducing traffic congestion on the Ilesa-Benin Highway and similar routes across Nigeria.

ACKNOWLEDGEMENT

The authors wish to thank the publication funding from the Fundamental Research Grant Scheme (203/PPBGN/6711707) (Grant No: FRGS/1/2022/SSI02 /USM/03/1).

REFERENCES

Amah, F. O., Oladele, O. P., & Asemah, P. E. S (2022). *Influence of Federal Road Safety Corps (FRSC) Ember Months' Campaign on Motorists in Benin City, Nigeria*. 118 GVU Journal of Communication Studies, Vol. 5; https: journals.sau.edu.ng/index.php/sjmas

Asemah, E.S., Nwammuo, A.N. & Nkwam-Uwaoma, A. O. A. (2017). Theories and models of communication. Jos: Jos University Press.

Agyapong F. and Ojo T. (2018). Managing traffic congestion in the Accra central market, Ghana. *Journal of Urban Management, 7*(2018), 85–96.

Ajayi, O.; Bagula, A.; Isafiade, O.; Noutouglo, A (2019). Effective Management of Delays at Road Intersections Using Smart Traffic Light System. In Proceedings of the International Conference on e-Infrastructure and e- Services for Developing Countries, Porto-Novo, Benin, 3–4 December. Springer: Cham, Switzerland, 2019; pp. 84–103.

Ajiboye A.O., Kolawole O.J., and Adebanjo A.A (2020): Assessment of Statutory Duties of the Federal Road Safety Corps at Reducing Crashes and Carnages in Ibadan, South-western Nigeria. *Journal of Art, Architecture, and Built Environment (JAABE), 3*(2), 01-17.

Atubi A.O. (2012). A Monthly Analysis of Road Traffic Accidents in Selected Local Government Areas of Lagos State, Nigeria. *Mediterranean Journal of Social Sciences*, Vol. 3 (11) November 2012. ISSN 2039-9340

Alade W.R. (2012). The roles of vehicle inspection officers in authenticating motor vehicle roadworthiness certification [paper presentation]. The National Conference on Vehicle Road Worthiness Inspection and Testing, Abuja. July 3-4, 2012.

Chidoka, O. (2009). Road Accidents Claim 25,939 Lives. Federal Road Safety Commission Bulletin, 9:40–51.

Federal Road Safety Corps Nigeria. FRSC annual report 2017. https://frsc.gov.ng/wp-content/uploads/2018/09/

Federal Road Safety Commission (FRSC). (2012). A report Road traffic crashes involving buses on Nigerian roads,

Filibus B.E. (2012). The roles of vehicle inspection officers in authenticating motor vehicle roadworthiness certification [paper presentation]. National conference on vehicle road-worthiness inspection and testing, Abuja, July 3-4, 2012.

Gana A.J. and Emmanuel J.A. (2014). Road Transportation and Traffic Law Enforcement in Nigeria: A Case Study of the Federal Road Safety Corps (FRSC). *West African Journal of Industrial and Academic Research, 11*(1), 134– 154.

Maduagwu, M. O. (1998). "Nigerian Cultural Values and Road Traffic Accident: A Cultural Reflection," in Osagie, E. Omidiji. A.A. and Maduagwu, M.O. (eds) Road Safety and Accident Reduction in Nigeria: A Blueprint for the year 2010, Kuru, National Institute Press.

Ogunyemi, F. O., Mohamad, D., Badarulzaman, N., Othman, A. G. (2021). Traffic Congestions, Time Spent at The Expressway Junctions, And Its Impact on Individual Productivity: A Perception Study of Ilesa-Owo-Benin Expressway in

Akure Ondo State, Nigeria. *PLANNING MALAYSIA: Journal of the Malaysian Institute of Planners VOLUME 19* ISSUE 5(2021), Page14–25.

Okafor, I. P., Odeyemi, K. A., Dolapo, D. C., Ilika, A. L. & Omosun, A. O. (2014). Effectiveness of road safety education in Nigeria using a quasi- experimental trial: Findings from the Road Safety Intervention Project. *Africans Journals Online,12*(1), 1–10.

Onuka, A.O. & Akinyemi, T. F. (2012). The effectiveness of FRSC public education program on drivers' road traffic habits in Lagos and Oyo states of Nigeria. *British Journal of Arts and Social Sciences, 6*(1), 130-131

Owoeye, S. A., Oyelade, O. J., & Adegbenjo, A. O. (2021). An Assessment of Traffic Congestion and Control Measures in Akure, Nigeria. *Transportation Research Procedia*, 56, 215-222. doi: 10.1016/j.trpro.2021.02.067

Purwoko, B. A., Chotib & Yola, L. (2022). Willingness to Modal Shift from Private to Public Transportation in Jakarta Metropolitan Area; *PLANNING MALAYSIA: Journal of the Malaysian Institute of Planners VOLUME 20* ISSUE 2(2022), Page 22–34.

Raji B.A. (2014). Automobile safety belt usage in Ibadan Metropolis, Ago-Iwoye. *Journal of Social and Behavioural Sciences, 3*(1), 36–54.

Stephens M.S., Ogwude I.C., and Wilfred I.U. (2015): Empirical Analysis of Road Safety Policy Adherence in Nigeria: Seat Belt use. *Risk Governance and Control: Financial Markets and Institution, 5*(4), 233–242.

Received: 18th March 2024. Accepted: 17th August 2024

PLANNING MALAYSIA:
Journal of the Malaysian Institute of Planners
VOLUME 22 ISSUE 5 (2024), Page 332 – 346

INTEGRATING LAND USE ANALYSIS WITH WATER DEMAND ESTIMATION: A CASE STUDY OF PUTRAJAYA, MALAYSIA

Nur Diyana Mohamad[1], Zulfa Hanan Ash'aari[2], Faradiella Mohd Kusin[3], Syafrina Abdul Halim[4]

[1,2,3]*Department of Environment, Faculty of Forestry and Environment,*
UNIVERSITI PUTRA MALAYSIA
[4]*Department of Mathematics, Faculty of Science,*
UNIVERSITI PUTRA MALAYSIA

Abstract

The challenges posed by population growth, urbanization, and changing land use patterns on sustainable water resource management are significant. This paper puts forth an integrated framework aimed at assessing future water demand in Putrajaya, Malaysia. The proposed framework combines population projections, estimations of water demand, and analyses of land use activities. Through an examination of demographic trends and land use patterns, the framework predicts population growth and identifies areas with high water demand. Daily water use patterns in homes and businesses (temporal analysis) inform the designing future water infrastructure, incorporating temporal aspects. Statistical and spatial analysis techniques are then utilized to merge these projections with water demand estimations to quantify water requirements in various zones and types of land use. This study has unveiled two daily peaks in water demand, which align with household schedules. Residential areas emerge as the primary consumers of water, displaying an evening peak distinct from the midday peak seen in businesses. The current water demand in Putrajaya is estimated at 94 million litres per day, with domestic usage surpassing non-domestic usage in a ratio of 3:2. Projections based on future land use plans foresee a 19% increase in demand, underscoring the urgency for proactive water management strategies. Spatial analysis has highlighted residential areas as the main users of water, with demand levels varying throughout the city. By comprehending these temporal and spatial patterns, water authorities can strategically target interventions, optimize infrastructure siting, and forecast future demand trends. These proactive measures are essential for securing a sustainable water future for Putrajaya.

Keywords: Sustainable Water Resource Management, Population Forecasts, Water Demand Estimation, Land Use Activities, Spatial Analysis

[1] PhD Candidate Email: diyanamohas@gmail.com

INTRODUCTION

As a crucial natural resource, water plays a vital role in supporting life (Leitão et al., 2019) and facilitating various economic activities (Santos et al., 2021). The rapid development to meet human needs has led to a constrained and jeopardized supply of clean water (Rashid et al., 2021). Recent years have seen significant factors like climate change, population growth, urbanization, and industrial expansion impacting a rise in water consumption while diminishing available water reserves (Leitão et al., 2019; Pagsuyoin and Santos, 2021). Studies by Hasibuan et al. (2024) have highlighted swift urban development changes in major Southeast Asian cities characterized by population growth, increased building density, and clustering of economic activities. Forecasting water demand is crucial for effective water resource management (Stańczyk et al., 2022). Understanding the interplay between urban water demand, infrastructure, and population forecasts is essential in environmental planning. The accuracy of water demand forecasting depends on true population data, water consumption information, and understanding consumer types, land uses, and socio-economic factors, especially within communities (Azlan et al., 2022; Nigam and Ragi, 2016).

The escalating demand for potable water and the challenges related to water scarcity and diminishing water supply in Putrajaya, Malaysia, are urgent issues that need immediate attention. Changes in land use driven by population and economic growth have had an impact on Malaysia (Mohamad et al., 2023). With forecasts indicating 85% of the population shifting to urban areas and a projected population of 33.8 million by 2040 in Malaysia, an increase in built-up regions is expected (Samat et al., 2020). Despite abundant water resources, Putrajaya's urban transport system predominantly focuses on land-based modes, indirectly contributing to water scarcity through urban development and related activities (Jiang, 2023). Efforts to address water scarcity in Putrajaya include setting standards and exploring alternative water sources such as greywater reuse and wastewater treatment for reuse (Azhar, 2024). Maintaining the ecological balance of wetlands and lakes like Putrajaya Lake is emphasized through integrated water quality monitoring and catchment management practices (Najah et al., 2021). Pollution incidents, caused by substances like brominated flame retardants in water sources like Sungai Buah, have led to water shortages affecting water supply in areas like Putrajaya (Sha'arani et al., 2019). These challenges highlight the need for sustainable water management practices and effective water quality standards to ensure clean water availability amid the growing demands from Putrajaya's population and urban development.

Multiple studies have showcased the successful application of population forecasting, water demand estimation based on land use activities, and temporal and spatial analysis to improve water management in urban areas. For example, Baskoro et al. (2021) developed a system dynamics model for

sustainable water supply strategies in Sentul City, focusing on predicting water supply and demand and analysing policies on wastewater management and rainwater harvesting. This model provided insights into effective water resource planning and allocation. Similarly, Praveena et al. (2019) conducted a study in Putrajaya, Malaysia, focusing on pharmaceutical residues in drinking water, highlighting the importance of analysing water quality parameters to address potential health risks. Additionally, Fazli et al. (2018) utilized spatial similarity-based modelling to predict water quality in Malaysian lakes, demonstrating the value of advanced modelling techniques for sustainable water quality management.

The recent Selangor water crisis, including Putrajaya, underscores the importance of water demand control as part of Economic Scarce Water control (Lim, 2019; Yusof, 2019). Given the diverse activities associated with land use, water supply management in Putrajaya heavily relies on estimating water requirements for all activities (McKinsey and Company, 2009). With a growing population necessitating more space for infrastructure, public facilities, and housing (JPBD, 2016), integrating these approaches enables city planners and water managers to forecast population growth accurately, estimate water demand effectively, and conduct comprehensive temporal and spatial analyses to optimize water allocation strategies, ensuring efficient water distribution and sustainable water management practices.

RESEARCH METHODOLOGY

Study Area

Putrajaya, the federal administrative capital of Malaysia, is characterized by its modern urban setting with a diverse population, varied land utilization, and water usage profiles. Investigating water demand in Putrajaya can yield valuable insights applicable to other urban areas in Malaysia and similar regions globally. Encompassing a land area of 49.3 km^2 divided into eleven precincts, which include residential zones, Putrajaya's structured development offers a controlled setting that helps mitigate potential factors that could influence water demand analysis. Elements such as urban planning regulations, infrastructure growth, and population dynamics can be more readily managed in a meticulously planned city like Putrajaya. Furthermore, Putrajaya is expected to possess abundant and detailed data on water consumption, population demographics, land usage, and infrastructure, which can greatly aid in conducting precise analyses and modelling of water demand trends.

Water consumption in Putrajaya is categorized into two main segments: domestic and non-domestic (Ryan, 2014). In the context of this study, "domestic water use" encompasses the consumption of water for household purposes, both indoors and outdoors, such as drinking, cooking, cleaning, bathing, laundry, and watering plants and gardens. On the other hand, "non-domestic consumption"

pertains to water usage in commercial, industrial, and public settings like shops, offices, hospitals, and schools. Industrial water consumption is influenced by production processes and technological resources, typically quantified in litres per unit of raw material or product (Anang et al., 2019). The specific details related to the study area for both domestic and non-domestic sectors in Putrajaya are outlined in Table 1.

Table 1: Description of the study area

Precinct	Type of premises/buildings
Precinct 1	Government office (main), mall, complex, school, mosque, business centre, hotel, restaurant, cooling plant
Precinct 2	Government office, business centre, cooling plant
Precinct 3	Government office, business centre, mosque, , cooling plant
Precinct 4	Government office, business centre, restaurant
Precinct 5	Residential, government office, school, hall, cooling plant
Precinct 6	Residential, government office, sports complex
Precinct 7	Government office, business centre, hospital
Precinct 8	Residential, government office, school, business centre, wet market, restaurant, petrol station, library, hall, complex
Precinct 9	Residential, government office, school, business centre, restaurant, petrol station, hall/complex
Precinct 10	Residential, government office, hall, complex
Precinct 11	Residential, government office, school, restaurant, petrol station, clinic, hall/complex
Precinct 12	Residential, construction sites
Precinct 13	Corporate office, wetland
Precinct 14	Residential, government office, school, complex
Precinct 15	Residential, government office, school, business centre, restaurant, hall/complex
Precinct 16	Residential, government office, school, business centre, restaurant, petrol station, hall/complex, wet market, sports facility
Precinct 17	Residential, school
Precinct 18	Residential, government office, school, business centre, restaurant, petrol station, hall/complex, futsal complex
Precinct 19	Corporate office, water treatment plant
Precinct 20	Corporate office, place of worship, cemetery

Population Forecasting Methods

Designing a water supply network to fulfill water demand relies on projected population figures for a specific city or town for the design timeframe. If this figure is underestimated, the system may be inadequate, whereas overestimation can lead to unnecessary costs. Population dynamics in a city change over time due to various factors like births, deaths, migration, and annexation, necessitating the need for the system design to consider the projected population at the end of the design period (Anisha et al., 2016). Influential factors on population changes include increases from births, decreases from deaths, variations due to migration,

and changes from annexation (Mekonnen, 2018). Various methods of population forecasting are utilized to perform comparative analyses to predict population trends in Putrajaya City.

1. Arithmetic Increase Method

The Arithmetic Increase Method is a straightforward way of predicting population trends, even though it tends to provide conservative estimates. This method assumes a consistent population growth rate from one decade to the next. The average population increase per decade is calculated by analysing census data from previous decades. This average increment is then projected forward by adding it to each successive decade's population projection. The formula to calculate the future population (Pn) after n decades is as follows:

$$Pn=P+nI \quad \ldots\ldots (1)$$

where Pn is the future population at the end of *n* decades from present, P is the present population, and I is the average increment for a decade.

2. Geometric Increase Method

The Geometric Increase Method involves assuming a consistent percentage growth in the population from one decade to the next. By analysing population data from previous decades, the percentage increase in population is calculated and averaged. If IG represents the geometric mean percentage, the formula to calculate the population (Pn) after n decades from now is as follows:

$$Pn=P(1+(IG/100))n \quad \ldots\ldots (2)$$

3. Exponential Growth Method

The Exponential Growth Method involves projecting population growth based on an exponential function, which signifies rapid growth over time. This method assumes that population growth continuously accelerates rather than remaining constant. It is particularly useful for modelling scenarios where growth rates increase over time, such as in developing cities or regions experiencing rapid urbanization. To forecast population growth, you need to know its growth rate by having at least two population estimates for different time points. Extending the model to cover longer time frames involves using linear regression, where the natural logarithm of the population size is regressed against time.

$$P(t+n) = P(t) \times ern \quad \ldots\ldots (3)$$

where r is the constant annual growth rate,

$$r = \log e(P(t+n)/P(t))/n \quad \ldots\ldots (4)$$

Water Demand Estimation

According to Malaysia's National Water Service Commissions (SPAN, 2018) uniform technical guidelines, the water supply requirements for development

need to be specified in terms of total daily demands. These demands are typically determined by evaluating submitted layout plans, the proposed types of physical developments, and the unit rates of demand for various types of premises. In this study, the estimation of water demand was based on the guidelines provided by SPAN (2018).

Spatial Analysis Using Geographical Information System (GIS)

The spatial analysis employed in this study utilizes Geographical Information System (GIS) to merge spatial data (base map) with non-spatial data (land use data). Spatial overlays and interpolation techniques are utilized to analyse and estimate water demand across the study area. This analysis was carried out through two main approaches: area-based methods (zoning with land use data) or point-based methods (using demand data with land use activities). The resulting outputs include spatial demand maps that inform water management strategies such as infrastructure planning, leakage detection, and targeted water conservation efforts. Figure 1 illustrates the overall flowchart involved in this study.

Research Flowchart

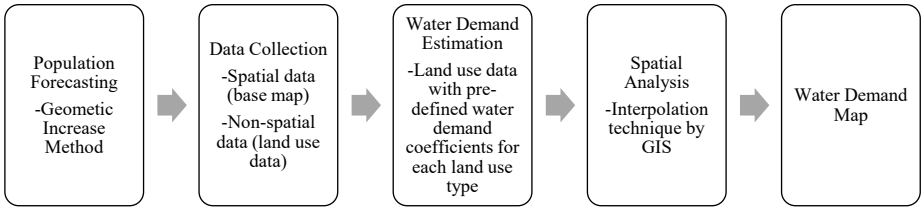


Figure 1: Overview of the flowchart of this study

ANALYSIS AND DISCUSSION

Population Growth Projection

The population of Putrajaya city was estimated using the latest census data provided by the Department of Statistics Malaysia (DOSM, 2024) in 2020 and projected for the next three decades up to the year 2050. Upon assessing all three methods, the Geometric Increase Method emerged as the most appropriate approach for this study. Moreover, the Geometric Increase Method works best in developing cities or towns where population increase is proportionate to the current population growth (Gawatre et al., 2016).

Table 2 and Figure 1 present the current and projected population growth figures for Putrajaya city, indicating a growth rate of 3.84 percent per year and an expected percentage change of 49 percent per decade. Consequently, the projected population by the conclusion of the study period in 2050 is 359,586.

Table 2: The present and projection population of Putrajaya city for the year 2010-2050

Year *projection	Arithmetical	Geometrical	Exponential
2010	73400	73400	73400
2020	109200	109200	109200
2030*	145000	162461	177837
2040*	180800	241700	289616
2050*	216600	359586	471654

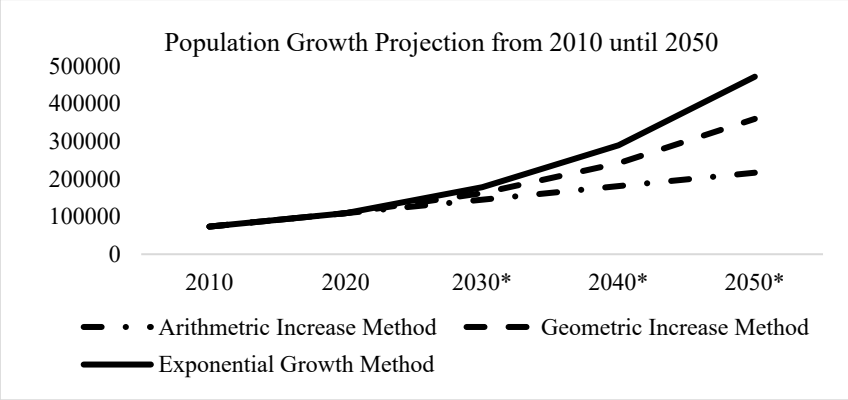


Figure 1: Population Growth Projection from 2010 until 2050 in Putrajaya

Temporal Analysis – Diurnal Pattern

Understanding peak water demand patterns throughout the day is crucial for optimizing water supply infrastructure design and operation. By aligning infrastructure capacity with peak demand times, utilities can ensure a reliable water supply without the need for excess construction or facing shortages during high-demand periods. Identifying the daily water consumption trends is vital for infrastructure optimization, efficient resource allocation, implementation of demand management strategies, system performance monitoring, and improving emergency response readiness in water utilities and management organizations.

Figure 2 depicts two distinct peaks in water demand, corresponding to morning and evening usage patterns. The morning peak occurs between 6:00 and 8:00 hours as individuals typically prepare themselves before heading to work. The evening peak, between 18:00 to 20:00 hours, is characterized by a significant increase in internal household water consumption. These findings are consistent with previous studies, as indicated by established patterns (Cole and Stewart, 2013). Around 54% of the average hourly household water demand during the morning peak (at 07:00 hours) is met through their respective water tank supply systems, while specifically 46% of the total demand during the evening peak hour (at 19:00 hours) is generally associated with end-user activities, such as toilet use,

showers, kitchen tap usage, and dishwashing after individuals return home from work.

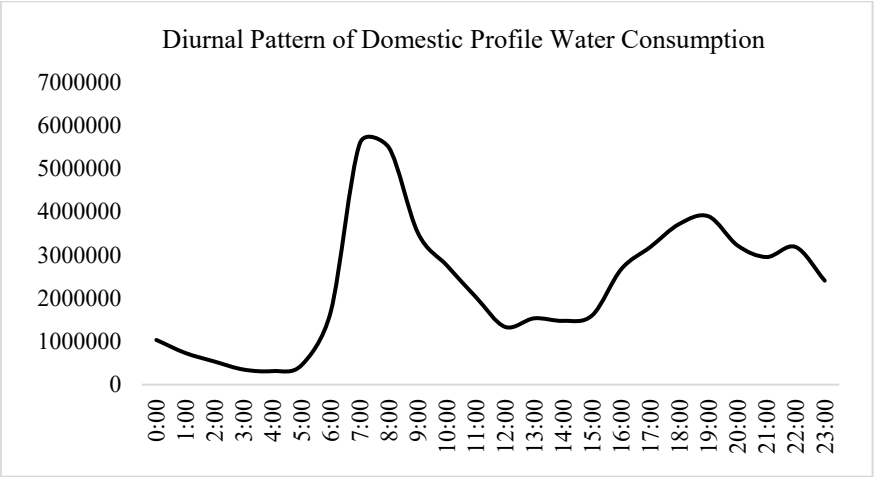


Figure 2: The diurnal pattern of water consumption for domestic profile

Non-domestic water consumption profiles tend to display a pattern where commercial and industrial usage peaks around midday and tapers off before the evening residential peak. Typically, residential water consumption constitutes the bulk of overall water usage for most utilities, showing up as the characteristic twin peaks in daily consumption. However, in specific supply areas or municipalities, the commercial sector might play a more significant role in altering this daily consumption pattern. Monitoring these diurnal consumption patterns enables water utilities to identify unusual usage patterns that could indicate leaks or inefficiencies in commercial properties. By swiftly identifying and addressing leaks, water utilities can minimize water loss, lower costs, and ensure the smooth functioning of the water distribution system.

In this study, Figure 3 illustrates the diurnal water consumption pattern for a non-domestic profile, wherein commercial customers, including governmental entities, accounted for 76.47% of the consumption, primarily during the 8:00-18:00 working hours. Given that Putrajaya comprises government facilities, a consistent pattern emerges during these working hours. Even in regions with higher proportions of commercial consumption, residential (domestic) water usage tends to have more daily fluctuations due to the relatively lesser variability in commercial consumption. Overall, various factors such as lifestyle choices, outdoor usage of water, appliance use, individual behaviors, and regulatory variations contribute to the increased water demand in residential areas compared to commercial sites (Cole & Stewart, 2013). Nevertheless, by pinpointing periods of high-water demand, utilities can prioritize infrastructure

upgrades and expansion projects to meet the growing water needs of commercial establishments in a cost-effective manner.

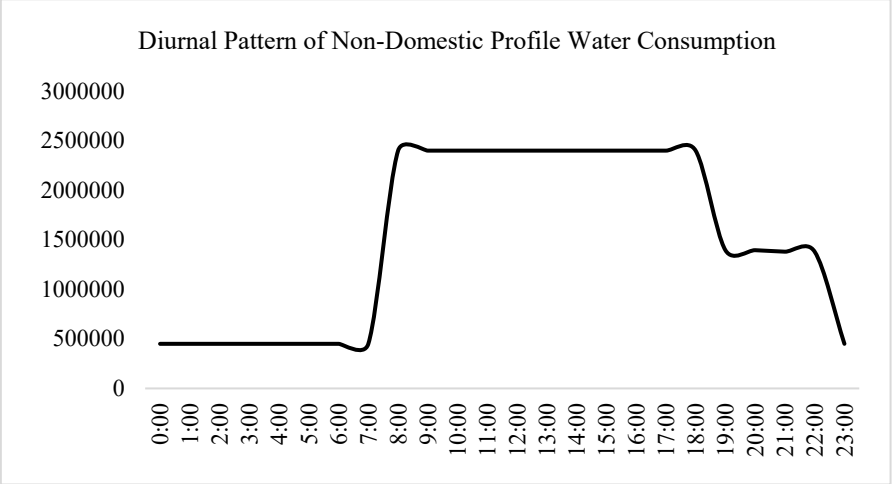


Figure 3: The diurnal pattern of water consumption for non-domestic profile

Water Demand Estimation based on Land Use Activities

According to the data presented in Table 3, the current total water demand in Putrajaya for 2023 is reported to be 94,233,765 litres per day. This total is distributed between the domestic sector, accounting for 58,102,500 litres per day, and the non-domestic sector, which comprises 36,131,265 litres per day. It is apparent from these figures that the demand is projected to rise continuously in parallel with the growing population. Additionally, taking into account the anticipated water demand for future city development, a further increase of 21,997,176 litres per day is predicted, representing an increase of 18.93%, leading to a total projected demand of 116,230,941 litres per day.

Table 3: The estimation of total daily average water demand for the present and future plan of land use category

Land use	Type	Total water demand (l/day)	Percentage (%)
Domestic			
Residential	Double storey terrace	7,003,500	**61.66**
	Triple storey terrace	357,000	
	Semi-detached	4,222,000	
	Apartment	43,656,000	
	Bungalow	652,000	
	Condominium	2,212,000	
Total		**58,102,500**	
Non-Domestic			
Government Use	Office	22,133,920	**38.34**
Commercial	Business centre	2,090,404	
	Restaurant	1,370,891	
	Hotel	100,500	
	Wet market	747,000	
	Petrol station	100,000	
Public Amenities	School	1,795,350	
	Hospital/Clinic	889,500	
	Mall/Hall/Complex	4,963,942	
	Mosque	1,750,000	
Service Industries	Cooling plant	189,757	
Total		**36,131,265**	
Differences between present and future land use water demand			
Current	**Total**	**94,233,765**	**81.07**
Future plan	**Total**	**21,997,176**	**18.93**
Total		**116,230,941**	**100.00**

The ratio of domestic to non-domestic areas is 3:2, corresponding to a ratio of 60:40 (DA: NDA = 60:40) according to the Malaysia Water Industry Guide (MWIG, 2018). Based on data presented in Table 3, the average daily water demand for domestic and non-domestic sectors was calculated to be 58,102,500 litres per day (61.66%) and 36,131,265 litres per day (38.34%) respectively, reflecting the 60:40 split. These estimates align closely with figures reported by the MWIG in 2018. A projection of future land use developments as outlined in the city's master plan combined with the current water demand indicates a significant surge in the need for clean water in the upcoming years.

Following the standards set by the National Water Service Commission (SPAN, 2018), the recommended range for clean water discharge from reservoirs is ideally between 0.0024 m3/sec and 0.0162 m3/sec. As Table 4 illustrates, four reservoirs in Putrajaya are currently utilizing more than 60% of their water supply capacity. Notably, reservoirs WR6 and WR3 share supply zone nodes, resulting in excessive capacity utilisation in WR6. Nonetheless, a comparison of the current clean water flow from reservoirs to the desired range reveals a shortfall.

Persistent over-extraction of water from reservoirs can trigger water shortages in urban areas, particularly during peak demand periods or dry spells. This predicament may necessitate water rationing, service disruptions, and interference with daily operations, affecting households, businesses, and public amenities. Consequently, it is imperative to conduct optimization analyses to tackle the challenges brought about by the limited availability of raw water in Putrajaya, especially in anticipation of future water demands.

Table 4: The reservoir capacity and its respective zone supply precincts

Reservoir	Zone supply precinct	Capacity (l/d)	Average water demand (l/d)	Percentage of capacity used (%)
WR1	7,8,9,10	30,283,294	23,619,452	77.99
WR2	2,3,4,18	52,995,765	11,145,851	21.03
WR3	1,12,14,15,16,17	45,424,941	30,430,314	66.99
WR4	5,6,20	37,854,118	11,155,484	29.47
WR5	11	15,141,647	11,882,227	78.47
WR6	15	3,785,412	6,000,438	158.51

***Some pipe nodes are sharing in the reservoir WR3 and WR6**

Spatial Analysis – Water Demand Distribution

Figure 4 illustrates the land use activities and current water demand distribution in Putrajaya city. The study's findings indicate that high water demand predominantly affects residents in residential areas. The spatial distribution of water demand varies based on the entry point of the distribution network. Utilizing the water demand map as a preliminary tool, priority areas can be identified for the implementation of protective measures. This paves the way for initiatives such as regional early warning systems, community involvement in conserving source water, and the establishment of communication programs to address water quality risks.

Understanding the spatial layout of water demand is crucial for optimizing the placement and capacity of infrastructure. This optimization involves strategically locating water treatment plants, reservoirs, pumping stations, and distribution networks in areas where they can efficiently cater to high-demand regions. Spatial analysis is instrumental in forecasting future water demand by considering factors like population growth, urban development, and land use alterations. Such forecasting aids in long-term planning for water resource management and infrastructure enhancement.

The land use map in Figure 4 indicates areas inclusive of precincts 8, 9, 10 (WR1), precincts 5, 6 (WR4), and precincts 11 and 13 (WR5) that exhibit higher vulnerability to contamination within the respective supplied zones. This data assists in identifying sectors and times of the year where monitoring efforts should be intensified. Notably, precinct 1 experiences a cluster of high water demand due to numerous government activities, while in precinct 13, elevated

water demand is closely tied to wetland activities. By identifying these focal points, urban planners can strategically allocate resources and enhance infrastructure development to meet demand effectively. Further details on water demand classification are detailed in Table 5.

Table 5: The water demand classification

Classification	Total water demand (l/day)
Very low	0 – 20,000
Low	21,000 – 40,000
Moderate	41,000 – 60,000
High	61,000 – 80,000
Very high	81,000 – 1,000,000

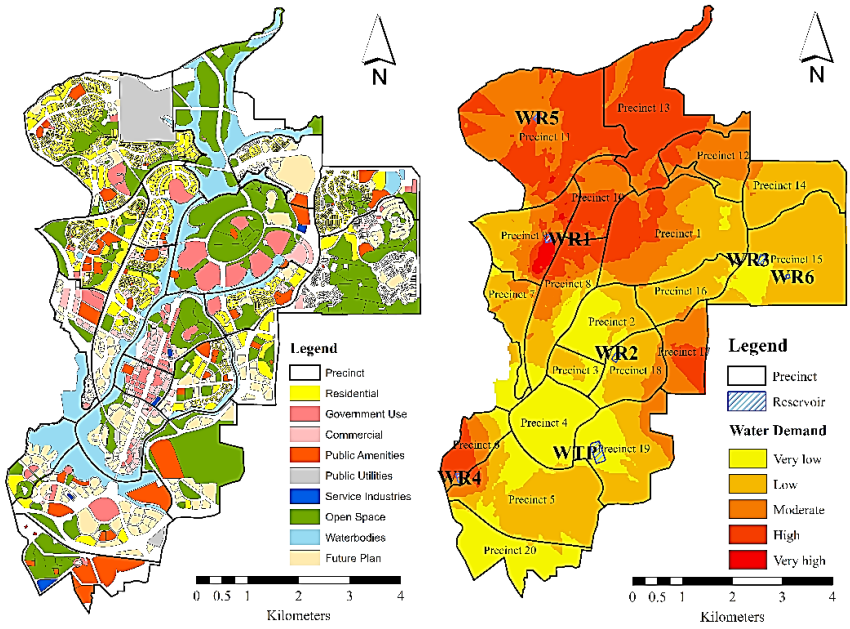


Figure 4: The land use map and water demand distribution in Putrajaya respectively

Water managers can utilize the outcomes of this study to prioritize their monitoring activities spatially and temporally, by considering various factors such as population vulnerability, infrastructure sensitivity, water quality indicators, and socio-economic deprivation. The water demand map facilitates the swift and clear ranking of areas based on the importance of protective measures. This aids local, state, and national authorities in deciding where to allocate resources for drinking water systems, such as treatment facilities and source water protection plans.

CONCLUSION

In conclusion, the study conducted in Putrajaya, Malaysia, integrating water demand patterns, unveiled distinct temporal and spatial trends. Daily water usage demonstrated a bimodal trend, with peaks corresponding to morning and evening household activities, emphasizing the dominance of residential consumption, particularly with a notable peak in the evening compared to the midday peak in non-residential sectors.

The current total water demand in Putrajaya stands at 94 million litres per day, with domestic use surpassing non-domestic consumption. Projections indicate an expected 19% rise in total demand due to future land use changes. Spatially, the analysis pinpointed residential areas as primary drivers of water demand, showcasing variations across the city.

These results underscore the critical importance of comprehensive water management strategies. Water authorities can strategically implement targeted protection measures in high-demand regions by leveraging insights into temporal and spatial water demand patterns. This understanding can guide the optimal placement of infrastructure to ensure efficient water supply and aid in developing long-term water resource management plans that consider projected population growth and changing land utilization patterns in Putrajaya.

ACKNOWLEDGMENT

The authors gratefully acknowledge the research funding from the Ministry of Education (MOE) under Trans-Disciplinary Research Grant Scheme [TRGS/2016/5535713].

REFERENCES

Anisha, G., Kumar, A., Kumar, J. A., & Raju, P. S. (2016). Analysis and Design of Water Distribution Network using EPANET for Chirala Municipality in Prakasam District of Andhra Pradesh. *International Journal of Engineering and Applied Science, 3*(4): 53–60. https://doi.org/10.13140/RG.2.1.3131.4320

Azhar, N., Yap, C. K., Nulit, R., Omar, H., Syazwan, W. M., & Leow, C. S. (2024). A preliminary study of direct observation and selected water quality monitoring in Putrajaya Lake: the status between October-December 2022. *International Journal of Sustainable Energy and Environmental Research*, *13*(1), 25–35. https://doi.org/10.18488/13.v13i1.3682

Azlan, N. N. I. M., Saad, N. M., Norhisham, S., Malek, M. A., Shkuri, N. S. M., Zolkepli, M., Ean, L. W. & Mohamad, A. M. (2022). Water demand management at rural area using Micro-Component Analysis: a case study at Kenyir Lake, Malaysia. *IOP Conference Series: Earth and Environmental Science, 955*(012027), 1755–1315. https://doi.org/10.1088/1755-1315/955/1/012027

Baskoro, D. A. P., Hermawan, A., & Permadi, T. (2021). System Dynamic Model for Sustainable Water Supply Strategy in Sentul City Area. *Jurnal Pengelolaan Sumberdaya Alam dan Lingkungan (Journal of Natural Resources and*

Environmental Management), 11(2), 233–240. https://doi.org/10.29244/jpsl.11.2.233-240

Cole, G., & Stewart, R. A. (2013). Smart Meter Enabled Disaggregation of Urban Peak Water Demand: Precursor to Effective Urban Water Planning. *Urban Water Journal, 10*(3), 174–194. https://doi.org/10.1080/1573062X.2012.716446

DOSM. (2024, May 2). Department of Statistics, Malaysia. Population Quick Info website. Retrieved from http://pqi.stats.gov.my/searchBI.php

Fazli, B., Shafie, A., Mohamed, A., Mohamad, M. F., Yahaya, N. K., & Noordin, N. (2018). Development of spatial similarity-based modelling to improve integrated lake water quality management in Malaysia. *Lakes & Reservoirs: Research & Management*, 23(1), 24–33. https://doi.org/10.1111/lre.12204

Gawatre, D. W., Kandgule, M. H., & Kharat, S. D. (2016). Comparative Study of Population Forecasting Methods. *IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE), 13*(4), 16–19. https://doi.org/10.9790/1684-1304051619

Hasibuan, H. S., Koestoer, R. H., Permana, C. T., Elizandri, B. N., Danial, M. H., & Abdullah, J. (2024). Transport Policies, Transit-Oriented and Development Redistribution of Population in Peri-Urban: Lessons from Kuala Lumpur and Jakarta Metropolitan Area. *Planning Malaysia Journal, 22*(1), 256–269. https://doi.org/10.21837/pm.v22i30.1438

Jiang, K. (2023). Transportation System Evolution during Garden City Construction and Its Environmental and Economical Impacts in Putrajaya, Malaysia. Highlights in Science, *Engineering and Technology*, 37, 82–88. https://doi.org/10.54097/hset.v37i.6042

JPBD. (2016). Jabatan Perancangan Bandar dan Desa. Malaysia National Report for the 3rd United Nations Conference on Housing and Sustainable Urban Development (Habitat III). 1–97. file:///C:/Users/Asus/Downloads/MALAYSIA_NATIONAL_REPORT_FOR_THE_3RD_UNI.pdf

Lim, I. (2019, August 6). Klang Valley Water Disruption: Why Does It Happen So Often? Retrieved from https://www.malaymail.com/news/malaysia/2019/08/06/klang-valley-water-disruption-why-does-it-happen-so-often/1777926

McKinsey & Company (2009). The Global Corporate Footprint – Risks, Opportunities and Management Options. *CCSI Water & Adaptation Service Line*, 3–9. https://www.mckinsey.com/~/media/mckinsey/dotcom/client_service/Sustainability/PDFs/Report_Large_Water_Users.ashx

Mekonnen, Y. A. (2018). Population Forecasting for Design of Water Supply System in Injibara Town, Amhara Region, Ethiopia. *Civil and Environmental Research, 10*(10): 54–65. https://core.ac.uk/download/pdf/234678796.pdf

Mohamad, S., Ash'aari, Z. H., Ramli, M. F., Abdullah, R., & Rehan, B. M. (2023). Application of a Hybrid Cellular Automaton-Markov Model in Land Use Change Detection and Prediction in Flood-Prone Area, Johor, Malaysia. *Planning Malaysia Journal, 21*(6), 170–184. https://doi.org/10.21837/pm.v21i30.1394

MWIG. (2018). Malaysia Water Industry Guide. The Malaysian Water Association (MWA); 2018.

Najah, A., Teo, F. Y., Chow, M. F., Huang, Y. F., Latif, S. D., Abdullah, S., Ismail, M. &

El-Shafie, A. (2021). Surface water quality status and prediction during movement control operation order under COVID-19 pandemic: Case studies in Malaysia. *International Journal of Environmental Science and Technolog*y, 18, 1009–1018.https://doi.org/10.1007/s13762-021-03139-y

Nigam, A. K., Rahi, D. C. (2016). Analysis of Water Demand and Forecasting Water Demand for Year 2048 Jabalpur City. *SSRG International Journal of Civil Engineering, 3*(7), 37–42. https://doi.org/10.14445/23488352/IJCE-V3I7P130

Pagsuyoin, S. A., & Santos, J. R. (2021). Modeling Regional Impacts and Resilience to Water Service Disruptions in Urban Economies. *Environment and Planning B: Urban Analytics and City Science, 48*(5), 1058-1074. https://doi.org/10.1177/2399808321998703

Praveena, S. M., Rashid, M. Z. M., Nasir, F. A. M., Yee, W. S., & Aris, A. Z. (2019). Occurrence and potential human health risk of pharmaceutical residues in drinking water from Putrajaya (Malaysia). Ecotoxicology and environmental safety, 180, 549–556. https://doi.org/10.1016/j.ecoenv.2019.05.051

Rashid, M. F., Rahman, A. A., & Abdul Rashid, S. M. R. (2021). Analyzing the Factors and Effects of Water Supply Disruption in Penang Island, Malaysia. *Malaysian Journal of Society and Space, 17*(3), 62–75. https://doi.org/10.17576/geo-2021-1703-05

Ryan, P. (2014). Water Consumption. In: Michalos, A.C. (eds) Encyclopedia of Quality of Life and Well-Being Research. *Springer*, 7001–7003 https://doi.org/10.1007/978-94-007-0753-5_3191

Samat, N., Mahamud, M.A., Tan, M.L., Maghsoodi Tilaki, M.J., & Tew, Y.L. (2020). Modelling Land Cover Changes in Peri-Urban Areas: A Case Study of George Town Conurbation, Malaysia. *Land, 9*(373), 1–16. https://doi.org/10.3390/land9100373

Santos, A. S. G., Ramalho, P. S., Viana, A. T., Lopes, A. R., Gonçalves, A. G., Nunes, O. C., Pereira, M. F. R. & Soares, O. S. G. (2021). Feasibility of Using Magnetic Nanoparticles in Water Disinfection. *Journal of Environmental Management, 288*(112410), 1–14. https://doi.org/10.1016/j.jenvman.2021.112410

Sha'arani, S. A. W., Khudri, M. A. M. R. S., Othman, A. R., Halmi, M. I. E., Yasid, N. A., & Shukor, M. Y. (2019). Kinetic Analysis of the Adsorption of the Brominated Flame Retardant 4-bromodiphenyl Ether onto Biochar-immobilized Sphingomonas sp. *Bioremediation Science and Technology Research*, *7*(1), 8–12. https://doi.org/10.54987/bstr.v7i1.457

SPAN. (2018). Uniform Technical Guidelines: Water Reticulation and Plumbing: Suruhanjaya Perkhidmatan Air Negara, Selangor, Malaysia, https://epermohonan.samb.com.my/Document/Uniform%20Technical%20Guidelines%20for%20Water%20Reticulation%20and%20Plumbing.pdf

Stańczyk, J., Kajewska-Szkudlarek, J., Lipiński, P., & Rychlikowski, P. (2022). Improving Short-Term Water Demand Forecasting Using Evolutionary Algorithms. *Scientific Reports, 12*(1), 13522. https://doi.org/10.1038/s41598-022-17177-0

Yusof, T. A. (2019, December 23). It's Time to Get Serious About Water Contamination. Retrieved from https://www.nst.com.my/news/nation/2019/12/550237/its-time-get-serious-about-water-contamination

Received: 19th March 2024. Accepted: 3rd September 2024

PLANNING MALAYSIA:
Journal of the Malaysian Institute of Planners
VOLUME 22 ISSUE 5 (2024), Page 347 – 359

APPLICATION OF JOINT TENANCY ON REAL PROPERTY AND ITS IMPACT UNDER THE LAW OF SUCCESSION IN MALAYSIA

Azhani Arshad[1], Rahmawati Mohd Yusoff[2], Syuhaeda Aeni Mat Ali[3], Akmal Hidayah Halim[4] & Nur Akmal Adnan[5]

[1,3]*Faculty of Law*,
[2]*Department of Law*,
UNIVERSITI TEKNOLOGI MARA (UiTM)
[4]*Ahmad Ibrahim Kulliyyah of Laws*,
INTERNATIONAL ISLAMIC UNIVERSITY MALAYSIA
[5]*Department of Tourism and Hospitality,*
POLITEKNIK MERLIMAU MALAYSIA

Abstract

Joint ownership refers to property owned by two or more persons. Two significant forms of joint ownership in real estate exist joint tenancy and tenancy-in-common. Under common law, joint tenancy is applied as a mechanism for administering an estate, which takes effect after the joint owner's or joint tenant's death. The National Land Code (Act 828) recognises only tenancy-in-common tenancy rather than joint tenancy. Hence, this study proposes a regulatory framework and a suitable mechanism for the land conveyance process in the application of joint tenancy. This study is based on qualitative research and analysis of primary and secondary materials. For a comparative analysis, the study explores the law and practice of joint tenancy in Singapore and Australia for the dual legal and Torren systems. It is predicted that the joint tenancy application would give the proprietor more options in planning the management of his property and rightly give the surviving joint tenant full enjoyment of the property.

***Keywords*:** Joint-Ownership, Joint Tenancy, Tenancy-in-Common, Law of Survivorship, Law of Succession

[1] Corresponding author Email: azhani_arshad@uitm.edu.my

INTRODUCTION

Joint ownership refers to the property owned by two or more persons. There are two significant forms of real estate joint ownership: joint tenancy and tenancy-in-common.

Under the common law, joint ownership in the form of joint tenancy is the most popular form of co-ownership between married people because upon the death of either spouse, the survivor automatically becomes the sole owner without the need for a grant of representation. Eventually, joint ownership can also be one of the mechanisms to deal with joint assets acquired during a subsisting marriage and for administering an estate, which takes effect after the co-owner's or co-tenant's death.

In Malaysia, the National Land Code (Act 828) (NLC) recognises the concept of joint ownership in the form of tenancy-in-common in Sections 343 to 345. The concept of joint tenancy with the right of survivorship is acknowledged in the National Land Code (Penang and Malacca Titles) Act 1963 (Act 1963) under Section 47(1).

Hence, there is inconsistency, particularly when the joint tenancy can overcome the succession disputes after the death of the joint tenant. The joint tenancy would also give more options to the proprietor in planning the management of his property and rightly provide the advantage to the joint tenant towards the full enjoyment of the property. Further, the increased standard of living and value of real property require contemporary and new contracts, which serve as an option for purchasing and owning a property.

In pursuance of the above matter, this study explores and analyses the concept of joint tenancy and its impact under the law of succession or estate management via the principle of gift *inter vivos* or conditional gift (as the case may be) in Malaysia. The objectives are to (i) explore the application of joint tenancy and its impact on the Malaysian law of succession, (ii) compare the law and practice of joint tenancy in other jurisdictions, and (iii) propose a legal framework or mechanism for regulating joint tenancy in real property in Malaysia.

The outcome of this study includes a legal framework or mechanism for regulating the application of joint tenancy in dealing with joint ownership of land in Malaysia.

LITERATURE REVIEW

Joint tenancy is equivalent to tenancy-in-common with two vital differences: the shares of ownership and the right of survivorship. Joint tenancy is a common-law principle introduced by the British to Penang at the end of 1807, vide the First Royal Charter of Justice 1807. The salient feature of the English deed system introduced in Penang is that one's land ownership is not ascertained by title

registration but is based only on deeds or documents executed between the parties.

On the law of succession, Sulong (2019) defines joint tenancy as a kind of possession in common law where all asset sharers have equivalent rights and each tenant acquires the same portion. Consent from all co-owners is required in any transaction towards the property. Thus, joint tenancy is not separable ownership but rather a joint possession between co-owners who act on a mutual decision (Rahman, 2012). If any of the joint tenants die, the left portion of the deceased will be obligatorily conceded to the survivor (Rasban, 2010). Based on this principle, joint tenancy is uncommon in the land ownership concept, and cannot be divided through the inheritance process (Noordin et al., 2016).

In Nur Aamal Arif's (2013) analysis, she found that the ownership by joint tenancy among the Muslims in Singapore under civil law contradicts the MUIS Fatwa (2008). Meanwhile, Section 343 (1)(a) of the National Land Code (Act 828) (NLC) recognises joint ownership in the form of undivided shares, as the provision underlines that in the incident of co-ownership where any property is vested in two or more individuals as co-owners, their allocations therein shall be equivalent except that different amounts are underlined in the registration records (Mustar & Muhamad, 2013).

Under the same Code, the law acknowledges joint tenancy in Sections 343 to 345, but only for the property beheld by the trustee. Thus, when one trustee dies, or when the trustee is a body, the body is dissolved. The right of survivorship arises, the interests of the deceased trustee/dissolved body are extinguished, and the interests of the remaining trustees *qua* trustees are enhanced (Sihombing, 2017).

Under the National Land Code (Penang and Malacca Titles) Act 1963, Penang and Malacca have recognised joint tenancy as a mechanism in which the whole estate is succeeded by the left joint tenant who survived. The law also acknowledges the intent under the joint tenancy contract, giving the surviving joint tenant an undivided portion. The law recognises the right to survivorship, as highlighted in Section 47(1)(c); such a right is embedded between two or more persons whose names were recorded in the provisional record (Sulong, 2019).

The equivalent concept of joint ownership in Muslim law is called *hibah ruqba,* or conditional gift. The Department of Mufti of Wilayah Persekutuan and the Shari'ah committee of some institutions, such as the Securities Commission, Bank Negara, and State Shari'ah Judiciary Department, acknowledge the concept of conditional gift. This recognition is paralleled with the underlining stipulation of joint tenancy in the law pertaining to the land of the National Land Code (Penang and Malacca Titles) Act 1963 and the National Land Code.

In the above respect, it was shown that the NLC does not recognise joint tenancy. Thus, this study explores the concept of joint tenancy under the common

law and examines its validity under the law of succession in Malaysia. The proposal for its application needs to be coupled with a proposed legal framework, new guidelines, and an appropriate mechanism to regulate joint tenancy in the existing land conveyance and applicable law in Malaysia, should the concept be legally recognised.

RESEARCH METHODOLOGY

This study aims to achieve a depth of understanding rather than a breadth of experience. Qualitative research addresses research objectives by selecting specific data sources from which the data are collected. Hence, this study adopts a qualitative method that is divided into primary and secondary research. This study explores the concept of joint tenancy in joint land ownership in Malaysia from a common law perspective.

The study also adopts a comparative approach, focusing on Singapore and Australia. These countries were chosen because both apply the Torrens system. Singapore, like Malaysia, inherited principles of English common law from the same legal system. Both nations apply a dual legal system and have adopted and regulated joint tenancy in land conveyances as an estate planning mechanism.

To gather fresh perspectives on joint tenancy application and verify the proposed legal framework, focus group discussions (FGDs) were conducted. The FGDs included representatives from the Land Office, the Shari'ah High Court, and subject matter experts (SME) in the law of succession and land law.

The qualitative data review involved manually examining the current primary and secondary sources, including interviews, the data collected from the FGDs, legislative provisions, case laws, and other legal and non-legal literature relating to the law and procedure for the administration of joint tenancy in joint ownership land in Malaysia.

An analysis of the statutes, including but not limited to the Rules of Court 2012, National Land Code, National Land Code (Penang and Malacca Titles) Act 1963, Civil Law Act 1956, and state enactments, was conducted to explore and propose the most appropriate method in regulating the application of joint tenancy in Malaysia.

Finally, the collected data were analysed using a data triangulation approach. Triangulation in qualitative research involves the use of multiple methods or data sources to understand a phenomenon comprehensively (Patton, 2014). Triangulation has also been viewed as a qualitative research strategy to test validity by converging information from different sources. This approach was applied to validate the data and produce the best results.

ANALYSIS AND FINDINGS

This study explores the application of joint tenancy of the common law in land conveyance and its impact on the Malaysian law of succession. The issues directed by the research questions, which focus on exploring the application of joint tenancy in Malaysia and the law and practice in other jurisdictions, are as follows:

Benefits of Joint Tenancy

This study identified the benefits of joint tenancy other than providing an option aside from the normal way of obtaining ownership over a property. Owning a property as a joint tenant is similar to providing a gift. An owner is giving up some value and control of the property to other joint owners.

At present, purchasing public housing (HDB) in Singapore (managed by the government's Housing and Development Board (HDB) through a joint tenancy contract) is a popular choice where a property is purchased together with a relative or someone who is in a relationship. This mechanism can be an advantage because it simplifies beneficial ownership.

Joint tenants who desire to hold a property for the purposes of estate planning may choose joint tenancy due to the ease of the automatic transfer of ownership to surviving co-owners. Joint tenancy also eliminates the need to apply for probate on the joint property and avoids complicated property transfers by the deceased owner's estate.

The Legal Concept of Joint Tenancy in Malaysia

Currently, the legal framework does not provide a legal framework for holding land as joint tenants. The provision of Section 343 of the NLC recognises joint ownership in the form of an undivided share; it underlines that in the incident of co-ownership where any property is vested in two or more individuals as co-owners, their allocations therein shall be equivalent, except that different amounts are underlined in the registration records.

In a nutshell, joint tenancy is not recognised by the NLC but applies only in Sections 343 to 345 for property beheld by the trustee or personal representative. In contrast, Section 47(1)(c) of the National Land Code (Penang and Malacca Titles) Act 1963 allows for the registration of land with a right of survivorship in the Interim Register. The Interim Register is a registration book that keeps all landholdings before implementing the NLC and the Torrens system. The data is migrated from the former land title (deed system) to the land title under the NLC.

The 1963 National Land Code (Penang and Malacca Titles) Act was introduced during the transition from the deed system to the Torrens system. On the grant, it is not known as joint tenancy, but rather as co-proprietors with the

right of survivorship. For Malacca, the term used to describe joint tenancy is *joint proprietorship with a right of survivorship*.

Registration of Joint Tenancy

A joint tenancy contract, as acknowledged by the National Land Code (Penang and Malacca Titles) Act 1963 (Act 1963), denotes that the survivor will succeed the whole estate under the rule of survivorship. The rights of survivorship are recognised by the statute as underlined in Section 47(1)(c) of Act 1963. These rights are embedded between two or more individuals, whose names are registered in the provisional record.

Under the Act of 1963, there is a form of temporary registration to register land ownership based on the current conveyance. This form, called the Interim Register (IR), entails land ownership under the NLC. All important and relevant information on the conveyance, including land ownership through joint tenancy, will be included in the IR. Hence, co-proprietorship owners who used joint tenancy based on previous joint tenancy registration are transferred to the IR.

Validity of Joint Tenancy

In the case of joint tenancy, the analysis of its validity under the existing law has been categorised into two:

(i) Involving a Muslim's Estate

Most of the reported cases on the issue of joint tenancy involved the Muslim estate (see: *Shafeeg bin Salim Talib and Anor v Fatimah bte Abud bin Talib and Ors* [2010] SLR 1123, *Salmah bt Omar & Ors v Ahmad Rosli bin Aziz (administrator of the estate of Osman bin Mohamed, deceased) & Anor* [2012] 3 MLJ 567, *Saliza Othman (waris yang sah ke atas harta pusaka Haznah Binti Aziz @ Abdul Aziz, si mati) v Che Rokian Desa & Ors* [2013] 1 LNS 185, *Mohamad Taupik Bin Mohamad Nor & Ors v Siti Rahmah Mohd Noor & Ors* [2016] 1 LNS 1462 & *Peter Chong & Anor v Khatijah bt Md Ibrahim & Anor (personal representative of Aishah bt Ibrahim, the deceased) and another suit* [2018] 10 MLJ 735). However, the validity of joint tenancy under land conveyance and Islamic law has been the crux of the argument in these cases. As a result, the court determined that Islamic law does not prevent or negate conveyance or the resulting joint tenancy. Even if this is true, the fact that the conveyance is a hibah ruqba does not violate Islamic law.

Based on the above arguments, the civil court does not have jurisdiction to declare the validity of any transactions involving Muslims. Therefore, to challenge the validity and applicability of the principle "right of survivorship" under joint tenancy, the matter should be referred to the Shari'ah Court.

(i) Involving a Non-Muslim's Estate

No Malaysian has reported cases involving a non-Muslim immovable property, except for moveable asset. Presently, the application of joint tenancy over immovable property has not been an issue for non-Muslims, except in dealing with monies held in a joint account. The principle is that when money is placed in a joint account in the name of two or more persons, they hold it as joint tenants in the absence of a contrary intention. (see: *Public Bank Berhad v New Ace Digital Print Sdn Bhd & Anor* [2019] 3 MLJ 421 & *Phuah Beng Chooi @Koh Kim Kee v Koh Heng Jin* [2015] MLJU 2168)

Joint Tenancy for Muslims in Singapore

This study showed that the issue of ownership in the form of joint tenancy in Singapore has evolved over the past 20 years since 1997. There are three fatwas issued pertaining to joint tenants.

A joint tenancy contract is religiously valid without the need to draw additional documents. It is thus a new form of contract with benefits that serve the community's needs. Islamic scholars are of the opinion that the general ruling of a new contract is permissible. Although it is considered a contemporary and new contract that cannot be found in traditional Islamic law, it is permitted because it does not conflict with Islamic principles and is based on the legal maxim "the original rule in the transaction is permissibility." Furthermore, the objective of the contract is straightforward, does not contain any ambiguity, and contains no elements of injustice, oppression, or deceit. The latter has given Muslims a clear option to purchase and own property in Singapore.

Thus, joint owners have the option to select joint tenancy contracts or tenancy-in-common contracts during their lifetime. The manner of holding a property will significantly impact the legal heirs. Undeniably, both forms of joint ownership have their advantages. By selecting one of the above, the owners agreed to meet the conditions set out and the objectives of each of the agreements they had made during their lifetime.

New Form of Contract on Purchasing and Owning Property

Based on the above premise, the study found that a joint tenancy contract is applied to purchase leased public housing (HDB) flats in Singapore, which are managed by the government's Housing and Development Board (HDB). It was reported that over 80% of Singapore's population lives in an HDB flat. These homes are affordable and can be easily purchased by an average Singaporean, as the facilities are subsidised by the government and are offered with housing grants (Rahim & Qureshi, 2018).

The salient part of the contract is that it allows two or more flat owners to change the proportion of shares held by each owner from joint tenancy to

tenancy-in-common and vice versa. The two available types of contracts for owning an asset provide the public with the option to acquire an asset.

Conditional Hibah under the Islamic Law Principles

In Islamic law, a gift is a conveyance to someone else without expecting repayment or compensation. This is performed willingly throughout the donor's lifetime. Al-Hibah is recommended in Islam.

According to the majority of Islamic scholars, al-hibah has four pillars: the donor (al-wahib), the recipient (al-mawhub lah), the gift itself (al-mawhub), and the utterance of contract (sighah). The utterance of al-grant occurs immediately if the utterance of al-hibah is general. This is because the utterances indicate the granting of ownership to others that arise immediately. However, if the utterance of al-hibah has any restriction, it will be treated as a condition of the utterance. For example, the conditions of the utterance regarding time limit are Al-Hibah Al-Umra and Al-Hibah Al-Ruqba.

The difference between al-hibah and the two varieties of al-hibah, Al-Hibah Al-Ruqba and Al-Hibah Al-Umra, is that al-hibah ownership is eternal. However, Al-Hibah Al-Ruqba ownership is subject to time, i.e. the parties' death and the recipient's death in Al-Hibah Al-Umra.

It is evident from the traditions of the Prophet (PBUH) that the utterance of the al-hibah is valid despite the void between the two conditions of al-umra and al-ruqba. In addition, Imam Abu Hanifah and Imam Muhammad ibn Al-Hassan said that if the owner gives a house with the term *Al-Ruqba*, the term changes as the house was given on the term of the loan, and the owner can take it from the recipient whenever he wishes.

Application of Hibah in Malaysia

The National Land Code (Act 828) permits the transfer of land through a gift by virtue of Section 215, whereby the title of the transferor shall pass to and vest in the transferee upon the registration of any such transfer, together with the benefit of any registered interests enjoyed with the land.

One case illustrating the acceptance of hibah ruqba by our Shari'ah Court in the case of *Rafizah bt Abd Karim v Kamar bin Abd Karim & 4 Ors*. The judge, in this case, referred to the decision of the Shari'ah Advisory Council (SAC) of the Security Commission, which confirmed the principles of hibah ruqba in the execution of the hibah declaration form for transactions involving joint accounts of Unit Trust Funds held by Muslims. Thus, the judge decided that the hibah was a hibah ruqba, which took place between the grantor and recipient of the hibah through the declaration document of the hibah. Therefore, the hibah was valid (Azalan & Said).

During the study, we also discovered the existence of a new form of a deed of gift executed between married couples. This form is considered an

instrument of estate management provided and promoted by a trust estate company for Muslims. A conditional contract known as "*Perjanjian Aset Perolehan Bersama*" involves the gift of an asset, whether registered in both or sole name, during the subsisting marriage. The declaration section of the contract states that the transfer of the matrimonial property will be enforceable in the mentioned circumstances, namely, if the husband contracted a polygamous marriage, dissolution of the marriage, or death of either party.

Nonetheless, the validity of such an instrument can only be verified in court, i.e. Shari'ah Court, upon the occurrence of the circumstances or condition. The parties' names would not be endorsed on the land title during his lifetime.

Prohibition on Reception of English Common Law

The crucial part of the proposed joint tenancy is the prohibition of the importation of common law into our existing law. Joint tenancy is a common law practice in English law in England. The law was formally introduced in Penang by the first charter of justice in 1807 with the proviso that "as far as local circumstances will admit."

However, after the cut-off date of 7 April 1956, Section 6 of the Civil Law Act 1956 (CLA) excluded the application of English law to land matters. It provides inter alia 'nothing in this Part shall be taken to introduce into Malaysia or any of the States comprised therein any part of the law of England relating to the tenure, conveyance, or assurance of succession to any immovable property or any estate, right or interest therein.'

Hence, Section 6 ousts the application of common law and rules of equity relating to land tenure, transfer or transmission of immovable property, or any estate, right or interest therein. The co-proprietorship of tenancy-in-common or joint tenancy deals with shareholding of the undivided share, which falls within the rules of law that govern the incidents of land tenure.

Therefore, by restricting the reception of English common law, the principle of joint tenancy with the right of survivorship has no statutory force under the National Land Code and cannot be made part of the local law. Thus, its introduction will go beyond the proviso of Section 3 and contravene Section 6 of the CLA.

CONCLUSION AND RECOMMENDATIONS

This study explored the roles of the application of joint tenancy in Malaysia. The discussion includes a legal framework or mechanism to regulate the application of joint tenancy in dealing with joint ownership of land in Malaysia. The proposed legal framework aligns with current needs, existing law, and Islamic succession law where applicable.

Insertion of the Concept of Joint Tenancy

At the outset, Section 6 of the Civil Law Act 1956 prohibits the incorporation, importation, or reception of the common law concept of joint tenancy in our land law of tenure and conveyance. The principle of joint tenancy with the right of survivorship has no statutory force under the National Land Code and cannot be made part of the local law. Thus, its introduction will go beyond the ambit of the proviso of Section 3 and contravene Section 6 of the Civil Law Act 1956.

Should the interpretation of Section 6 of the Civil Law Act allow such tenure to be applied in our Torrens system or an amendment be made to such provision, it is proposed that the amendment be made to the existing Section 342 of the National Land Code (Act 828) by inserting a manner of holding an undivided share of immovable property by the joint tenant. The provision of co-proprietorship and the manner of holding under the Land Titles Act 1993 would be the model of the law and procedure.

Legalising a Joint Tenancy Contract

A joint tenancy contract is valid under the contract law and Islamic transactions. A contract for a sale or acquisition of land or any interest in land will be legally binding when the contracting parties mutually agree upon all the terms and conditions.

It is proposed that the two types of contract, namely the joint tenancy contract and the tenancy-in-common contract, be introduced for the purchasing and owning of a property that involves two or more individuals, whether spouses, couples, relatives, or family members (Arshad et al, 2023). Ultimately, it would be robust to purchase a property due to the increased standard of living and value of the real property.

Execution of Deed of Gift Inter Vivos or Hibah

A gift inter vivos transfers any property from one person to another gratuitously. It is an act whereby anything is voluntarily transferred from the actual possessor to another person, with the full intention that the thing shall not return to the donor and with the full intent on the part of the receiver to retain the thing entirely as his own without restoring it to the giver. Two things are necessary for a gift inter vivos: the intention to give and the acts giving effect to the intention. So long as the intention is not entirely carried out, the gift is imperfect, and the donee has no legal rights against the donor. It is a gift between living persons and, in Roman law, intended to be effective irrespective of the donor's death.

In Malaysia, the hibah instrument is usually used by Muslims in planning asset distribution to the intended beneficiaries in relation to specific assets, whereby the ownership of the asset is transferred to the beneficiary during the donor's lifetime (inter vivos) or in certain limited circumstances, conditionally passed over after the donor's death.

The concept of joint tenancy in land ownership can be implemented by executing a deed of gift or hibah in Islam, which can be made in writing, by conduct, or orally. Advisable is a letter of hibah or deed of hibah of a donor who voluntarily gave the asset to the donee unconditionally or with conditions attached to it (valid and considered as hibah ruqba).

Instrument of gift inter vivos or hibah with the right of survivorship may be endorsed or implemented over the real estate in the following manner:

I. There are two contracts–a gift contract and a second contract–through mutual agreements. A deed of gift with a right of survivorship, known as hibah ruqba or conditional gifts, is executed with the condition that upon the co-owners death, the survivor shall be entitled to the whole share. After completing the first contract (ijab and qabul), the condition must be inserted. The transfer is based on the deed of gift using Form 14A. In contrast, the second contract (conditional gift with the stipulation of joint tenancy in the law) is enforced by a vesting order obtained against the estate after the passing of the co-owners pursuant to Section 417 or 420 of the National Land Code.
II. Execution of a deed of gift or hibah with conditions attached to it as a valid and considered hibah ruqba. The registered proprietor or any third party will hold the land or Form 14A in escrow of the donee until a particular condition has been met, i.e. death of the proprietor. After that, his/her title or interest will be registered or vested thereon.
III. Execution of the hibah ruqba and the implementation after the proprietor's death by a declaration of the court or vesting order under Section 417 or 420 of the National Land Code.

Holding Property as Trustee

The next option is to register the co-owner as a trustee, using the requisite form (executed and attested before the Land Administrator or lawyer [designated persons in the Fifth Schedule]), enclosed deed of trust, issued title document, and registration fee. Where there is more than one trustee, they hold "as trustee" and consequently as joint tenants. This is pursuant to Section 344 of the National Land Code.

The co-owner should execute a trust deed holding the property on behalf of the co-owner. Although generally, a trust deed should be executed for the disabled (namely an infant/minor or person who is unsound mind), most states do not require the registration of trust to be made for the disabled. This allows the trust to be registered over the land accordingly.

Another option is to transfer the property by hibah and subsequently register the donor as a trustee, known as hibah amanah. Interestingly, the instrument of hibah can be combined with the concept of trust. Based on the

concept of trust, the property involved in the hibah amanah will be held by the trustee for the agreed period before it is handed over to the recipient of the hibah in absolute.

Thus far, the study concludes that it is high time that a contract or conveyance of land by way of joint tenancy is regulated. While acknowledging that the process of amending and introducing new laws is not straightforward, the above recommendation should prove to be the solution at hand to be used as a basis for regulating the contract or concept of joint tenancy in the existing legal framework governing land tenure and the law of inheritance, consistent with the intentions of the holders or co-owners.

ACKNOWLEDGMENT

The authors acknowledge the sponsorship from the Institut Penilaian Negara (INSPEN) under a National Real Property Research Coordinator (NAPREC) for funding this Research Project (REF NO: INSPEN.600-4/12/1(2) & 100-TNCPI/GOV 16/6/2 (030/2021)

REFERENCES

Arshad, A., Yusoff, R.M, Mat Ali, S.A., Halim, A.H. & Adnan, N.A. (2023). A Comparative Analysis of The Application of Joint Tenancy in the Administration of Real Property in Malaysia, Singapore, and Australia. *Planning Malaysia, 21(3)*, 196-208.

Abdullah, M. A. (2005). *The Concept of Tarikah In The Islamic Law of Succession With Special Reference to The Practices of The Civil Courts and the Syariah Courts In Malaysia*. (Unpublished doctoral dissertation). Durham University.

Al-Syarbini, Muhammad al-Khatib. (1958). *Mughni al-Muhtaj*. N.p: Mustafa al-Babi al-Halabi.

Arif, N. A. (2013). *Islamic Inheritance Law and Its Application in The Republic of Singapore: An Analytical Study on Joint-Tenancy*. Unpublished master thesis. Malaysia: International Islamic University Malaysia.

Azalan, N. S., & Said, N. L. M. (2016). Keputusan Hakim Syarie dalam Kes-kes Pengesahan Hibah Ruqba, [The decision of the Syarie Judge in Ruqba Hibah Confirmation Cases]. *Journal of Contemporary Islamic Law*, *1*(2), 91-101.

Hassan, R. & Zaizi, N. A. M. (2020). The Concept and Application of Hibah As A Financial Instrument From The Malaysian Legal Perspective: An Analysis. *IIUMLJ*, *28*(1), 227-252.

Khalil, K. A. R. (1981). *Al-Hibbah wa Ahkamuha fi al-Syari'ah al-Islamiyyah*. Unpublished master thesis. Jami'ah al-Malik 'Abd al-'Aziz.

Leiden, Brill, E.J. (1965). *First Encyclopedia of Islam 1913-1936*, vol. iii at p. 783.

Megarry, R. E., & Wade, H. W. R. (1984). *The Law of Real Property*. Sweet & Maxwell.

Mei, Y. C. (2005). The Role of English Equity in the Peninsular Malaysian Torrens System of Land Law: A Review of Salient Statutory Provisions (Part1). *Malayan Law Journal Articles,* 1, lxviii.

Miles, M. B., & Huberman, A. M. (1994). *Qualitative Data Analysis: An Expanded Sourcebook.* Sage.

Moore, A. P., Grattan S. & Griggs L. (2016). *Bradbrook, MacCallum and Moore's Australian Real Property Law*, Lawbook.

MUIS. (2011). *Guidelines for Muslims on Purchasing and Owning an HDB Property under Joint Tenancy*. Islamic Religious Council of Singapore, pp 1-9.

MUIS. (2019). *Guidelines for Muslims on Purchasing and Owning Property*. Islamic Religious Council of Singapore, pp 1-22.

Mustar, S., & Muhamad, N. H. N. (2013). Kedudukan Joint-Tenancy dan Kepentingannya dalam Pemilikan Rumah Menurut Perspektif Undang-Undang Islam dan Sivil di Singapura, [Joint-Tenancy Position and Its Importance of Home Ownership According to the Islamic and Civil Law Perspective in Singapore]. *Jurnal Teknologi*, *65*(1), 29–37.

Mustar, S., & Nor Muhamad, N. H. (2013). Kedudukan Joint-Tenancy dan Kepentingannya dalam Pemilikan Rumah Menurut Perspektif Undang-Undang Islam dan Sivil di Singapura, [Joint-Tenancy Position and Its Importance of Home Ownership According to the Islamic and Civil Law Perspective in Singapore]. *Jurnal Teknologi*, *65*(1), 29–37.

Noordin, N. H., Ismail, M. I., Rahman M. A. H. A., Haron, S. N., Abdullah, A. (2016). Re-evaluating the Practice of Hibah Trust in Malaysia. *Humanomics*, *32*(4), 418-436.

Patton, M. Q. (2014). *Qualitative Research & Evaluation Methods Integrating Theory and Practice* (4th ed). Sage Publications.

Rahim, A.A. & Qureshi, S.L. (2018). A Review of IBS Implementation in Malaysia & Singapore. *Planning Malaysia, 16(2)*, 323-333.

Rahman, M. H. (2012). *A Juristic Analysis on Hibah al-'Umra and al-Ruqba and Their Application to The Joint Tenancy and Disbursement of Takaful Benefit*. Paper presented on Seminar of Contemporary Fiqh: Issues and Challenges, International Islamic University of Malaysia, December 2012.

Rasban, S. (2010). *Hibah al Ruqba & Pemilikan Bersama (Joint Tenancy) di Dalam Hukum Shari'ah.* HTHT Advisory Services.

Sihombing, J. (2017). Co-proprietorship. In *National Land Code: A commentary* (pp XXVII). LexisNexis.

Sulong, J., Taha, M. M. & Mohamad, A. (2019). Joint Tenancy In The Islamic Law and Its Application in Malaysia. *The European Proceedings of Social & Behavioural Sciences*, 1.

Tyabji, F. B. (1968). *The Personal Laws of Muslims in India and Pakistan*. N M Tripathi Private Ltd.

Zhi., H. L. (2014). A Comparison of Convenience Sampling and Purposive Sampling. *PubMed*, 105-11.

Received: 8th March 2024. Accepted: 30th August 2024

PLANNING MALAYSIA:
Journal of the Malaysian Institute of Planners
VOLUME 22 ISSUE 5 (2024), Page 360 – 375

IMPLEMENTATION STRATEGY OF SUSTAINABILITY AND HIGHEST BEST USE (SHBU) APPROACH FOR FELDA LAND DEVELOPMENT

Muhamad Asri Abdullah Kamar[1], Salbiah Mokhtar[2], Mohd Fadzil Abdul Rashid[3], Siti Mazwin Kamaruddin[4], Suzanah Abdullah[5]

[1,2,3,5]*Department of Built Environment Studies and Technology,*
College of Built Environment,
UNIVERSITI TEKNOLOGI MARA, PERAK BRANCH, MALAYSIA
[4]*Centre of Studies for Town and Regional Planning,*
College of Built Environment,
UNIVERSITI TEKNOLOGI MARA, SELANGOR BRANCH, MALAYSIA

Abstract

Sustainability and Highest Best Use (SHBU) approach is believed to be useful in assisting the Federal Land Development Authority (FELDA) to develop its land towards improving settlers' prosperity and livelihood. This research aims to demonstrate a proposed strategy for implementing the SHBU using a mixed methods approach which integrates interviews and Geographical Information System-based Multiple-criteria Decision Analysis (GIS-based MCDA). The interview component seeks to obtain feedback and development aspirations from respondents in FELDA Gunung Besout 03, while GIS technology generates and displays the findings in spatial forms to empower decision-making. Data were analysed using content analysis and spatial analysis accordingly. The findings from interview shows that generally, the SHBU approach is suitable for land development. Besides, GIS-based MCDA reveals four types of future land development spanning about 796 hectares encompassing cropland, residential areas, and small business centres. The findings become the basis for crafting the implementation strategies aimed at developing FELDA land within the study area.

Keywords: FELDA, highest best use, land development, strategy, sustainability

[1] Senior Lecturer at Universiti Teknologi MARA Perak Branch. Email: masri418@uitm.edu.my

INTRODUCTION

Generally, the Federal Land Development Authority (FELDA) has successfully increased the socio-economic status of targeted groups through the development of settlement areas. This achievement has had positive impacts on FELDA settlers such as ensuring stable income, adequate infrastructures, and overall prosperity. However, many FELDA households have a low living level (Government of Malaysia, 2019). Many factors contribute to this, including unproductive crop activities, commodity market volatility, a lack of reform strategies, high debt, and a variety of other issues, as highlighted by Datuk Seri Mustapa Mohamed, former Minister in the Prime Minister's Department (Economy), on the FELDA recovery plan (Bernama, 2021). As a result, many FELDA lands have yet to be used to their full potential, which contradicts their desired goals.

Hence, innovative efforts should be designed to optimize the FELDA land uses. Rashid et al. (2023) and Mokhtar et al. (2023) introduced the Sustainability and Highest Best Use **(**SHBU) framework, which is a missing link approach to the existing FELDA blueprint, particularly the Settlers Development Programme (SDP) and Smart Plantation Management System (SPMS). As a continuation, this paper attempts to emphasize the application of the SHBU by using a mixed methods approach. It incorporates interviews and Geographical Information System-based Multiple-criteria Decision Analysis (GIS-based MCDA) to strengthen SHBU's results in making the decisions for FELDA land development. Specifically, two objectives set for this research which are to identify the suitability of the SHBU approach for land development based on an interview, as well as to apply the SHBU based on GIS-MCDA for determining potential areas for future land development.

LITERATURE REVIEW

Introduction to SHBU in the FELDA Development Context

Walacik et al. (2020) posited that the concept of sustainable development involves more than the 'green' issue, and thus can create an added value for real estate analysis. Meanwhile, Pratama (2019) explained that the Highest Best Use (HBU) refers to utilizing an asset in the most possible and optimal way, taking into consideration physical feasibility, legal permission, financial viability and maximizing the asset's value. From these definitions, it can be said that sustainable development and the HBU promote the best effort in land development. Both concepts consider many aspects such as economic, social, environment and legal factors in land development.

Furthermore, Rashid et al. (2023) integrated sustainability and highest-best use into a new approach called SHBU to bring about positive changes and

synergize FELDA. That approach based on five dimensions, parallel to the fundamental issues of FELDA land development. Those dimensions are FELDA Business Centre (FBC), FELDA Residential Compound (FRC), FELDA Agropreneur (FAgp), FELDA Industry-based Crops (FIbC), and SHBU Plan Management (SPM).

Current Implementation of SHBU

Previous works have applied the SHBU for FELDA land development through different methods, each seeking to achieve specific purposes. For instance, Kamar et al. (2022) utilized a qualitative approach to obtain feedback from the respondents in relation to adopting the SHBU. Besides that, Rashid et al. (2023) applied the SHBU as a quantitative approach by using GIS-based MCDA to identify the potential areas for future development. Both approaches have their own strengths and weaknesses. For example, the findings from the qualitative approach cannot be visualized in the spatial form, while the results from GIS-based MCDA do not consider the feedback from the respondents. But both fit their roles and purposes in demonstrating the suitability of the SHBU for FELDA land development decision-making.

Therefore, this research attempts to utilize a mixed methods approach. It combines qualitative and quantitative data collection and analysis within a single study (Molina-Azorin et al., 2018). It is understood that the mixed methods approach has some limitations, such as time and resource constraints. However, this research overcomes these limitations by incorporating both qualitative and quantitative approaches. Integrating qualitative community insights and quantitative spatial analysis offers a comprehensive approach to decision-making processes.

RESEARCH METHODOLOGY

This research employs a mixed methods approach. It comprises interviews and GIS-based MCDA, which are considered qualitative and quantitative, respectively.

An Interview

An interview is selected because the first objective of this research is to identify the feedback regarding the suitability of adopting the SHBU approach based on five dimensions for FELDA land development. Merriam (2009) stated that there is no definite answer in determining the ideal sample size for qualitative research. However, Walker (2012) believed in the data saturation concept, suggesting that once sufficient information is gathered to replicate the study, a smaller sample size is enough. Earlier studies often involved interviews with a small number of respondents. For example, Fabeil et al. (2020) conducted interviews with only

two informants. Hence, in this study interviews were conducted with the key informants from two representatives of FELDA Gunung Besout 03.

The first informant was the Manager of FELDA Gunung Besout 03, while the second informant was the Head of Settlers as he was among the first generations of settlers. The interviews were conducted face-to-face in the study area on the 10th of November 2021. More respondents were invited for the interview. Unfortunately, only two had attended the session. It was due to fluctuation of COVID-19 cases nationwide. Moreover, the emergence of new viruses such as Delta and Omicron had increased the people's fear about being infected. However, it is strongly believed that both respondents had vast knowledge and experience about the study area. The audio recorded interviews were later transcribed by the research assistant and the notes taken by the researchers were then analysed to obtain rich information.

GIS-based MCDA

A GIS-based MCDA approach is an excellent analysis tool for dealing with and managing spatial decision problems (Prieto-Amparán et al., 2021). In this research, the land development planning decision-making includes identifying both the suitability of land for crops and future physical potential projects such as creating a business centre. Figure 1 shows the process of generating the SHBU's FELDA land development using a GIS-based MCDA approach proposed by Rashid et al. (2023). This paper will discuss it briefly. Further elaboration on that approach can be obtained from Rashid et al. (2023). It includes two steps:

i. Step 1 (HBU Domain): Assessing crop available land.
ii. Step 2 (Sustainability Domain): Assessing area for future development.

The following process involves three main stages to accomplish the execution of the SHBU model which are generating criterion maps and sub-criterion maps; weighting criterion maps; and creating outcomes which are composite maps of cropland suitability and future physical development. Only areas within a two-kilometre radius from the central points of the case study were delineated for the SHBU model execution. This limitation arose from cost constraints associated with acquiring Unmanned Aerial Vehicle (UAV) images and generating GIS data layers.

Step 1: Assessing Crop Available Land

a) Generating the criterion map

The assessment of cropland is done at Stage 001 and Stage 003 of plantation area. It is based on five determined criteria which are crop map, slope level, access network, fertile area, and water body (Table 1). Each criterion had gone through

two important processes prior to generating a composite map of cropland suitability which were classification, and criterion scores standardization. Each classification process involved various geospatial analyses in the ArcGIS software, such as buffers, clips, merges as well as vector to raster conversion. For example, the crop criterion map was classified into three sub-criterion maps.

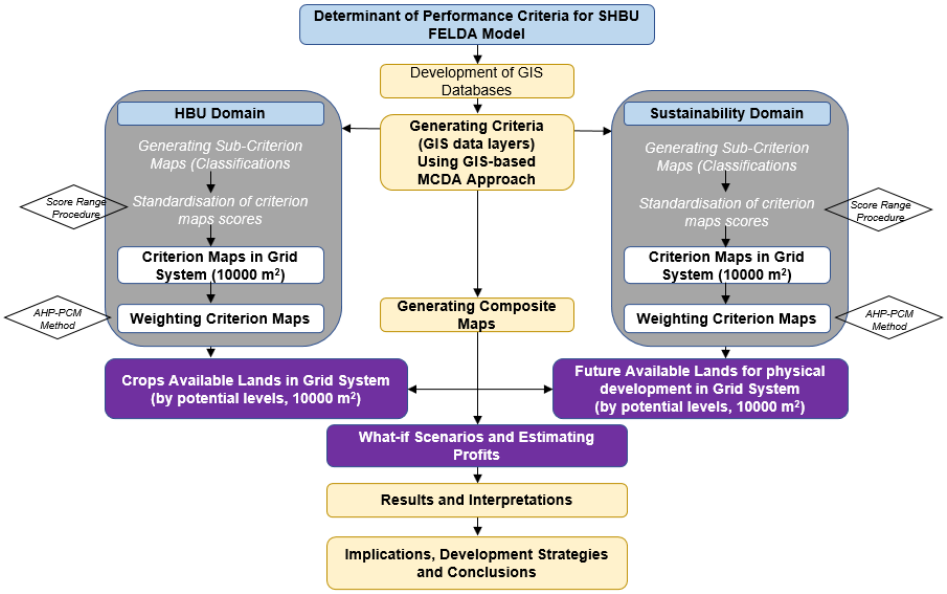


Figure 1: A GIS-based MCDA approach
Source: Rashid et al. (2023)

Each sub-criterion map had different level of importance (or effect) on the cropland suitability. They were evaluated and given raw scores based on the magnitude of their effects. The greater the effects on cropland suitability, the higher score was given. To enable direct comparison, the sub-criterion maps were converted into a uniform measurement unit, using the standardization of criterion scores method. The value of the standardized scores ranges from zero to one, where the lowest score is zero, and the highest score is one. Then, the criterion maps were converted into a grid system in the value of 10000 m^2 to complete the process of generating the criterion maps of the cropland assessment.

b) Weighting the criterion map

The important stage before generating the composite map of cropland suitability is the weighting criteria. This was necessary because the five criterion maps of the cropland suitability assessment had varying degree of importance in the

overall assessment. Hence, exercises to determine their relative importance were required. This issue was addressed by applying MCDA-based Analytic Hierarchy Process based Pairwise Comparison Matrix (AHP-based PCM).

Table 1: Criteria and standardized scores for cropland potential level

Criterion Maps with Weights	Sub-criterion Map in Raster System (Classifications by 10000 m^2)	Justifications	Raw Score	Standardization of Scores
Crop map	Productive area.	Area with productive oil palm trees.	2	1.0
	Productive area but require replanting.	Area with unproductive oil palm trees (above 25 years old).	1	0.5
W = 0.402	Non-productive area with constraint (or merged with constraint area).	Constraint area due to a higher slope level and difficult to access.	0	0.0
Slope level	Suitable areas for crops (slope level 0-12 degree).	Acceptable slope levels for oil palm and others (multiple interim crops).	3	1.0
W = 0.273	Suitable areas for crops (slope level 13-20 degree).	Acceptable slope levels for oil palm and others (short term crops).	2	0.7
	Suitable areas for crops (slope level 21-25 degree).	Acceptable slope levels for oil palm and others (medium-long term crops).	1	0.3
	Constraint areas (slope level above 25 degree).	Constraint slope levels for oil palm.	0	0.0
Access network	Areas within radius (buffer) 100m.	Areas with a higher accessibility (for crops management).	1	1.0
W = 0.110	Areas outside radius (buffer) 100m.	Areas with a lower or no accessibility (for crops management).	0	0.0
Fertile area	Vacant estate lands (with no existing crops).	Areas that can take into consideration for crops planting (based on the current physical features).	1	1.0
W = 0.146	Vacant estate lands with constraint (or merged with constraint areas).	Constraint areas due to a higher slope level and difficult to access.	0	0.0
Water body	Areas within radius (buffer) 50m.	Area with a higher accessibility to water resource- for crop management.	2	1.0
W = 0.068	Areas outside radius (buffer) 50m.	Area with a lower accessibility to water resource- for crop management.	1	0.5
	The existing river/water bodies (as constraint).	Constraint area (no development on river / water bodies).	0	0.0

Source: Rashid et al. (2023)

c) Generating the composite map

The final stage is generating the composite map by applying the standardized scores for each sub-criterion across the five criterion maps (within the GIS raster system), and the respective weights assigned to each criterion map. This process employs a Weighted Linear Combination (WLC) or scoring technique that is based on the concept of a weighted average (Rashid et al., 2023).

Step 2: Assessing Available Areas for Future Physical Development
The assessment of land for future physical development is conducted at the settlement area. It is based on five determined criteria which are reserve (alternative development) land, access network, slope level, water body and legal aspect (if any). Basically, this assessment follows a similar procedure to the initial one, but with a different set of data. The set of data used along with its sub-criteria and weight, is outlined in Rashid et al. (2023).

Study Area
The study area for this research is FELDA Gunung Besout 03. It is in Trolak region, Mukim of Sungkai, District of Batang Padang, Perak, Malaysia. It was selected because Trolak is one of 11 regions of FELDA that recorded a low average monthly income for settlers in oil palm plantation (RM3220.15) during the first half of 2021 (Jabatan Perladangan FELDA, 2021). There are 21 settlement areas within Trolak region itself. However, this research only focused on FELDA Gunung Besout 03 due to limitations in researchers' capacity.

FINDINGS AND DISCUSSIONS

Findings of Interviews and Discussion

Upon the feedback from both informants, it is worth noting that the SHBU approach is suitable for FELDA land development, especially in Gunung Besout 03. The proposed five dimensions are deemed appropriate. However, some requirements need to be considered carefully before adopting this approach.

FELDA Industry-based Crops
Briefly, the respondents highlighted these four requirements to be considered:

a. Only oil palm plantation is allowed in the study area.
b. Illegal oil palm plantation is found on FELDA reserve land.
c. Poor drainage leads to flood, especially in Stage 003 of plantation area.
d. Soil erosion occurs at the farm, especially in Stage 003 of plantation area.

The finding underscores the importance of maintaining the oil palm plantation as the primary crop in the study area. In addition, the up-stream and down-stream activities are highly encouraged to maximize profits within the palm oil industry. For instance, in down-stream activity, Aziz et al. (2020) recommended that recently manufactured high-rate anaerobic reactors serve as the most suitable and efficient pre-treatment technique for maximizing the extraction of biogas from palm oil mill effluent.

FELDA Business Centre
Basically, the respondents asserted the challenges as follows:

a. There is no vacant land to create FBC in the study area.
b. The location of the study area is unsuitable for FBC, where even previous night market was not successful.
c. The location of FBC should be within the combination of three FELDA areas.

The study indicates that the viability of FBC depends on the size of the area and its population to ensure its success. Therefore, the optimal location of FBC should be at the centre of Trolak region, providing equal distances from surrounding areas.

FELDA Residential Compound
The respondents highlighted the following challenges:

a. There is no vacant land to create FRC in the study area.
b. The proposed 100 units plus of houses in FELDA Gunung Besout 02 for second generation settlers are insufficient.
c. Poor drainage system contributed to soil erosion at some parts of the settlement area.

The study shows that FRC needs a vacant and large area to accommodate more residential units for the second generation of FELDA settlers. This is to address the issue of insufficient housing supply within the FELDA scheme (Government of Malaysia, 2019). With this initiative, the study area would be able to retain its workforce, as youths do not need to migrate to other places in search of suitable housing.

FELDA Agropreneur
The respondents emphasized three potentials and certain requirements as follows:

a. The study area boasts many potential tourism products, including the scenic view at Bukit Selfie, tours of oil palm farms, and the tranquil environment of FELDA villages.
b. To address the shortage of labour in farming, it is crucial to attract the younger generation of FELDA settlers to the oil palm industry. For instance, students in schools should be exposed to oil palm trees, and FELDA, together with the government should impart knowledge and skills related to oil palm plantation operation and management in other suitable educational institutions.
c. Strengthening the cooperation in business, especially in farm operation.

The findings reveal a need to educate the settlers especially the younger generation to become successful agropreneurs. This intention can be achieved by enhancing the tourism products such as Bukit Selfie. Encouraging the FELDA's youths to engage in the oil palm industry could alleviate the labour shortages on the farms They can also be trained to become capable farm managers and entrepreneurs. Johari et al. **(**2020**)** found many young agropreneurs have succeeded in various agricultural endeavours such as crop cultivation.

The respondents highlighted certain requirements to be considered before implementing the FAgp. Their insights are based on experience with SDP projects. Usually, projects conducted by individuals under SDP lack continuity as there were no successors to take over the projects after the original participants passed away.

This finding discloses the challenge faced by FAgp based on previous SDP projects where many projects came to a halt with the death of the participants. Hence, the proposed FAgp model operated by individuals should include a protégé to ensure continuity in the case of the participants' demise.

SHBU Plan Management

The respondents highlighted three requirements to be considered as follows:

a. Only 117 settlers (43.2%) surrendered their farm to FELDA management. Other 154 settlers (56.8%) managed the farm themselves.
b. Loss of oil palm plantation income was due to settlers selling the palm fruits to other oil palm mills.
c. Lack of manpower has caused ineffective harvest of many tonnes of oil palm fruits. It caused a great loss of income to the settlers and the FELDA.

The finding shows that before implementing SPM, specific requirements must be met as not all settlers are in agreement regarding farm management practices. Only 43.2% of settlers have relinquished their farms to FELDA management. Hence, initiatives should be taken to attract other settlers to join the FELDA farm management. Besides, to prevent the loss of income from the oil palm plantation, all settlers are encouraged to sell their yields exclusively to FELDA oil palm mills. Additionally, efforts should be made to motivate all settlers, especially the youth to become successful farm operators with attractive income. This initiative could alleviate the issue of labour shortages on the farm.

Therefore, conducting the interviews has successfully gathered valuable feedback and development aspirations from the respondents in the study area. However, interviews have limitations in representing the findings in spatial forms. Hence, other techniques are needed to provide geospatial results of the SHBU's dimensions to enhance decision-making process.

Findings of a GIS-based MCDA and Discussion
This section covers the potential lands for crop and future physical development.

Potential Cropland
Figure 2 depicts the results of GIS-based MCDA for cropland in the study area. Almost all croplands (100.00%) are suitable for plantations (Table 2).

Potential Future Physical Land Development
Figure 3 illustrates the results of GIS-based MCDA for physical land development at settlement area. It has identified the location and size of land (about 39.15 hectares) which is suitable for future development (both the most potential and potential areas). It has the potential for developing a housing area with a small business centre that would cater to the needs of residents.

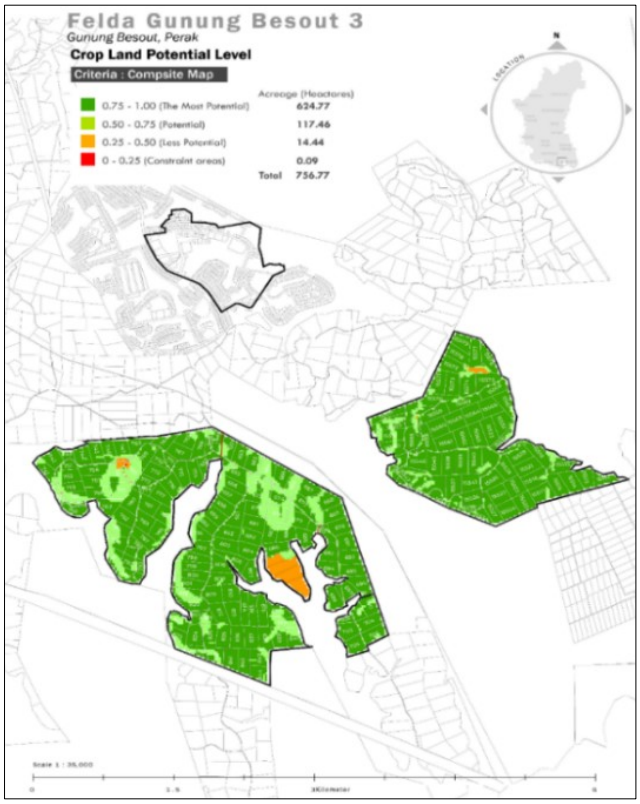


Figure 2: Cropland by Potential Level in the Study Area

Table 2: Cropland Potential Level

Potential Levels	Acreage - Hectare (%)	Explanation
The most potential	624.77 (82.56)	It is the most productive area for cultivating oil palm trees, supplemented by interim crops planted alongside the oil palms, particularly in the areas where replanting is underway.
Potential	117.46 (15.52)	This area is also designated for oil palm plantation with mitigation to better manage the trees, production and harvesting process.
Less potential	14.44 (1.91)	This area is reserved for oil palm plantation with all the needed mitigations to better manage the trees, production, and harvesting process.
Constraint area	0.09 (0.01)	The vast land area has the potential to be developed into plantation-based tourism, recreational and adventure sports activities.
Total	**756.77 (100.00)**	

It is proven that GIS is very fruitful in giving the result of analysis in the spatial form. A GIS-based MCDA approach is an excellent analysis tool for dealing with and managing spatial decision problems (Prieto-Amparán et al., 2021). However, GIS has a limitation that it fails to incorporate the aspirations and suggestions of residents. Consequently, a GIS-based MCDA approach also cannot function as a stand-alone method but requires other techniques for support.

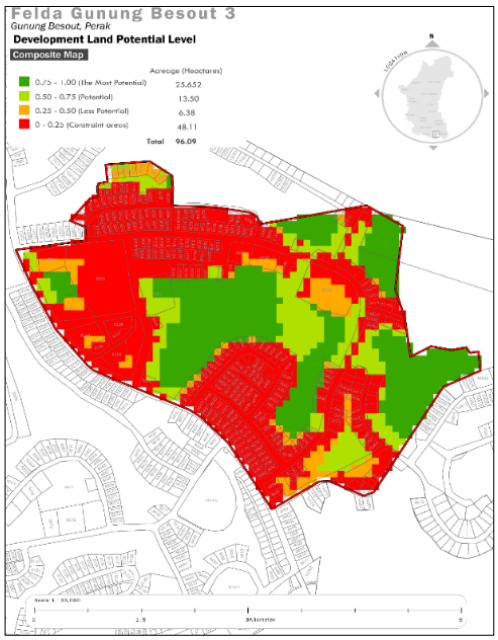


Figure 3: Future Physical Development Land by Potential Levels

Enhancement of SHBU Results: Interviews and GIS-based MCDA

The results from both methods prove to be more affluent and refined for making development decisions. Table 3 outlines the essential summary of the findings from the interviews and GIS-based MCDA. It would indicate that the potential opportunities outweigh the challenges. More importantly, it could identify the specific development projects for the study area, such as the identifying suitable locations for housing areas with small business centres to meet the local demands, SDP agricultural projects and SDP marketing hub. Table 3 shows improved research findings as it combines interview data with GIS-based MCDA results, which offers a more comprehensive perspective. Hence, this paper proposes a mixed methods approach to SHBU (Figure 3). A better understanding can be achieved, for example, by triangulating one set of results with another, thereby strengthening the validity of inferences (Molina-Azorin et al., 2018). This method should be employed in the future to obtain superior outcomes from the SHBU.

With regards to the critical summary findings, Table 4 outlines the proposed development intervention strategy of the SHBU aimed at optimizing the FELDA land development. It is formulated after considering the findings from both interviews and GIS-based MCDA. The strategy includes aspects related to crop management, physical development, and enhancement of the SHBU. Hence, integrating the proposed strategy with existing FELDA initiatives such as SDP and SPMS can lead to better outcomes.

Table 3: Critical Summary Findings of an Interview and GIS-based MCDA

Dimensions	Challenges (C)			Potentials (P)			Findings
	L1	L2	L3	L1	L2	L3	
Felda Industry-based Crop (FIbC)	/	/	/	/	/	/	C1 - only oil palm plantation is allowed. C2 - illegal oil palm plantation is found on FELDA reserve land. C3 - poor drainage leads to flood and soil erosion in Stage 003 of plantation area. P1 - potential for interim crops (SDP projects), managed by cooperation. P2 - potential for enhancing Bukit Selfie and oil palm farms as tourism attractions. P3 - potential for adventure sports at hilly area.
FELDA Business Centre (FBC)	/			/	/		C1 - FBC should be proposed at Trolak regional level to support its viability. P1 - the adjacent business centre in Gunung Besout 01 should be strengthened. P2 - GIS shows available reserve land which can be developed as a small business centre.
FELDA Residential Compound (FRC)	/	/		/			C1 - respondents said no vacant land for FRC. C2 - the proposed 100 units of houses for the second-generation settlers are insufficient. P1 - GIS shows available FELDA reserve lands that can be developed as a housing area.

Dimensions	Challenges (C)			Potentials (P)			Findings
	L1	L2	L3	L1	L2	L3	
FELDA Agropre-neur (FAgp)	/			/	/	/	C1 - previous SDP projects conducted by individuals are not continuous. Nobody took over the projects when the participants died. P1 - FAgp is proposed and the individuals who participate in the project should have a protégé to continue the business if the participant died. P2 - the study area has many potential tourism products such as Bukit Selfie, an oil palm farm tour and a serene FELDA village. P3 - attract the youths to work in the oil palm industry to overcome the labour shortage.
SHBU Plan Manage-ment (SPM)	/	/	/	/	/	/	C1 - only 117 settlers (43.2%) surrendered their farm to FELDA management. Others (56.8%) managed the farm themselves. C2 - loss of oil palm income was due to settlers selling their yields to other oil palm mills. C3 - the shortage of employee has caused an inefficient harvest, loss of many tonnes of oil palm fruits. This has resulted in a great loss of income for both the settlers and FELDA. P1 - there is a potential to attract 56.8% of settlers to join FELDA farm management. P2 - all settlers should sell their yields to FELDA oil palm mills to increase the income. P3 - encourage the youths to become farm operators to address the labour shortages.

Note: L1 = Low, L2 = Medium, L3 = High

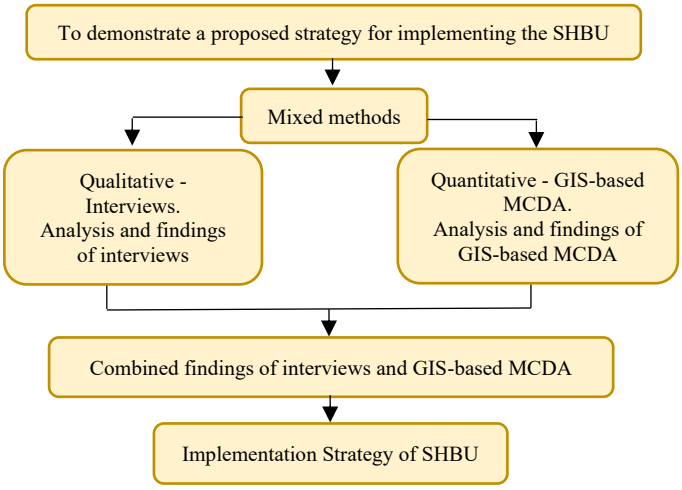


Figure 3: A Mixed Methods Approach to SHBU in Search for Implementation Strategy

Table 4: Proposed Development Intervention Strategy for the Study Area

Aspects	Proposed Implementation Strategies
Crop	● Planting interim crops at the potential area.
Future physicals development project	● Develop a housing scheme with a small business centre at the potential area. ● Enhance the recreation / tourism activities such as an open view at Bukit Selfie, farm tour at oil palm plantation area, tourism route in village area, adventure sports at the hilly area.
Enhancement of the SHBU	● Enhance SHBU Plan Management: o All oil palm plantation areas should be operated by FELDA management to achieve optimum operation and management. o All settlers should only sell their yields to FELDA oil palm mills to avoid the loss of oil palm plantation income. o Train the youth with current knowledge in oil palm operation and management to resolve the issue of labour shortage.

CONCLUSIONS

This research has achieved two study objectives. Firstly, it was found that the SHBU approach is suitable for FELDA land development in the study area. However, every dimension requires the fulfilment of additional requirements before execution. Secondly, about 795.92 hectares of potential area for future development were identified. Additionally, this research has utilized the SHBU results to inform decision-making concerning land development. It is hoped the proposed development intervention strategy of the SHBU will be able to optimize FELDA land development in the study area.

This research contributes to both new knowledge and practice. In terms of new knowledge, this research has contributed to methodology enhancement by proposing a mixed methods approach, which integrates interviews and GIS-based MCDA within the SHBU framework. Furthermore, it has demonstrated the suitability of the SHBU approach for land development and determined the potential areas for future development in spatial form. Practically, the proposed strategy can provide valuable input to relevant parties to enhance the study area.

This research has no intention of generalizing its findings. Nonetheless, it is believed that the findings of this research have the potential to be implemented in other FELDA schemes. This research has some limitations. For example, there was a lack of respondents to adequately represent the population in the study area. In addition, due to time and budget constraints, the application of GIS-based MCDA was limited to calculating spatial data within a two-kilometre radius from the centroid points. Furthermore, detailed data for the cropland criterion map, such as land fertility and land type, were also limited. Hence, future research could focus on improving these aspects accordingly. This would enable the crafting of a better implementation strategy for the future SHBU approach.

ACKNOWLEDGEMENT

The authors would like to thank *Institut Penilaian Negara* for funding this research through the National Real Estate Research Coordinator (NAPREC), 12th Malaysia Plan, grant reference number INSPEN.600-4/10/4(2).

REFERENCES

Aziz, M. M. A., Kassim, K. A., ElSergany, M., Anuar, S., Jorat, M. E., Yaacob, H., Ahsan, A., Imteaz, M. A., & Arifuzzaman. (2020). Recent advances on palm oil mill effluent (POME) pretreatment and anaerobic reactor for sustainable biogas production. *Renewable and Sustainable Energy Reviews, 119*, 1-31. https://doi.org/10.1016/j.rser.2019.109603

Bernama. (2021, July 12). Govt implements FELDA recovery plan. *The Sun Daily*. Retrieved from Govt implements Felda recovery plan (thesundaily.my)

Fabeil, N. F., Pazim, K. H., & Langgat, J. (2020). The impact of COVID-19 pandemic crisis on micro-enterprises: Entrepreneurs' perspective on business continuity and recovery strategy. *Journal of Economics and Business, 3*(2), 837-844. https://doi.org/10.31014/aior.1992.03.02.241

Government of Malaysia. (2019). *Kertas putih ke arah kelestarian Lembaga Kemajuan Tanah Persekutuan (FELDA).* Kuala Lumpur, Malaysia: Government of Malaysia. WJD011490 Kulit Kertas Putih.pdf (pmo.gov.my)

Jabatan Perladangan FELDA. (2021). *Taklimat kepada UiTM bagi tujuan kajian bertajuk rangkakerja bagi memperkasa pembangunan tanah FELDA ke arah kelestarian (sustainability) dan penggunaan terbaik tertinggi (highest and best-used)* [PowerPoint slides]. Slideshare.

Johari, A. N., Mohamad, A., & Ishak, A. K. **(**2020**).** Profile of successful SMEs young agropreneurs at north Peninsular Malaysia: Descriptive analysis. *Advanced International Journal of Business, Entrepreneurship and SMEs, 2*(4), 36-46. https://doi.org/10.35631/aijbes.24004

Kamar, M. A. A., Mokhtar, S., Rashid, M. F. A., Kamaruddin, S. M., Abdullah, S., & Ali, M. A. F. (2022). Profiling the suitability of sustainability and highest best use approach for FELDA land development. *International Journal of Academic Research in Business and Social Sciences, 12*(10), 500-513. DOI: 10.6007/IJARBSS/v12-i10/14707

Merriam, S. B. (2009). *Qualitative research - A guide to design and implementation*. San Francisco, United States of America: Jossey-Bass.

Mokhtar, S., Rashid, M. F. A., Kamaruddin, S. M., Kamar, M. A. A., Abdullah, S., & Ali, M. A. F. (2023). The formulation of sustainable and highest best-use (SHBU) model for FELDA land use development. *Planning Malaysia Journal of the Malaysian Institute of Planners, 21*(2), 213-225. https://doi.org/10.21837/pm.v21i26.1272

Molina-Azorin, J. F., Tari, J., Lopez-Gamero, M. D., Pereira-Moliner, J., & Pertusa-Ortega, E. M. (2018). The implementation and advantages of mixed methods in competitive strategy and management systems. *International Journal of Multiple Research Approaches, 10*(1), 412-421. https://doi.org/10.29034/ijmra.v10n1a28

Pratama, A. F. B. R. (2019). Analisis konsep highest and best use untuk tanah wakaf menurut perspektif Islam. *Journal of Islamic Economics, Finance and Banking, 2*(2), 157-176. https://doi.org/10.12928/ijiefb.v2i2.856

Prieto-Amparán, J. A., Pinedo-Alvarez, A., Morales-Nieto, C. R., Valles-Aragón, M. C., Álvarez-Holguín, A., & Villarreal-Guerrero, F. (2021). A regional GIS-assisted multi-criteria evaluation of site-suitability for the development of solar farms. *Land, 10* (217), 1-19. https://doi.org/10.3390/land10020217

Rashid, M. F. A., Mokhtar, S., Kamaruddin, S. M., Kamar, M. A. A., Abdullah, S., & Ali, M. A. F. (2023). A GIS-based sustainability and highest-best use (SHBU) for FELDA lands development planning decision-making. *Planning Malaysia, 21*(1), 444-458. https://doi.org/10.21837/pm.v21i25.1249

Walacik, M., Renigier-Biłozor, M., Chmielewska, A., & Janowski, A. (2020). Property sustainable value versus highest and best use analyses. *Sustainable Development, 2020*, 1-18. https://doi.org/10.1002/sd.2122

Walker, J. L. (2012). The use of saturation in qualitative research. *Canadian Journal of Cardiovascular Nursing, 22*(2), 37-46. The use of saturation in qualitative research - PubMed (nih.gov)

Received: 30th June 2024. Accepted: 10th September 2024

PLANNING MALAYSIA:
Journal of the Malaysian Institute of Planners
VOLUME 22 ISSUE 5 (2024), Page 376 – 390

EXPLORING ISSUES AND ENHANCING SUSTAINABILITY: AFFORDABLE HOUSING DYNAMICS IN MALAYSIA

Nur Aqlima Ramli[1], Nurul Nadiah Zainol[2*], Anis Syazwani Sukereman[3], Nurul Arafah Ishak[4]

[1]*Department of Surveying,*
UNIVERSITI TUNKU ABDUL RAHMAN (UTAR)
43000 Kajang, Selangor, Malaysia.
[2,3]*School of Real Estate and Building Surveying, College of Built Environment,*
UNIVERSITI TEKNOLOGI MARA (UiTM)
40450 Shah Alam, Selangor, Malaysia.
[4]*Project Department,*
BRAMA IMPRESA DESIGN AND BUILD SDN BHD
47120 Puchong, Selangor, Malaysia

Abstract

This study delves into the issues of affordable housing and elements influencing the sustainability of affordable housing, with a specific focus on the Malaysian context. The primary objective is to identify the issues associated with affordable housing in Malaysia, as well as to determine the elements crucial for enhancing sustainability in the housing sector. A quantitative method using a questionnaire survey was conducted involving three groups of respondents: building designers, facility managers, and GBI facilitators. The research employed the Kruskal Wallis statistical analysis method and Importance Index Calculation as the key methodologies. Two significant findings emerged from the study. Firstly, the issues related to 'location and accessibility' and 'financing challenges' were identified as critically important, shedding light on the obstacles faced in these domains. Secondly, the elements of 'adaptability and upgradability' and 'location and accessibility' were highlighted as pivotal contributors to the sustainability of affordable housing in Malaysia. These findings provided valuable insights for policymakers, urban planners, and stakeholders in addressing key issues and promoting sustainable practices in the realm of affordable housing.

Keywords: Issues, Elements, Sustainability, Affordable Housing

[2] Senior lecturer: nadiahzainol@uitm.edu.my

INTRODUCTION

Housing is a crucial aspect of modern life, not merely because of its cost but also because of its connection to various urban challenges. It helps residents maintain economic stability, cope with climate change, and address urban violence issues (Vale and Shamsuddin, 2014). Those with limited income often end up in poor housing, as claimed by Wahi et al. (2018) and Abdullahi & Aziz (2011). The Malaysian government is actively committed to low-income housing (Eng, 2023; Almeida & Cheah, 2017). In recent years, significant growth has been witnessed in affordable housing to meet the needs of the population, with units priced affordably to ensure accessibility for low-income individuals (Ling, 2017; Abdullahi & Aziz, 2011). Government initiatives support the efficient and widespread availability of housing for all citizens. According to Eng (2023) and Ling (2017), this reflects the increasing focus on sustainability in the Malaysian housing sector.

Affordable Housing in Malaysia

Affordable housing in Malaysia is designed for the lower-income population segments, including B40, M40, and T20 groups (Eng, 2023; Romeli, 2023). Romeli (2023) and KPKT (2022) asserted that within the B40 group, there are 3.16 million households earning less than RM5,250. To address housing needs, especially for the financially limited (B40), the Malaysian government has implemented various initiatives and programs outlined by KPKT (2022). These schemes are listed on the MyGov portal as of January 2:

a) Perumahan Penjawat Awam Malaysia (PPAM)
b) PR1MA
c) Federal Territory Malaysia Home/ RUMAWIP
d) MyHome
e) My Selangor Home

The 12th Malaysia Plan (12MP) oversees Malaysia's growth until 2025, prioritizing affordable and sustainable housing in the face of urbanization challenges. However, there are apprehensions over the equilibrium of economic, social, and environmental considerations in these undertakings. This research aims to understand and enhance the sustainability of affordable housing within the 12MP, providing practical suggestions for policymakers, planners, and communities.

LITERATURE REVIEW

This section explores the issues and factors that influence the sustainability of affordable housing.

Issues of Affordable Housing

In Malaysia, across many other nations, affordable housing encounters distinct obstacles shaped by the local context. Several challenges related to affordable housing encompass the following:

Table 1: Issues of Affordable Housing

No.	Issues	Elaboration	Authors
1.	Location and Accessibility	Affordable housing projects are often located far from cities and jobs, making it hard for residents to find work and access essential services.	Romeli, 2023; Wahi et al., 2018; Almeida & Cheah, 2017; Ling, 2017; Bakhtyar et al., 2013; Sulaiman et al., 2016
2.	Urbanization and Land Costs	Increasing urbanization in Malaysia has raised land costs, making it hard to build affordable housing in desirable areas. Additionally, finding suitable land for affordable housing in cities is challenging.	Romeli, 2023; Wahi et al., 2018; Almeida & Cheah, 2017; Ling, 2017; Sulaiman et al., 2016; Vale et al., 2014
3.	Community Amenities	Lack of quality schools and healthcare affects residents' well-being. Inadequate parks and recreational areas also lower the quality of life in these communities.	Wahi et al., 2018; Sulaiman et al., 2016; Vale et al., 2014; Goh et al., 2013; Abdullahi et al., 2011
4.	Infrastructure and Utilities	Some affordable housing lacks proper roads, water, and sanitation, affecting living conditions. Utilities like electricity and water can also be inconsistent or insufficient.	Eng, 2023; Romeli, 2023; Wahi et al., 2018; Almeida & Cheah, 2017; Ling, 2017; Bakhtyar et al., 2013
5.	Construction and Quality Issues	Rising costs of materials and labor make affordable housing less affordable. Cost-cutting measures can also compromise construction quality, affecting the durability and safety of the units.	Romeli, 2023; Wahi et al., 2018; Bakhtyar et al., 2013; Sulaiman et al., 2016; Goh et al., 2013; Abdullahi et al., 2011
6.	Social Stigma	Affordable housing projects may face social stigma, influencing the community's perception and creating challenges for residents to integrate into society.	Xingrui & Ibrahim, 2024; Almeida & Cheah, 2017; Ling, 2017; Vale et al., 2014; Bakhtyar et al., 2013
7.	Financing Challenges	Low-income individuals may struggle to get loans or mortgages for affordable housing. Even with financing options, high interest rates can make homeownership difficult for them.	Eng, 2023; Romeli, 2023; Almeida & Cheah, 2017; Ling, 2017; Bakhtyar et al., 2013; Sulaiman et al., 2016
8.	Government Policies and Regulations	Strict zoning laws can hinder affordable housing development and limit construction. Approval delays and bureaucratic hurdles can also slow down these projects.	Romeli, 2023; Almeida & Cheah, 2017; Ling, 2017; Wahi et al., 2018; Sulaiman et al., 2016; Vale et al., 2014
9.	Supply and Demand Mismatch	The need for affordable housing may exceed what is available, causing a shortage. Also, the designs and types of	Almeida & Cheah, 2017; Ling, 2017; Sulaiman et al., 2016; Vale et al., 2014;

No.	Issues	Elaboration	Authors
		affordable housing may not always match what people need, leading to mismatches in supply and demand.	Bakhtyar et al., 2013; Goh et al., 2013; Abdullahi et al., 2011

Addressing these challenges in Malaysia requires a concerted effort from the government, private sector, and civil society to develop holistic and sustainable solutions for affordable housing. This may involve revising policies, fostering public-private partnerships, and implementing community development programs to enhance the overall quality of affordable housing.

Elements that contribute to the sustainability of affordable housing.

The concept of sustainable development in Malaysia is in its initial phases (Ramli, 2023; Zainol, 2023). Despite Malaysia initiating its environmental policy efforts ahead of many developing nations, the sustainability agenda is a relatively recent addition to the Malaysian policy framework (Ramli et al., 2019). Achieving sustainable development in affordable housing involves integrating social, economic, and environmental considerations, aligning with the principles of the Triple Bottom Line (TBL). The sustainability of affordable housing involves various elements that address economic, social, and environmental considerations. Here are crucial elements that contribute to the sustainability of affordable housing:

Table 2: Elements that contribute to the sustainability of affordable housing.

No.	Elements	Elaboration	Authors
Social			
1.	Community Infrastructure	Developing adequate roads, water supply, sanitation, and recreational spaces to enhance community well-being.	Jian and Huay Ying, 2021; Samsons, 2018; Au Yong et al., 2019; Ebekozien et al., 2018b
2.	Social Integration	Promoting a sense of community and inclusion within affordable housing projects to address social issues and improve residents' overall quality of life.	Xingrui & Ibrahim, 2024; Au-Yong et al., 2018; Noraziah et al., 2018; Ahmad Ezanee et al., 2015
3.	Mixed-Income Communities	Integrating diverse housing types to create economically mixed communities, reducing the concentration of poverty and fostering social diversity.	Jian and Huay Ying, 2021; Wan Sumayyah et al., 2018; Ahmad Ezanee et al., 2015; Rima & Davies, 2011
4.	Community Engagement	Encouraging the involvement of residents in the decision-making processes and community development initiatives to empower them and build a sense of ownership.	Olanrewaju et al., 2021; Olanrewaju et al., 2018; Rima & Davies, 2011

No.	Elements	Elaboration	Authors
5.	Supportive Services	Providing essential services like education, healthcare, and vocational training within or near affordable housing developments.	Jian and Huay Ying, 2021; Olanrewaju et al., 2021; Samsons, 2018; Au Yong et al., 2019; Ebekozien et al., 2018b
6.	Legal Security of Tenure	Ensuring residents have legal rights to their homes, providing security of tenure, and protecting against forced eviction.	Wan Sumayyah et al. 2018; Olanrewaju et al., 2021; Ahmad Ezanee et al., 2015
Economic			
1.	Affordability	Ensuring that the cost of acquiring and maintaining affordable housing remains within the financial means of the target population.	Noraziah et al., 2018; Zaid and Graham, 2017; Olanrewaju et al., 2018; REHDA report, 2016; Yap and Ng, 2018; Che Ani et al., 2011
2.	Financial Inclusion	Facilitating access to financial services and homeownership programs that empower low-income individuals to purchase and sustain their homes.	Olanrewaju et al., 2021; Noraziah et al., 2018; Yap and Ng, 2018; Au-Yong et al., 2018; Noraziah et al., 2018; Ahmad Ezanee et al., 2015
3.	Adaptability and Upgradability	Designing housing units that can be easily adapted or upgraded over time to meet changing needs and accommodate improvements in living standards.	Olanrewaju et al., 2021; Pleshivcev, 2019; Seshadhri and Kumar Paul, 2018; Fallahi, 2017; Chan and Adabre, 2019
4.	Government Policies and Support	Implementing supportive government policies and initiatives that encourage the development and sustainability of affordable housing.	Wan Sumayyah et al., 2018; Olanrewaju et al., 2018; REHDA Report, 2016
Environmental			
1.	Energy Efficiency	Incorporating energy-efficient design and technologies to reduce utility costs for residents and minimize the environmental impact of housing units.	Wan Sumayyah et al., 2018; Samsons, 2018; Seshadhri and Kumar Paul, 2018; Fallahi, 2017; Chan and Adabre, 2019
2.	Green Material and Practice	Using eco-friendly construction practices and materials to reduce the environmental footprints of affordable housing developments.	Zaid and Graham, 2017; Olanrewaju et al., 2018; REHDA Report, 2016; Yap and Ng, 2018; Che Ani et al., 2011
3.	Location and Accessibility	Strategic placing of affordable housing in accessible locations with proximity to employment opportunities, public transportation, and essential services to minimize environmental impact.	Jian and Huay Ying, 2021; Wan Sumayyah et al., 2018; Ahmad Ezanee et al., 2015; Rima & Davies, 2011; Che Ani et al., 2011

No.	Elements	Elaboration	Authors
4.	Quality of Construction	Ensuring that construction adheres to high-quality standards, providing durable and safe living spaces for occupants.	Jian and Huay Ying, 2021; Winkler et al., 2001; Olanrewaju et al., 2018; REHDA report, 2016; Ahmad Ezanee et al., 2015
5.	Technology and Innovation	Embracing technological advancements and innovative construction methods to enhance efficiency, reduce costs, and improve the overall sustainability of affordable housing.	Olanrewaju et al., 2021; Zaid and Graham, 2017

RESEARCH METHODOLOGY

The research methodology involved several processes, which consisted of a literature review, reliability test, and the main survey, as illustrated in Figure 1

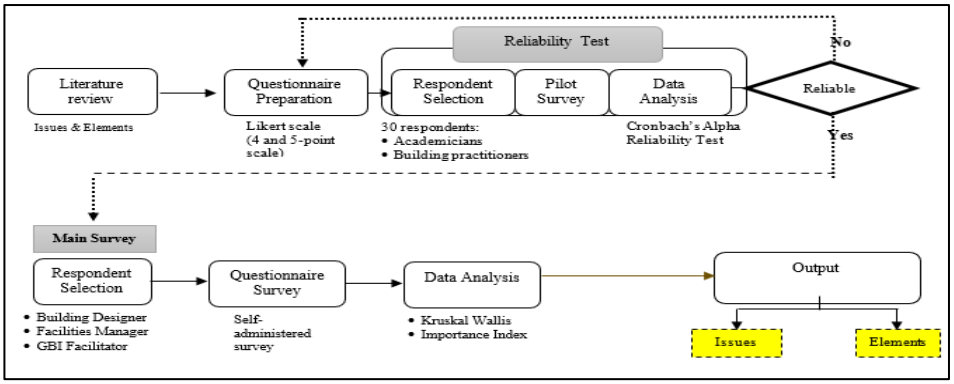


Figure 1: Research Diagram

Literature Review

A literature review is a detailed analysis of research on a topic involving reading the review of theses, books, journals, and other sources pertaining to the area of study. Researchers use it to learn about affordable housing issues in Malaysia and globally. The information provided enhances their comprehension of the issue, facilitates problem identification, aids solution discovery, and addresses research questions. Tables 1 and 2 outline the concerns and components associated with affordable housing.

Reliability Test

A pilot survey is preliminary research undertaken before the main survey to evaluate methods, data collection instruments, sample recruitment strategies, and other methodologies. It assists in identifying shortcomings and limitations in the selected research tools. Cronbach's alpha, frequently employed with Likert-type scales, was chosen to test the reliability in this study, as it is widely utilized in social science research to evaluate instrument reliability (Gliem & Gliem, 2003; Hassan, 2006).

Main Survey

The study collected data from three groups: Building Designers, Facilities Managers, and GBI Facilitators, to understand sustainability in affordable housing. These groups were selected for their roles in designing and maintaining buildings. Using Gill et al.'s (2010) formula with a 95% confidence level and 5% margin of error, respondents were contacted via telephone and email for their consent before receiving the questionnaires. The required sample sizes and response rates for each group are shown in Table 4.

Table 3: Total population from the three groups of respondents

No	Population Group	Total Population	Number of Samples	Approval Rate	Returned Questionnaire
1.	Building Designers (Registered with BAM)	2547	322	163	113
2.	Facilities Managers (Registered with MAFM)	30	30	27	21
3.	GBI Facilitators (GBI website)	932	260	122	94
	TOTAL	**3502**	**612**	**312**	**228**

RESULT ANALYSIS AND DISCUSSION

The analysis of the data addresses the significance of factors influencing sustainability in affordable housing and the degree to which these factors are implemented in the affordable housing project.

Reliability Test Cronbach Alpha

The Cronbach's Alpha reliability test was conducted to identify the reliability of the responses obtained for each of the issues and elements listed in the questionnaire. The result of the reliability test is shown in Table 5 and Table 6.

Table 4: Reliability statistics for the issues of affordable housing.

Cronbach's Alpha	N of Items
0.899	9

Table 5: Reliability statistics for the elements contributing to sustainability in affordable housing.

Cronbach's Alpha	N of Items
0.921	15

The Cronbach's Alpha Reliability Test shows that the scale is reliable, with an alpha value of more than 0.70. This suggests that all the issues and elements are statistically reliable, and the questionnaire can be used for the main data collection.

Kruskal Wallis Nonparametric Test

The Kruskal Wallis Nonparametric test was performed to identify the difference of opinions among the three groups of respondents (building designer, facilities manager, GBI facilitator) on issues and elements contributing to sustainability in affordable housing. The results of the Kruskal Wallis Nonparametric test are shown in Table 7 and Table 8.

Table 6: Kruskal Wallis nonparametric test (Issues of affordable Housing)

No.	Issues	Asymp. Sig.
1.	Location and Accessibility	0.312
2.	Urbanization and Land Costs	0.114
3.	Community Amenities	0.434
4.	Infrastructure and Utilities	0.296
5.	Construction and Quality Issues	0.298
6.	Social Stigma	0.134
7.	Financing Challenges	0.400
8.	Government Policies and Regulations	0.213
9.	Supply and Demand Mismatch	0.277

Table 7: Kruskal Wallis nonparametric test (elements contributing to sustainability in affordable housing)

No.	Elements	Asymp. Sig.
1.	Community Infrastructure	0.175
2.	Social Integration	0.109
3.	Mixed-Income Communities	0.221
4.	Community Engagement	0.298
5.	Supportive Services	0.271
6.	Legal Security of Tenure	0.313
7.	Affordability	0.113
8.	Financial Inclusion	0.245
9.	Adaptability and Upgradability	0.362
10.	Government Policies and Support	0.105

No.	Elements	Asymp. Sig.
11.	Energy Efficiency	0.323
12.	Green Material and Practice	0.412
13.	Location and Accessibility	0.211
14.	Quality of Construction	0.453
15.	Technology and Innovation	0.324

The result of the Kruskal Wallis Nonparametric test showed no significant difference in mean ranking based on the *p*-value being less than 0.05. This indicates that there is no significant difference of opinion among the three groups of respondents on all issues pertaining to affordable housing in Malaysia and elements contributing to sustainability in affordable housing in Malaysia.

Importance Index Calculation

The importance index calculation was conducted using the important index formula, which provides the important value for each of the issues and elements of sustainability in affordable housing. However, the importance index value (I.I. Value) should be weighed against the value of standard deviation (SD) to identify the level of importance of each issue and element. According to Zainol (2016), the level of importance can be separated into four categories: very important, important, somewhat necessary, and least important. Table 9 presents the indicators of the types of relevance.

Table 8: Importance Level Categories (Source: Zainol, 2016)

Category	Indicator
Very Important	I. I. Value more than one SD above the mean
Important	I.I. Value is between the mean and the one SD above the mean
Somewhat Important	I.I. Value is between the mean and the one SD below the mean
Least Important	I.I. Value less than one SD below the mean

The results of the importance index calculation for issues of affordable housing are presented in Table 10 below.

Table 9: Importance index calculation for issues of affordable housing.

No.	Issues of affordable housing	Importance Index Value (I.I Value)	Level of Importance
1.	Location and Accessibility	1.021	Very Important
2.	Urbanization and Land Costs	0.827	Somewhat Important
3.	Community Amenities	0.832	Somewhat Important
4.	Infrastructure and Utilities	0.851	Somewhat Important
5.	Construction and Quality Issues	0.792	Somewhat Important

No.	Issues of affordable housing	Importance Index Value (I.I Value)	Level of Importance
6.	Social Stigma	0.693	Least Important
7.	Financing Challenges	1.103	Very Important
8.	Government Policies and Regulations	0.989	Important
9.	Supply and Demand Mismatch	0.774	Somewhat Important
	Mean Importance Index	= 0.876	
	Standard Deviation	= 0.132 (1SD below Mean=0.744, 1SD above Mean=1.008)	

Financing Challenges

Addressing financing challenges in affordable housing is crucial because low-income individuals face significant obstacles in securing stable housing. These challenges include difficulties in obtaining loans due to strict criteria set by financial institutions, as highlighted by Eng (2023). Many low-income families could not meet the high credit score requirements, forcing them into less favorable options like subprime loans with higher interest rates (Eng, 2023). Romeli (2023) indicated that, notwithstanding financing, elevated interest rates augment monthly payments, complicating stability for low-income homes. This frequently results in elevated fail-to-pay rates, perpetuating a cycle of indebtedness.

Furthermore, the lack of affordable financing options forces low-income families into substandard housing (Almeida and Cheah, 2017). Ling (2017) argued that limited access to housing financing prevents low-income families from accumulating assets, perpetuating poverty and limiting social mobility. Policy interventions can facilitate the low-income group by introducing inclusive lending practices and government-backed loan guarantees. Strengthening tenant protections and increasing affordable rental options are also crucial. Overall, addressing financing challenges is essential for equitable access to housing (Eng, 2023; Romeli,2023; Almeida and Cheah (2017); and Ling (2017).

Location and Accessibility

Addressing location and accessibility issues in affordable housing is crucial because placing such housing in remote or poorly connected areas poses significant challenges to the residents. This situation can perpetuate poverty and social exclusion among low-income individuals.

One major problem with locating affordable housing in remote areas is that it creates limited access to job opportunities, as highlighted by Romeli (2023). Long commutes consume time and money, reducing time for family, education, and community activities. It also adds financial strain to low-income families. Moreover, being far from urban amenities like healthcare and education

services can negatively impact residents' quality of life (Wahi et al., 2018). This can lead to poorer health and educational outcomes.

According to Ling (2017), the location of affordable housing also affects social inclusion and community engagement, Remote locations can lead to social isolation, diminishing the sense of community and belonging. Furthermore, placing affordable housing in less desirable areas can reinforce negative stereotypes and stigmatization of low-income individuals, creating further barriers between socio-economic groups. Strategically locating affordable housing near urban centers can mitigate these issues by providing easier access to jobs and urban amenities, improving residents' economic prospects and overall quality of life.

In conclusion, addressing location and accessibility issues in affordable housing is essential for fostering social and economic inclusivity. Research conducted by Romeli (2023), Wahi et al. (2018), and Ling (2017) underscored the importance of strategic placement in creating equitable communities.

Table 10: Importance index calculation for elements that contribute to sustainability through housing

No.	Elements that contribute to sustainability through affordable housing	Importance Index Value (I.I Value)	Level of Importance
1.	Community Infrastructure	0.875	Somewhat Important
2.	Social Integration	0.809	Somewhat Important
3.	Mixed-Income Communities	0.721	Least Important
4.	Community Engagement	0.798	Somewhat Important
5.	Supportive Services	0.871	Somewhat Important
6.	Legal Security of Tenure	0.803	Somewhat Important
7.	Affordability	0.913	Somewhat Important
8.	Financial Inclusion	0.945	Important
9.	Adaptability and Upgradability	1.062	Very Important
10.	Government Policies and Support	0.905	Somewhat Important
11.	Energy Efficiency	0.923	Important
12.	Green Material and Practice	1.012	Important
13.	Location and Accessibility	1.211	Very Important
14.	Quality of Construction	0.953	Important
15.	Technology and Innovation	0.924	Important
	Mean Importance Index	= 0.915	
	Standard Deviation	= 0.119 (1SD below Mean =0.796; 1SD above Mean =1.034)	

Incorporating adaptability and upgradability into affordable housing design is crucial for long-term sustainability and resilience. Adaptability allows housing units to easily adjust to changing needs, like family growth or lifestyle shifts. Flexible floor plans and movable partitions can enhance the functional lifespan of housing (Samsons, 2018). This approach supports varied family

structures and evolving lifestyle requirements, such as remote work or multi-generational living (Seshadhri & Kumar Paul, 2018). Designing homes with adaptability ensures they remain relevant and useful, promoting social sustainability. Upgradability focuses on integrating new technologies and meeting updated safety, efficiency, and environmental standards. Housing that can incorporate new systems like energy-efficient heating or smart home technologies, as noted by Pleshivcev (2019) and Fallahi (2017), extends its operational life and reduces environmental impact. By considering adaptability and upgradability, affordable housing can create resilient communities that thrive in changing conditions.

Seshadhri and Kumar Paul (2018) argued that integrating affordable housing into well-connected urban areas supports the creation of inclusive communities, enhancing social integration and unity. Hence, it is imperative to ensure that the sustainability of affordable housing is closely linked to location and accessibility. Placing housing projects near urban centers and essential services is crucial for several reasons. Proximity to job markets and amenities like healthcare and education makes it easier for residents to access employment opportunities and necessary services, reducing the financial burden on low-income households (Chan and Adabre, 2019). Moreover, strategically located housing minimizes transportation-related impacts by reducing the need for long travels, lowering greenhouse gas emissions, and promoting sustainable transportation options like public transit, walking, and cycling, as highlighted by Samsons (2018). Focusing on location and accessibility ensures that affordable housing contributes to economic viability, social inclusion, and environmental sustainability, creating resilient communities for the future.

CONCLUSION

In conclusion, the sustainability of affordable housing is intricately tied to various issues, and key elements should be incorporated into the design and implementation of such projects. Financing challenges, adaptability, upgradability, and the strategic consideration of location and accessibility are paramount factors influencing the long-term viability of affordable housing solutions. By tackling financing obstacles, we pave the way for increased accessibility and affordability, making homeownership a reality for low-income individuals. Moreover, designing housing units with adaptability and upgradability ensures that they remain relevant and meet evolving needs over time. Finally, the strategic choice of location, emphasizing accessibility to urban centers and services, not only enhances the quality of life for residents but also contributes to the overall sustainability of affordable housing by fostering social inclusion and minimizing environmental impacts. A holistic approach that addresses these multifaceted issues and elements is essential for creating resilient, inclusive, and sustainable affordable housing solutions that stand the test of time.

REFERENCES

Abdullahi, B.C. & Aziz, W.N.A.W.A., 2011. Pragmatic housing policy in the quest for low-income group housing delivery in Malaysia. *Journal of Design and Built ..., 8*(1), pp.1– 18.

Ahmad Ezanee, H., Siti Aida, S., Faridah, I. and Zulhabri, I. (2015), "Managing facilities on Malaysian affordable public residential for sustainable adaptation", Procedia – Social and Behavioral Sciences, Vol. 168, pp. 52-60, doi: 10.1016/j.sbspro.2014.10.209

Almeida, S. J., Ho, S. W., & Cheah, S. L. (2017). BNM QUARTERLY BULLETIN Affordable Housing: Challenges and the Way Forward Q4. *Economic and Financial Developments in the Malaysian Economy in the Fourth Quarter of 2017*, *2011*, 19–26. http://www.bnm.gov.my/files/publication/qb/2017/Q4/p3ba1.pdf

Au-Yong, C., Azlan Shah, A. and Chua, S. (2019), "A literature review of routine maintenance in high-rise residential buildings", *Journal of Facilities Management*, Vol. 17 No. 1, pp. 2-17, doi: 10.1108/jfm-10-2017-0051.

Au-Yong, C., Nur Farhana, A. and Nur Aaina, M. (2018), "Maintenance of lift systems affecting resident satisfaction in affordable high-rise residential buildings", Journal of Facilities Management, Vol. 16 No. 1, pp. 17-25, doi: 10.1108/jfm-04-2017-0015.

Bakhtyar, B. et al., 2013. Housing for poor people: A review on low-cost housing process in Malaysia. *WSEAS Transactions on Environment and Development, 9*(2), pp.126–136.

Chan, A. and Adabre, M. (2019), "Bridging the gap between sustainable housing and affordable housing: the required critical success criteria (CSC)", *Building and Environment*, Vol. 151, pp. 112-125, doi: 10.1016/j.buildenv.2019.01.029.

Che-Ani, A.I., Mustafa, N.K.F., Tahir, M.M., Tawil, N.M. and Ramly, N.M. (2011), "Kajian rintis terhadap konsep kualiti perkhidmatan dalam membentuk model teori keberksanan pengurusan fasiliti perumahan bertingkat Di Malaysia", *International Surveying Research Journal (ISrJ)*, Vol. 1 No. 1, pp. 57-65

Ebekozien, A., Abdul Rashid, A. and Mastura, J. (2018b), "Low-cost housing leakages in Malaysia: the unexplored dimension", *Pacific Rim Property Research Journal*, Vol. 24 No. 3, pp. 249-264, doi:10.1080/14445921.2018.1552471

Eng, M. (2023). Pros and Cons of Affordable Housing Schemes in Malaysia. *PropertyGuru*, 1–11. https://www.propertyguru.com.my/property-guides/pros-and-cons-of-affordable-housing-schemes-in-malaysia-65373

Fallahi, B. (2017), "Evaluation of national policy toward providing low-cost housing in Malaysia", *International Journal of Social Sciences*, Vol. VI No. 1, doi: 10.20472/ss2017.6.1.002

Gill, J., Johnson, P. and Clark. M. (2010) Research Methods for Managers. SAGE Publications, Washington DC.

Gliem, R. R., & Gliem, J. A. (2003). Calculating, interpreting, and reporting Cronbach's alpha reliability coefficient for Likert-type scales

Hassan, Zailinawati & Schattner, Peter & Mazza, Danielle. (2006). Doing A Pilot Study: Why Is It Essential? Malaysian Family Physician.

Jian, L. and Huay Ying, O. (2021), "Can Malaysia's national affordable housing policy guarantee housing affordability of low-income households?", *Sustainability*, Vol. 13 No. 16, p. 8841, doi:10.3390/su13168841.

KPKT. (2022). Statistik Terpilih KPKT Sehingga 30 September 2022. *Statistik Suku Tahun Dan Tahunan*, *September*, 60.

Ling, C. S., & Almeida, S. J. (2017). Demystifying the affordable housing issue in Malaysia. *Bank Negara Malaysia Annual Report 2016*, 90–98. https://www.bnm.gov.my/files/publication/ar/en/2016/cp04_002_box.pdf

Noraziah, W., Rosli, M., Vikneswaran, M., Ismail, M. and Syahrizan, J. (2018), "Problems and issues of high-rise low-cost housing in Malaysia", IOP Conference Series: Materials Science and Engineering, Vol. 341, p. 012027, doi: 10.1088/1757-899x/341/1/012027.

Olanrewaju, A., Tan, Y. and Soh, S. (2021), "Defect characterisations in the Malaysian affordable housing", *International Journal of Building Pathology and Adaptation*, doi: 10.1108/ijbpa-11-2018-0095.

Olanrewaju, A.L., Lim, X.Y., Tan, S.Y., Lee, J.E. and Adnan, H. (2018), "Factors affecting housing prices in Malaysia: analysis of the supply side", *Planning Malaysia*, Vol. 16 No. 6, pp. 225-235

Pleshivcev, A. (2019), "Sustainability analysis of transformable low-rise buildings production and construction integration zones", MATEC Web of Conferences, Vol. 265, p. 07011, doi: 10.1051/matecconf/201926507011.

Ramli, N. A., Ahmad Zawawi, E. M., Muhamad Ariff, N. R., & Zainol, N. N. (2023). Environmental cleaning battling against Covid-19 infection in healthcare facilities. *Facilities*, *41*(11–12), 725–741. https://doi.org/10.1108/F-03-2022-0044

Ramli, N. A., Zawawi, E. M., Ariff, N. R. M., Zainol, N. N., & Kadir, S. S. (2019). A study on the green cleaning benefits for malaysian public school. *Malaysian Construction Research Journal*, *8*(3 Special issue), 50–59.

REHDA Report (2016), available at: www.rehdainstitute.com/ceo2016/

Rima Nor, M. and Davies, H. (2011), "Multi-owner low-cost housing management in Malaysia", *International Journal of Housing Markets and Analysis*, Vol. 4 No. 3, pp. 268-289, doi: 10.1108/17538271111153031

Romeli, R. H. (2023). *From B40 to T20: A Closer Look at Malaysias Income Groups*. 1–7.

Samson, A. (2018), "Better public housing management in Ghana", *Architecture and the Built Environment*, Vol. 7, doi: 10.7480/abe.2018.7.2101

Seshadhri, G. and Kumar Paul, V. (2018), "User satisfaction index: an indicator on building
performance", Journal of Civil Engineering and Structures, Volume, Vol. 2 No. 1, pp. 14-33, doi:10.21859/jces-02012.

Sulaiman, F.C., Hasan, R. & Jamaluddin, E.R., 2016. Users Perception of Public Low Income Housing Management in Kuala Lumpur. Procedia - Social and Behavioral Sciences, 234, pp.326–335. Available at: http://dx.doi.org/10.1016/j.sbspro.2016.10.249.

Vale, L.J. et al., 2014. What Affordable Housing Should Afford : Housing for Resilient Cities. *A Journal of Policy Development and Research, 16*(2), pp.21–50.

Wan Sumayyah, S., Mohd Rozaimy, R. and Noor Amira, S. (2018), "Demystifying the low-cost housing issues in Malaysia", *GADING (Online) Journal for Social Sciences*, Universiti Teknologi Mara Cawangan Pahang, Vol. 22 (Special Issue September), KONAKA.

Wahi, N., Mohamad Zin, R., Munikanan, V., Mohamad, I., & Junaini, S. (2018). Problems and Issues of High-Rise Low-Cost Housing in Malaysia. *IOP Conference Series: Materials Science and Engineering*, *341*(1). https://doi.org/10.1088/1757-899X/341/1/012027

Xingrui, C., & Ibrahim, F. I. (2024). THE IMPACT OF GREEN SPACES TO HUMAN PSYCHOLOGY AND THEIR MENTAL HEALTH. *PLANNING MALAYSIA*, *22*(33). https://doi.org/10.21837/pm.v22i33.1563

Yap, J.B.H. and Ng, X.H. (2018), "Housing affordability in Malaysia: perception, price range, influencing factors and policies", *International Journal of Housing Markets and Analysis*, Vol. 11 No. 3, pp. 476-497, doi: 10.1108/ijhma-08-2017-0069.

Zainol, N. N., Ramli, N. A., Mohammad, I. S., Sukereman, A. S., & Sulaiman, M. A. (2023). Assessing measurement model of green cleaning components for green buildings. *Journal of Facilities Management*, *21*(4), 556–572. https://doi.org/10.1108/JFM-11-2021-0147

Zainol, N. N. (2016). A Structural Model of Green Cleaning Components and Requirements for Green Buildings (Universiti Teknologi Malaysia)

Received: 28th Jan 2024. Accepted: 30th August 2024

PLANNING MALAYSIA:
Journal of the Malaysian Institute of Planners
VOLUME 22 ISSUE 5 (2024), Page 391 – 401

RESIDENTS' PERCEPTION ON MANAGEMENT BODIES' SERVICE DELIVERABLES: THE CASE OF AFFORDABLE STRATA HOUSING IN KLANG VALLEY, MALAYSIA

Damira Aripin[1], Mariana Mohamed Osman[2], Noor Suzilawati Rabe[3], Ainul Ashiqin Ahmad Shuhaimi[4], Nur Atheefa Sufeena M Suaree[5]

[1,2,3,4]*Kulliyyah of Architecture and Environmental Design,*
INTERNATIONAL ISLAMIC UNIVERSITY MALAYSIA
[5]*Faculty of Law,*
UNIVERSITI KEBANGSAAN MALAYSIA

Abstract

The rapid urbanization in Malaysia has led to a significant increase in low-cost and low-medium-cost strata housing. However, managing these schemes presents unique challenges due to residents' financial constraints. Challenges often happen in this housing scheme, resulting in poor maintenance, overcrowding, and inadequate amenities, affecting residents' overall quality of life. The study aims to understand the challenges residents and management bodies face in these strata schemes and develop strategies for improving their management. This study helps identify primary issues and problems encountered by residents, assess their perceptions of their management body performance, and propose practical strategies for improving strata management practices. A mixed-mode methodology is employed utilizing primary data collected through questionnaire surveys of strata residents and analysed using SPSS. The findings highlight the differences between active and non-active management bodies in managing strata properties. This study highlights residents' perceptions that shed light on the difficulties in managing and maintaining affordable housing strata schemes, offering important information for formulating strategies to improve strata management practices in Malaysia.

Keywords: Management Body, Residents, Roles, Residential Strata

[1] Msc Candidate: Email: aripindamira@gmail.com

INTRODUCTION

Living in high-rise residences has become popular, particularly in Malaysia's major urban areas (Rabe et al., 2021). Due to Malaysia's lack of available land, real estate prices have increased, and the remaining land is being used to create high-rise residences that support residential property developments. As a result, this style of construction has grown common in Malaysia. It has been very successful in maximizing the use of land resources, as evidenced by the approximately 1,444,858 strata titles for individual parcels that have been recorded as of 2020 (Izanda et al., 2020). As urbanization grows, so does the need for property and housing density. Cities and other developed places like Kuala Lumpur, Selangor, Penang, and Johor Bahru can no longer choose to ignore this problem.

Despite the prevalent adoption of high-rise residential living, the management of strata properties presents notable challenges. Effective management and maintenance are essential to ensuring a comfortable living environment for residents. However, persistent issues such as low participation in general meetings, delays in the issuance of strata ownership title, and maintenance problems, including leakages from adjacent units, continue to affect these properties. However, issues such as participation in general meetings, delayed issuance of strata ownership, and maintenance problems, like leakages from adjacent units, persist.

Understanding residents' perceptions of their management bodies' roles is essential for developing effective management practices. This study aims to provide insights that can help management bodies improve their service delivery, ultimately enhancing resident satisfaction and living conditions in strata properties. To ensure the provision of quality services, it is crucial to have a comprehensive understanding and assessment of residents' views on these services, as this serves as a vital check-and-balance mechanism. Ignoring residents' perceptions and satisfaction levels can create a knowledge gap, leading to ineffective maintenance and management practices.

LITERATURE REVIEW

Numerous studies (Nor Amira Abdul Samad et al., 2018; Isma et al., 2011; Tawil et al., 2010) have shown that people's preferences for living in high-rise buildings vary depending on their lifestyle and investment goals. A capable management team and ownership structure are essential for guaranteeing that residents live comfortably and that all strata properties are well-maintained (Tiun, 2009). According to a survey by the Malaysian Reserve in 2022, 34.4% of Malaysians prefer acquiring condominiums as their homes, believing that stricter access and control will enhance health and safety (Annuar & Naharul, 2023). Building high-

rise residential buildings is an economically sound and sensible way to address the imbalance between supply and demand (Mohd Tawil et al., 2009).

The intricate and numerous responsibilities of strata management are vital to the high-rise living experience. It encompasses various aspects, including cooperative neighborhood living, sharing common property, restoring ownership authority to parcel owners, property management, and pooling financial resources for the upkeep and management of the partitioned structure and common land. The parties involved in strata management include developers, parcel owners, property managers, service providers, real estate agents, land surveyors, and the government. Each has a crucial role in ensuring efficient and effective strata management.

Many residents have voiced complaints about the difficulties of living in a strata community. These difficulties range from irate parcel owners demanding transparency in managing maintenance accounts to those dissatisfied with their elected committee (JMB or MC) for failing to maintain and manage the strata building according to their expectations and demands.

The Strata Management Act (Act 757) 2013 outlines the formation and responsibilities of the Joint Management Body (JMB) and Management Corporation (MC), which manage the common areas of stratified developments, enforce bylaws, collect maintenance fees, contribute to sinking funds, and perform other duties.

The timeline for forming the JMB and MC under the Strata Management Act highlights the roles and transitions between these bodies. Despite the regulations, common issues such as delayed formation of the JMB/MC, inadequate maintenance, and financial mismanagement persist. These challenges underscore the need for better education and communication among strata property residents regarding management legislation and their rights and responsibilities. Residents' active involvement can significantly impact the quality of strata living.

RESIDENT SATISFACTION

According to Jaafar et al. (2015), a person's level of satisfaction in a stratum living environment is influenced by several factors, including the community's effectiveness, accessibility of facilities, sense of belonging, readiness to relocate, and participation in social groups. While service quality focuses on the delivery and aspects of services, customer satisfaction encompasses a broader range of concepts. This relationship between service quality and customer satisfaction can be seen as a methodological match.

Residents perceive daily cleaning, inspections, and preventative maintenance as the most crucial components of building care. By prioritizing these tasks, residents believe that building maintenance is effectively performed.

Furthermore, communication, proactive action, and prompt problem resolution significantly raise tenant satisfaction regarding service quality (Kuo et al., 2011).

Research by Musa et al. (2020) highlights that residents expect management to respond to complaints and comments. Effective communication and timely actions to address issues are critical to maintaining high resident satisfaction levels. Residents value transparency and efficiency from their management bodies in resolving problems, which enhances their overall satisfaction with their living environment.

Residents' dissatisfaction was also evident in the number of cases filed with the tribunal between 2017 and 2020. According to Ahmad Shuhaimi, et al. (2022), 7 out of 12 offenses under Act 757 were related to the failure of the management body—including the Management Corporation (MC), Joint Management Body (JMB), and the developer during the management period—to perform their duties and services. The author concluded that the prevalent issue of unpaid maintenance charges was largely due to residents refusing to pay in response to poor maintenance and management services provided by the management body. This preliminary finding underscores the significance of this study, as it aims to further examine the link between poor fee collection, poor maintenance and management and resident satisfaction. The resulting vicious cycle between inadequate fee collection and limited funds hinders the ability to conduct quality maintenance and management, ultimately affecting the building condition of the respective strata schemes.

RESEARCH METHODOLOGY

This study employs a quantitative methodology, utilizing data obtained from a structured questionnaire survey to evaluate residents' perceptions of strata management bodies. In addition to the survey data, literature and document reviews will be used to provide supplementary insights. The survey targets residents residing in low-cost, low-medium-cost, and Public Housing Project (PPR) areas within the Klang Valley. The questionnaire is designed to capture residents' opinions on the performance and responsiveness of their strata management bodies.

A stratified random sampling method was employed to select participants from high-rise buildings in the Klang Valley region. According to Yamane (1976), a sample size of at least 389 respondents is required to achieve a 95% confidence level for a population of 10,000 or more. Following data cleaning and validation, the final valid sample size for this study comprises 476 respondents.

SPSS is used for data analysis, and the Relative Importance Index (RII) will be applied to rank the significance of various factors affecting residents' satisfaction. The study aims to understand residents' satisfaction with their strata

management bodies by analysing survey data through SPSS and ranking factors using RII to identify critical areas for improvement.

One-Way ANOVA is used because it is particularly effective for comparing the mean satisfaction levels across multiple groups, such as different stratum types or demographic categories. Since the research aims to determine if there are significant differences in how residents perceive the effectiveness of their management bodies, One-Way ANOVA this analysis is well-suited to handle comparisons across three or more independent groups. This. method allows for a simultaneous assessment of differences across these groups, reducing the risk of Type I errors that could arise from conducting multiple t-tests.

FINDINGS AND DISCUSSION

This section shows the results of the survey analysis and the interview data. The first section summarizes residents' responses based on their profiles. The analysis's primary goal is to comprehend how stratum occupants see their management bodies' effectiveness and room for development.

The findings reveal critical insights into residents' views on their strata management bodies. The analysis highlights areas where management bodies are performing well and identifies opportunities for improvement. By examining the responses, the study aims to provide a comprehensive understanding of residents' satisfaction and expectations, which can guide future enhancements in strata management practices.

ANALYSIS

A total of 476 respondents participated in this questionnaire and provided their feedback. Information on the respondent's residential information such as housing categories and municipalities, and ownership. Responses were recorded in **Table 1** below.

Table 1: Residential Information

Item		**Count**	**%**
Strata Housing Categories	Low Cost	161	33.8
	Low Medium Cost	145	30.5
	Projek Perumahan Rakyat (PPR)	170	35.7
	Total	**476**	**100.0**

Referring to the table above, a total of 35.7% of respondents who participated in the questionnaire of this study are from the *Projek Perumahan Rakyat* (PPR) respectively. A total of 30.5% of respondents who participated in this questionnaire came from low-medium-cost housing, and 33.8% of

respondents from low-cost housing participated in this questionnaire. 70.6% of 476 residents that were interviewed own the units that they currently reside while only 29.4% rent the strata unit.

Respondent Background

It can be seen from Table 2 that 52.3% of respondents participated in this survey were male, while 47.7% were female. Meanwhile for age group, the highest percentage of respondents belongs to 41 to 60 years old group, followed by 21 to 40 years old (46.4%) and more than 60 years old were 4.2% only. It can be seen that 83.8% of respondents being surveyed have income less than RM 8,389, which belongs to the B40 income group, while 16.2% have no income.

Table 2: Resident's Profile

Categories	**Variables**	**N**	**%**
Gender	Male	249	52.3
	Female	227	47.7
	Total	**476**	**100.0**
Age	21 - 40 years old	221	46.4
	41 - 60 years old	235	49.4
	Equal or more than 61 years old	20	4.2
	Total	**476**	**100.0**
Average Monthly Income	B40 (<RM 2.500 – RM 8,389)	399	83.8
	No Income	77	16.2
	Total	**476**	**100.0**

The respondents were also asked on the status of their management body, whether the management body in their strata was established and active. Table 3 below presents the finding.

Table 3: Active Strata Management Body

Option	**Count**	**%**
Yes	388	81.5
No	88	18.5
Total	476	100.0

Source: Author (2021)

Table 3 above shows that 81.5% of the total responses received stated that they have an active strata management body, 18.5. Forward from these responses, respondents that are residing in a non-active management body looks forward to having a proper management and maintenance services.

Majority of the justification on the establishment of management body includes; to establish an authority within the strata scheme to manage, reduce and resolve unused or broken cars parked in the parking area. The establishment of an active management would also able to facilitate the maintenance and management of the strata schemes.

PERCEPTIONS ON DELIVERANCE OF STRATA MANAGEMENT BODY SERVICES

The study on resident satisfaction with the management body on services provided since it is the greatest way to gauge how well the management body handles issues with managing strata properties. As a result, respondents were questioned about their satisfaction with a number of crucial strata management issues. They were to rate how satisfied they were with each of the six topics, including neighbourhood security, inter-floor leaking problems, maintenance fees, and sinking funds. Not at all satisfied = 1, Dissatisfied = 2, Satisfied = 3, and Very Satisfied = 4 were the rankings they gave their experiences.

Table 4: RII on Assessment on the Effectiveness of Management Handling Critical Issues Throughout Strata Management Operations

Aspect of Strata Management Body Services	**Not At All Satisfied**		**Dissatisfied**		**Satisfied**		**Very Satisfied**		**Total**		**ΣRII**	**Rank**
	N	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**		
Managed service charges and sinking funds	47	9.8	93	19.5	290	60.9	46	9.7	476	100.0	**0.679**	**1**
Management handover from developer to JMB/MC	54	11.3	88	18.5	281	59	53	11.1	476	100.0	**0.678**	**2**
Safety management	67	14.0	93	19.5	239	50.2	77	16.2	476	100.0	**0.674**	**3**
Managed participation in General Meeting	62	13.0	78	16.4	290	60.9	46	9.7	476	100.0	**0.671**	**4**

Aspect of Strata Management Body Services	**Not At All Satisfied**		**Dissatisfied**		**Satisfied**		**Very Satisfied**		**Total**		**ΣRII**	**Rank**
	N	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**		
Managed late issuing Strata Ownership Rights	68	14.3	98	20.6	275	57.8	35	7.4	476	100.0	**0.648**	**5**
Managed Leakage from adjacent unit	80	16.8	92	19.3	259	54.4	45	9.5	476	100.0	**0.644**	**6**

Based on the RII table above, the management body effectively handled or managed sinking funds and services charges (RII 0.679), followed by the management handover from the developer to JMB/MC with RII 0.678 and safety (RII 0.674). Meanwhile, issues like leakage from adjacent units (RII 0.644), late issuing of strata ownership rights (RII 0.648), and participation in general meetings (RII 0.671) were handled less efficiently by the management of the strata.

A Spearmen Rho correlation test was conducted to investigate respondents' responses on the assessment with their background. Summary of analysis between assessment feedback and respondents' age and income Table 9 below.

Table 5: RII on Assessment on the Effectiveness of Management Handling Critical Issues Throughout Strata Management Operations

Aspect of Strata Management Body Services	**Age**			**Income**		
	cc	**p-value**	**Remark**	**cc**	**p-value**	**Remark**
Managed service charges and sinking funds	-0.182**	0.000	significant	0.001	0.987	Not significant
Management handover from developer to JMB/MC	-0.189**	<0.001	significant	0.033	0.474	Not significant
Safety management	-0.194**	<0.001	significant	0.053	0.245	Not significant
Managed participation in General Meeting	-0.196**	<0.001	significant	-0.035	0.445	Not significant

Managed late issuing Strata Ownership Rights	-0.046	0.654	Not significant	0.068	0.136	Not significant
Managed leakage from adjacent unit	-0.166**	<0.001	significant	0.089	0.051	Not significant

** Correlation is significant at the 0.01 level (2-tailed).

Result in table above shows for relationship between age and since the significant p-value are less than 0.05, thus the null hypothesis can be rejected. Based on the correlation coefficient value in the table, there are negative relationship between respondent's age and all aspects of management body services shows the older the age group, the less favourable the perception towards management body services. Meanwhile, the data indicate that income groups do not strongly influence participation in general meetings within the context of strata management.

This study applied a statistical method for comparing the means of several groups by using one-way ANOVA (analysis of variance). Analysis using ANOVA was to examine difference on strata management practices across type of strata management body.

Table 6: One-Way ANOVA on type of strata management body and strata management body services

	Age		
Strata management body services	**F**	**P-value**	**Remarks**
Managed service charges and sinking funds	9.380	<0.001	Significant differences
Managed leakage from adjacent unit	6.560	0.002	Significant differences
Management handover from developer	7.899	<0.001	Significant differences
Managed participation in General Meeting	8.058	<0.001	Significant differences
Managed late issuing Strata Ownership Rights	6.144	0.002	Significant differences
Safety management	12.190	<0.001	Significant differences

Based on table above, it can be seen that there is a significant difference in satisfaction levels based on the perceived effectiveness of the mean on all aspect of strata management body services as it varies significantly based on age. It shows that older group have slightly lower service charges and contribute less to sinking funds, they have different safety concerns or expectations on safety

management, and less active in attending meetings and experienced delay in receiving late issuing Strata Ownership Rights, and may affected by such problems.

CONCLUSION

The findings suggest that the strata management body in this particular context has effectively handled sinking funds and service charges, followed closely by the management handover and safety management. However, areas such as leakage from adjacent units, late issuance of strata ownership rights, and participation in general meetings require further attention and improvement.

Age was found to be a significant factor influencing respondents' perceptions of strata management services. Older respondents generally perceived these services less favourably compared to younger respondents, particularly in areas such as service charges, safety management, and participation in general meetings. While income groups did not significantly impact participation in general meetings, it is important to note that other factors, such as education level, cultural background, and personal experiences, may also influence respondents' perceptions and satisfaction with strata management.

Overall, the study highlights the importance of effective communication, transparency, and timely resolution of issues to ensure high levels of satisfaction among strata owners. By addressing the areas identified in this research, strata management bodies can improve the overall quality of life for residents and enhance the long-term sustainability of strata developments.

REFERENCES

Abdul Jalil, Rohaya and Abdul Samad, Nor Amira and Khairul Anuar, Nurul Azreena Nabila (2018) Residents perception strata property shared facilities potential for commercialisation. *International Journal of Real Estate Studies (INTREST)*, 12 (2). pp. 1-9. ISSN 1832-8505

Ahmad Shuhaimi, A. A., Mohamed Osman, M., Rabe, S., Syed Khuzzan Alhabshi, S. M., & Aripin, D. (2022). ENFORCEMENTS AND OFFENCES UNDER THE STRATA MANAGAMENT ACT. *PLANNING MALAYSIA, 20*(20). https://doi.org/10.21837/pm.v20i20.1077

Annuar, A., & Naharul, M. A. (2023). Live higher up, or closer to the ground? The Malaysian Reserve. https://themalaysianreserve.com/2023/02/10/live-higher-up-or-closer-to-the-ground/

Chang Kim Loong. 2020. Differences between JMB and MC: 5 things you should know. 01 February. https://www.edgeprop.my/content/1638543/differences-between-jmb-and-mc-5-things-you-should-know

Chang Kim Loong. 2019. Management bodies and how they function. 12 April. https://www.edgeprop.my/content/1511677/management-bodies-and-how-they-function

Che-Ani, A. I., Jamil, M.. Zain, M. F. M., Mohd-Nor, M. F. I., & Mohd-Tawil, N. (2009). A satisfaction survey of high-rise residential management in Malaysia: sustainable indicators. *WIT Transactions on Ecology and the Environment*, 120, 643-652.

Che-Ani, A. & Mohd Tawil, Norngainy & Sairi, A. & Goh, Nurakmal & Mohd Tahir, Mazlan & Surat, M0., (2010). Facility management indicators for high-rise residential property in Malaysia. *WSEAS Transactions on Environment and Development*. 6. 267-276.

Isma Haniza Fakhrudin, Mohd Zailan Suleiman & Roslan Talib (2011). *Journal of Facilities Management, 9*(3), pp. 170-180

Izanda, N. S. S., Samsudin, S., & Zainuddin, M. (2020). European Journal of Molecular & Clinical Medicine Strata Title Reforms in Malaysia: A Review and Challenges of Regulatory and Governance Panacea. *European Journal of Molecular & Clinical Medicine, 7*(8), 413–426.

Jaafar, M., Hasan, N. L., Mohamad, O., & Ramayah, T. (2005). The Determinants of Housing Satisfaction Level: A Study on Residential Development Project by Penang Development Corporation (PDC). *Jurnal Kemanusiaan*.

JMB, Joint Management Body Malaysia. JMB Malaysia. (2024, July 24). https://jmbmalaysia.my/

Khalid, M. S., Ahmad, A. H., Zakaria, R., Arshad, R., & Pon, Y. (2017). Towards Strengthening Building Maintenance and Management by Joint Management Bodies (JMB) in High Rise/Stratified Housing in Malaysia. *International Journal of Social Science and Humanity, 7*(4), 239.

Kuo, Yao-Chen & Chou, Jui-Sheng & Sun, Kuo-Shun. (2011). Elucidating how service quality constructs influence resident satisfaction with condominium management. *Expert Systems with Applications*. 38. 5755-5763. 10.1016/j.eswa.2010.10.057.

Musa, Zairul & Azriyati, Wan & Zyed, Zafirah & Hanif, Noor & Aini, Ainoriza & Tedong, Peter & Sarip, Abdul Ghani. (2020). Vertical living satisfaction of homeowners in a medium-cost residential building in Klang Valley, Malaysia. *Journal of Facilities Management*. ahead-of-print. 10.1108/JFM-01-2020-0004.

Rabe, N. S., Osman, M. M., Abdullah, M. F., Ponrahono, Z., & Abdul Aziz, I. F. (2021). Issues Faced by Tenants in High-Rise Strata Residential: Case Study of Klang Valley. *Planning Malaysia, 19*(5), 180–191. https://doi.org/10.21837/pm.v19i19.1070.

Received: 31st May 2024. Accepted: 15th September 2024

PLANNING MALAYSIA:
Journal of the Malaysian Institute of Planners
VOLUME 22 ISSUE 5 (2024), Page 402 – 416

CHALLENGES IN THE OPERATION AND MAINTENANCE OF ASSETS AND FACILITIES IN ELDERLY CARE CENTRES IN MALAYSIA

Nor Syahila Mohd Tombel[1], Nur Affah Mohyin[2]*, Mohd Fairullazi Ayob[3]

[1,2,3]*Department of Quantity Surveying,*
Kulliyyah of Architecture and Environmental Design,
INTERNATIONAL ISLAMIC UNIVERSITY MALAYSIA

Abstract

Abreast with the rapid growth of older people every year, the number of elderly care centres has increased tremendously to cater to the demands of older people to spend their time after retirement in Malaysia. Effective operation and maintenance activities in an elderly care centre can optimise the service life of assets that indirectly lead to well-maintained facilities and provide the occupants with a safe, comfortable, and efficient living environment. Throughout the asset life cycle, operation and maintenance are the most extended phases, with various core activities that determine the financial health of an organisation. Nevertheless, this area remains relatively underexplored in the existing literature, particularly concerning the challenges posed by Malaysia's ageing population by 2030. Accordingly, this study seeks to investigate the issues of operation and maintenance of assets and facilities in elderly care centres. The method used to collect the data is through site observations and interviews in three elderly care centres, one in Perak and two in Selangor. These findings reveal three significant challenges the operators face: safety inside the accommodation, high operation and maintenance costs, and lack of a structured approach to managing the assets and facilities. Finally, the paper ends with implications of the findings that provide directions for future research.

Keywords: Elderly Care Centre, Retirement Village, Elderly Pondok, Operation and Maintenance, Facility Management

[2] Corresponding Author's E-mail: affah@iium.edu.my

INTRODUCTION

The ageing population is a global phenomenon that shows people today are living longer and healthier, thanks to the triumph of medical, technological advancement, and economic development. Like other developing countries, Malaysia is expected to become an ageing nation in 2030, with 15% of the population aged 60 and above (Md Nor & Ghazali, 2021). According to the Department of Statistics Malaysia (2022), the composition of the population aged 65 years and over (old age) increased from 7.0% in 2021 to 7.3% in 2022, encompassing 2.4 million people, indicating that Malaysia is experiencing population ageing. This phenomenon has been seen as an opportunity for public and private agencies to provide various service facilities and infrastructure for the well-being of older people (Syed Akil & Abdullah, 2014). Elderly care centres are vital since older people require advanced care, safety, and a secure living environment. The mushrooming numbers of these facilities show that many sectors are aware of the importance of providing advanced care for older people.

In Malaysia's context, guidelines published by the Federal Department of Town and Country Planning Malaysia are named Physical Planning Guideline for the Elderly (PLANMalaysia, 2018). The primary purpose of the guideline is to guide physical planning for agencies such as federal and state authorities, local authorities, public agencies, students, private agencies, and non-governmental organisations in planning, developing, and designing elderly dwellings. Based on the guideline, there are three (3) dwelling concepts for older people. The first concept is the Elderly Care Centre, which consists of two categories: Day Care Centre and Residential Care Centre. The second concept is a Retirement Village, and the third is Ageing in Place.

This study focuses on the first dwelling concept, which is the Elderly Care Centre, and its second category, which is the Residential Care Centre. These centres are divided into three categories: low care, where the residents are independent; medium care, for the residents who require monitoring and medical supervision; and high care, for the bedridden residents. The services of these centres were delivered either in a nursing home or elderly *Pondok* (PLANMalaysia, 2018). A nursing home is defined internationally as a facility with a domestic-styled environment that provides 24-hour functional support and cares for persons who require assistance with Activities of Daily Living (ADLs) and often have complex health needs and increased vulnerability (Sanford et al., 2015).

Meanwhile, the elderly *Pondok* provides religious teaching and learning with residential facilities for Muslim ageing communities. In Malaysia, the elderly *Pondok* system has become popular because the operators incorporate educational and spiritual elements into the residential activities and facilities for older people (Ismail, Alaudin, Abdul Talib and Salleh, 2021). In their comparative studies, Sufian and Mohamad (2013) pointed out the concept and

practice of the *Pondok* system, which is similar to the retirement village practised in Australia and the United Kingdom. Hence, the Pondok is also known as a Muslim retirement village or 'Pondok Pengajian Warga Emas' (Abdul Mutalib, Kamaruzaman and Abdulah, 2023; Majid, Hamidi, and Denan, 2018; Sufian and Mohamad, 2013). The facilities in this kind of elderly care centre have attracted the needs and interests of the elderly, particularly Muslim retirees who are independent and want to continue to fill their time for Islamic discourse, congregational prayer, and socialising among their age group (Ismail et al., 2017).

Several studies have argued and concluded that the operators/providers of elderly care centres need well-developed strategies to overcome many issues such as lack of standard of facilities (Areff & Lyndon, 2018; Salleh, Abdul Talib, Ismail & Alauddin, 2021; Ismail et al., 2021), different maintenance practices (Chua, Au-Yong, Ali & Hasim, 2018), non-typical application of operation management because it involves more than one organisation such as health care and institutional care (Rintala, Karppinen & Koivuniemi, 2021), lack of planning to sustain for a long time (Ismail et al., 2021; Chen & Zhou, 2022), and low quality of care (Schweighart, O'Sullivan, Klemmt, Teti & Neuderth, 2022). Specifically on elderly Pondok, there are many issues found in the literature, such as a lack of standard of facilities management (Nordin et al., 2017; Ismail et al., 2021), not suitable for active ageing homes (Ali, Au-Yong & Chua, 2019), no nursing or medical facilities provided (Areff & Lyndon, 2018) and lack of sustainable invention (Salleh et al., 2021).

Moreover, the prevailing literature on operation and maintenance to optimise building performance with little emphasis on elderly care centres, as it primarily focuses on commercial buildings (Siti Nurathirah & Salmiah, 2019), educational buildings (Zakiyudin, Fathi, Rambat, Tobi & Rejab, 2014), hospital buildings (Olanrewaju, Fang & Tan, 2018), government public building (Yusof, 2013), and high rise-residential building (Au-Yong, Tem & Chua, 2023). However, the limited literature on elderly care centres suggests significant gaps in the body of knowledge in this area. Thus, the objectives of this exploratory study are two-fold: 1) to identify the assets and facilities in elderly care centres and 2) to explore issues operators face in their operation and maintenance. This paper presents the outcomes of the exploratory study on the operation and maintenance of assets and facilities, which is part of the ongoing research on "Investigation of the Economic Aspects of the Operation and Maintenance of Elderly Care Centres".

LITERATURE REVIEW

Operation and Maintenance of Assets and Facilities in the Elderly Care Centre

According to the Malaysia Government Building Scheduled Maintenance Guidelines (Malaysian Public Works Department, 2019), an asset is defined as any land or buildings and infrastructure, plants, machinery, equipment and system, drawings, and technical data, any books, reports, and records, including all operating and maintenance manuals, any spare parts, tools, and other assets to enable the Contractor/caretaker to provide the services. In contrast, a facility is a collection of assets built, installed, or established to serve an entity's needs. These assets are categorised as immovable and movable assets. The immovable assets, known as fixed assets that are permanent in place, difficult to remove, or efforts to dismantle involve the need for relevant technical or legal expertise, including inherited immovable assets. Meanwhile, movable assets comprise inventory, plant, machinery, vehicles, equipment, and spare parts for any equipment and furnishing supplied with buildings or other infrastructure (Malaysian Public Works Department, 2019).

Implementing asset management in an organisation can increase economic productivity (Sara, Saputra & Utama, 2021) and is the best way to save long-term costs. Accordingly, Malaysia has established a system called MySPATA to standardise, manage and monitor government ministries' immovable assets, which are accessible for all the agencies involved to monitor the Government's case efficiently and effectively (Nasir, Azri & Ujang, 2022). However, no specific manual or guideline for non-government assets refers to private ownership property.

Zawawi, Ismail, Kamaruddin, and Kurdi (2014) mentioned that effective operation and maintenance of assets and facilities can help the building systems deliver services to consumers. Both operation and maintenance are a part of the building life cycle costs, where 80-90 per cent of the building costs are on operation, maintenance, and financing (Shankar Kshirsagar, El-Gafy, and Sami Abdelhamid, 2010). Unsurprisingly, Musarat et al. (2023) have stated that the operation and maintenance phase accounts for most of a building's lifecycle costs. The operation usually involves the activities that operate daily, weekly, monthly, quarterly, or yearly. Maintenance includes activities to prolong service and prevent sudden breakdowns, which may involve various types of maintenance such as planned, unplanned, preventive, corrective, predictive, reactive, or emergency. Operation and maintenance are the areas that need to be focused on to achieve long-term goals of economy, energy efficiency, resource conservation, and pollution.

Referring to the Malaysian Guideline on Operation and Maintenance 2021, five scopes of asset operation can help maintain the premises' cleanliness, safety, aesthetics, and sustainability. They are housekeeping management, pest

control management, security control management, landscape management, and utility management (Malaysian Public Works Department, 2021). The maintenance and repair work scope is divided into planned and unplanned maintenance involving civil and structure, mechanical, electrical, information and communication technology (ICT), finishing, and architecture. According to Chua et al. (2018), planned maintenance involves proactive or preventive maintenance, where maintenance activities are scheduled in advance based on a predetermined plan. In contrast, unplanned maintenance is reactive and occurs in response to unforeseen issues. It comprises emergency maintenance and corrective maintenance. Ideally, incorporating preventive measures can reduce the frequency of unplanned maintenance, thus minimising downtime and optimising resource utilisation.

Rintala et al. (2021) pointed out that the operation and maintenance of elderly care homes differ from typical buildings. This is because the services for elderly residents involve a range of activities carried out by various organisations, including healthcare and institutional care, mainly provided by private entities. Despite its importance, limited literature on asset and facilities management practices exists, particularly on operation and maintenance for private sectors, including elderly care centres. Hence, identifying the assets and facilities in the elderly care centre is the first step for this study to discover the challenges the management and operator face in the critical phase of the asset-building life cycle: operations and maintenance.

RESEARCH METHODOLOGY

The study is qualitative in nature, and to gather such qualitative data, a case study methodology was adopted to collect rich and profound data and an in-depth analysis of the phenomenon in question (Yin, 2018). The qualitative data was gathered via semi-structured interviews and site observations in three selected elderly care centres. All three centres are categorised under the Residential Care Centre with low care. The main entry requirements for the centres are health and independence. Informed consent for participation in the research was obtained from all subjects involved in the case study. Site observations were carried out for all three cases, with permission granted and operational officers accompanying the process.

Generally, the first case study is *Pondok* Umumi, located in Gerik, Perak (C1). The *Pondok* was established in 2018 and is comprised of 17 units of single-storey semi-detached houses. Currently, 43 residents are registered and managed by five staff members, including a chief executive officer, teachers, admin staff, and general officers.

The second case study is Pondok Unais, established in 2018 and located in Dengkil, Selangor (C2). The type of building is double-storey freestanding and consists of 103 individual rooms. Seven staff members manage the centre: three

administrative staff, three teachers, and one guard and there are 96 elder residents living at this *Pondok*.

The last selected case is also located in Selangor, specifically in Bangi, known as Darul Insyirah (C3). The centre was officially established in 2013 and has two branches: Darul Insyirah Aisyah and Darul Insyirah Khadijah. For this study, Darul Insyirah Aisyah was chosen, and it is a double-storey freestanding corner lot building in the landed housing area. The centre is managed by 18 staff consisting of six administrative staff, nine nurses, and three general officers to manage 40 residents in both branches. The summary of the case study background is shown in Table 1.

Table 1: Background of Case Studies

Name	Year Established	Total Residents	Type of building	
Pondok Umumi (C1)	2018	43	Single-storey semi-detached houses	
Pondok Unais (C2)	2018	96	Double-storey freestanding building	
Darul Insyirah Aisyah (C3)	2013	40	Double-storey freestanding corner lot house	

The selected case studies were chosen based on accessibility to first-hand data, allowing for the feasible collection of primary information through direct interviews and site observations. This approach enabled the gathering of comprehensive and relevant data necessary for the study. Additionally, the research is funded by a private grant, ensuring the availability of resources needed to conduct thorough and effective fieldwork to identify the current issues.

To achieve the first objective of this study, site observation was adopted to identify the assets and facilities available in those elderly care centres. The site observation of the assets and facilities is guided by a checklist of facility components, which incorporates the Physical Planning Guideline for the Elderly (PLANMalaysia, 2018) to enhance the reliability and consistency of the assessment process. Subsequently, the data for this study was also collected using semi-structured interviews with the staff in charge of the operation and maintenance. The interview questions consist of three parts: 1) to know the background of the case study, 2) to identify the management of the study area, and 3) to determine the challenges that the management and operator face in operating and maintaining the assets and facilities. The average time to complete

the interview, including the site observation, was about 60 minutes. The transcribed answers from the interviews were analysed to identify the underlying issues faced by operators of the elderly care centre. The interview has insightful strengths, providing an explanation and personal views. The findings are discussed and supported by the literature in the next section.

ANALYSIS AND DISCUSSION

The findings are divided into two parts. Firstly, the findings from the site observation. Secondly, the findings from semi-structured interviews with the operators of the elderly care centres.

Assets and Facilities in the Elderly Care Centres

The finding shows that assets and facilities related to religious activities are provided in all centres, such as prayer rooms and classrooms for Islamic discourse. The need for facilities and environments suitable for the practice of worship has become why older people prefer to live in elderly care centres in their golden age, especially with the Pondok system. As mentioned by Abd. Majid, Ismail, Abu Bakar, Abd. Razak and Usman (2020), the design of the Pondok institution ensures that accommodations, study areas, and places for worship are easily accessible for elderly residents. The findings from the site observation reveal eight main categories of facilities at the three elderly care centres, as summarised in Table 2.

Table 2: Facilities at Elderly Care Centres

NO.	FACILITIES	COMPONENT	C1	C2	C3
A	Administration & Management Building	Administration office	✓	✓	✓
		Management office	✓	✓	✓
		Worker's quarters	✓	✓	✓
		Individual rooms	✓	✓	✓
		Toilet	✓	✓	✓
		Guest house/ room	×	✓	×
B	Integrated Facilities	Elderly activity space	✓	✓	✓
		Reading room	✓	✓	✓
		Lounge area	×	✓	✓
		Office and store	✓	✓	✓
		Multi-purpose room	✓	✓	×
		Kitchen and dining room	✓	✓	✓
		Prayer room/ area	✓	✓	✓
		Laundry facilities	×	✓	✓
		Toilet and bathroom	✓	✓	✓
		Leisure place	✓	×	×
		Parking lot	✓	✓	✓
		Corridor	✓	✓	×
C	Health	Treatment room	×	✓	×
		Transportation for treatment	×	×	✓

NO.	FACILITIES	COMPONENT	C1	C2	C3
		Consultation room	×	✓	×
		Medical services	×	✓	×
		Counselling	✓	✓	✓
		Physiotherapy	×	✓	✓
D	Recreation	Community garden, park, gazebo, sheltered resting area	✓	✓	×
		Gap generation area	✓	×	×
E	Safety	Guarded	×	✓	✓
		Guardhouse	×	✓	×
		Emergency button	×	×	✓
		CCTV	×	✓	✓
		Fire safety facilities	×	✓	✓
		Lift/ Stairlift	×	✓	✓
F	Religious	Mortuary	×	×	×
		Prayer room	✓	✓	✓
		Study room	✓	✓	✓
G	Access	Ramps	×	✓	×
		Staircase	×	✓	✓
		Entrance foyer	×	✓	✓
H	Support Facilities	Trash area	×	✓	✓
		Wakaf area	✓	×	✓
		Fence	✓	✓	✓
		Streetlight	✓	✓	✓
		Entrance & exit pathway	✓	✓	✓
		Soft & hard landscape	✓	✓	×
		Ambulance/ hearse parking	×	✓	×
		Signboard	✓	✓	×
		Information board	×	✓	×
		Bench or seat	×	✓	×
		Mailbox	×	✓	✓
		Trash bins by category	×	✓	×

CHALLENGES IN OPERATING AND MAINTAINING ASSETS AND FACILITIES

The three most challenging issues mentioned by staff in charge of the operation and maintenance of the three elderly care centres are safety inside the accommodation, high operation and maintenance costs and lack of a structured approach to managing the assets and facilities.

Safety issues inside the accommodation

The safety of older people is always a priority for the care centre. Safety inside the accommodation becomes a challenge for the operators even though the entry requirements for the three elderly care centres are healthy and independent.

The safety concerns vary in each case based on the facilities provided. In C1, the operator supplies fire extinguishers as elderly residents cook using gas

stoves. In C2, the concern is about residents' ability to seek help if an accident occurs, so the operator plans to install emergency buttons in each room. In C3, the focus is on supporting mobility with handrails. No major incidents have been reported so far, and the operators can still monitor residents' movement and conditions effectively.

All three elderly care centres have an Islamic discourse daily, which is compulsory for the residents. Thus, the operator monitors the attendance of every elderly to the classes and will look out for the resident's condition. However, older people are often synonymous with physical fragility, various illnesses, and disabilities (Mafauzy, 2000). Accordingly, operators always look forward to providing more safety measures by considering older people's privacy and physical strength, such as installing an alarm system or sensor to detect smoke and accidents or sending a signal to alert operators. As suggested by Su, McDonnell, and Li (2021), when addressing health challenges in safety, the operator may be involved in implementing technology-based solutions. This includes artificial intelligence-powered disease surveillance systems, smart home-based monitoring systems, wearable biometric sensors, and teleconsultation services.

Furthermore, safety issues have been affecting the health of elderly residents since the outbreak of the COVID-19 pandemic. The operators are aware that the pandemic not only threatens the well-being of elderly residents but also causes the discontinuation of their businesses (Hasmuk et al., 2020). This issue has been mentioned in the room layout in the elderly care centre, where the number of beds significantly affects the risk of disease infection (Hasmuk et al., 2020; Su et al., 2021; Zhu et al., 2022). Based on the findings, C1 and C2 provided one room for each older person, except C3, where one room accommodated four older people. However, prioritising safety with special attention, additional measures for protection, and social support provided by the caregiver and the safe surrounding environment can help the operator amid global crises other than COVID-19. Thus, it upholds the statement of the World Bank (2020) that aged care homes should ensure the residents' health and safety and the quality of aged care services.

High operation and maintenance cost

The findings highlighted three operation costs concerning the operators: 1) utility, 2) maintenance and 3) catering. This is caused by the lighting, air-conditioners, electricity, and water usage, which are operated almost 24 hours a day.

Firstly, operators are concerned about rising utility costs due to inefficient equipment needing repairs. Maintenance is typically reactive, responding to occupant complaints or emergencies. Nasir, Azri, and Ujang (2022) support these findings, highlighting unplanned maintenance practices in Malaysia that are triggered mainly by public complaints.

Secondly, all three centres face high maintenance costs, each with distinct concerns. C1, located in a hilly area, struggles with drainage issues during the rainy season. The system often gets blocked by soil, requiring costly cleaning and maintenance. A lack of expertise to manage upgrades has prolonged the issue. As Sohn, Brody, Jun-Hyun, and Ming-Han (2020) noted, effective stormwater drainage systems can minimise property loss and expenses. In C2, leaking water pipes behind walls caused severe damage, only noticed once discoloured walls and ceilings appeared, which led to high repair costs. Mydin, Mohd Nawi, and Che Munaaim (2017) emphasise the need for early preventative measures to avoid structural damage like cracking.

Similarly, C3 faces leaks from an ageing roof over ten years old. Poor maintenance has led to additional costs, with Au-Yong, Siaw, Chen, and Wahab (2022) pointing out the importance of effective management to ensure building functionality. As Le, Domingo, Rasheed, and Park (2018) suggested, regular inspections and repairs could reduce corrective maintenance costs.

The third issue is catering services. Catering services are a significant operational cost in C3, where meals are provided daily. Thus, the management welcomes donations in that centre through basic food aid to reduce costs. This reflects their effort to provide age-appropriate nutrition. In contrast, residents in C1 and C2 can cook or buy food, but the management has no control over their nutrition, which may lead to health problems like diabetes or gout. The management raises awareness through talks and activities to address this issue. Nutrition is one of the top five needs for older people, along with physical health and self-care (Schweighart et al., 2022). Catering services are becoming an attraction and a crucial factor when older people choose a place to stay.

In a nutshell, the operation and maintenance costs pose challenges for operators of the elderly elderly care centres who want to keep their best services for elderly residents. The operation and maintenance phase accounts for most of a building's lifecycle costs (Musarat et al., 2023). This issue is faced globally; for instance, nursing homes in Japan have been facing financial challenges leading to closures and, in some cases, bankruptcy (Japantimes, July 2023). This matter impacts not only the elderly residents who rely on the facilities but also the broader community and healthcare system. From the findings, the operators of the elderly care centres are already aware of which operation and maintenance activities cost the most and are looking for a cost-effective and sustainable approach.

Lack of structured approach in managing the assets and facilities

The findings reveal that operators manage assets and facilities without a structured approach. Only C3 keeps proper records of its assets. The assets and facilities at C2 and C3 care centres are monitored by individuals who are given the position of operational officer who handles procurement for maintenance

works. In contrast, C1 relies on a manager to supervise due to staff shortages. The interviewees cite a lack of expertise, management training, and facilities management knowledge, with financial constraints as the primary obstacle. Funding for asset operation and maintenance mainly comes from public contributions and is managed by senior executives such as the secretary, head of administration, and operational officer before being approved by the founder.

These findings are consistent with existing literature highlighting that private elderly care centres face challenges in obtaining government funds (Noor, Isa & Nor, 2020), making hiring facility managers a low priority (Ismail et al., 2021). This also hampers the integration of sustainable practices (Salleh et al., 2021). Nonetheless, facilities management can highlight the benefits of asset and facility management, including human capital development, business growth, and sustainability (Awang, Mohammed, Md. Salleh, Johari, & Khair, 2017).

Clearly, the operation and maintenance phase involve many routine activities, a long time, and high costs. Efficient operation and maintenance within an institution can optimise service delivery performance (Che-Ghani, Myeda & Ali, 2023). The Malaysian Public Works Department (2021) guidelines on operation and maintenance management emphasise the importance of focusing primarily on maintaining and extending the lifespan of assets and facilities. This approach aims to ensure that assets and facilities remain in optimal condition and deliver high performance, enabling the successful delivery of services. Hence, the operator can adopt facilities management practices to gain customer satisfaction, increase work productivity, ensure stability in the business environment, boost profits, and achieve the organisation's core objectives (Abdul Wahab, Nizam Kamaruzzaman & Khairolden, 2012).

CONCLUSION

This study has identified the assets and facilities provided at elderly care centres with eight main categories of facilities: 1) administration and management, 2) integrated facilities, 3) health, 4) recreational, 5) safety, 6) religious, 7) access, and 8) support facilities. In addition, the three significant issues related to the operation and maintenance of the assets and facilities are safety, high operation and maintenance costs, and lack of a structured approach to managing assets and facilities. The findings of this study will add to the stream of literature on the operation and maintenance of assets and facilities in elderly care centres in Malaysia. The analysis concludes that there is a need for facilities management practices and strategies to maintain the assets and facilities effectively. Hence, future studies may be appropriate to develop strategies to assist the operators in achieving optimal operation and maintenance to improve facility performance that ultimately caters to the needs and enhances resident satisfaction.

ACKNOWLEDGEMENT

The authors would like to thank the International Islamic University Malaysia (IIUM) for supporting this research and Lavasse Berhad for funding this ongoing research on "Investigation of the Economic Aspects of the Operation and Maintenance of Elderly Care Centres" (Project ID: SPP23-170-0170). This credit also goes to various organisations for their helpful assistance, input, and encouragement toward the accomplishment of this research.

The study being reported herein is drawn from a Master of Science in Built Environment (by research work) carried out by the first author, under the co-supervision of the second and third authors, who is a Graduate Research Assistant who received funding from Lavasse Berhad. The outcome of this study has been presented in the form of an oral presentation by the first author at the 4th Facility Management Asia Conference, with the theme of "Embracing ESG to Future Proof the Facilities Management Industry", on May 27, 2024.

REFERENCES

Abd Majid, M., Ismail, S., Abu Bakar, S., Abd. Razak, A. Z., & Usman, A. H. (2020). *Self Needs of Senior Citizens towards Migration to Pondok (Pesantren)*. *7*(19), 5733–5740.

Abdul Mutalib, M., Kamaruzaman, N. A.-F., & Abdulah, N. A. (2023). Elderly Education and Lifelong Learning: Legal and Shariah Perspectives. *Malaysian Journal of Syariah and Law*, 11(2), 230–242.

Abdul Wahab, M., Kamaruzzaman, S.N. & Khairolden, M. (2012). The Significance of Strategic Planning and Management in Facilities Management. *The Professional Journal of Royal Institution of Surveyors Malaysia.* Vol 47, No.2. 23-29

Ali, A. S., Au-Yong, C. P., & Chua, S. J. L. (2019). A Case Study on the Building Condition of Elderly Homes and Its Maintenance Recommendations. *Malaysian Construction Research Journal*, *29* (3), 31-46.

Areff, N. A., & Lyndon, N. (2018). Elder's Decision of Moving to Pondok Living Arrangement in Malaysia. *e-BANGI Journal*, 13(2). 51-72

Au-Yong, C. P., Chen, A. S. E., & Wahab, M. A. (2022). Establishing Effective Operation and Maintenance that Enhances the Energy Performance of Green Office Buildings in Malaysia. *International Journal of Real Estate Studies*, 16(S1), 104-113.

Au-Yong, C. P., Tem, J. Y., & Chua, S. J. L. (2023). The Relationship between the Maintenance Management Problems and the Maintenance Performance of High-Rise Residential Buildings. *International Journal of Real Estate Studies, 17*(2), 90-101.

Awang, M., Mohammed, Abd. H., Md. Salleh, M. N., Johari, N. H., & Khair, N. (2017). Facilities Management - Future Prospect in Malaysia. *Sains Humanika*, *9* (1–5). 1-9.

Che-Ghani, N. Z., Myeda, N. E., & Ali, A. S. (2023). Efficient operation and maintenance (O&M) framework in managing stratified residential properties. *Journal of Facilities Management*, 21(4), 609–634.

Chen, S., & Zhou, J. (2022). The Reflections on the Governance of Nursing Homes during the Epidemic. *International Conference on Real Estate, Population and Green Urbanism* (REPGU 2022), 31–38.

Chua, S. J. L., Au-Yong, C. P., Ali, A. S., & Hasim, M. S. (2018). Building Maintenance Practices towards the Common Defects and Resident's Satisfaction of Elderly Homes. *Journal of Design and Built Environment*, *2018*(1), 62–71.

Department of Statistics Malaysia. (2022). *Current Population Estimates, Malaysia, Population by Age Group*. Press Release. Retrieved July 23, 2023, from https://v1.dosm.gov.my/v1/index.php?r=column/pdfPrev&id=dTZXanV6UUdyUEQ0SHNWOVhpSXNMUT09

Hasmuk, K., Sallehuddin, H., Tan, M. P., Cheah, W. K., Ibrahim, R., & Chai, S. T. (2020). The Long-Term Care COVID-19 Situation in Malaysia. *International Long-Term Care Policy Network*, 1-20.

Ismail, K., Alauddin, K., Abdul Talib, Y., & Salleh, N. (2021). Conceptualisation of Cultural Sustainability for Elderly Pondok Village (EPV). *IOP Conference Series: Earth and Environmental Science*, *881*(1). https://doi.org/10.1088/1755-1315/881/1/012024

Ismail, N. S. A., Abdullah, N., Hassan, K., Samsudin, S., Ahmad Zakuan, U. A., Yusof, R., & Mohamed Zaki, N. (2017). Kesejahteraan Hidup Warga Emas: Perancangan Berasaskan Gender. *Malaysian Journal of Society and Space*, *13*(3), 75–85. https://doi.org/10.17576/geo-2017-1303-08

Japantimes (2023, July). Survey finds that *27% of nursing homes in Japan face bankruptcy due to price hikes.* Retrieved September 30, 2023, from https://www.japantimes.co.jp/news/2023/07/08/business/nursing-homes-bankruptcy-survey/

Le, A. T. H., Domingo, N., Rasheed, E., & Park, K. S. (2018, September). Building Maintenance Cost Planning and Estimating: A Literature Review. In *Proceedings of the 34th Annual ARCOM Conference,* 697-706.

Mafauzy, M. M. (2000). The Problems and Challenges of the Aging Population of Malaysia. *The Malaysian Journal of Medical Sciences*, 7(1), 1-3.

Majid, N. H. A., Hamidi, M. H., & Denan, Z. (2018). Retirement Village for Malay Muslims. *Asian Journal of Environment-Behaviour Studies*, *3*(9), 137-150. *Studies*, *3*(9), 137-150.

Malaysian Public Works Department. (2019). *Government Building Scheduled Maintenance Guidelines (GBSMG).* http://epsmg.jkr.gov.my/images/c/c4/Government_Building_Scheduled_Maintenance_Guidelines_(GBSMG).pdf

Malaysian Public Works Department. (2021). *Garis Panduan Pengurusan Operasi dan Penyenggaraan (GPOP)*. Bahagian Perundingan Pengurusan Aset. https://jpak.jkr.gov.my/documents/garispanduan/GARIS%20PANDUAN%20PENGURUSAN%20OPERASI%20DAN%20PENYENGGARAAN%20TAHUN%202021.pdf

Md Nor, N. N. F & Ghazali, S. (2021). Malaysia Towards an Ageing Country. *Malaysian Journal of Society and Space*, *17*(3), 234–245.

Musarat, M. A., Alaloul, W. S., Cher, L. S., Qureshi, A. H., Alawag, A. M., & Baarimah, A. O. (2023). Applications of Building Information Modelling in the Operation

and Maintenance Phase of Construction Projects: A Framework for the Malaysian Construction Industry. *Sustainability*, *15*(6), 5044. https://doi.org/10.3390/su15065044

Mydin, M. A. O., Nawi, M. N. M., & Munaaim, M. A. C. (2017). Assessment of waterproofing failures in concrete buildings and structures. *MCRJ Special Issue*, 2(2), 166-179.

Nasir, A. A. I. M., Azri, S., & Ujang, U. (2022). Asset Management in Malaysia: Current Status. *IOP Conference Series: Earth and Environmental Science*, 1064(1). https://doi.org/10.1088/1755-1315/1064/1/012035

Noor, S., Isa, F. M., & Nor, L. M. (2020). Ageing Care Centre Women Entrepreneur: A Silver Bullet for Ageing Tsunami in Malaysia. *Sains Humanika*, 12(1), 51–62.

Nordin, N. M. F. B. N., Hasbollah, H. R. B., Ibrahim, M. A. H. Bin, Marican, N. D. B., Halim, M. H. B. A., Rashid, A. F. B. A., & Yasin, N. H. B. M. (2017). Nursing Home Facilities in Malaysia (premise, shared facilities & individual accommodation: Space requirement): A literature review. *AIP Conference Proceedings*, *1891*(October). https://doi.org/10.1063/1.5005442

Olanrewaju, A., Fang, W. W., & Tan, S. Y. (2018). Hospital Building Maintenance Management Model. *International Journal of Engineering and Technology*, 2(29), 747-753.

PLANMalaysia, Jabatan Perancangan Bandar dan Desa, Kementerian Wilayah Persekutuan. (2018). *Garis Panduan Perancangan Fizikal Bagi Warga Emas*. (GP031-A) https://mytownnet.planmalaysia.gov.my/ver2/gp/GPP_WARGA_EMAS.pdf

Rintala, A., Karppinen, H., & Koivuniemi, J. (2021). Operations Management in Improving Elderly Home Care. *International Journal of Services and Operations Management*, 24(3), 331-362.

Salleh, N. A., Abdul Talib, Y., Ismail, K., & Alauddin, K. (2021). Challenges in Maintaining Facilities in Elderly Pondok Village Environment. *IOP Conference Series: Earth and Environmental Science*, *881*(1). https://doi.org/10.1088/1755-1315/881/1/012039

Sanford, A. M., Orrell, M., Tolson, D., Abbatecola, A. M., Arai, H., Bauer, J. M., ... & Vellas, B. (2015). An international definition for "nursing home". *Journal of the American Medical Directors Association*, *16*(3), 181-184.

Sara, I., Saputra, K. A. K., & Utama, I. W. K. J. (2021). The Effects of Strategic Planning, Human Resource and Asset Management on Economic Productivity: A Case Study in Indonesia. *The Journal of Asian Finance, Economics and Business,* 8(4), 381-389.

Schweighart, R., O'sullivan, J. L., Klemmt, M., Teti, A., & Neuderth, S. (2022). Wishes and Needs of Nursing Home Residents: A Scoping Review. *Healthcare (Switzerland)*, *10*(5), 1–29. https://doi.org/10.3390/healthcare10050854

Shankar Kshirsagar, A., El-Gafy, M. A., & Sami Abdelhamid, T. (2010). Suitability of Life Cycle Cost Analysis (LCCA) as Asset Management Tools for Institutional Buildings. *Journal of Facilities Management, 8*(3), 162-178.

Siti Nurathirah, C. M. N., & Salmiah, A. (2019). Performance of Building Maintenance in Operation & Management at Commercial Buildings. *International Journal of Modern Trends in Business Research*, 2(6). 15-28.

Sohn, W., Brody, S., Jun-Hyun, K., & Ming-Han, L. (2020). How Effective are Drainage Systems in Mitigating Flood Losses? *Cities 2020,107*, 102917. https://doi.org/10.1016/j.cities.2020.102917

Su, Z., McDonnell, D., & Li, Y. (2021). Why is COVID-19 more deadly to nursing home residents? In *QJM: An International Journal of Medicine, 114*(8), 543–547

Sufian, A., & Mohamad, N. A. (2013). "Pondok" System as a Model for Retirement Village in Malaysia: A Legal Perspective. *ALAM CIPTA, International Journal of Sustainable Tropical Design Research and Practice*, *6*(2), 23–37. http://irep.iium.edu.my/34135/

Syed Akil, S. M., & Abdullah, S. (2014). Challenges in Managing Elderly Care Centres in Malaysia. *International Journal of Arts & Sciences*, *07*(03), 1944–6934.

World Bank. (2020, November). *Malaysia Development Experience Series, A Silver Lining - Productive and Inclusive Aging for Malaysia International Bank for Reconstruction and Development*, Retrieved July 30, 2023, from https://documents1.worldbank.org/curated/en/287981606116408851/pdf/A-Silver-Lining-Productive-and-Inclusive-Aging-for-Malaysia.pdf

Yin, R. K. (2018). Case Study Research and Applications: Design and Methods (6th Edition). Thousand Oaks, CA: Sage Publication.

Yusof, Y. (2013). *The Effectiveness of Public Sector Asset Management in Malaysia*. Doctoral dissertation, Queensland University of Technology.

Zakiyudin, M. Z., Fathi, M. S., Rambat, S., Tobi, S. U., & Rejab, N. (2014). An overview of building maintenance management in Malaysia. In *7th IRERS IBIMA International Conference.* https://www.researchgate.net/publication/265178898

Zawawi, Z. A., Ismail, F., Kamaruddin, N., & Kurdi, M. K. (2014). The Core Services of the Facilities Management Based Company in Malaysia. In *MATEC Web of Conferences* (Vol. 15, p. 01016). EDP Sciences.

Zhu, X., Lee, H., Sang, H., Muller, J., Yang, H., Lee, C., & Ory, M. (2022). Nursing Home Design and COVID-19: Implications for Guidelines and Regulation. *Journal of the American Medical Directors Association*, *23*(2), 272-279.

Received: 6th July 2024. Accepted: 5th September 2024

PLANNING MALAYSIA:
Journal of the Malaysian Institute of Planners
VOLUME 22 ISSUE 5 (2024), Page 417 – 432

WALKING FOR HEALTH & WELLBEING: THE EFFECT OF STEP FREQUENCY

Nurain Mohd Talmizi[1], Nor Eeda Haji Ali[2], Muhammad Rijal Mohamad[3], Nurhidayah Samsul Rijal[4], An Nisha Nur Welliana Abd Rased[5]

[1,2,3,4,5] *College of Built Environment,*
UNIVERSITI TEKNOLOGI MARA PERAK BRANCH, MALAYSIA

Abstract

Walking as a mode of transport and recreation to get more active and stay fit. People of all ages can benefit from walking, evaluation of earlier research in this field shows that a study of walking specifically among those with different health challenges in Malaysia is lacking. This paper sets out to identified whether individual, environmental and social factors influence walking in neighbourhood, which is the objectives: to examine whether people in a neighbourhood walk during the week, to identify whether people who have health problems walk more or not at all, and to examine the relationship between people's frequency of walk and their physical wellbeing. Data from 410 adults of between 18 and 60 years of age are analysed using a multiple linear regression analysis technique. Overall, the findings reveal that the respondents regularly walk despite their health status as none of them (0.00%) have assessed their health as being poor to begin with. Nevertheless, there is a significant correlation between self-reported health states and walking (X=22.519, p0.05), and their frequency of walk (X= 22.673, p0.05). The results indicate that 19.40% of the respondents walk regularly on a weekday compared to 21.20% on the weekend only, and 18.20% during both weekday and weekend. This study suggests that the neighbourhood must be safe, and the built environment is conducive and appropriate for proper walking. These factors are pertinent considerations for both housing developers and state policies to implement to initiate and promote more walking for physical wellbeing, recreation as well as for transportation purposes.

Keywords: Walking, good health, step frequency, neighbourhood

[1] Lecturer at Universiti Teknologi MARA Perak Branch. Email: nuraintalmizi@uitm.edu.my

INTRODUCTION

Walking is a simple, affordable, and accessible form of physical activity. It can be easily incorporated into daily routines, such as walking to work or school, taking the stairs instead of the elevator, or going for a stroll during breaks. Numerous research has looked at how the environment affects walking (Hosseinzadeh, 2021). Behavioural theories associate physical activity influence with multiple factors including intrapersonal (demography and psychology), interpersonal (social support), environmental (distance to the facilities), and policy (laws and regulations) (Vancampfort et. al., 2019).

Not many of us know nonetheless that to maximize the benefits of walking for physical fitness and to combat diseases, people should aim for at least 150 minutes of moderate-intensity walking or 75 minutes of vigorous-intensity walking each week as recommended by WHO (2023). All 191 UN Member States have committed to working towards the 17 Sustainable Development Goals (SDGs), which contain 169 targets, by the year 2030. SDG 3 places a strong emphasis on health: the promotion of well-being for all people at all ages, supported by 13 aims that span the breadth of WHO's mission. A future free of poverty, hunger, sickness, and want is what the 17 Sustainable Development Goals, endorsed by world leaders in September 2015, set out to achieve.

According to World Population (2019) the highest prevalence of obesity among adults in South-east Asia is Malaysia (15.6%), followed by Brunei (14.1%), Thailand (10%) and Indonesia (6.9%) Malaysia's rising trend in weight gain accounted for 50.1% of adults who are 30.4% overweight and 19.7% who are obese (Chan et al., 2019). The rate of obesity and non-communicable diseases linked to physical inactivity has exponentially increased sedentary lifestyle over the last two decades in Malaysia (Cian et. al., 2016). The country has been identified as one of the least physically active countries in the world with over 60% of adults being essentially sedentary (Cian et al., 2016). According to the latest estimates from World Health Organization (WHO) 2019, Malaysia has the highest rate of obesity among Asian countries, with about 64% of male and 65% of female being either obese or overweight.

Additionally, some of the reasons adduced to this increase in the number of people living with obesity are changing lifestyles in terms of consumption of food with high sugar and fat concentration, popularly regarded as 'fast food' or 'junk food', sedentary lifestyle (i.e., inactivity), physical inactiveness, and changing work-related lifestyle by mechanization and computerization (Cheong et. al., 2010). Engaging in walking or other physical activities by the citizens is seen as some of the ways to address the problem of obesity in the country. This is predominantly because many Malaysians depend on private vehicle transportations to cater for their daily travel needs as high automobile-dependency for transportation is a common occurrence among the

urban population (Othman & Ali, 2020). Most people nowadays depend greatly on car travel. High car dependency not only creates and exacerbates traffic congestion on urban road networks, but it also seriously undermines the role of public transportation, which has become less cost effective and efficient due to reduced usage and increasing traffic congestion (Othman & Ali, 2020). In the smaller towns and villages most Malaysians still regularly walk as a form of transport, recreation and exercise as the air is fresher, there are fewer obstructions for walking about, and fewer vehicles used by motorists from home to farms, compared to commuting to school, shops, factories and offices by automobiles in the urban areas.

Aside from walking for numerous health benefits, several studies have examined associations between neighborhood characteristics and physical activity participation among older adults, such as walkability of neighborhoods (Choi et. al., 2022; Herbolsheimer et. al., 2020; Barnett et. al., 2017; Chudyk et. al., 2017; Mooney et. al., 2017). On the other hand, older adults who perceive their neighborhoods as less safe tend to engage in less activities outside the homes (Choi et. al., 2022; Gallagher, 2010). Older adults who perceive their neighbors to be helpful and their neighborhoods to be safe also tend to report better health conditions (Choi et. al., 2022; Cain et… al., 2018). Furthermore, many older adults are not physically active and physical activity level varies by racial/ethnic groups (Choi et al., 2022; Barnett et al., 2017). A community-based study in a historically African American neighborhood indicate that prosocial behaviors is positively and significantly linked with physical activity (Choi et. al., 2022; Moore et. al., 2020).

Although there is indication that people of all ages can benefit from walking, evaluation of earlier research in this field shows that a study of walking specifically among those with different health challenges in Malaysia is lacking. According to the research from National Institutes of Health Ministry of Health Malaysia (2017), about 33.5% of adults in Malaysia are reported to be physically inactive, with 38.30% and 28.90% of male and female respectively, within the age range of 18-59 years. Therefore, to address the knowledge gap this study investigates the walking behavior of adults with medical challenges in a selected residential neighborhood of Shah Alam in the state of Selangor. Indeed, ccommunities and neighborhoods that encourage walking will intentionally boost physical activity and wellness among residents of that area. Studies on walking and walkability include a thesis by the author (forthcoming) that has identified whether individual, environmental and social factors influence walking in a Malaysian neighbourhood, either as a form of transport to work, shop and school, or for recreation. Among these factors is a study concerning walking for health and physical wellness, which is the main objective of this paper: (i) to examine whether people in a neighbourhood walk during the week, (ii) to identify whether

people who have health problems walk more or not at all, and (iii) to examine the relationship between people's frequency of walk and their physical wellbeing.

LITERATURE REVIEW

Walking In Neighbourhood

Impact of disease with regards to physical inability and chronic illnesses is inevitable. To address the problem, this study examines walking characteristics such as personal desire in walking, including amount, frequency, duration and period of walking. For example, earlier work with Auckland children shows that active travel is associated with destination accessibility on weekdays only, and differential relationships between activity, and built environment characteristics are also observed between weekends and weekdays (Smith et. al., 2019; Oliver et. al., 2016). In this study it is inferred that the convenience of the weekday and/or weekends as well as the walking environment in the living area have a significant impact on the reactions and daily walking activities of the residents, especially among the sickly and elderly.

Adults achieving ≥10,000 pedometer steps per day are more likely to achieve recommended levels of physical activity (McCormack et al., 2006; Le-Masurier et. al., 2003) as well as experience improvement in bodyweight (Schneider et. al., 2006), stable blood pressure levels (Tully & Cupples, 2011; Swartz et. al., 2003), and glucose tolerance (Swartz et. al., 2003). The extent to which walkability indexes are associated with health outcomes at population scales is a key consideration in their utility to benchmark and guide planning and policy aimed at reducing population-levels of overweight and obesity (Mayne et. al., 2019, Grasser et. al., 2013).

Past research indicates that walking also reduces anxiety, depression and anger. Major chronic diseases such as diabetes, hypertension, obesity, inactivity, and depressive symptoms are often accompanied by a decline in the physiological reserves of all the organ functions in compromising homeostasis and resistance to disease. Insufficient physical activity has been linked to a wide range of diseases, including stroke, type 2 diabetes, cardiovascular disease, depression and cognitive decline (Brister, 2018; Kyu et. al., 2016; Rebar et. al., 2015). Studies have shown that participation in pedometer-facilitated physical activity interventions is associated with improved weight status among overweight and obese adults with both type II diabetes (Cian et. al., 2016) and without (Richardson et. al., 2008), reduced resting heart rate among sedentary workers (Chan et. al., 2004), reduced systolic blood pressure (Bravata et. al., 2007), improved positive affect (Baker et. al., 2008), and including improved physical function and decreased pain and disability among those with musculoskeletal disorders (Mansi et. al., 2014), (adapted from McCormack et. al. (2019).

Numerous past studies have also focused on age-related walking behaviors. Considering that the elderly carry out a large part of their activities by walking, and to support active living lie behind greater reliance on their local neighborhood amenities and social networks. Currently, the population of the developed world is steadily ageing. In the European Union, approximately 22% of persons are over 60 years of age and this was projected to increase to more than 27% by the year 2020. This problem has major implications for health care resources and for maintaining the productive workforce. Ageing population is also becoming a major challenge in developing countries such as Malaysia, with 7 percent of the population expected to be over 60 in 2020, and 11 percent by 2030 (Nordin & Nakamura, 2020). Soon it will emerge as a threat to government welfare policies and economic growth although several developed countries are starting to take an interest in the active living of the elderly (e.g., the EU's view of the silver economy and healthy aging in the US) (Kim, 2020). Active living among all age groups will significantly improve quality of life, increase physical fitness, reduce health problems and prolong life. Generally, people's physical functions deteriorate with age, making older people less active and less mobile (Milanovic et. al., 2013), which tends to lead to physical inactivity, as has been found in 48.8% of Malaysian men and women aged 60 years and above (Nordin & Nakamura, 2020; Chanet et. al., 2019). Other studies in the field include eating behaviour and age (young and old) (Achananuparp et. al., 2018); and age, income, gender, education, marital status, region, house locality, job characteristics, and medical conditions (Cheah & Poh, 2014).

METHODOLOGY

This study is conducted in Shah Alam which is the state capital of Selangor. Shah Alam City or the Central Business District (CBD) (year 1978) is usually the most expensive part of the city to live in, with a high concentration of office buildings, retail outlets, restaurants, and other businesses. According to MBSA, 2020, it is estimated that the total population of Shah Alam is 650,000. The three main racial groups are Malay that constitutes the largest percentage 42.80%, followed by Chinese 35.40%, and Indian 21.0%, and 0.80% of the other racial groups. The residential estate in Sections 1-14 in Shah Alam City that is selected for this study has a population of 95.254, with 49.677 males and 45,577 females (see Table 1). During the field work survey, the region surrounding the study area is found to be very well developed, and the study area itself is endowed with good accessibility, facilities, and infrastructure. That means that the environment is suitable, and it caters for its surrounding neighborhoods in terms of provision of necessary infrastructure, walk friendly urban/neighborhood design, and the potential social atmosphere that encourages walking and other physical activities. With regards private housing, the study area consists of three (3) types of

residential properties (low-cost housing, medium cost housing, and high-cost housing). The local community from the middle-income level lives in this study area.

Considering of a possible low response rate, a total of 410 questionnaires are distributed to the respondents who are selected based on a systematic sampling to equally represent the different housing categories. In some cases, the questionnaires are distributed to the respondents by hand to be answered and then picked up later. In this case, the researcher explained the procedure to these respondents before they began to answer their questionnaires. Normally in a study of this kind, neighbourhoods are chosen based on a high ageing population rate. However, to facilitate this research, respondents from the respective active neighbourhood associations are chosen instead. The targeted population are the heads of the respective households who reside in the research area consisting of three types of residential properties. These are the low cost, medium cost, and high-cost housing categories.

The target population are the residents living in Sections 1-14 of between 18 to below 60 years of age (refer to Table 1). The choice of these age categories is based on two things. First, those below age 18 are teenagers and may not be ill, and who are full of energy and are mostly likely to be playing and jumping around in school or in the neighbourhoods where they live without necessarily having to engage in a formal physical activity. Second, some of those above 60 years may be too weak or incapacitated due to sickness or old age to engage in any rigorous physical activity including regular or prolonged walking outdoors.

Table 1: Population of Sections 1-14, Shah Alam City

Section	Population	Male	Female
Section 1	1,664	831	833
Section 2	1,991	948	1,043
Section 3	1,332	644	688
Section 4	1,702	815	887
Section 5	-	-	-
Section 6	3,033	1573	1460
Section 7	44,646	23172	21474
Section 8	7,440	3712	3728
Section 9	6,403	3242	3161
Section 10	1,072	537	535
Section 11 & 12	3,586	2118	1468
Section 13	18,187	10073	8114
Section 14	4,198	2012	2186
Total Population	**95,254**	**49,677**	**45.577**

Source: Department of Statistics Malaysia, (2021)

This study investigates the nexus between frequency of walking and human wellbeing. However, caution should be accorded in interpreting the results displayed in Table 2 below, because this is not a clinical trial involving laboratory tests or investigations, rather it is a self-reported study comprising randomly selected respondents from the study area. As claimed in Mohd Talmizi et. al., (2022), whether they are young or old, people walk.

Table 2: Variables and Questions

Variables	Question asked in the survey
Health-Well being	How did you feel about your health?
Health Challenges	What causes your health challenges?
Health Problems	What are your most common health problems?
Self-rated Health	What is your self-rated health of life?

The main tool used to gather raw data from a group of respondents in this survey is a questionnaire. A questionnaire is a research instrument that is commonly used in market research as well as in the social and health sciences using questions to ask for feedback. Using a questionnaire for investigation is cheap, self-paced, easy to administer for a large group, and anonymous and suitable for a sensitive topic like the respondents' personal health and their perceptions, attitudes, experiences, or opinions about walking as an exercise to mitigate any health challenges.

This study employs three (3) types of research methods to collect, process and analyze the raw data. They are qualitative, quantitative, and mixed mode. The mixed mode is a contemporary method that combines quantitative and qualitative approaches to provide additional perspectives, create a richer picture and present multiple findings based on the researcher's personal experiences living in Malaysia and the audience. The sampling technique enables the numerical data obtained in the Questionnaire items to be tabulated using the Quantitative method that involves a variety of statistical tests of significance for ensuring validity and reliability of the results.

The survey (see Figure 1) consists of two questionnaire formats, namely Semi structured Questionnaire and Self-administrated Questionnaire that includes a 5-point Likert scale section from strongly agree (5) to strongly disagree (1), multiple-choice questions section, but some questions have 4-point Likert scale formula to specify day of week they would normally walk or not at all on: 1- weekday, 2- weekend, 3- weekday and weekend, and 4- Not interested.

The self-administered questionnaire is designed explicitly to be completed by the respondents. It is bi-lingual (i.e., written in English and Malay) to give respondents who may not be able to read and write in English the opportunity to participate. The questionnaire is distributed by hand to the target

population in the study neighborhoods. According to Mohd Talmizi et. al., (2022), the best technique for analysing context-specific behaviours in population studies is self-report assessments

This combination of close-ended and open-ended questions will generate a multitude of quantitative and qualitative information. The quantitative data is numerical and measurable, while the qualitative data is non-numerical and should be analyzed further. Each data set that is collected is then analyzed to find answers for the research questions and to test the research hypotheses. Besides the basic demographic information, the respondents are asked in the questionnaire survey to state the four variables pertaining to their health and wellbeing as listed in Table 2 above.

A total of data from 410 respondents are collected and then coded into SPSS 20 software package for analysis. Multiple linear regression analytical technique is employed to test the relationship that exists between the respondents' walking behaviour (number of times spent on walking per day or per week) and their health status. Multiple linear regression analysis is a statistical technique that measures the relationship between the dependent variable and a set of independent variables (predictors). The idea is to produce a model of equation that explains the relationship and thus enables prediction of the outcome (dependent variable) in cases where it is unknown (Gallimore et. al., 1996).

FINDINGS

The present results focused on health challenges and frequency of walk per week, self-rated health and frequency of walk and frequency of walk and physical wellbeing.

Health Challenges and Frequency of Walk Per Week

Overall, the data reveal that not all the walkers have a chronic disease. Out of a total of 410 respondents, only nine (9) suffer from diabetes, 61 from insomnia, 30 from high blood pressure, and 25 from depression. The results in Table 3 demonstrate that out of the nine (9) respondents that suffer from diabetes, only three (3) (33.30%) walk at all during the week, while four (4) (44.4%) would walk during the weekday, and 11.10% during the weekend and all week (weekday and weekend).

Furthermore, of the 61 respondents who suffer from insomnia (sleeplessness), more than half of them 36 (59.00%) are mindful to walk during weekdays, and 12 (19.6%) during the weekday and weekend, compared to 11 (18.00%) who are not interested to walk at all. In addition, 13 (43.30%) out of the 30 respondents suffering from high blood pressure walk during weekdays while 8 (26.70%) do not engage in walk entirely. Only 25 respondents suffer from depression as found in the answers in the questions asked in Table 1. Out of this

number, only 2 (8.00%) do not walk. On the other hand, 18 among them (72.00%) frequently walk during the weekdays compared to 5 (20.00%) during both the weekdays and weekends. Data for obesity portray that 24 (52.20%) out 46 would walk to lose weight only during the weekdays, and 9 (19.60%) during weekdays and weekend, and 10 (21.70%) do not walk to keep fit (not interested). Analysis of the results point to more walking is required for fresh air, mobility, good exercise for health, as well as for fun and and recreation.

Table 3: Health Challenge and Frequency of Walk Per Week

Frequency of walk Per Week	**Health Challenge**				**Total**
	None		**Diabetes**		
	f	%	f	%	
Weekday	166	97.60	4	2.40	170
Weekend	51	98.10	1	1.90	52
Weekday and weekend	65	98.50	1	1.50	66
Do not walk (Not interested)	119	97.50	3	2.50	122
Total	401	97.80	9	2.20	410
	None		Insomnia		
Weekday	134	78.80	36	21.20	170
Weekend	50	96.20	2	3.80	52
Weekday and weekend	54	81.80	12	18.20	66
Do not walk (Not interested)	111	91.00	11	9.00	122
Total	349	85.10	61	14.90	410
	None		High blood pressure		
Weekday	157	92.40	13	7.60	170
Weekend	48	92.30	4	7.70	52
Weekday and weekend	61	92.40	5	7.60	66
Do not walk (Not interested)	114	93.40	8	6.60	122
Total	380	92.70	30	7.30	410
	None		Obesity		
Weekday	146	85.90	24	14.10	170
Weekend	49	94.20	3	5.80	52
Weekday and weekend	57	86.40	9	13.60	66
Do not walk (Not interested)	112	91.80	10	8.20	122
Total	364	88.80	46	11.20	410
	None		Depression		
Weekday	152	89.40	18	10.60	170
Weekend	52	100.00	0	0.00	52
Weekday and weekend	61	92.40	5	7.60	66
Do not walk (Not interested)	120	98.40	2	1.60	122
Total	385	93.90	25	6.10	410

** Frequency = f*

As stated earlier, this study is not a clinical test; there could be other predisposing biases causing these chronic diseases although lack of physical

exercise in terms of walking may be among the major causes of some of the highlighted health challenges facing the urban population. In general, the results have shown that majority of the respondents who suffer from health issues such as diabetes, insomnia, high blood pressure, depression and obesity would walk quite frequently even on weekdays, presumably to mitigate their health issues.

Self-Rated Health and Frequency of Walk

The focus of this study is based solely on frequency of walk among all the respondents surveyed regardless of their medical history. The act and frequency of walking per week is self-reported or admitted by the respondents. That is not to say that they claimed, or the study results indicate that infrequent or lack of walking for exercise is the cause and/or cure for their existing health issues. The results obtained (see Table 4) indicate that more than 70.00% of respondents rated their state of health as good while about 0.50% rated it as poor health. A closer look at the number of times the respondents who actively walked (frequency of walk per week) shows that those who did so during the weekday have a better health condition 83.50% in contrast to those who walked exclusively on the weekend 71.20%. Recall that all respondents who initially said they would walk during weekday and weekday/weekend never rated their health status as being poor (0.00%). The Chi-square statistics in Table 4 demonstrate that there is a significant association between self-assessed state of health and high frequency of walk ($X=22.519$, $p<0.05$).

Table 4: Self-Rated Health and Frequency of Walk

Frequency of Walk Per Week	Self-Rated Health								Total	Chi-Square X	P
	Excellent		Good		Fair		Poor				
	f	%	f	%	f	%	f	%			
Weekday	17	10.00	142	83.50	11	6.50	0	0.00	170		
Weekend	7	13.50	37	71.20	7	13.50	1	1.90	52		
Weekday and weekend	18	27.30	38	57.60	10	15.20	0	0.00	66	22.519	.007
Do not walk (Not interested)	20	16.40	87	70.30	14	12.50	1	0.80	122		
Total	62	15.10	304	74.10	42	10.20	2	0.50	410		

** Frequency = f*

Frequency of Walk and Physical Wellbeing

The results in Table 5 also found that about 49.20% of the respondents who did not engage in walking at all claimed that they would wake up feeling refreshed only occasionally. Also, those who said that they woke up every time feeling fresher and more rested consist of 19.40% who walked on weekdays, 21.20% on

weekend and 18.20% all week. As evident in the Chi-square statistics, there is a positive correlation between frequency of self-reported wellbeing and frequency of walk among the respondents (X= 22.673, p<0.05). That means the persons who walked regularly on any day of the week felt healthier and more refreshed than those who did not engage in walk at all. This is a good sign that the very act and amount of walking any day of the week is beneficial for both mental and physical wellbeing.

Table 5: Frequency of Walk and Physical Wellbeing

Frequency of Walk Per Week	Wake up feeling fresh and rested										Total	Chi-Square X	P
	Every time		Almost every time		Occasionally		Almost never		Never				
	f	%	f	%	f	%	f	%	f	%			
Weekday	33	19.40	44	25.90	63	37.10	21	12.40	9	5.30	170		
Weekend	11	21.20	20	38.50	19	36.50	2	3.80	0	0.00	52		
Weekday and weekend	12	18.20	19	28.80	27	40.90	6	9.10	2	3.00	66	22.673	.031
Do not walk	16	13.10	40	32.80	60	49.20	6	4.90	0	0.00	122		
Total	72	17.60	123	30.00	169	41.20	35	8.50	11	2.70	410		

** Frequency = f*

Similarly, the correspondence between self-reported state of wellbeing and frequency of walk (see Table 6) revealed that the percentage of respondents who said that they felt more active and vigorous is higher for both that walked on a weekday 14.70% as well as during the weekend 19.20%, compared to 11.50% who did not walk. On the other hand, about 51.60% of persons who did not walk at all claimed that they felt active and vigorous only occasionally, while 38.20% during the weekdays and 42.3% on weekends felt robust and energetic. The chi-square test demonstrates a significant relationship between frequency of walk and always feeling well and active after an exercise by walking (X= 24.102, p<0.05).

Table 6: Frequency of Walk and Wellbeing Active

Frequency of Walk Per Week	Felt active and vigorous										Total /f	Chi-Square X	P
	Every time		Almost every time		Occasionally		Almost never		Never				
	f	%	f	%	f	%	f	%	f	%			
Weekday	25	14.7	51	30.0	65	38.2	21	12.4	8	4.7	170		
Weekend	10	19.2	18	34.6	22	42.3	2	3.8	0	0.0	52		
Weekday and weekend	8	12.1	27	40.9	23	34.8	6	9.1	2	3.0	66	24.102a	.020
Do not walk	14	11.5	41	33.6	63	51.6	4	3.3	0	0.0	122		
Total 100%	57	13.9	137	33.4	173	42.2	33	8.0	10	2.4	410		

** Frequency = f*

CONCLUSION

When and how often people walk would depend on day of week, availability of time, convenience, urgency, personal preference as well as knowledge of exercise to maintain fitness and health. Firstly, as can be seen from the results in this study that frequency of walk, no walk at all, and day of the week walking are not closely related. Nevertheless, walking anytime has numerous benefits for both physical and mental well-being. According to Mohd Talmizi et. al., (2022), walking as a kind of recreation for people encourages healthy living.

In general, the results have shown that majority of the respondents who suffer from health issues such as diabetes, insomnia, high blood pressure, depression and obesity would walk more frequently as those who have no existing health problems. This study also shows that the percentage of respondents who felt more active and vigorous is higher for those who engage in walk regularly during weekdays and weekends compared to those who do not walk at all, and who then felt active and vigorous only occasionally. This demonstrates a significant association between frequency of walk and physical wellbeing. In conclusion, this paper contributes to public awareness about walking for health and fitness. In addition, as this paper is confined to walking in a residential neighbourhood, the results will assist the local authorities and housing developers to provide proper walkways and modern infrastructure that will support and encourage people to walk comfortably and safely for transport, recreation and exercise every day of the week. Walking is a popular and accessible form of physical activity that offers numerous benefits for overall wellbeing. Whether people engage in brisk walks or leisurely strolls, incorporating walking as a daily routine can positively impact one's physical, mental, and emotional health.

REFERENCES

Achananuparp, P., Lim, E. P., & Abhishek, V. (2018). Does journaling encourage healthier choices? Analyzing healthy eating behaviors of food journalers. ACM *International Conference Proceeding Series*. 35–44. https://doi.org/10.1145/3194658.3194663.

Baker, G., Gray, S. R., Wright, A., Fitzsimons, C., Nimmo, M., Lowry, R., Mutrie, N., & Scottish Physical Activity Research Collaboration (SPARColl) (2008). The effect of a pedometer-based community walking intervention "Walking for Wellbeing in the West" on physical activity levels and health outcomes: a 12-week randomized controlled trial. *The international journal of behavioral nutrition and physical activity*, *5*, 44. https://doi.org/10.1186/1479-5868-5-44

Barnett, D. W., Barnett, A., Nathan, A., Van Cauwenberg, J., Cerin, E., & Council on Environment and Physical Activity (CEPA) – Older Adults working group (2017). Built environmental correlates of older adults' total physical activity and walking: a systematic review and meta-analysis. *The international journal of behavioral nutrition and physical activity*, *14*(1), 103. https://doi.org/10.1186/s12966-017-0558-z.

Bravata, D. M., Smith-Spangler, C., Sundaram, V., Gienger, A. L., Lin, N., Lewis, R., Stave, C. D., Olkin, I., & Sirard, J. R. (2007). Using pedometers to increase physical activity and improve health: a systematic review. *JAMA*, *298*(19), 2296–2304. https://doi.org/10.1001/jama.298.19.2296.

Brister, M. (2018). *Systematic Review on the Role of Exercise in Cardiovascular Disease.* Doctoral dissertation.

Cai Lian, T., Bonn, G., Si Han, Y., Chin Choo, Y., & Chee Piau, W. (2016). Physical Activity and Its Correlates among Adults in Malaysia: A Cross-Sectional Descriptive Study. *PloS one*, *11*(6), e0157730. https://doi.org/10.1371/journal.pone.0157730.

Cain, A. A., Edwards, M. E., & Still, J. D. (2018). An exploratory study of cyber hygiene behaviors and knowledge. *Journal of Information Security and Applications,* 42, 36-45. https://doi.org/10.1016/j.jisa.2018.08.002.

Chan, C. B., Ryan, D. A., & Tudor-Locke, C. (2004). Health benefits of a pedometer-based physical activity intervention in sedentary workers. *Preventive medicine*, *39*(6), 1215–1222. https://doi.org/10.1016/j.ypmed.2004.04.053.

Chan, Y. Y., Sooryanarayana, R., Mohamad Kasim, N., Lim, K. K., Cheong, S. M., Kee, C. C., Lim, K. H., Omar, M. A., Ahmad, N. A., & Mohd Hairi, N. N. (2019). Prevalence and correlates of physical inactivity among older adults in Malaysia: Findings from the National Health and Morbidity Survey (NHMS) 2015. *Archives of gerontology and geriatrics*, *81*, 74–83. https://doi.org/10.1016/j.archger.2018.11.012.

Cheah, Y. K., & Poh, B. K. (2014). The determinants of participation in physical activity in malaysia. *Osong public health and research perspectives*, *5*(1), 20–27. https://doi.org/10.1016/j.phrp.2013.12.002.

Choi, A., Blanco, L., & Hays, R. D. (2022). Race and Ethnicity Differences in Walking and Associations with Neighborhood Perceptions among Older Adults in California. *Journal of applied gerontology: the official journal of the Southern Gerontological Society*, *41*(12), 2499–2510. https://doi.org/10.1177/07334648221118902.

Othman, A. G., & Ali, K. H. (2020). Transportation and quality of life. *Planning Malaysia*, *18*(3), 35–50. https://doi.org/10.21837/PM.V18I13.774.

Smith, M., Amann, R., Cavadino, A., Raphael, D., Kearns, R., Mackett, R., Mackay, L., Carroll, P., Forsyth, E., Mavoa, S., Zhao, J., Ikeda, E., & Witten, K. (2019). Children's Transport Built Environments: A Mixed Methods Study of Associations between Perceived and Objective Measures and Relationships with Parent Licence for Independent Mobility in Auckland, New Zealand. *International journal of environmental research and public health*, *16*(8), 1361. https://doi.org/10.3390/ijerph16081361.

Kim, H. (2020). *Wearable sensor data-driven walkability assessment for elderly people*. Sustainability (Switzerland), *12*(10). https://doi.org/10.3390/SU12104041.

Cheong, S. M., Kandiah, M., Chinna, K., Chan, Y. M., & Saad, H. A. (2010). Prevalence of obesity and factors associated with it in a worksite setting in Malaysia. *Journal of community health*, *35*(6), 698–705. https://doi.org/10.1007/s10900-010-9274-1.

Chudyk, A., McKay, H.A., Winters, M. *et al.* Neighborhood walkability, physical

activity, and walking for transportation: A cross-sectional study of older adults living on low income. *BMC Geriatr* **17**, 82 (2017). https://doi.org/10.1186/s12877-017-0469-5.

Department Statistics Malaysia (DOSM) (2021). Retrieved August 25, 2022. https://www.dosm.gov.my/portal-main/landingv2.

Draf Rancangan Tempatan (MBSA) (2020). Retrieved October 21, 2019.

Gallagher, M. (2010). Are schools panoptic? *Surveillance & Society* 7(3/4), 262-272. Retrieved October 22, 2022. http://www.surveillance-and-society.org.

Gallimore, P., Fletcher, M., & Carter, M.J. (1996). Modelling the influence of location on value. *Journal of Property Valuation and Investment, 14*, 6-19.

Grasser, G., Van Dyck, D., Titze, S., & Stronegger, W. (2013). Objectively measured walkability and active transport and weight-related outcomes in adults: a systematic review. *International journal of public health*, *58*(4), 615–625. https://doi.org/10.1007/s00038-012-0435-0.

Herbolsheimer, F., Mahmood, A., Michael, Y. L., & Chaudhury, H. (2020). Everyday Walking Among Older Adults and the Neighborhood Built Environment: A Comparison Between Two Cities in North America. *Frontiers in public health*, *8*, 564533. https://doi.org/10.3389/fpubh.2020.564533.

Hosseinzadeh, A. (2021). What affects how far individuals walk? *SN Applied Sciences*, 3(3), 1-10.

Kyu, H. H., Bachman, V. F., Alexander, L. T., Mumford, J. E., Afshin, A., Estep, K., Veerman, J. L., Delwiche, K., Iannarone, M. L., Moyer, M. L., Cercy, K., Vos, T., Murray, C. J., & Forouzanfar, M. H. (2016). Physical activity and risk of breast cancer, colon cancer, diabetes, ischemic heart disease, and ischemic stroke events: systematic review and dose-response meta-analysis for the Global Burden of Disease Study 2013. *BMJ (Clinical research ed.)*, *354*, i3857. https://doi.org/10.1136/bmj.i3857.

Le Masurier, G. C., Sidman, C. L., & Corbin, C. B. (2003). Accumulating 10,000 steps: does this meet current physical activity guidelines?. *Research quarterly for exercise and sport*, *74*(4), 389–394. https://doi.org/10.1080/02701367.2003.10609109.

Mansi, S., Milosavljevic, S., Baxter, G. D., Tumilty, S., & Hendrick, P. (2014). A systematic review of studies using pedometers as an intervention for musculoskeletal diseases. *BMC musculoskeletal disorders*, *15*, 231. https://doi.org/10.1186/1471-2474-15-231.

Mayne, D. J., Morgan, G. G., Jalaludin, B. B., & Bauman, A. E. (2019). Area-Level Walkability and the Geographic Distribution of High Body Mass in Sydney, Australia: A Spatial Analysis Using the 45 and Up Study. *International journal of environmental research and public health*, *16*(4), 664. https://doi.org/10.3390/ijerph16040664.

McCormack, G., Giles-Corti, B., & Milligan, R. (2006). Demographic and individual correlates of achieving 10,000 steps/day: use of pedometers in a population-based study. *Health promotion journal of Australia: official journal of Australian Association of Health Promotion Professionals*, *17*(1), 43–47. https://doi.org/10.1071/he06043.

McCormack, T., O'Connor, E., Cherry, J., Beck, S. R., & Feeney, A. (2019). Experiencing regret about a choice helps children learn to delay gratification. *Journal of experimental child psychology*, *179*, 162–175. https://doi.org/10.1016/j.jecp.2018.11.005.

Milanović, Z., Pantelić, S., Trajković, N., Sporiš, G., Kostić, R., & James, N. (2013). Age-related decrease in physical activity and functional fitness among elderly men and women. *Clinical interventions in aging*, *8*, 549–556. https://doi.org/10.2147/CIA.S44112.

Mooney, S. J., Joshi, S., Cerdá, M., Kennedy, G. J., Beard, J. R., & Rundle, A. G. (2017). Contextual Correlates of Physical Activity among Older Adults: A Neighborhood Environment-Wide Association Study (NE-WAS). *Cancer epidemiology, biomarkers & prevention: a publication of the American Association for Cancer Research, cosponsored by the American Society of Preventive Oncology*, *26*(4), 495–504. https://doi.org/10.1158/1055-9965.EPI-16-0827.

Moore, S. A., Faulkner, G., Rhodes, R. E., Brussoni, M., Chulak-Bozzer, T., Ferguson, L. J., Mitra, R., O'Reilly, N., Spence, J. C., Vanderloo, L. M., & Tremblay, M. S. (2020). Impact of the COVID-19 virus outbreak on movement and play behaviours of Canadian children and youth: a national survey. *The international journal of behavioral nutrition and physical activity*, *17*(1), 85. https://doi.org/10.1186/s12966-020-00987-8.

National Institutes of Health Ministry of Health Malaysia (2017). *In: National Health and Morbidity Survey* (NHMS).

Mohd Talmizi, N., Haji Ali, N. E., & Mokhtar, S. (2022). The Effect of Socio-Demographic Attributes on Walking Behaviour of Residents in Shah Alam City, Malaysia. *Planning Malaysia, 20(21).* https://doi.org/10.21837/pm.v20i21.1110.

Nordin, N., & Nakamura, H. (2020). *The Influence of the Objective and Subjective Physical Neighbourhood Environment on the Physical Activity of Older Adults: A Case Study in the Malaysian Neighbourhoods of Johor Bahru.* https://doi.org/10.3390/su12051760.

Oliver, M., Parker, K., Witten, K., Mavoa, S., Badland, H. M., Donovan, P., Chaudhury, M., & Kearn, R. (2016). Children's Out-of-School Independently Mobile Trips, Active Travel, and Physical Activity: A Cross-Sectional Examination from the Kids in the City Study. *Journal of physical activity & health*, *13*(3), 318–324. https://doi.org/10.1123/jpah.2015-0043.

Rebar, A. L., Stanton, R., Geard, D., Short, C., Duncan, M. J., & Vandelanotte, C. (2015). A meta-meta-analysis of the effect of physical activity on depression and anxiety in non-clinical adult populations. *Health psychology review*, *9*(3), 366–378. https://doi.org/10.1080/17437199.2015.1022901.

Richardson, C. R., Newton, T. L., Abraham, J. J., Sen, A., Jimbo, M., & Swartz, A. M. (2008). A meta-analysis of pedometer-based walking interventions and weight loss. *Annals of family medicine*, *6*(1), 69–77. https://doi.org/10.1370/afm.761.

Schneider, P. L., Bassett, D. R., Jr, Thompson, D. L., Pronk, N. P., & Bielak, K. M. (2006). Effects of a 10,000 steps per day goal in overweight adults. *American journal of health promotion: AJHP*, *21*(2), 85–89. https://doi.org/10.4278/0890-1171-21.2.85.

Swartz, A. M., Strath, S. J., Bassett, D. R., Moore, J. B., Redwine, B. A., Groer, M., & Thompson, D. L. (2003). Increasing daily walking improves glucose tolerance in overweight women. *Preventive medicine,* 37(4), 356–362. https://doi.org/10.1016/s0091-7435(03)00144-0.

Tully, M. A., & Cupples, M. E. (2011). UNISTEP (university students exercise and physical activity) study: a pilot study of the effects of accumulating 10,000 steps on health and fitness among university students. *Journal of physical activity & health*, *8*(5), 663–667. https://doi.org/10.1123/jpah.8.5.663.

Vancampfort, D., Van Damme, T., Firth, J., Smith, L., Stubbs, B., Rosenbaum, S., Hallgren, M., Hagemann, N., & Koyanagi, A. (2019). Correlates of physical activity among 142,118 adolescents aged 12-15 years from 48 low- and middle-income countries. *Preventive medicine*, *127*, 105819. https://doi.org/10.1016/j.ypmed.2019.105819.

World Health Organization (WHO) (2019). https://www.who.int/emergencies/diseases/novel-coronavirus-2019/advice-for-public/when-and-how-to-us e-masks.

Received: 30th June 2024. Accepted: 10th September 2024

PLANNING MALAYSIA:
Journal of the Malaysian Institute of Planners
VOLUME 22 ISSUE 5 (2024), Page 433 – 447

THE ELEMENTS OF THE COMPACT CITY ON SUSTAINABLE URBAN DEVELOPMENT IN PETALING JAYA, SELANGOR, MALAYSIA

Syima Zayanah Nor'Azmi[1], Syazwani Sahrir[2]

[1,2]*Department of Environment,*
Faculty of Forestry and Environment,
UNIVERSITI PUTRA MALAYSIA

Abstract

Urbanization is an ongoing global phenomenon that demands innovative approaches to balance economic growth with environmental sustainability. This study investigates the elements contributing to the development of a compact city and their impact on sustainable urban development in the context of Petaling Jaya, Selangor. The study aims to identify the elements of compact cities that contribute to sustainable urban development in Petaling Jaya and explore the elements that contribute to sustainable urban development in Petaling Jaya. The research employs a qualitative approach, combining interviews with experts and document analysis of compact cities. Through thematic analysis, the study identifies the core elements of compact cities in Petaling Jaya, exploring their influence on sustainability. Preliminary findings reveal that the compact city is shaped by population density, mixed land use, and transportation infrastructure. Stakeholder perspectives shed light on these compact city elements' perceived benefits and challenges. Additionally, the document analysis examines the elements of the compact city that may influence sustainable urban development. This study contributes to the existing body of knowledge by providing a nuanced understanding of the elements contributing to the compact city characteristics and their role in fostering sustainable urban development.

Keywords: Compact City, Elements of Compact City, Sustainable Urban Development, Urban Sustainability

[2] Senior Lecturer at Universiti Putra Malaysia. Email: syazwani_sahrir@upm.edu.my

INTRODUCTION

Over the past 30 years, compact city design and development have been the preferred solution for addressing sustainable development challenges. Both global and local policies strongly support this approach due to its benefits in advancing the economic, environmental, and social sustainability goals (Bibri et al., 2020). The compact city is considered one of the most recommended sustainable urbanism paradigms for tackling these challenges effectively (Bibri, 2020). However, urbanization processes worldwide consume significant portions of limited but essential natural land resources (Liu, 2018; Yang et al., 2018), leading to detrimental effects such as ecosystem and land degradation (Liu et al., 2014, 2018a; Zhang et al., 2020), loss of fertile agricultural land, and food security issues (Gao et al., 2019; Salvati, 2014).

According to Bibri (2020), the compact city is the foremost paradigm of sustainable urbanism for addressing the multifaceted challenges of sustainable development. Despite the numerous studies conducted on compact cities, there is a lack of research in the context of Malaysia. Bibri et al. (2020) discuss how two Swedish cities implement and justify the compact city model in urban planning and development. Additionally, Mouratidis (2017) focuses on a compact city survey within the European context, specifically in the metropolitan area of Oslo. However, there are contradictions in studies regarding the advantages of compact cities.

The objective of this study is twofold: (i) to identify the elements of compact cities that contribute to sustainable urban development in Petaling Jaya and (ii) to explore how these elements contribute to sustainable urban development in Petaling Jaya. This study's outcome highlights the compact city's elements contributing to sustainable urban development.

LITERATURE REVIEW

Compact City

Bibri et al. (2020) stated that the compact city is one of the most influential models of sustainable urbanism. Over the past 30 years or more, compact city design and development have been the go-to solution to problems related to sustainable development. Due to its benefits in advancing sustainability's economic, environmental, and social aims, it is vigorously supported by global and local policies (Azmi et al., 2021). The three sustainability pillars are examined in relation to the compact city model's application and justification in urban planning and development and any advancements made in this area (Bibri, S. E., Krogstie, J., & Kärrholm, M., 2020).

Elements of Compact City

According to Bibri et al. (2020), the elements of a compact city, including the reduction of travel distances and commute times, a decrease in reliance on private

vehicles, a decrease in per capita energy consumption, a reduction in the consumption of building materials and infrastructure, the mitigation of pollution, the preservation of diversity in workplaces, service facilities, as well as social connections and the preservation of green and natural areas. These elements promote sustainability through several means. This is supported by the principles of compact city development, which emphasise intensified development and activities, set limits on urban expansion, encourage mixed land use and social integration, and prioritise the importance of public transportation and high-quality urban design (Fahmi et al., 2023). These factors collectively contribute to promoting sustainability within the compact city framework. (Bibri, S. E., Krogstie, J., & Kärrholm, M. 2020).

Sustainable Urban Development

According to Bibri, S. E., Krogstie, J., & Kärrholm, M. (2020), the compact city is the primary planning strategy employed by the two cities, and it tries to combine social, economic, and environmental aspects to promote more sustainable urban growth. Bibri et al. (2020) stated that it is grounded in the examination of the correlation between urban planning and sustainable development within the context of rapid urbanization, and sustainable urbanism focuses on the study of cities and the methodologies employed to design and develop them, with an emphasis on enhancing their long-term resilience and viability. This is achieved by reducing material consumption, decreasing energy usage, mitigating pollution, minimising waste, and promoting social equity and well-being. The compact city concept is at the core of sustainable urbanism, serving as its central paradigm. Won and Jung (2023) stated that fostering urban development conducive to sustainable communities is paramount in contemporary urban planning.

Consequently, there is a growing discourse on the concept of "compact urban form" among environmentalists, urban planners, policymakers, and private developers. This discourse seeks to counteract the adverse impacts of rapid urbanization, particularly the escalation of Land Surface Temperature (LST). Compact development, at its core, signifies a commitment to high-density development, the integration of land uses, enhanced accessibility, and the repurposing of existing urban areas. Simultaneously, it emphasises the preservation of natural landscapes on the urban periphery (De Roo, 2000). Generally, the compact city model is perceived as more environmentally sustainable than sprawled cities as it strives to minimise energy consumption and land utilisation.

Urban Sustainability

Bibri et al. (2020) claim that the key design principles of compact city planning and development are compactness, density, diversity, mixed land use, sustainable

transportation, and green space, with the latter contextually linked to the idea of green structure, an institutional framework under which the two cities function. The compact city model also clearly demonstrates the synergy between the underlying methods in terms of how they work together to produce combined results that are greater than the sum of their impacts concerning the advantages of sustainability as it relates to its tripartite composition. Furthermore, this study shows that the compact city concept, as implemented in the two cities, is justified by its capacity to advance sustainability's economic, environmental, and social objectives.

Wang (2022) stated in the study stated that sustainable urban forms have been advocated by scholars such as Jenks (2009) as a means to foster low-carbon and green societies. In pursuit of this goal, urban planning and design often aim to increase the density of built environments (Yang, 2013). This entails promoting compact built forms, higher population densities, diverse housing options, and well-connected spatial arrangements (Davoudi & Sturzaker, 2017; Kaza, 2010; Makido et al., 2012). Compact development is considered an urban spatial policy that is believed to contribute to economic prosperity and prevent environmental degradation (Jenks, 2019; OECD, 2012). Western scholars have encouraged cities to embrace compact development principles and translate them into practical implementation (Burton, 2000; Ewing, 1997).

Despite the widespread endorsement of compact development, there is a need for a new study that evaluates its suitability while considering the quality of life (QOL). Quality of life has been recognised as a crucial aspect of the contemporary sustainable urbanism movement (De Vries, 2012; Farr, 2008). Therefore, this study aims to review the compatibility of compact development with a specific focus on enhancing the overall quality of life.

RESEARCH METHODOLOGY

Through qualitative methods such as document analysis and semi-structured interviews, the goal is to gather and analyse relevant data using thematic and content analysis. By employing purposive sampling, the study ensures data relevancy. The methodology aims to interpret patterns and dynamics related to compact city elements, emphasizing meticulous interview preparation and execution for data quality. Semi-structured interviews consist of several key questions to define the areas of exploration; they also allow for divergence to pursue ideas or responses in more detail, providing flexibility and depth.

The data analysis involves using thematic and content analysis methods to interpret the collected data. Thematic analysis helps identify and interpret the underlying meanings within the data, while content analysis focuses on examining the explicit content of the interview data. By systematically coding and categorizing the information, these methods provide a comprehensive

understanding of the compact city elements and their implications for sustainable urban development in Petaling Jaya.

Overall, the aim is to provide a systematic and thorough approach to gaining a deep understanding of the compact city elements and their contributions to sustainable urban development. This approach ensures that the data collected is relevant and rich in detail, offering valuable insights into the dynamics of compact city planning and its sustainability impacts.

ANALYSIS AND DISCUSSION

Table 1 presents a comprehensive overview of the findings regarding compact city elements obtained from various sources, including journals, articles, official reports, and semi-structured interviews. The table outlines the elements identified through these sources and highlights any observed similarities. The table provides insights into the consistency and convergence of information regarding compact city elements by comparing the findings across different sources.

Table 1: Elements of Compact City

Findings	**Journal and Article**	**Official Report**	**Interview Method**
Public Transport	✓	✓	✓
Accessibility to the city centre	✓	✓	✓
Mixed land use	✓	✓	✓
Reduce the amount of traveling	✓	✓	✓
Shorten commute time	✓		✓
Decrease car dependency	✓	✓	✓
Lower per capita rates of energy use	✓		✓
Limit the consumption of building and infrastructure materials	✓		
Mitigate pollution	✓		✓
Maintain the diversity of choice among workplaces, service facilities and social contacts	✓		
Limit the loss of garden and natural area	✓		
Low green space impacts	✓		
Reduce energy consumption and carbon emissions	✓	✓	✓
Provide housing and accessibility	✓		✓
Reduce low efficiency consumption of land resources	✓		
Higher neighbourhood density	✓		
Reliance on public transport	✓	✓	✓

Findings	Journal and Article	Official Report	Interview Method
Smaller dwellings	✓		
Less green space	✓		
High density	✓	✓	✓
High public transport accessibility	✓	✓	✓
Diversity	✓		
Sustainable transportation	✓	✓	
Comprehensive service facility	✓		
Short distances	✓		✓
Reduce pollution	✓	✓	✓
Encourage cycling	✓		✓
Social interactions	✓		✓
High population density	✓		✓
Proximity	✓		✓
Efficient use of energy	✓		✓
Green space	✓		✓
Public amenities	✓	✓	✓
Inclusivity			✓
Reduce urban sprawl			✓
Encouraging walking	✓		✓
Well-organised urban infrastructure	✓		
Centralised activities	✓		✓
Dense and proximate	✓		
Access to public transit and street connectivity	✓		
Reduce congestion	✓	✓	✓

.

Experts across the board underscore the pivotal role of efficient transportation and mixed land use in driving sustainable urban development within compact cities. Expert 1 highlights their significance in emission reduction, land optimization, investment attraction, and community cohesion while noting the importance of infrastructure resilience and active transportation for public health. Expert 2 echoes this sentiment, emphasizing their contribution to carbon reduction, accessibility enhancement, and economic diversity, exemplified by the PJ City Food Valley project. However, challenges persist, including obtaining community consent amidst diverse viewpoints and addressing communication issues and economic disparities. Similarly, Experts 3 and 4 stress these elements' environmental, economic, and social benefits yet acknowledge hurdles in gaining community approval and trust. Expert 5

underscores the importance of proximity, space optimization, and mixed land use in curbing urban sprawl and promoting resource efficiency, albeit with challenges in shifting traditional land use practices. Lastly, Expert 6 singles out public transportation as paramount, advocating for transit-oriented development and active commuting options despite coordination challenges between rail line alignment and land use planning agencies. These elements promise sustainable urban development, overcoming community resistance, communication barriers, and coordination issues remains imperative for their effective implementation.

Table 2: Elements of Compact City on Sustainable Urban Development

Findings	Document Analysis Method	Interview Expert 1	Interview Expert 2	Interview Expert 3	Interview Expert 4	Interview Expert 5	Interview Expert 6
Public Transport	✓	✓	✓	✓	✓	✓	✓
Accessibility to the city centre	✓					✓	✓
Mixed land use	✓	✓	✓	✓	✓	✓	✓
Reduce the amount of traveling	✓	✓					✓
Shorten commute time	✓						
Decrease car dependency	✓	✓	✓	✓	✓	✓	✓
Lower per capita rates of energy use	✓						
Limit the consumption of building and infrastructure materials	✓						
Mitigate pollution	✓	✓	✓	✓	✓	✓	✓
Maintain the diversity of choice among workplaces, service facilities and social contacts	✓						✓
Low green space impacts	✓						
Reduce energy consumption	✓	✓					✓

Findings	Document Analysis Method	Interview Expert 1	Interview Expert 2	Interview Expert 3	Interview Expert 4	Interview Expert 5	Interview Expert 6
and carbon emissions							
Provide housing and accessibility	✓						✓
Reduce low efficiency consumption of land resources	✓						
Higher neighbourhood density	✓	✓	✓			✓	✓
Reliance on public transport	✓	✓	✓	✓	✓	✓	✓
Smaller dwellings	✓						
Less green space	✓						
High density	✓	✓	✓	✓	✓		✓
High public transport accessibility	✓	✓	✓	✓	✓	✓	✓
Diversity	✓						
Sustainable transportation	✓						
Comprehensive service facility	✓						
Short distances	✓	✓	✓			✓	✓
Reduce pollution	✓	✓	✓	✓	✓	✓	✓
Encourage cycling	✓	✓	✓				✓
Social interactions	✓					✓	✓
High population density	✓						
Proximity	✓						
Efficient use of energy	✓					✓	✓
Green space	✓						

Findings	Document Analysis Method	Interview Expert 1	Interview Expert 2	Interview Expert 3	Interview Expert 4	Interview Expert 5	Interview Expert 6
Public amenities	✓	✓	✓	✓	✓		
Inclusivity				✓	✓		✓
Reduce urban sprawl							✓
Encouraging walking	✓	✓	✓	✓	✓		✓
Well-organised urban infrastructure	✓						✓
Centralised activities	✓						✓
Dense and proximate	✓					✓	
Access to public transit and street connectivity	✓	✓	✓			✓	✓
Reduce congestion	✓	✓	✓	✓	✓	✓	✓

.

The elements listed in Table 2 are essential components for achieving sustainable development in compact cities. These include public transportation, mixed land use, accessibility to the city centre, low car dependency, high density, green space, and diversity. Each element contributes to environmental sustainability, economic vibrancy, and social connectivity within urban environments. Overall, they form the backbone of compact, liveable, and sustainable cities, supporting the well-being of residents and ensuring the efficient use of resources.

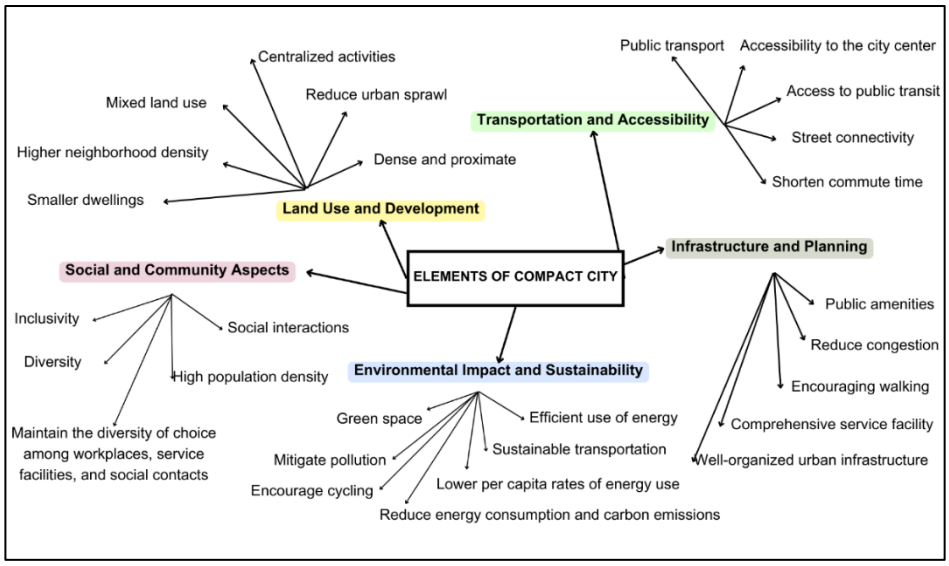


Figure 1: Elements of Compact City

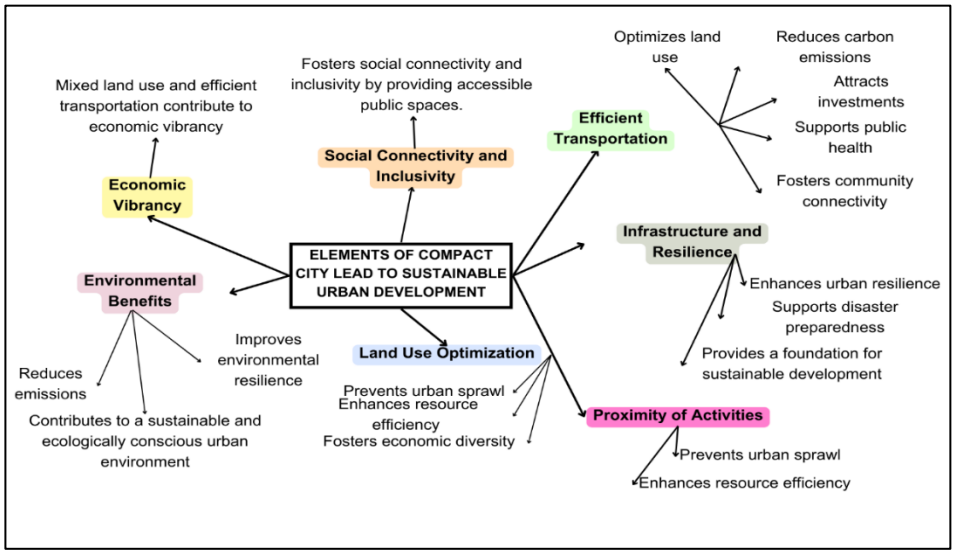


Figure 2: Elements of Compact City towards Sustainable Urban Development

In exploring the understanding of compact cities, the experts collectively outlined vital attributes essential for sustainable urban development. High population density, efficient transportation, mixed land use, and intentional spatial design emerged as defining features. The strategies proposed by the experts included minimizing land consumption, promoting resource efficiency,

and optimizing transportation for cleaner, healthier, and more sustainable urban environments.

Transitioning to the Petaling Jaya context, Experts 1 and 2 aligned compact city principles with the Petaling Jaya Smart, Sustainable & Resilient 2030 initiative. Both recognised the seamless integration of compact city attributes, such as high-density living, mixed land use, and efficient transportation, with the initiative's overarching goals. Despite alignment, challenges related to community disagreements were acknowledged by Experts 3 and 4, emphasizing the need for an intricate weaving of compact city principles into PJSSR 2030 to achieve a sustainable, resilient, and forward-thinking urban future.

Examining the key elements of a compact city, all experts emphasised the pivotal role of efficient transportation and mixed land use. Challenges were acknowledged, including diverse community perspectives, communication hurdles, economic disparities, environmental concerns, and mistrust. Despite these challenges, the experts collectively stressed the importance of integrating these elements for environmental benefits, economic vibrancy, and social connectivity.

Regarding the future outlook and recommendations, Experts 1, 2, and 3 highlighted efficient transportation, particularly public transportation, as crucial for sustainable urban development. They proposed solutions such as one-way systems, Bus Rapid Transit (BRT), and the adoption of electric vehicles. Meanwhile, Expert 4 emphasised the integration of public transport, mixed land use, and public facilities, recommending electric vehicles as a transformative technology. Expert 5 stressed the importance of proximity and mixed land use, emphasizing the need for low-carbon and climate-resilient cities. Expert 6 identified public transportation as the key, proposing transit-oriented development (TOD) and the 20-minute city concept. These forward-thinking recommendations align with a collective vision for a cleaner, more sustainable urban environment.

CONCLUSION

The comprehensive exploration of the elements of a compact city and their implications for sustainable urban development in Petaling Jaya has yielded valuable insights that collectively shape the overall conclusion of this study. The investigation, spanning document analysis, expert interviews, and meticulously examining compact city elements, has contributed to a nuanced understanding of how urban planning principles can foster sustainability. As we synthesise the key findings, several overarching conclusions emerge.

The identification and analysis of compact city elements, including mixed land use, public transportation, proximity, and community inclusivity, reveal their interconnectedness and collective impact on creating a sustainable

urban environment. When strategically integrated, these elements reduce environmental impact, enhance resource efficiency, and improve social connectivity.

The role of expert insights and perspectives in shaping our understanding of compact city elements cannot be understated. Expert opinions have provided valuable guidance, emphasizing the importance of longitudinal studies, comparative analyses, community engagement, technological integration, and economic impact assessments for a holistic examination of sustainable urban development.

Furthermore, the study underscores the significance of future research directions in advancing the field of urban planning. Recommendations for longitudinal studies will contribute to tracking the lasting impact of compact city elements, while comparative analyses with other cities will offer insights into contextual variations and successful strategies. Exploring community engagement, technological integration, and economic impact studies are vital for fostering inclusivity, staying abreast of technological advancements, and achieving a balanced approach to sustainability. In conclusion, this study comprehensively examines compact city elements and their implications for sustainable urban development in Petaling Jaya. By blending expert insights with rigorous research methodologies, the study provides a foundation for future investigations.

REFERENCES

Azmi, N. A., Osman, M. M., Rabe, N. S., Ramlan, N. H., Azizan, A., & Amiruddin, S. (2021). A Comparative Analysis of Transit Oriented Development Guidelines Between Malaysia and Other Countries. *Planning Malaysia, 19*(15). https://doi.org/10.21837/pm.v19i15.935

Bamrungkhul, S., & Tanaka, T. (2023). Paradigm shift in sustainable urban planning for Thailand's provincial cities from the perspective of urban development stages during the 2010s. *World Development Sustainability*, 3, 100085. https://doi.org/10.1016/j.wds.2023.100085

Bibri, S. E., Krogstie, J., & Kärrholm, M. (2020). Compact city planning and development: Emerging practices and strategies for achieving the goals of sustainability. *Developments in the Built Environment*, 4, 100021. https://doi.org/10.1016/j.dibe.2020.100021

Bibri, S. E. (2020). Compact urbanism and the synergic potential of its integration with data-driven smart urbanism: An extensive interdisciplinary literature review. *Land Use Policy*, 97, 104703. https://doi.org/10.1016/j.landusepol.2020.104703

Bibri, S. E., Krogstie, J., & Kärrholm, M. (2020). Compact city planning and development: Emerging practices and strategies for achieving the goals of sustainability. *Developments in the Built Environment*, 4, 100021. https://doi.org/10.1016/j.dibe.2020.100021

Bowen, G. A. (2009). Document Analysis as a Qualitative Research Method. *Qualitative Research Journal, 9*(2), 27–40. https://doi.org/10.3316/qrj0902027

Briassoulis, H. (2019, February 1). Combating Land Degradation and Desertification: The Land-Use Planning Quandary. *Land, 8*(2), 27. https://doi.org/10.3390/land8020027

Burton, E. (2000). The Compact City: just or just Compact? A preliminary analysis. *Urban Studies, 37*(11), 1969–2006. https://doi.org/10.1080/00420980050162184

Dali, M., Sharifi, A., & Adnan, Y. M. (2022). Envisioning sustainable and resilient Petaling Jaya through Low-Carbon and Smart City Framework. In Springer eBooks (pp. 213–238). https://doi.org/10.1007/978-3-030-95037-8_10

Denzin, N. K. (1970). The research act: A theoretical introduction to sociological methods. New

Fahmi, A. H., Sahrir, S., & Rahim, N. N. R. N. A. (2023). An Assessment of Traffic Congestion In Taman Sri Serdang, Selangor, Malaysia. *Planning Malaysia*, 21. https://doi.org/10.21837/pm.v21i29.1366

York: Aldine. Farquhar, J., Michels, N., & Robson, J. (2020). Triangulation in industrial qualitative case study research: Widening the scope. *Industrial Marketing Management*, 87, 160–170. https://doi.org/10.1016/j.indmarman.2020.02.001

Haarstad, H., Kjærås, K., Røe, P. G., & Tveiten, K. (2023). Grounding the compact city. *Dialogues in Human Geography, 13*(1), 50–53. https://doi.org/10.1177/20438206231151743

Iizuka, S., Xuan, Y., Takatori, C., Nakaura, H., & Hashizume, A. (2020). Environmental impact assessment of introducing compact city models by downscaling simulations. *Sustainable Cities and Society*, 63, 102424. https://doi.org/10.1016/j.scs.2020.102424

Li, X., Lu, Z., Gao, S., Wang, Y., & Zhang, M. (2022). Will city cluster cope with water dilemma? *Journal of Cleaner Production*, 371, 133548. https://doi.org/10.1016/j.jclepro.2022.133548

Long, H., Zhang, Y., Ma, L., & Tu, S. (2021). Land Use Transitions: Progress, Challenges and Prospects. *Land, 10*(9), 903. https://doi.org/10.3390/land10090903

Miyauchi, T., & Setoguchi, T. (2023). Does low urban density increase municipal expenditure? Population density as a performance target for compact city planning in Japan. *Journal of Urban Management, 12*(4), 375–384. https://doi.org/10.1016/j.jum.2023.08.003

Moon, M. D. (2019). Triangulation: A Method to Increase Validity, Reliability, and Legitimation in Clinical Research. *Journal of Emergency Nursing, 45*(1), 103–105. https://doi.org/10.1016/j.jen.2018.11.004

Mouratidis, K. (2019). Compact city, urban sprawl, and subjective well-being. Cities, 92, 261–272. https://doi.org/10.1016/j.cities.2019.04.013

Mouratidis, K. (2022). COVID-19 and the compact city: Implications for well-being and sustainable urban planning. *Science of the Total Environment*, 811, 152332. https://doi.org/10.1016/j.scitotenv.2021.152332

Mouratidis, K., De Vos, J., Yiannakou, A., & Politis, I. (2023). Sustainable transport modes, travel satisfaction, and emotions: Evidence from car-dependent compact

cities. *Travel Behaviour and Society*, 33, 100613. https://doi.org/10.1016/j.tbs.2023.100613

Newman, P., & Kenworthy, J. R. (1989). Cities and automobile dependence: A Sourcebook. Gower Publishing Company, Limited.

Patton, M. Q. (1990). Qualitative evaluation and research methods (2nd ed.). Newbury Park, CA: Sage.

Rogatka, K., & Ribeiro, R. R. R. (2015). A compact city and its social perception: A case study. *Urbani Izziv, 26*(1), 121–131. https://doi.org/10.5379/urbani-izziv-en-2015-26-01-005

Renz, S., Carrington, J. M., & Badger, T. A. (2018). Two strategies for qualitative content analysis: an intramethod approach to triangulation. *Qualitative Health Research, 28*(5), 824–831. https://doi.org/10.1177/1049732317753586

Shi, L., Yang, S., & Gao, L. (2016). Effects of a Compact City on Urban Resources and Environment. *Journal of Urban Planning and Development, 142*(4). https://doi.org/10.1061/(asce)up.1943-5444.0000324

Some Strategies for Developing Interview Guides. (n.d.). Harvard University.

Stevenson, M., Thompson, J., De, T. H., Ewing, R., Mohan, D., McClure, R. J., Roberts, I., Tiwari, G., Giles-Corti, B., Sun, X., Wallace, M., & Woodcock, J. (2016). Land use, transport, and population health: estimating the health benefits of compact cities. *The Lancet, 388*(10062), 2925–2935. https://doi.org/10.1016/s0140-6736(16)30067-8

Sulaiman, F. B. (2023). Compact City: What is the extent of our exploration for its meanings? A systematic review. *Sustainability, 15*(13), 10302. https://doi.org/10.3390/su151310302

Tan, P. Y., & Rinaldi, B. M. (2019). Landscapes for compact cities. *Journal of Landscape Architecture, 14*(1), 4–7. https://doi.org/10.1080/18626033.2019.1623540

Unit Komunikasi Korporat, Majlis Bandaraya Petaling Jaya. (2023). PANDUAN PELAKSANAAN EKSA MAJLIS BANDARAYA PETALING JAYA (MBPJ). https://www.mbpj.gov.my/sites/default/files/panduan_pelaksanaan_eksa_pj_plus_-_web_new.pdf.

Wang, H. C. (2022). Prioritizing compactness for a better quality of life: The case of U.S. cities. Cities, 123, 103566. https://doi.org/10.1016/j.cities.2022.103566

Wang, Q., Liu, X., Zhang, F., Gu, Y., & Zhou, X. (2023). Does compact city shape matter to residents' happiness? *Cities*, 141, 104524. https://doi.org/10.1016/j.cities.2023.104524

Won, J., & Jung, M. C. (2023). Does compact development mitigate urban thermal environments? Influences of smart growth principles on land surface temperatures in Los Angeles and Portland. *Sustainable Cities and Society*, 90, 104385. https://doi.org/10.1016/j.scs.2022.104385

Yao, Y., Pan, H., Cui, X., & Wang, Z. (2022). Do compact cities have higher efficiencies of agglomeration economies? A dynamic panel model with compactness indicators. *Land Use Policy*, 115, 106005. https://doi.org/10.1016/j.landusepol.2022.106005

Yu, J., Li, Z., Lee, Y., Wen, C., & Yang, A. (2023). Effect of wind-based climate-responsive design on city breathability of a compact high-rise city. *Journal of Building Engineering*, 78, 107773. https://doi.org/10.1016/j.jobe.2023.107773

Zambrano-Prado, P., Pons-Gumí, D., Toboso-Chavero, S., Parada, F., Josa, A., Gabarrell, X., & Rieradevall, J. (2021). Perceptions on barriers and opportunities for integrating urban agri-green roofs: A European Mediterranean compact city case. *Cities*, 114, 103196. https://doi.org/10.1016/j.cities.2021.103196

Received: 19th March 2024. Accepted: 3rd September 2024

PLANNING MALAYSIA:
Journal of the Malaysian Institute of Planners
VOLUME 22 ISSUE 5 (2024), Page 448 – 466

ANALYSIS OF THE CROWD MANAGEMENT AND PEDESTRIAN MOVEMENT DURING HAJJ PILGRIMAGE ON MAKKAH

Sadeq Kadi[1], Alias Abdullah[2], Syahriah Bachok[3], Ziad Baydoun[4], Abdelaziz Berghout[5]

[1] *Department of Urban and Engineering Research, The Custodian of The Two Holy Mosques Institute for Hajj and Umrah Research,*
UMM AL-QURA UNIVERSITY
[1,2,3]*Kulliyyah of Architecture and Environmental Design,*
UNIVERSITI ISLAM ANTARABANGSA MALAYSIA
[4] *Department of Architecture, Faculty of Built Environment,*
UNIVERSITI MALAYA, MALAYSIA
[5] *Kulliyyah of Revealed Knowledge and Human Sciences,*
UNIVERSITI ISLAM ANTARABANGSA MALAYSIA

Abstract

The Hajj pilgrimage, the world's largest annual mass gathering, poses significant challenges in crowd management and pedestrian movement due to the sheer number of participants and logistical complexities. This study emphasizes the need for effective strategies to ensure the safety of millions of pilgrims in Mecca, Saudi Arabia. By reviewing literature and analysing pedestrian movement systems, it identifies key bottlenecks and safety risks, especially during high-density periods like Nafra day. Field observations from 2019 to 2024, including the post-COVID-19 era, offer insights into crowd behaviour and the effectiveness of management strategies. The study highlights the importance of integrating advanced simulation tools with urban design to optimize pedestrian pathways and prevent overcrowding, contributing to Saudi Vision 2030's goals of enhancing the pilgrimage experience and ensuring participant safety.

Keywords: crowd management, Hajj pilgrimage, Saudi Arabia

[1] Sadeq Kadi lecturer at Department of Urban and Engineering Research, The Custodian of The Two Holy Mosques Institute for Hajj and Umrah Research, Umm Al-Qura University: sadeq_kadi@hotmail.com

INTRODUCTION

Major global events like the Olympic Games, FIFA World Cups, and the Hajj pilgrimage draw large crowds, placing heavy demands on host locations. The Hajj pilgrimage, with millions of participants, exemplifies these challenges, requiring extensive planning and resource allocation to ensure safety. The 2015 Mina stampede, which resulted in over 2,000 deaths, highlights the critical need for effective crowd management (Yue et al., n.d.). Saudi Arabia's Ministry of Municipal and Rural Affairs has implemented decision support systems (Baydoun et al., 2024). However, further research is essential to refine strategies and improve public space planning, particularly in the context of Islamic architecture and its principles of community and spirituality (Baydoun et al., 2023). This study explores crowd management parameters and evaluates pedestrian movement during the Hajj, aiming to enhance safety, efficiency, and the overall pilgrim experience, and prevent future disasters. It further evaluates the effectiveness of facility and identified potential improvements by simulating the behaviour of the pilgrims and analysed the crowd distribution.

LITERATURE REVIEW

Crowd movement and management during the Hajj pilgrimage

Pedestrian crowds are dynamic, shaped by various factors. Effective crowd management ensures safety and efficiency through careful planning and resource allocation (Al-Shaery et al., 2020). According to literature, density (physical space) and crowding (perceived space) influences pedestrian behaviour and the crowd dynamics. Furthermore, crowd well-being is also shaped by emotional and psychological states within crowded environments and influenced by social interactions and individual needs. While safety becomes critical in uncontrollable crowds, understanding factors like relatedness and autonomy is also the key to enhancing well-being (Beermann, n.d.). other factors influencing crowd movement are aged and gender. Elderly pedestrians have distinct movement patterns due to aging-related physical changes like reduced eyesight and balance, affecting their walking speed and reaction times. Current design standards often neglect their needs (Xuan et al., 2023). Elderly mobility and its movement is important factor in creating more inclusive pedestrian environments.

Crowd monitoring and measures

Effective crowd management relies on robust monitoring and traditional methods like CCTV are limited. But with advances in smartphone-based sensing and data analytics these technologies can offer better insights into crowd density and movement (Darsena et al., 2023). These tools help to monitor movement and later needed to be included in the development of strategies in order to reduce risks and improve public safety. Crowd management requires understanding and controlling behaviour as traditional methods like CCTV have some limitations,

pedestrian simulation models are able to predict dynamics and guide design for the movement of pilgrims. Metrics like density and flow rate are vital, but distinguishing between physical density and perceived crowding is key to addressing discomfort and safety risks. Large-scale events like the Hajj pilgrimage risk crowd-related disasters. Effective management demands careful planning, coordination, and resource allocation. Checkpoint design and operation are crucial for controlling crowd flow and ensuring safety.

Crowd management principles and strategies

Crowd management ensures safety and comfort in large gatherings by proactively planning and designing spaces, unlike crowd control, which reacts to issues. For religious events, it involves respecting cultural practices and collaborating with religious authorities. Effective strategies include "Before Event" planning, "During Event" measures for unforeseen issues, and "After Event" policies to alleviate post-event crowding, creating safe and enjoyable experiences for participants (Haghani et al., 2023). Figure 2 shows the crowd event timeline.

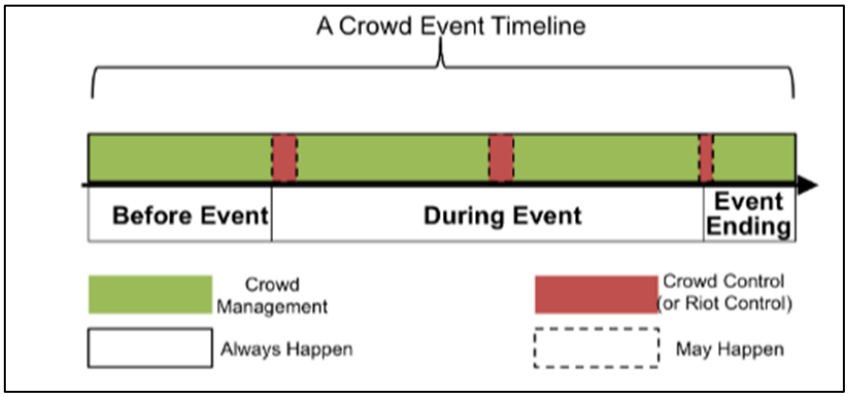


Figure 1: The crowd event timeline

Existing frameworks like the Pedestrian Fundamental Diagram (PFD) and Social Force Model (SFM) analyse pedestrian flow and simulate behaviour. While useful, they have limitations, and further research is needed for large-scale urban environments (Yuan et al., n.d.). Design principles for the Hajj pilgrimage include spatial organization, human scale, crowd dynamics, sacred geometry, safety, and sustainability. These principles ensure effective pedestrian flow, safety, and a meaningful experience for pilgrims (Felemban et al., 2020). By understanding crowd behaviour and integrating sacred symbolism while prioritizing safety and sustainability, the Hajj can offer a safe and efficient experience for millions. The research combines urban design and crowd management frameworks to optimize pedestrian movement and the key elements include clear pathways, sidewalks, amenities, lighting, and wayfinding. It also

involves planning, monitoring, communication, and safety factors in providing effective solutions for pedestrian movement during the Hajj pilgrimage.

RESEARCH METHODOLOGY

This study uses a mixed-methods approach to optimize pedestrian movement along the Arafah-Muzdalifah pathway during Hajj 2019 and Hajj 2023. By combining quantitative data (counts, simulations) and qualitative data (observations, video analysis, interviews), it analyses flow dynamics, identifies bottlenecks, and proposes design improvements to enhance pilgrim safety and experience. Field observations with SimWalk simulation are adopted to identify pedestrian behaviour during Hajj and the field work observations are able to capture real-time dynamics, while SimWalk programme will models the movement virtually. This integration helps identify bottlenecks, assess design interventions, and develop strategies to optimize flow and safety.

SimWalk Simulation

Simulating pedestrian behaviour is crucial for managing crowd dynamics. While macroscopic models look at overall flow, microscopic models analyse individual behaviour for more accurate predictions. This study highlights the value of microscopic simulations in understanding interactions, evaluating designs, and informing crowd management strategies. In term of parameters, the simulation parameters include pedestrian attributes (speed, size, behaviour), environmental factors (facilities, obstacles), modelling worst-case peak densities and Origin-Destination data that represented flow patterns. Pedestrian movement at large-scale events present challenges due to high density and hazards. Simulation tools help plan and manage crowd flow by modelling behaviour, environments, and emergencies. This study proposes a checklist to evaluate simulation software based on environmental representation, pedestrian modelling, output analysis, and robustness.

Data collection procedure

Pedestrian behaviour data was collected via on-site observations, video recordings, and manual counts, with cameras discreetly placed to avoid disturbance (see Figure 2). This data was analysed using Excel and Silicon Coach software to inform a SimWalk simulation of the Arafah-Muzdalifah pathway. Comparing simulation results with real-world observations helped identify strategies for improving crowd management and urban design.

Figure 2: Camera locations along the pathway between Arafat and Muzdalifah

SimWalk process

SimWalk is useful for crowd management and evacuation simulations but has limitations in modelling complex pedestrian behaviours. While it provides basic crowd modelling and outputs like movement patterns, density, and speed, its suitability for detailed behaviour analysis is limited.

Overview to the routes of Arafah and Muzdalifah

Pedestrian paths in Mecca's holy sites, from Muzdalifah through Arafat to Mina, are designed for pilgrim comfort and safety. Features include paved surfaces, benches, shade, misting systems, concrete barriers, LED lighting, and accessibility for people with disabilities (see Figure 3). These paths are essential infrastructure for the Hajj pilgrimage. Pedestrian walking speed varies by gender and age. Males typically walk faster than females (1.5 m/s vs. 1.2 m/s). Older pedestrians, especially those over 55, walk slower due to decreased physical capabilities, though age-related variations are less pronounced than gender differences. Pedestrian simulation models predict crowd behaviour by simulating individual movements and interactions. They help improve transportation systems and understand dynamics by considering factors like density, design, and attributes. Analysing outputs identifies bottlenecks, optimizes space, and enhances safety and comfort.

Figure 3: The Beginning of the Pedestrian Path from Arafat to Muzdalifah

Justification of choosing the pathway strip

Pedestrian pathways connect Mount Arafat and Muzdalifah were separate from vehicle roads. Six routes link Namira Mosque and Jabal al-Rahmah, with Route 1 being the most congested due to its proximity to services and Jabal al-Rahmah. Mobile medical services are provided on Route 1 to support pilgrims. High pedestrian density is noted near charitable distribution vehicles on Route 1, where video recording was conducted to analyse flow. Scaffolding was installed at key points for camera placement to capture movement data. Video cameras on Route 1 captured pedestrian flow in both directions during peak times. The selected area, with the highest density (2.32 people/m²) and various features (toilets, water fountains, charity trucks), provided diverse data for analysis.

RESULTS AND ANALYSIS

Observation of Hajj 2019 and Hajj 2023/1444 AH

This research, in collaboration with the Custodian of the Two Holy Mosques Institute for Hajj and Umrah Research, involved fieldwork during Hajj, including observations and data collection. The Institute provided support, equipment, and personnel, enabling comprehensive data and insights for the study. Field observation during Hajj 1444 AH revealed significant changes in charity car distribution. The mobile service model replaced the fixed distribution points used in previous years. However, the observed queuing patterns, influenced by visibility and road direction, disrupted pedestrian paths.

Figure 4: The queue heading to the charity distribution truck

Observation of Hajj 2023/1444 AH
SILICONCOACH analysis

Video analysis revealed average usage times during Hajj: charity distribution (2 minutes), bathrooms (10 minutes), waiting areas (5 minutes), water fountains (10 minutes), and seats (10 minutes). These insights aid in improving facility design and resource allocation for future pilgrimages. Figure 5 shows camera locations and directions.

Figure 5: The location and direction of cameras

Summary of the Extracted Information from The Selected Area for Analysis

Table 1 provides a comprehensive overview of the distribution of activities within the studied area, along with insights into the density of individuals per square meter.

Table 1: The distribution of activities

Activity	Number of individuals	Percentage
Walking	232	75%
Waiting area	19	7%
Queue	55	18%
Total	**309**	**100**

Additional Information:

- Total Area Studied: 25 meters * 5 meters = 125 square meters.
- Total Number of People in the Area: 309 people.
- Excluding Those Sitting (19 people): 309 - 19 = 290 people.
- Density Calculation: Approximately 2.32 people per square meter (290 people / 125 square meters).

Video analysis showed average service usage times: 2 minutes for charity distribution, 10 minutes for bathrooms, 5 minutes for non-designated waiting areas, and 10 minutes for water fountains and chairs. These findings offer insights for improving facility design and resource allocation during future Hajj pilgrimages.

SIMWALK simulation

Initialization and Model Setup

SimWalk PRO was used to create a simulation model of the pedestrian pathway, incorporating a detailed map, pedestrian parameters (average speed, age distribution, gender ratio), and facilities (charity vendors, toilets, waiting areas, water fountains). The simulation included 6,000 pedestrians, with service usage and scheduling adjusted to reflect observed behaviour. These inputs facilitated a realistic simulation of pedestrian flow and service utilization during Hajj, as shown in Figure 7.

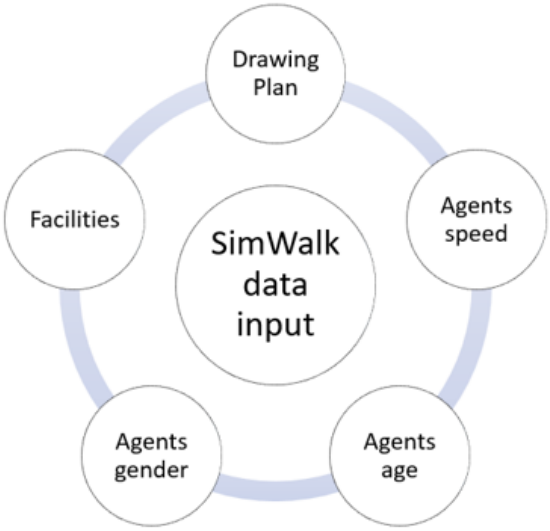


Figure 6: Data input for SIMWALK

Simulation scenarios

Current state Scenario

This research offers a detailed analysis of urban planning strategies for the unidirectional pathway during Nafrah day, with actionable insights based on simulation results. The model accurately reflects real-world data and conditions. Figure 7 shows the AutoCAD drawing of the current pathway scenario, including five parameters used to test speed and congestion.

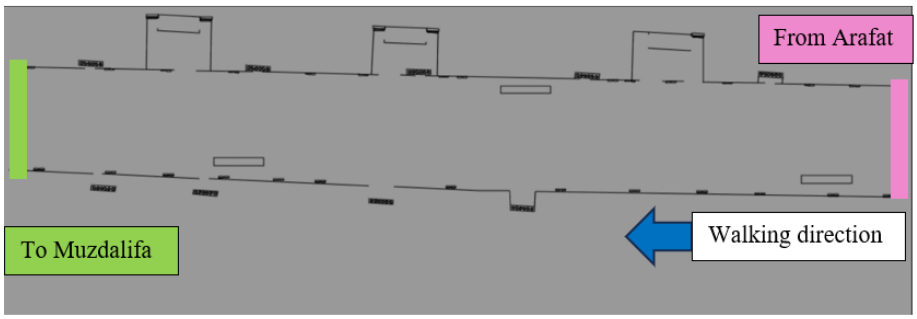


Figure 7: The plan of the first proposal for the road. All charitable distribution trucks have been removed, while the rest of the services have been kept as they are

a. Density - level of Service

Analysis of the Density-Level of Service (LOS) diagram reveals severe congestion along the Arafah-Muzdalifah pathway during Nafrah day, with over 91% experiencing moderate to severe issues. To improve pedestrian movement

and safety, it's recommended to redistribute services, implement real-time monitoring, and redesign the pathway to address bottlenecks.

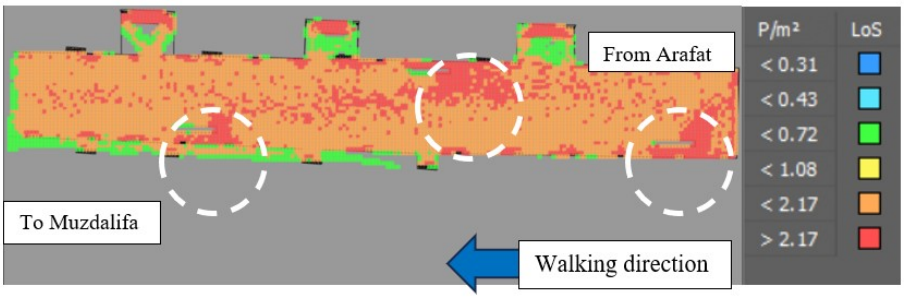


Figure 8: The current state Density - level of Service diagram

b. Spatial utilization

Spatial analysis shows that 76.05% of the pathway is highly utilized, 11.37% is moderately utilized, and 12.58% has low to moderate use. These findings identify congestion areas and suggest strategies to improve pedestrian flow and reduce bottlenecks.

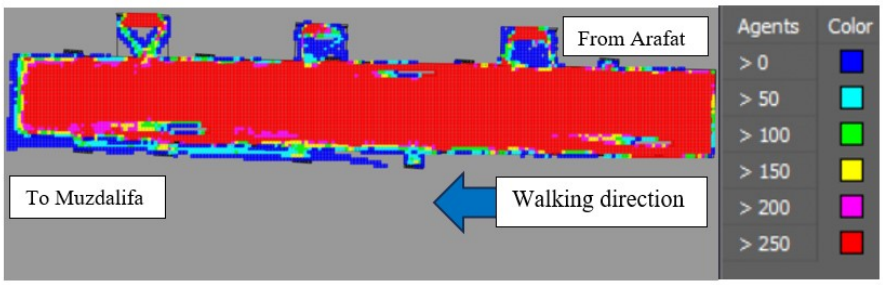


Figure 9: The Spatial utilization diagram

c. Speed loss diagram

Speed loss analysis shows that 89.52% of the pathway experiences significant speed reduction, 4.28% has moderate speed loss, and 5.19% has low speed loss. This highlights areas where congestion hampers pedestrian movement.

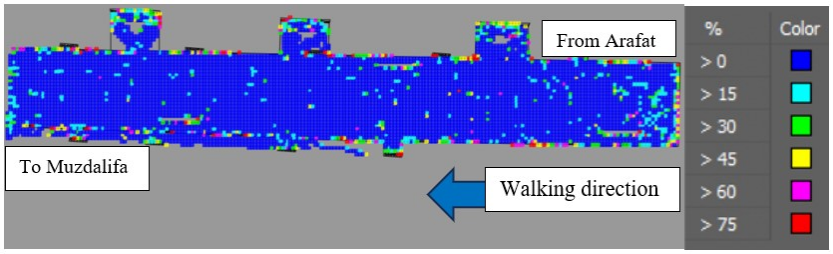


Figure 10: The speed loss diagram

The proposed scenarios

Scenario 1 Analysis: Implementation of Squares with Service Areas

A design proposal added three squares along the Arafah-Muzdalifah pathway, featuring charitable distribution points, seating, and waiting areas. Curved connections enhance movement flexibility, with distribution areas on the left, followed by plazas, seating, and waiting areas.

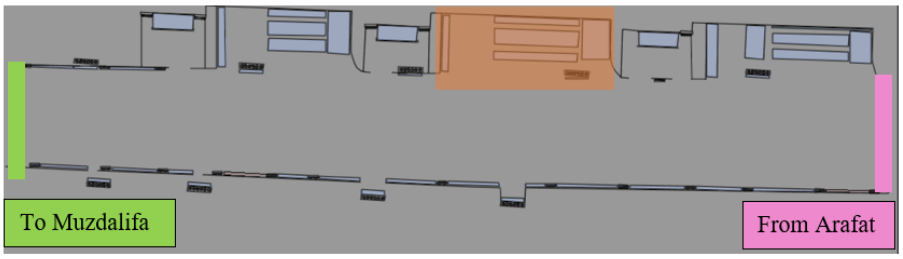


Figure 11: The scenario 5

a. Density - level of Service

Introducing squares with service areas reduced congestion. The orange zone (58.33%) remains dominant, indicating moderate to high density. The red zone (28.96%) is reduced compared to previous scenarios. The blue zone is absent, indicating minimal congestion in specific areas.

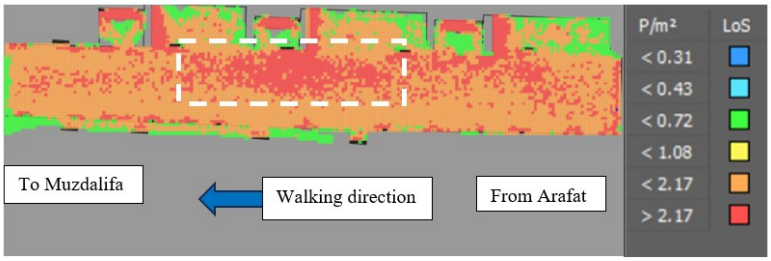


Figure 12: The scenario 5 - level of Service diagram

b. Spatial utilization

Introducing squares with service areas improved spatial utilization. The red zone (63.07%) indicates high usage, while the blue zone increased to 20.07%, showing moderate usage. The decrease in lighter zones suggests improved pedestrian flow and reduced congestion.

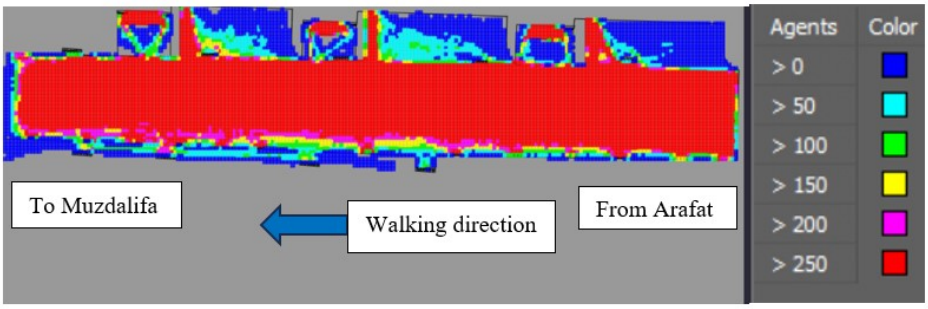


Figure 13: The scenario 5- spatial utilisation diagram

c. Speed loss diagram

Introducing squares with service areas did not significantly improve speed loss. The blue zone remains dominant (89.33%), indicating significant speed reduction due to high pedestrian density.

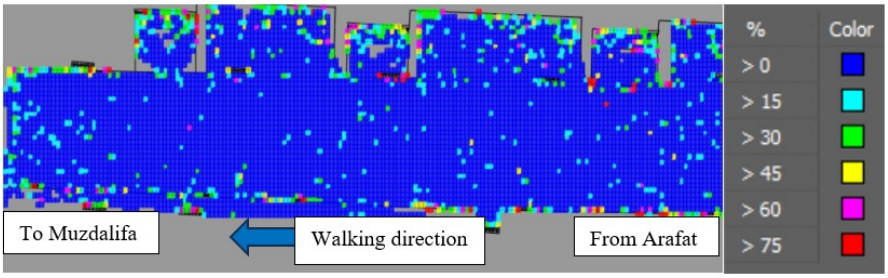


Figure 14: The scenario 5- The speed loss diagram

Scenario 2 Analysis: Services Moved Outside with Enhanced Square Utilization

Services were relocated outside the right of way with curved connections between the road and redesigned squares. The first and third squares featured water bars, seating, and waiting areas, while the second was for charitable distribution. Water fountains were added to and relocated within the squares, bathrooms were enlarged, and their entrances were cleared.

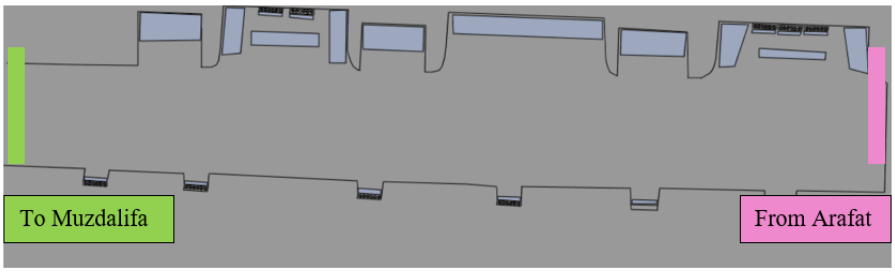


Figure 15: The scenario 6 plan

a. Density - level of Service

Relocating all services outside the pathway reduced congestion. The orange zone (62.14%) remains dominant, indicating moderate to high density. The red zone (37.14%) is reduced compared to previous scenarios. The green zone (0.72%) is small, indicating minimal congestion.

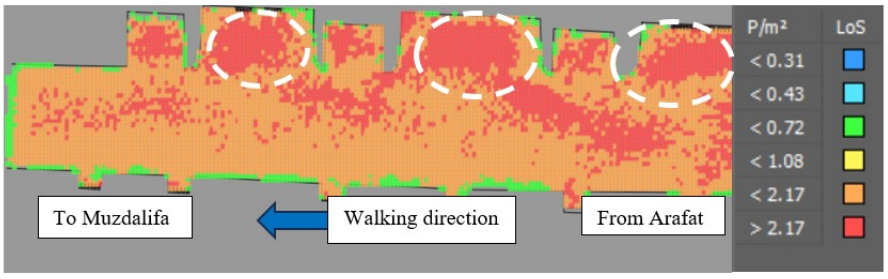


Figure 16: The scenario 6 - level of Service diagram

b. Spatial utilization

Relocating services and redesigning squares enhanced spatial utilization. The red zone (66.92%) remains dominant, while the blue zone increased to 10.84%. The reduction in lighter zones indicates improved pedestrian flow and reduced congestion.

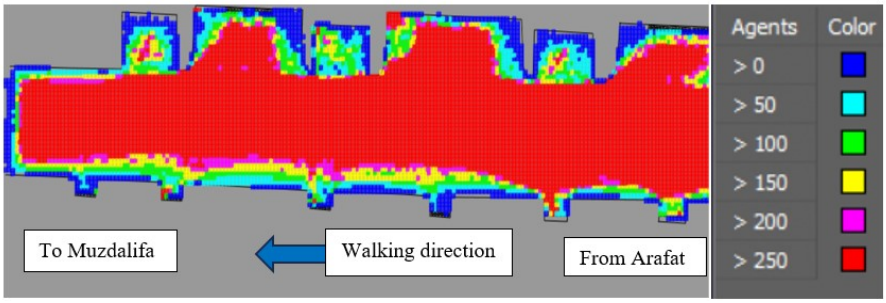


Figure 17: The scenario 6- spatial utilisation diagram

c. Speed loss diagram

Relocating services and redesigning squares did not significantly reduce speed loss. The blue zone remains dominant (94.02%), indicating ongoing congestion and significant speed reduction.

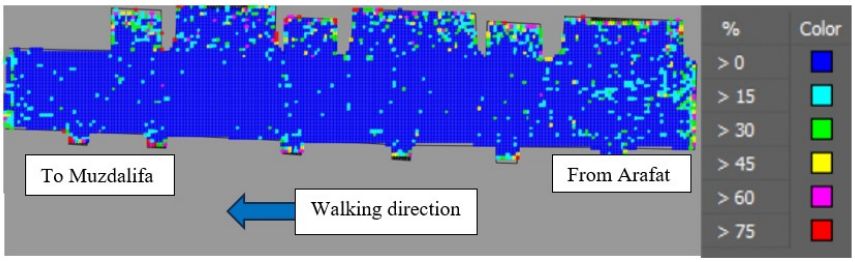


Figure 18: The scenario 6- The speed loss diagram

RESULTS AND DISCUSSION

A comparative analysis of various scenarios evaluated urban design strategies for improving pedestrian movement during Hajj, focusing on pedestrian speeds, crowd densities, waiting times, and flow efficiency. The current scenario showed moderate pedestrian speeds, high crowd densities, extended waiting times, and moderate flow efficiency. Scenario 1 and 2 demonstrated significant improvements in these metrics, with Scenario 2, which included relocated services and redesigned squares, proving to be the most effective strategy. This approach provides valuable insights for enhancing urban design and managing crowds during the pilgrimage.

Table 2: Comparison of Pedestrian Flow Scenarios: Evaluating Speeds, Densities, Waiting Times, and Efficiency

Scenario	Pedestrian Speeds	Crowd Densities	Waiting Times at Amenities	Overall Flow Efficiency
Current	Moderate	High in Orange/Red zones	Long at critical points	Moderate
Scenario 1	Higher speeds in some areas	Moderate to high in squares	Moderate to high	Moderate to high
Scenario 2	Highest speeds	Lowest in redesigned squares	Lowest in redesigned squares	Highest

A comparative analysis of six pedestrian flow scenarios was conducted, evaluating pedestrian speeds, crowd densities, waiting times, and flow efficiency

and can be seen in Table 3. The current scenario showed moderate speeds, high densities, long waiting times, and moderate efficiency. Scenario 1 improved speeds and densities with redesigned squares, achieving a density range of 50-70 P/m². Scenario 2, with optimized flow and strategic amenity placement, achieved the highest speeds and lowest densities, with a range of 30-50 P/m². This highlights the effectiveness of strategic planning in enhancing pedestrian flow and reducing congestion.

Table 3: Summary of Pedestrian Flow Scenarios: LOS Density and Level of Service Analysis

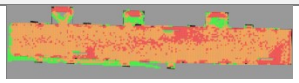
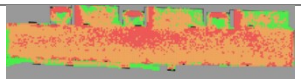
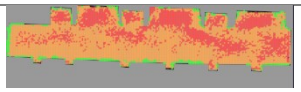
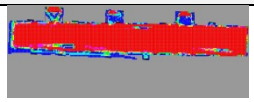
Scenario	Simulation capture	Explanation	LOS Density/level of service P/m^2
Current state		Represents existing conditions with moderate to high density levels and varied LOS	60 – 80 Based on observed data and simulation results
1.		Illustrates increased activity in redesigned squares, affecting LOS moderately	50 – 70 Higher speeds in some areas due to square redesign
2.		Shows lowest congestion and improved flow efficiency in redesigned areas	30 – 50 Highest speeds due to optimized layout and service placement

Table 4 compares six pedestrian flow scenarios, focusing on spatial utilization and agent-based simulation results. The current scenario serves as a baseline, while Scenario 1 shows improved utilization in redesigned squares. Scenario 2, with an optimized layout and redesigned service areas, achieves the most efficient spatial use. This highlights the importance of strategic spatial planning in managing pedestrian flow and reducing congestion during large-scale events like Hajj, with Scenario 2 demonstrating the most effective approach.

Table 4: Analysis of Spatial Utilization and Agent-Based Simulation for Pedestrian Flow Scenarios

Scenario	**Simulation capture**	**Explanation**	**Spatial utilization agent**
Current state		Represents current spatial utilization patterns observed in the pathway between Arafah and Muzdalifah during the Hajj pilgrimage season	Various existing locations

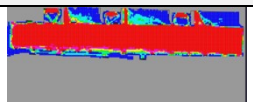
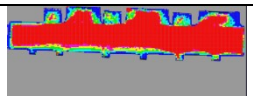
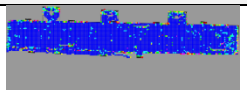
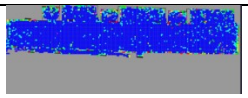
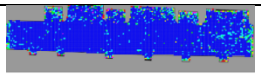
Scenario	Simulation capture	Explanation	Spatial utilization agent
1.		Illustrates enhanced spatial utilization in newly redesigned squares to improve flow dynamics	Redesigned squares
2.		Shows the most efficient spatial utilization with an optimized layout and service placement strategy	Curved road connections and redesigned service areas

Table 5 analyses six pedestrian flow scenarios, focusing on speed loss percentages. The current scenario shows varied speed loss based on existing conditions. Scenario 1, with redesigned squares and pathways, achieves enhanced speed and efficiency with an 88.35% speed loss. Scenario 2, featuring optimized layout and service placement, demonstrates the lowest speed loss at 94.02%. This underscores the importance of strategic spatial planning and service placement for improving pedestrian speed and efficiency during large-scale events like Hajj, with Scenario 2 highlighting the effectiveness of these strategies.

Table 5: Analysis of Pedestrian Speed Loss in Different Scenarios During Hajj Pilgrimage

Scenario	Simulation capture	Explanation	Speed loss %
Current state		Represents current speed loss patterns observed in the pathway between Arafah and Muzdalifah during the Hajj pilgrimage season	Varies based on observations
1.		Illustrates improved speed and efficiency in newly redesigned squares and pathways	88.35
2.		Shows the most optimized speed loss with an efficient layout and strategic service placement	94.02

Density - level of service (los)

Scenario 2 consistently demonstrated the lowest percentage of high-density areas, indicating better pedestrian dispersion compared to other scenarios. Scenario 1 improved density distribution but faced challenges. Overall, Scenario 2 emerged as promising strategies for reducing high-density areas and enhancing pedestrian flow.

Spatial utilization
Scenario 2 achieved the best balance in space utilization along the pathway through effective service relocation and square redesign. While Scenario 1 also improved spatial use, Scenario 2 proved most effective for optimizing space and managing pedestrian flow.

Speed loss
Scenario 2 achieved the lowest speed loss, indicating smoother pedestrian movement due to strategic service relocation and improved square design. Scenario 1, though featuring redesigned squares, had higher speed loss. Overall, Scenario 2 proved most effective in reducing density, balancing spatial utilization, and minimizing speed loss, making it a strong strategy for enhancing crowd management during Hajj.

Recommendation on urban planning strategies and solutions
This study recommends strategies to enhance public space during the Hajj pilgrimage through targeted urban planning. Key interventions include optimizing charitable distribution sites, centralizing seating, and redesigning restrooms and water fountains for better access. Three new squares along the pathway, with amenities and curved connections, aim to improve pedestrian flow and safety by relocating services outside the main pathway. These measures collectively enhance infrastructure efficiency and the overall pilgrim experience.

Framework development for optimizing pedestrian movement
Based on the analysis of the above scenarios and the current situation, a framework has been developed to optimize pedestrian movement systems (PMS) during the Hajj pilgrimage. This framework combines urban design principles, crowd management strategies, and crowd dynamics theory. It focuses on creating safe, comfortable environments with clear, vehicle-free pathways, wide sidewalks, and well-placed amenities. Effective crowd management includes robust planning, clear signage, and continuous monitoring. By addressing density and layout, the framework aims to enhance safety and efficiency during Hajj and offers practical insights for managing crowds in various urban settings.

ACKNOWLEDGMENT
I would like to express my sincere gratitude to IIUM University and the Department of Architecture for their continuous support. I am also deeply thankful to Zulfadly Azizi Bin Bohari for his invaluable assistance in training me on the SimWalk simulation software.

CONCLUSION

This study develops a framework to optimize pedestrian movement along the Arafah-Muzdalifah pathway during Hajj. By analysing various scenarios and integrating theoretical models, it highlights improvements in pedestrian flow and safety through better urban design, service relocations, and designated public spaces. Key recommendations include proactive planning, stakeholder collaboration, and the use of advanced technologies for crowd monitoring and emergency management. This research offers practical insights for enhancing infrastructure, public safety, and the overall pilgrimage experience.

REFERENCES

Al-Shaery, A. M., Alshehri, S. S., Farooqi, N. S., & Khozium, M. O. (2020). In-Depth Survey to Detect, Monitor and Manage Crowd. *IEEE Access*, *8*, 209008–209019. https://doi.org/10.1109/ACCESS.2020.3038334

Baydoun, Z., Alghamdi, N. A., & Kamarudin, Z. (2023). THE ISLAMIC ART AND DESIGN ELEMENTS APPLIED IN THE ISLAMIC CITY, A CASE STUDY OF PUTRAJAYA ISLAMIC CITY. *PLANNING MALAYSIA*, *21*(1), 314–328. https://doi.org/10.21837/PM.V21I25.1241

Baydoun, Z., Norishah, T., Baydoun, R., & Adam, M. (2024). Placement Principles of Islamic Calligraphy in Architecture: Insights from the Al-Hambra and Al-Azem Palaces. *Buildings 2024, Vol. 14, Page 2025*, *14*(7), 2025. https://doi.org/10.3390/BUILDINGS14072025

Beermann, M. (n.d.). *The Relationship between Pedestrian Density, Walking Speed and Psychological Stress: Examining Physiological Arousal in Crowded Situations*.

Cysek-Pawlak, M. M., & Pabich, M. (2021). Walkability – the New Urbanism principle for urban regeneration. *Journal of Urbanism: International Research on Placemaking and Urban Sustainability*, *14*(4), 409–433. https://doi.org/10.1080/17549175.2020.1834435

Darsena, D., Gelli, G., Iudice, I., & Verde, F. (2023). Sensing Technologies for Crowd Management, Adaptation, and Information Dissemination in Public Transportation Systems: A Review. *IEEE Sensors Journal*, *23*(1), 68–87. https://doi.org/10.1109/JSEN.2022.3223297

Felemban, E. A., Rehman, F. U., Biabani, S. A. A., Ahmad, A., Naseer, A., Majid, A. R. M. A., Hussain, O. K., Qamar, A. M., Falemban, R., & Zanjir, F. (2020). Digital Revolution for Hajj Crowd Management: A Technology Survey. *IEEE Access*, *8*, 208583–208609. https://doi.org/10.1109/ACCESS.2020.3037396

Haghani, M., Coughlan, M., Crabb, B., Dierickx, A., Feliciani, C., van Gelder, R., Geoerg, P., Hocaoglu, N., Laws, S., Lovreglio, R., Miles, Z., Nicolas, A., O'Toole, W. J., Schaap, S., Semmens, T., Shahhoseini, Z., Spaaij, R., Tatrai, A., Webster, J., & Wilson, A. (2023). A roadmap for the future of crowd safety research and practice: Introducing the Swiss Cheese Model of Crowd Safety and the imperative of a Vision Zero target. *Safety Science*, *168*, 106292. https://doi.org/10.1016/J.SSCI.2023.106292

Xuan, C. ;, Zhang, B. ;, Jia, X., Ojima, T., Jeong, S., Xuan, C., Zhang, B., & Jia, X. (2023). The Effect of Human Settlement Pedestrian Environment on Gait of Older People:

An Umbrella Review. *International Journal of Environmental Research and Public Health 2023, Vol. 20, Page 1567*, *20*(2), 1567. https://doi.org/10.3390/IJERPH20021567

Yuan, Z., He, B., Wan, Y., Wang, J., & Huang, B. (n.d.). *Simulation Study of Pedestrian Behavior in the Commercial Passageways of Subway Stations Considering Visual Attraction*. https://doi.org/10.2139/SSRN.4869187

Yue, Z., Ling, Z., Barahona Da Fonseca, F., Kadi, A., Habibi, R., Hu, X., Barakat, H., Zahalqa, H., & Gillem, M. (n.d.). *URBAN DESIGN AND PLANNING Volume 338 Contents*. *338*.

Received: 16th July 2024. Accepted: 6th September 2024

PLANNING MALAYSIA:
Journal of the Malaysian Institute of Planners
VOLUME 22 ISSUE 5 (2024), Page 467 – 481

INSPIRE AND IGNITE: ENABLING FACTORS FOR EARLY TOURISM DEVELOPMENT IN SABAH, MALAYSIA

Marcela Pimid[1], Azizan Marzuki[2], and Steven Sampil[3]

[1]*Institute for Tropical Biology and Conservation,*
UNIVERSITI MALAYSIA SABAH
[2]*School of Housing, Building, and Planning,*
UNIVERSITI SAINS MALAYSIA
[3]*Koperasi Aparu Moyog Berhad,*
LOT 30, TINGKAT BAWAH GRAND INDUSTRIAL CENTRE, FASA 2,
JALAN BUNDUSAN, 89500 PENAMPANG, SABAH.

Abstract

Community-based tourism (CBT) is renowned worldwide as a sustainable economic development and a means of improving rural communities' welfare and standard of living. Successful CBT greatly depends on local communities' readiness and active participation in ensuring equal distribution of CBT benefits. This study investigates the readiness of rural communities to engage in CBT under the management of Moyog Agrotourism and Tourism Park (MANTAP), a locally empowered organisation. The theoretical concept is framed by social exchange theory and the tourism development model is adjusted to match the local context. The study employs a cross-sectional approach, examining native perspectives on the early stages of CBT development in upper Moyog areas. Using the qualitative method, the findings reveal substantial local support for the CBT development. The study underscores the importance of demonstrating tourism benefits early on, as well as strong leadership and project legitimacy, which foster credibility and access to tourism resources. Native people who can picture themselves gaining benefits and be part of the tourism planning show more apparent support for tourism development in rural Penampang areas.

Keywords: Community-based tourism, qualitative, rural areas, community willingness, Penampang, Sabah

[1] Corresponding author: marcela@ums.edu.my

INTRODUCTION

As the idea of sustainable development began to evolve in tourism, the issue of involving local communities in destination development planning and policies received increasing attention (Dodds et al., 2018). Community participation is a crucial component of sustainable tourism development, particularly in community-based tourism (CBT). Tourism development through CBT focuses on the involvement of local communities (Woyo & Musavengane, 2023). This demonstrates that the capability of local communities to manage new or existing tourism is an important factor in determining whether or not tourism sites can sustain themselves in the long term. Capability is the ability, expertise, competence, and capacity possessed by individuals or groups to jointly manage potential, solve problems, and design goals to be achieved together (Hatipoglu et al., 2020; Dodds et al., 2018). The participation of local communities in various tourism activities in the surrounding environment brings various benefits, especially in the economic sector (Mwesiumo et al., 2022; Qin et al., 2021). This benefit is what motivates the community to get involved in tourism.

Community participation in tourism means the involvement of the community in the process of identifying a problem and tourism potential in their environment, selecting solutions for solving problems, implementing solutions for solving trouble, and being able to evaluate them (Qin et al., 2021). Participation should stem from the community's own will and awareness, preventing any element of coercion. Community participation in tourism, in general, consists of two types, namely real- and abstract-form participation (Mayaka et al. 2018). According to Sastropoetro (1986), the concept of community participation in tourism is classified into three dimensions based on its type. First, thought participation refers to the involvement that takes the form of ideas or constructive thinking. Secondly, energy participation refers to the act of physically contributing to the success of a plan. Third, material participation is the involvement of a person or group in the form of money, property, or goods to achieve joint efforts. Clear and specific benefit distribution, power sharing, regulation, and local leadership facilitate community involvement in CBT projects (Dodds et al., 2018; Woyo & Musavengane, 2023).

Sabah, the second largest state in Malaysia, is known as the Land Below the Wind and is situated in northern Borneo. Sabah views community-based tourism (CBT) as one of its key strengths, given the abundance of its natural diversity and beautiful beaches, and has more than 30 indigenous groups in this state (Sabah Tourism Board, 2024). Penampang District Strategic Development Plan (2024-2035) sets up five development cores, namely: (1) establishment of major business centres; (2) local economic generation; (3) development of prosperous communities; (4) clean and green environments; and (5) effective management. The Penampang District, situated in close proximity to the Kota Kinabalu city centre, presents a significant advantage in attracting tourists. The

Penampang District offers numerous fascinating locations for nature- and agrotourism-based tourism attractions. Despite this high potential, many tourists are unaware of the Upper Penampang attraction due to a lack of accommodation options and underdeveloped tourism products.

This study contributes to the existing knowledge on developing Penampang areas, known as upper Moyog areas, by examining the dynamics involved in navigating the early stages of rural CBT development projects. The study holds significance, especially considering that the Penampang district council has become a municipal council in 2024. The present study aims to address the following research question: what strategies can players employ to effectively navigate the early stages of a significant CBT development project with a focus on sustainability and local empowered leadership? The study offers practical solutions for early tourism development and contributes to theoretical implications that can inspire additional research in the field of early tourism destination development.

LITERATURE REVIEW

Conceptual framework for early tourism development

Researchers commonly acknowledge that tourist development has both beneficial and detrimental outcomes (Chi et al., 2018; Kang & Lee, 2018). These impacts are believed to have three aspects: economic, social, and environmental. Several research have examined the connections between residents' perception of positive and negative consequences of tourism and their views of tourism based on the social exchange theory (SET) (Chi et al., 2018; Kang & Lee, 2018). The findings of this research indicate that residents who have a higher perception of positive consequences from tourism are more likely to support tourism (Pimid et al., 2023). According to Ehigiamusoe (2020), there is a direct correlation between the strength of negative tourist impacts reported by individuals and their level of support. Despite its apparent usefulness in understanding people' responses to tourism growth, the SET has been recognised by scholars as having significant theoretical shortcomings (Qin et al., 2021). SET places excessive importance on individual rationality by focusing on the self-interest of individuals and disregarding the interests of the community (Chi et al., 2018).

Due to the limitations of the SET theory in explaining residents' attitudes towards tourism development, researchers have proposed integrating it with other concepts to gain a more comprehensive understanding of residents' attitudes (Qin et al., 2021). Thus, this study includes the life-cycle of tourism development model by Getz (1992). The aim is to provide better understanding of residents' support for early tourism development in this region. The seven life-cycles of tourism development are: exploration, involvement, development, consolidation, stagnation, decline, and rejuvenation (Getz, 1992). Exploration describes small number of explorers with little or no tourism infrastructure.

Involvement stage shows local investment in tourism, advertising, and emerging market area. Development stage shows the increase of visitor number, man-made attraction, and heavy advertising. Consolidation, stagnation, and decline depict the slowing down of tourism activities, whereas rejuvenation indicates new attraction might replace previous tourism lures. Using a framework in Figure 1, we examine the early development of MANTAP tourism and how the native people view this tourism plan in upper Moyog areas.

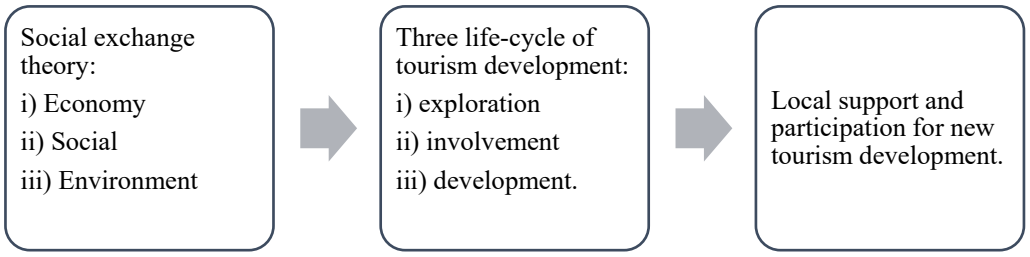


Figure 1: Conceptual framework for a new tourism development.

RESEARCH METHODOLOGY

Research design

The study was conducted at Penampang upper areas in Sabah. It employed a qualitative method using interviews to participants who attended the talk of Moyog Agro-Industry and Tourism Park (MANTAP) in May 2024 at D'Arch Hotel, Donggongon, Sabah. It applied a purposive approach by inviting local people who were interested to develop their lands as MANTAP development plan. There were 30 respondents who registered for the talk, but only 23 respondents came during the actual event. The talk showcased two important topics: (1) development potential of nature- and agriculture-based tourism in the upper Moyog area and (2) approval procedure for development plan (DP) and building plan (BP). This study is aligned with human ethics (non-clinical study) with a research approval code IBTP/2024/28-MAC/0001-MEI.2024-MEI.2027.

Interview and focus group discussion

Using qualitative method and a cross-sectional study, 23 interviews were conducted to each participant who present in the talk. The interviews used open- and closed- ended questions. Guidelines for collecting lists, short answers, and narratives (i.e., open ended questions) often suggest continuing interviews until saturation is achieved (Weller et al., 2018). Focus group discussion (FGD) was conducted during the talk after interviews. The plenary talks were moderated by Dr. Marcela Pimid, from the Universiti Malaysia Sabah. The FGD was important to examine each participant's understanding about the talk and gauge their concerns about possibilities, challenges, and potential solutions to solve tourism development plans. Focus group discussion is defined as a carefully planned

series of discussions designed to elicit perceptions about a defined area of interest in a permissive, non-threatening environment, in order to generate detailed insights of topics in a resourceful and timely manner (Larson et al., 2000). Group interaction can stimulate ideas from participants that may not have been available on an individual basis (Larson et al., 2000). Examples of questions in Table 1:

Table 1: Interview and focus group discussion

	Examples of questions
Section 1:	Respondent's demographic background: gender, age, ethnicity, education, occupation, and work experience in a tourism venture.
Section 2:	The local community's willingness to participate in tourism. a) Would you be interested in hosting tourists in your home as part of a tourism service? Please explain your answer. b) Please write your plans to develop your lands as part of MANTAP tourism plans. c) Do you have any financial resources available to invest in tourism accommodations? If so, please indicate.
Section 3:	Local perspectives on the attractions, benefits, and challenges of tourism. a) What are your main concerns about the MANTAP tourism development in your village? b) How do you think MANTAP tourism development will affect your village's social, economic, and environmental aspects? c) What natural attractions in your village do you think should be promoted for tourism? d) What challenges do you see in developing tourism accommodations in your village?

Qualitative analysis

The transcripts obtained from interviews and FGD were analysed using inductive content analysis (ICA) as described by Vears and Gillam (2022). In contrast to thematic analysis, which aims to contribute to the theoretical literature, ICA is useful when the researcher seeks a practical answer or application of the findings to develop practice guidelines for early tourism development, such as in the upper Moyog areas. The study applied manifest content, with a focus on the visible or apparent content that could be inferred from immediate text (Vears & Gillam, 2022). Inductive content analysis follows five stages: (1) read and familiarise with the transcripts; (2) organise data into a broad picture or category; (3) develop subcategories and fine codes; (4) compare and refine all subcategories; (5) synthesise and connect the categories to explain the phenomenon under study. Researchers combined the content categories and subcategories to provide a comprehensive understanding of the tourism development in the upper Moyog area. The results of interview and focus group discussion were compared and contrasted for triangulation purpose (Xin et al., 2020).

RESULTS

Demographic profile of respondents

The interviews generated 23 completed closed- and open-ended questions. Males made up the majority of the interviewees, accounting for 69.6% (n= 16), while females made up 30.4% (n= 7). The respondents are all native Kadazan or Dusun people. A majority of them were more than 51 years old. The respondents had mixed educational backgrounds, such as completed secondary high school, certificates, degrees, masters, and PhDs. The informants had different occupations, such as owning personal businesses, being retired, government staff, farmers, and private sector workers. Despite the high potential for tourism development in upper Moyog areas, many respondents (56.5%, 13 people) had no tourism experience.

Results of open-ended interview questions

Inductive analysis shows the exploration, involvement, and development of the MANTAP tourism plan in early stage (Table 2). The first stage indicates the importance of identifying multiple tourism benefits. Native people perceptions focus on job employment, increased income, road improvement, and better environmental protection. They request a proper planning using Environmental Impact Assessment (EIA). Despite positive opinion of tourism development, they anticipate an increase of garbage. The respondents suggest construction of guesthouse, glamping, herbal, garden, hiking track, photo station, open hall for traditional dance, and music performances as attraction for MANTAP tourism.
Early tourism development should share the efforts that will be implemented in the future, standard operating procedure (SOP), and registration requirements of local authorities with the residents. The reason for an early awareness creation is that MANTAP tourism plan requires support from local residents. The third stage shows the importance to provide courses, advisory services, and funding for tourism beginners. This includes to identify the space, location, and potential of the village people who have interests and commitments in participating tourism activities but they have no funds.

Table 2: Results of inductive analysis

Themes	Sub-themes and excerpts of inductive coding
Stage 1. Explore: Identify the multiple tourism benefits	
Socioeconomic benefits	R1: Upgrade existing village roads and increase the number of village roads open to the villagers. Agricultural roads should not be the sole focus of road improvement. R4: Reduce the rate of unemployment by working on your own land, which can prevent young people from migrating abroad to earn a living. Reduce unhealthy activities if the youth are busy developing their respective economies.

Themes	Sub-themes and excerpts of inductive coding
	R16: Job opportunities, increased income, community entrepreneurship. R20: Hoping it can improve the development of the Upper Moyog Penampang tourism industry.
Environmental impacts	R4: Flora and fauna are more preserved for their natural beauty. R9: There must be proper planning & EIA compliance. R14: The upper Moyog areas are better known and the environment is better protected. R17: The amount of garbage may increase**.** R22: MANTAP tourism development will be able to preserve the environment better if it is done without large-scale development.
Stage 2. Explore and involve: Identify local needs and plans	
Local plans for tourism development	R2: Homestay, guesthouse, camping site and hiking trail. R4: Construction of guesthouse, glamping, herbal, garden, hiking track, photo station, open hall for traditional dance, and music performances. R7: Make a building to be placed as a result of traditional handicrafts and sales. Cultivate herbal plants. R22: Create a recreational place related to the environment, especially the Moyog river (Mongkusilad). Suitable for development of homestay, camping site, and guesthouse.
Early tourism development	R1: The tagal system is used as a rural tourism theme. In addition to picnic and pedestrian (hiking) places. R2: Infrastructure, communication and public facilitation have to be set up. R8: Share with the residents the efforts that will be implemented in the future. R17: Entrepreneurs need to know the SOP and requirements of local authorities. This plan also requires support from local residents.
Stage 3. Explore, involve, and develop: Forge a support network	
Broad implementation	R4: Introduction of tourism benefits in the village. Need to give awareness to the youth to open up their minds to cultivate their own lands. Also, it is important to give a workshop on how to start and give basic knowledge about the activities being undertaken. R6: Preparation of local plans, invigorating strategy for tourism, and cooperation with local authorities. R11: Group mutual cooperation through women's cooperatives and youth development. R22: Develop tourism places based on nature. Make homestay and guesthouse. Introduce local food, plant paddy fields, cook and prepare local food.
Government roles	R4: Provide courses, advisory services, and funding for tourism beginners.

Themes	Sub-themes and excerpts of inductive coding
	R10: Provide expert assistance in terms of briefings, courses and infrastructure in the community. R11: Identify the space, location, and potential of the village people who have interests and commitments but they have no funds. R17: Simplify license approval matters. R21: Set up special committee at district level to help potential village candidate.

For confidentiality, R# denotes each respondent code used during the data collection.
Source: Author data (2024)

Results of focus group discussion

The focus group discussion was conducted in two stages. The first session was 'Development potentials of Moyog Agroindustry and Tourism Park in upper Moyog areas, Penampang.' The invited panel speaker was Ts. Mr. Alexander G. Gumisi, a trained engineer of more than 26 years. The speaker has worked 12 years in Penampang district council before he moves to Keningau district council. The speaker thoroughly explained about the potentials of developing the Moyog areas by sharing various product attraction and ongoing tourism activities in several villages located in Moyog areas. There are Integrated Agricultural Development Project (IADP) such as the development of the Agricultural Station Babagon (15.4 hectares) that produces quality agricultural yield and promotes agro-tourism. The Moyog areas are blessed with beautiful river and natural forests that offer memorable experiences of picnic, nature, and swimming along the Moyog river.

Importantly, Sabah Structure Plan (SSP 2033) has suggested that Penampang becomes a prime region for conservation tourism. A focus group discussion was first conducted in November 2023 to outline Penampang Development Plan (2023-2035). Several recommendations were raised in this plan such as to develop township, water theme park, herbal and floral garden, downstream product innovation, and empower local entrepreneurs who can run quality homestay and guesthouse activities (Sampil, 2023). There were existing tourism activities conducted in Moyog areas such as: Homestay Taman Dolime; Diana homestay and camping site; Kamagi Riverside, Retreat, and Recreation; Tampasak Eco Trill Hiking; Tintap Riverside View; and Poropok homestay.

Further question and answer session during the present FGD revealed that participants required assistance in identifying suitable product development for their lands. A few participants already initiated tourism activities but planning to expand their activities. They also highlighted the lagging tourism revenues after the COVID-19 pandemic. Hence, this session underscores the importance of identifying tourism product, increasing tourism skills, and learning marketing strategies.

The second session discussed an approval procedure for development plan (DP) and building plan (BP) for Moyog Agroindustry and Tourism Park. The lecture was delivered by Madam Darlene Robert Golumis, an engineer from the District Office of Penampang. Panel highlighted that the Moyog areas held wonderful nature-based attraction for tourists. Unfortunately, not many efforts were done to explore and promote this area. It was critical that the land owners needed to work concurrently with consultant for any CBT project to be implemented successfully. Here, consultants are professional and certified architecture that helps prepare interim and detail development plans for the land owners. Thorough assessment for each application involves Sabah Town and Regional Planning Department, Fire and Rescue Department of Sabah, Sabah Public Works Department, and Sabah local authorities (i.e., Pihak Berkuasa Tempatan). During this talk, two consultants known as Bisoni Architect and JK Architect were also invited to share their consultation experiences in preparing and solving issues of DP and BP.

In the second session, many matters raised by the participants related to financial costs in getting DP and BP done and the rates for hiring consultants. The panels reassured the participants that budget should not be a problem and anyone can get a free consultation before they decide in doing DP and BP. It is also important to note that improper conduct of DP and BP leads to failure in getting valid development license from the Sabah authority. A good suggestion has been proposed for the MANTAP management team to apply for a less stringent license procedure from the Sabah authority. This session reveals that both finance and license are critical matters for the tourism development to take place in this region.

DISCUSSION

Using a social exchange theory (Chi et al., 2018; Kang & Lee, 2018) and life cycle tourism development (Getz, 1992), a unified approach for examining the links between local support for tourism was established and confirmed in the context of early tourism development. The present results demonstrated that local inhabitants' positive perceptions of tourism had a considerable impact on their support for tourism. Strategies incorporating the stakeholder views are proposed to implement MANTAP tourism plan in upper Moyog areas.

Local support correlate with perceived tourism benefits

In this study, all participants are 100% native Kadazan Dusun people and the majority of respondents (56.5%; 13 people) are yet to experience actual tourism benefits. However, their supportive attitudes are commendable. Qualitative studies must incorporate demographic backgrounds (e.g., age, race, and working experience) of the respondents because their identities shape their unique experiences, beliefs, and behaviours (Jensen et al., 2013). Further investigation

shows early awareness creation conducted through the plenary talks has effectively inspired the participants to participate in this tourism venture. Native-born residents have a high awareness of both positive and negative impacts of tourism (Dedeoğlu et al., 2021). People's attitudes towards tourism development vary depending on whether or not they benefit from tourism, indicating the present study has consistent findings with the SET concept (Qin et al., 2021; Chi et al., 2018).

Notably, the Moyog Agroindustry and Tourism Park (MANTAP) is in infancy development, but the participants able to relate high tourism potential benefits by observing ongoing tourism activities in this region. In particular, 56.5% of respondents have no experience in tourism, but they are able to relate nature-based tourism potentials in this area. Most participants state the promising attraction of nature-based products such as natural river and pristine forest, including agricultural-based products. The nature-based attraction offered by the MANTAP tourism, such as 'Babagon Riverside Village Chalet and Campsite' and 'Kamagi Riverside Retreat and Recreation' offer countryside healing for many tourists who want to escape busy city lives. Previous studies support this notion; Engaging with nature can alleviate stress, promote relaxation of the autonomic nervous system, and boost happy emotions (Kou et al., 2024; Komppula et al., 2017).

The native people have encouraging views about tourism advantages in this region. Nevertheless, as tourist influx proliferate with the development of tourism, they anticipate that this business will increase the amount of garbage. The results imply native residents exhibit sensitivity to socio-economic effects to which they are exposed, albeit in indirect ways. Worldwide negative impacts of tourism development are illustrated well by many scholars – at early stage, tourism diminishes environmental problems, but exacerbates it as tourism activities intensify (Ehigiamusoe et al., 2020).

The way forward: Implications for Moyog rural area development

This section explains what strategies are required to succeed early tourism planning in upper Moyog areas. How can this place offer a whole atmosphere of countryside authenticity? In the near future, the implementation initiatives of Moyog Agroindustry and Tourism Park help fulfilled the Sabah Structure Plan 2033 and Penampang District Strategic Development Plan (2024-2035).

With the increasing popularity of CBT as a panacea for rural poverty and unemployment (Woyo & Musavengane, 2023), the level of poverty declines in areas where CBT thrives in terms of economic, social, and environmental benefits. Interestingly, the development of tourism MANTAP projects highlights that demonstrating tourism benefits is the first critical action required before other actions are implemented. The findings indicate that the native people must be able to envision themselves as part of the tourism beneficiaries and understand

how the development will impact their village as a whole. This criterion is followed by evaluating their needs and plans to develop their land for the MANTAP programs. These two crucial determinants should be followed by investigating how strong leadership can promote followership in early tourism planning. Demonstrating tourism benefits and good leadership are project legitimacy, which confers credibility, trust, stakeholder support, and access to essential resources for tourism operational purposes (Mwesiumo et al., 2022). More importantly, the current findings reveal that native people oppose tourism ideas because they do not understand their role in the overall tourism planning, underscoring the urgent need to establish 'benefit awareness' prior to implementing other tourism initiatives in the early stages of tourism development.

The development concept of MANTAP tourism aspires for the community to take charge of and have ownership over tourism activities, with the primary focus being to benefit the community itself. Therefore, the results indicate that MANTAP should adopt community-based tourism (CBT), as it is still in its early stages of tourism development. The identification of early tourism benefit awareness, local needs and plans, and strong leadership in the present study is well supported by global CBT projects (Hatipoglu et al., 2020; Dodds et al., 2018). Several pertinent factors of successful CBT are local management and empowerment of community members, collaboration and partnerships that facilitate connections to the tourism market, the establishment of environmental and community objectives, and support from enablers such as the government, funding institutions, and the private sector (Hatipoglu et al., 2020; Dodds et al., 2018). In the Upper Moyog area, CBT will transcend the sharing of culture and traditional knowledge between the native people here and tourists in the context of local customs, beliefs, and livelihoods. The local-tourist interaction can promote the preservation of native values while generating revenue for village residents.

Tourism development in upper Moyog areas can be materialised by incorporating native people attitudinal and perspectives in developing the CBT. The attraction in MANTAP areas can be developed using mixed tourism products, but it should be developed based on ‘one village one product’ (OVOP) concept to prevent competing with another village (Koswara et al., 2020). Product development must consider the strength of each village in terms of local support, village attraction, and native people ability to handle tourism services. Most respondents propose handicrafts, homestay, guesthouse, camping site, glamping, herbal garden, traditional dance, music performance, and hiking trail. The Moyog river areas are known for Tagal system (i.e., prohibition in the Dusun language) to protect aquatic river species. This is an added product value to nature-based product that can be offered in this region.

Apart from instilling project legitimacy, the development of the MANTAP project will greatly benefit from forging a support network (Mwesiumo et al., 2022). Tourism planning comprises seven life cycles, namely exploration, involvement, development, consolidation, stagnation, decline, and rejuvenation (Getz, 1992). This study shows the three stages—exploration, involvement, and development—of MANTAP tourism in the upper Moyog areas. The first stage is exploration, which involves identifying multiple tourism benefits provided by the MANTAP plan. In this study, why is it important to identify tourism benefits and then only explore local needs and plans? The interview findings indicate that the native people are highly concerned about the benefits they expect from the anticipated tourism activities. On-site visits show that natives' resistance is higher when they are unable to see how they can benefit from tourism development in their villages. The advantages of tourism include social development such as the expansion of road access, increased job opportunities and incomes, and community entrepreneurship. Environmental advantages encompass safeguarding flora and fauna, adhering to proper planning and EIA regulations, and avoiding large-scale tourism.

The second stage is exploration and local involvement. The strength of MANTAP tourism plans is that the implementation is spearheaded by leaders who have extensive experience in development and financial management without relying on the local authority assistance at the early tourism development. The informants emphasise the importance of communicating the tourism benefits and plans to their villages prior to the actual implementation. They demonstrate efforts to understand the standard operating procedure (SOP) and local authority requirements necessary for tourism development. These findings indicate three important enabling factors: the strength of locally empowered leadership; a collaborative approach that seeks to involve local residents in the decision-making process through active information sharing; and that the tourism initiatives meet all necessary regulations and standards. Notably, well-defined benefit distribution, power sharing, regulation, and local leadership contribute to successful CBT implementation (Dodds et al., 2018; Woyo & Musavengane, 2023).

The third stage entails exploration, involvement, and development stages after the initiation of MANTAP plans. This stage signals the importance of a strong support network for the MANTAP development (Figure 2). In this light, there are three enabling factors: working with local authorities; fostering group mutual cooperation through women's cooperatives and youth development; and establishing a special committee at the district level to assist potential native people who have land for development but lack funds. A robust support network directly benefits the community by providing expert assistance in areas such as tourism skills, advisory services, license approval, and funding support for novice tourism operators. This result speaks volumes about the availability, capacity, and

resources owned by the local people in this region, particularly in terms of funds and knowledge of how to do tourism business in the early development stage. When communities lack knowledge about tourism, have financial constraints, and have negative perceptions of tourism businesses, it distorts local participation and the positive impacts of CBT development (Azwar et al., 2023).

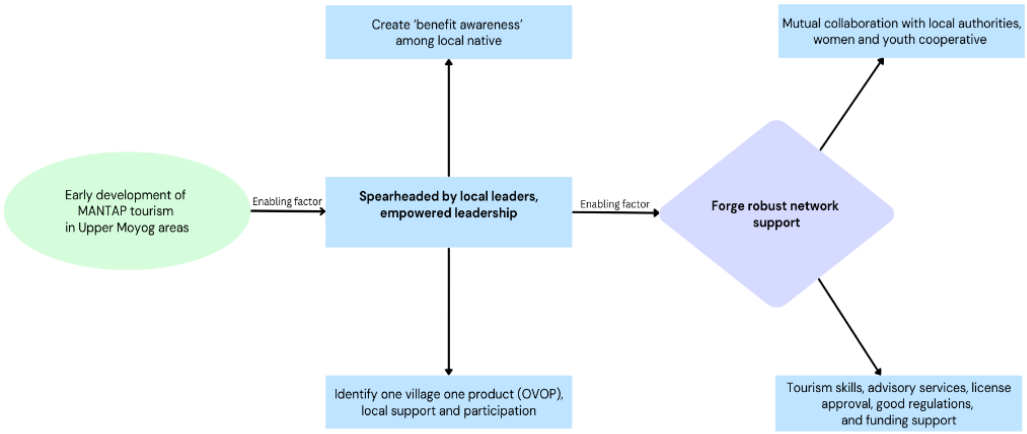


Figure 2: Enabling factors to navigate early development of MANTAP tourism in upper Moyog areas.
Source: Author data (2024)

CONCLUSION

Despite the fact that 56.5% of the Kadazan Dusun study participants have yet to experience tangible benefits from tourism, their supportive attitudes are notable. The Moyog Agroindustry and Tourism Park (MANTAP), still in its early stages, showcases the potential for high tourism benefits. The study emphasises the importance of sustainable tourism projects that promote economic, social, and environmental sustainability (SET concept). This study underscore two important practical implications. First, demonstrating tourism benefits early on is crucial for gaining native people's support and involvement. Second, strong leadership and project legitimacy, which foster credibility and access to resources, are also essential. The MANTAP tourism concept aims for community ownership and management of tourism activities, focusing on benefiting the local population. In the upper Moyog areas, CBT can protect native values while generating revenue, with traditional activities and nature-based products enhancing the tourism offering. Establishing a support network and inclusive planning processes are vital for the implementation of the MANTAP project. Future work will focus on implementing CBT concepts derived from this study to inspire more native people involvement in the MANTAP plans.

ACKNOWLEDGEMENT

We express our gratitude to the Sabah Tourism Board for providing the funding (Grant LPS2411) necessary for the CoBT development of MANTAP in the upper Moyog areas. We acknowledge the Institute for Tropical Biology and Conservation, Universiti Malaysia Sabah, for providing the support to complete this study. We extend our appreciation to the organiser and all participants in the Moyog Agroindustry and Tourism Park (MANTAP) program.

REFERENCES

Azwar, H., Hanafiah, M. H., Abd Ghani, A., Azinuddin, M., & Shariffuddin, N. S. M. (2023). Community-Based Tourism (CBT) moving forward: Penta helix development strategy through community local wisdom empowerment. *Planning Malaysia 21*(1), 72-88.

Chi, C. G. Q., Ouyang, Z., & Xu, X. (2018). Changing perceptions and reasoning process: Comparison of residents' pre-and post-event attitudes. *Annals of Tourism Research* 70, 39-53.

Dedeoğlu, B. B., Karakuş, Y., Çalışkan, C., & Aydın, Ş. (2023). A complexity perspective for antecedents of support for tourism development. *Journal of Hospitality and Tourism Insights 6*(1), 191-221.

Dodds, R., Ali, A., & Galaski, K. (2018). Mobilising knowledge: Determining key elements for success and pitfalls in developing community-based tourism. *Current Issues in Tourism 21*(13), 1547-1568.

Ehigiamusoe, K. U. (2020). Tourism, growth and environment: Analysis of non-linear and moderating effects. *Journal of Sustainable Tourism 28*(8), 1174-1192.

Getz, D. (1992). Tourism planning and destination life cycle. *Annals of Tourism Research 19*(4), 752-770.

Hatipoglu, B., Ertuna, B., & Salman, D. (2022). Small-sized tourism projects in rural areas: The compounding effects on societal wellbeing. *Journal of Sustainable Tourism 30*(9), 2121-2143.

Jensen, R. E., Christy, K., Gettings, P. E., & Lareau, L. (2013). Interview and focus group research: A content analysis of scholarship published in ranked journals. *Communication Methods and Measures 7*(2), 126-133.

Kang, S. K., & Lee, J. (2018). Support of marijuana tourism in Colorado: A residents' perspective using social exchange theory. *Journal of Destination Marketing & Management* 9, 310-319.

Komppula, R., Konu, H., & Vikman, N. (2017). Listening to the sounds of silence: Forest-based wellbeing tourism in Finland. In *Nature tourism* (pp. 120-130). Routledge.

Koswara, I., Gemiharjo, I., & Erlandia, D. R. (2020). Rural tourism development as a one village one product (OVOP) approach in West Bandung Regency. *Jurnal Ilmu-ilmu Sosial dan Humaniora 22*(3), 319- 324.

Kou, L., Wei, C., Chi, C. G., & Xu, H. (2024). Understanding sensescapes and restorative effects of nature-based destinations: a mixed-methods approach. *Journal of Sustainable Tourism* 1-23.

Larson, K., Grudens-Schuck, N., & Allen, B. L. (2004). Can you call it a focus group? Methodology Brief. Iowa State University. [http://www.extension.iastate.edu/

Publications/PM1969A.pdf]

Lemon, L. L., & Hayes, J. (2020). Enhancing trustworthiness of qualitative findings: Using Leximancer for qualitative data analysis triangulation. *The Qualitative Report 25*(3), 604-614.

Mayaka, M., Croy, W. G., & Cox, J. W. (2018). Participation as motif in community-based tourism: a practice perspective. *Journal of Sustainable Tourism 26*(3), 416-432.

Mwesiumo, D., Halfdanarson, J., & Shlopak, M. (2022). Navigating the early stages of a large sustainability-oriented rural tourism development project: Lessons from Træna, Norway. *Tourism Management* 89, 104456.

Pimid, M., Marzuki, A., Scian, J., & Krishnan, K. T. (2023). Rural development: motivational factors impacting community support for rural tourism. *Planning Malaysia 21*(6), 408-424.

Qin, X., Shen, H., Ye, S., & Zhou, L. (2021). Revisiting residents' support for tourism development: The role of tolerance. *Journal of Hospitality and Tourism Management* 47, 114-123.

Sabah Tourism Board (2024). About Sabah: Sabah, best of Borneo. https://sabahtourism.com/essential/about-sabah/

Sampil, S. (2023). Focused group discussion for Penampang Development Plan (2023-2035).

Sastropoetro, S. (1986). Partisipasi, komunitas, persuasi, dan disiplin dalam pembangunan nasional, alumni, Bandung.

Vears, D. F., & Gillam, L. (2022). Inductive content analysis: A guide for beginning qualitative researchers. *Focus on Health Professional Education: A Multi-Professional Journal 23*(1), 111-127.

Weller, S. C., Vickers, B., Bernard, H. R., Blackburn, A. M., Borgatti, S., Gravlee, C. C., & Johnson, J. C. (2018). Open-ended interview questions and saturation. *PloS One* 13(6), e0198606.

Woyo, E., & Musavengane, R. (2023). Has community-based tourism been a useful tool for poverty eradication in Southern African rural destinations? *African Journal of Hospitality, Tourism and Leisure 12*(2), 521-534.

Xin, C., Luyuan, L., & Pieter, U. (2020). Taking "social relations" as a cultural ecosystem service: A triangulation approach. *Urban Forestry & Urban Greening 55* 126790.

Received: 30th March 2024. Accepted: 10th September 2024

PLANNING MALAYSIA:
Journal of the Malaysian Institute of Planners
VOLUME 22 ISSUE 5 (2024), Page 482 – 494

NON-TIMBER FOREST AS AN ALTERNATIVE ECONOMIC SURVIVAL FOR INDIGENOUS COMMUNITY IN TERENGGANU, MALAYSIA: A CASE STUDY OF RATTAN

Mohamad Pirdaus Yusoh[1], Muhammad Fuad Abdullah[2], Mohd Nazip Suratman[3], Mohammad Nasrul Hakim Roslan[4] & Badli Esham Ahmad[5]

[1]Borneo Institute for Indigenous Studies,
UNIVERSITI MALAYSIA SABAH
[2]Faculty of Business and Management,
[3]Faculty of Applied Sciences,
[4]Academy of Contemporary Islamic Studies,
[5]Academy of Language Studies,
[2,3,5]Institute for Biodiversity and Sustainable Development,
UNIVERSITI TEKNOLOGI MARA

Abstract

Rattan holds significant prominence as a non-timber forest product, primarily distributed and extensively traded within the Southeast Asian region. This research aims to examine the role of rattan as non-timber forest products (NTFPs) and to explore the significant economic value of rattan, in providing economic sustenance for the Orang Asli communities. The study is a case study with a mix method approach where 95 Orang Asli respondents from Kampung Sungai Berua, Hulu Terengganu, Malaysia participated. The collected data was analyzed by economic value analysis. The study found that the economic value of rattan is RM34224 per year where the highest monthly income earned by the Orang Asli is RM600 and the lowest is RM70 for each type of rattans. The Orang Asli community rely on rattan for a variety of purposes, which include selling them as raw materials, or personal use for craftsmanship, cultural practices, and the production of tools and equipment. As such, this study emphasizes the necessity of striking a balance between economic, ecological, and cultural considerations in harnessing the potential of rattan and other NTFPs to support the livelihoods and cultural heritage of Orang Asli communities.

Keywords: Natural resources, traditional knowledge, socioeconomic, Orang Asli, survival

[1] Senior Lecturer at Universiti Teknologi MARA. Email: fuad.abdullah@uitm.edu.my

INTRODUCTION

The forestry sector is an important source of socioeconomic development in Malaysia. Socioeconomic activities can be defined as activities that involve the community in the field of economics and cover economic and social factors (Rahim, W. R. W. A., & Idrus, R. M., 2019). It is also a study related to the relationship between economic activities and social life. The term forest community simply means the management of a group of trees by a group of people who have a common goal (Abdul Rahim, W. R. W., 2019). Community forestry is defined as the control and utilization of local community profits from local forest resources. This profit is not only from wood production but has various values and benefits that can be obtained from the forest ecosystem, including cultural, spiritual, social, health, ecological, recreational, aesthetic, and economic (Curran et al., 1999)

Community forestry is a prevalent practice among indigenous populations, specifically the Orang Asli in Malaysia, who rely heavily on forests for their sustenance. This approach entails the allocation of specific portions of state forests to local communities that have historically utilized and maintained these areas, regardless of political demarcations. The Orang Asli community is granted complete autonomy in making decisions pertaining to forest management, utilization, and financial allocation (Abdullah et al., 2019). All revenues generated from the forest are directed towards forestry initiatives and local development endeavours.

The Orang Asli community is indigenous to Peninsular Malaysia, a minority group of only 209,575 people, which is 0.7 percent of the total Malaysian population. The indigenous people in Peninsular Malaysia are divided into three large groups, namely Negrito, Senoi, and Proto Malay. Each group is then divided into six small tribes, totalling 18 tribes, according to their culture, language, religion, economy, social organization, and physical characteristics 2022 according to (JAKOA, 2023).

However, in an effort to overcome the rapid development gap with mainstream society, the Orang Asli community is placed at all levels of development, starting from the most basic of their lives up to the community that has developed on par with mainstream society. Traditionally, Orang Asli community have relied on hunting and gathering activities, utilizing natural resources for their sustenance and cultural practices (Abdullah et al., 2023). The utilization of natural resources is an integral part of their traditional culture, playing a crucial role in their daily routines, including hunting, fishing, agriculture, construction, handicraft production, and medicinal practices for minor ailments (Abd Kadir et al, 2023). Previous studies have examined the utilization of plants, animals, and aquatic species by various indigenous communities, highlighting the significance of these natural resources in their

lives. These studies provide a comprehensive understanding of the close relationship between Orang Asli communities and their natural environment (Abdullah et al, 2021). Consequently, any changes in the environment can have profound impacts on the livelihood strategies of these communities, and conversely, alterations in their livelihood strategies can also affect the natural environment (Diansyah et al, 2022). The process of modernization and land development, in particular, has a significant impact on the symbiotic relationship between communities and nature. The Orang Asli community is not exempted from these effects (Abdullah et al., 2021). Figure 1, indicates the studies location at Kampung Sungai Berua, Hulu Terengganu, Malaysia.

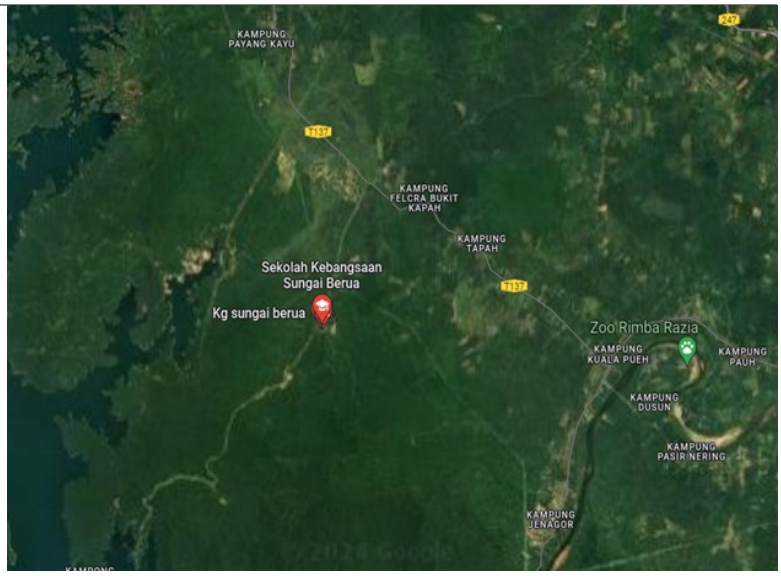


Figure 1: Location of the study area
Kampung Sungai Berua, Hulu Terengganu, Malaysia
Source: Google Maps, (2024)

LITERATURE REVIEW

Non-timber forest product

Non-timber forest products refer to all physical animal and plant-based commodities, excluding industrial timber, that can be harvested from forests for both subsistence and commercial purposes (Ros-Tonen,2000). Non-timber Forest Products (NTFPs) is a concept that refers to natural products obtained from Malaysian forests, other than logs. Malaysia has vast and diverse tropical

rainforests, which produce a wide variety of flora and fauna that have economic, social, and ecological value (Svarrer, 2005, Yusoh et al., 2023). These non-timber forest products play an important role in the economy and social life of rural communities in Malaysia, often produced and collected by local communities (LaFrankie, 1994). Non-timber forest product categories include herbs and medicinal plants, forest fruits, rubber and latex, rattan and woven materials, honey, natural fibers, livestock products, and more. It is important to manage non-timber forest resources wisely and promote sustainable harvesting to protect the country's natural wealth and ensure the quality of life of local communities. Malaysian government authorities have imposed controls and regulations to protect non-timber forest resources and control illegal logging, as well as promote the development of sustainable non-timber forest industries. In addition, Malaysia's biodiversity and non-timber forest resources are important in global efforts to preserve biodiversity and combat climate change (Tedong, 2022).

Rattan

Rattan, a plant native to tropical regions, holds significant importance as a renewable non-timber forest product in Malaysia. Its utilization extends to various countries including Indonesia, the Philippines, China, Bangladesh, Sri Lanka, Myanmar, and India. Rattan is renowned for its diverse applications in both industrial and domestic settings (Saifullah et al.,2018) . The design of rattan furniture, particularly the incorporation of loungers or swings, gained immense popularity from the 1960s to the late 1990s due to its aesthetic appeal.

This furniture has come to symbolize traditional Malaysian homes, transcending racial boundaries. Moreover, it has long been associated with the vibrancy of rural communities and has undeniably become an indispensable non-wood product manufactured in Asia (Lim et al.,1994). The material's strength and flexibility make it a preferred choice for crafting furniture and handicrafts. The production of rattan primarily revolves around product design, production methods, and the individuals involved in the manufacturing process. However, the availability of resources poses a significant challenge to the production of these items. In terms of its properties, rattan exhibits versatility, enabling further advancements in product development. Furniture, carpet beaters, and walking sticks are commonly crafted using larger-diameter rattan, while mats, baskets, traps, animal cages, and coarse wickerwork are made using smaller-diameter rattan (Kodoh et al., 2009). The National Forestry Policy 1987 (Amendment 1992) has outlined the need for non-timber forest resources to be managed on a sustainable basis to guarantee the interests of industries based on these resources. The bamboo planting project is an effort by the Forestry Department of Peninsular Malaysia to introduce non-timber products that have the potential to be commercialized. Permanent forest reserves have been managed based on the

concept of sustainable forest management since the beginning of the 20th century. Nowadays, with the shift in the demand and wishes of the general public for various forest products and services, the concept of sustainable forest management has been expanded to include other areas such as forest protection functions and the production of non-timber products (Forestry Department of Peninsular Malaysia. ,2023).

The scenario of Orang Asli in Malaysia

The Orang Asli community, indigenous to Peninsular Malaysia, has a unique cultural and socioeconomic significance, relying historically on forests for sustenance (Hazlan et al,.2022; Yusoh et al.,2022). This reliance on natural resources, especially NTFPs like rattan, signifies the critical connection between the community and its environment (Abdullah et al., 2020). However, challenges such as resource availability affect its production, emphasizing the need for sustainable management and utilization of these NTFPs. However, Unsustainable harvesting practices may contribute to habitat destruction. Clear-cutting or destructive harvesting methods can disrupt the ecosystems where these resources grow, affecting not only the target species but also other flora and fauna in the area. Furthermore, Communities dependent on non-timber forest products may face poverty and livelihood pressures, leading to unsustainable harvesting practices as they prioritize immediate economic needs over long-term sustainability (Abdullah et al., 2020). To overcomes this issue, the Orang Asli needs to broaden their range of economic well-being sources by incorporating various NTFPs in addition to rattan which also has the market value. This strategy not only mitigates the risks associated with relying solely on one resource but also plays a significant role in preserving biodiversity. The hypothesis of this study is the Orang Asli community greatly benefits from the presence of rattan, as it serves as a significant source of income that can either be their main or supplementary source, thereby contributing to their economic well-being. The study underscores the importance of preserving biodiversity, combatting climate change, and promoting sustainable harvesting of non-timber forest products for the well-being of both the Orang Asli community and the environment on a broader scale. The study intends to delve into the intricate relationship between the forestry sector, indigenous communities (specifically the Orang Asli in Malaysia), and the sustainable utilization of rattan as NTFPs. Thus, the principal objective of this investigation is to elucidate the considerable economic significance of rattan as a non-timber forest product within the Orang Asli community.

METHODOLOGY

This study constitutes an exploratory research initiative conducted within Kampung Sungai Berua, Hulu Terengganu, situated on the East Coast of Peninsular Malaysia and designated as an Orang Asli resettlement village. The study employed a mixed method approach, utilizing rapid rural appraisal and unstructured interviews. The purposive sampling had been used to 93 out of 95 heads of households (HoH) representing the Semaq Beri and Bateq tribes who have significant knowledge and experience with rattan use. to collect data from. The data acquisition process encompassed direct household interviews through a well-structured questionnaire, designed to extract information regarding the identity of the rattan collector among the Orang Asli and other pertinent variables.

Subsequently, the collected data underwent rigorous quantitative analysis, integrating field participation observations and questionnaire responses. The determination of rattan's annual economic value as a component of NTFPs was achieved through the prescribed formula below:

2.1 The average number of NTFPs

$$\text{The average number of NTFPs} = \frac{(\text{Xi} + \text{Xii} + \cdots \text{Xn})}{n}$$

Where:
Xi = Number of rattans taken
N = Large number of rattans collected

2.2 Total collection NTFPs per year

$$\text{TP} = \text{RJ X FP X JP}$$

Where:
TP = Total product (Total collection rattan per year)
RJ = Average number
FP = Frequency of retrieval
JP = Amount of retrieval

2.3 Economic value of NTFPs per year

$$NH = TP \times HH$$

Where:
NH = Value of forest products per type
TP = Total withdrawal (Unit/ year)
HH = Proce of forest products

2.4 The percentage of economic

$$\%NE = \frac{Nei}{(\sum NE)} \times 100\%$$

Where:
%NE = Percentage of economic value
Nei = Economic value of rattans types
ΣNE = Total economic value of all rattans

RESULTS AND DISCUSSION

Non-timber forest products (NTFPs) are intricately linked to the socio-economic and cultural aspects of the Orang Asli community, who rely heavily on forest resources. The livelihood systems of the Orang Asli, which revolve around forests, exhibit significant variations across different ethnic groups and regions, influenced by socio-cultural, historical, and ecological factors. The Orang Asli have been inhabiting forest areas for a long time, leading an isolated existence from mainstream society. The people's lifestyle is characterized by a harmonious and symbiotic relationship with nature. The impoverished state of the majority of the Orang Asli community can be attributed to their reliance on income derived from forest resources, a practice that has been ingrained in their traditions for an extended period. Typically, they venture into the adjacent forests to procure valuable yields, subsequently selling them to intermediaries.

Table 1 provides an overview of the various types of rattans with economic significance that are utilized by the Orang Asli. The highest monthly income that can be earned from rattans is RM600 which is from Manau A Grade and followed by Manau B grade which is RM300. However, the lowest is from Batu which only can contribute to RM70 per month.

Table 1: Type of rattans and income earned by the Orang Asli

No.	Type	Grade	Length (Feet)	Price per Unit (RM)	Estimation Collection for a week	Estimation Collection for a month	Monthly Income (RM)
1	Manau	A	9	3	50	200	600
2		B	9	1.5	50	200	300
3		C	9	0.5	50	200	100
4	Mantang	A	9	1.5	50	200	300
5		B	9	0.8	50	200	160
6		C	9	0.5	50	200	100
7	Tanah	None	24	0.5	100	400	200
8	Kangkung	None	24	0.3	100	400	120
9	Kerai	None	24	0.3	100	400	120
10	Tawau	None	10	0.3	100	400	120
11	Batu	None	24	0.18	100	400	72
12	Saga	None	9	0.5	50	200	100
13	Semambu	None	9	0.5	50	200	100
14	Duduk	None	9	0.5	50	200	100
15	Riau	None	24	0.3	100	400	120
16	Udang	None	24	0.3	100	400	120
17	Jernang	None	24	0.3	100	400	120

The economic worth of non-timber forest products (NTFPs) is determined by the product of the aggregate annual harvests and the prevailing prices of forest commodities. The study revealed that the employment of NTFPs in Kg Sungai Berua, Hulu Terengganu resulted in an economic value of RM34224 per annum. The economic value of individual NTFP categories in a single year is presented in Table 2.

Table 2. The economic value of rattans

No.	Type	Grade	Total taking (Unit/ year)	Unit price (RM)	Economic Value (RM)	Percentage (%)
1.	Manau	A	2400	3	7200	21.04
2.		B	2400	1.5	3600	10.52
3.		C	2400	0.5	1200	3.51
4.	Mantang	A	2400	1.5	3600	10.52
5.		B	2400	0.8	1920	5.61
6.		C	2400	0.5	1200	3.51
7.	Tanah	None	4800	0.5	2400	7.01
8.	Kangkung	None	4800	0.3	1440	4.21
9	Kerai	None	4800	0.3	1440	4.21
10.	Tawau	None	4800	0.3	1440	4.21
11.	Batu	None	4800	0.18	864	2.52
12.	Saga	None	2400	0.5	1200	3.51
13.	Semambu	None	2400	0.5	1200	3.51
14.	Duduk	None	2400	0.5	1200	3.51
15.	Riau	None	4800	0.3	1440	4.21
16	Udang	None	4800	0.3	1440	4.21
17	Jernang	None	4800	0.3	1440	4.21
Total			60000	11.78	34224	100

In the local language, the activity of finding and collecting rattan is known as 'rope work' or 'wicker work'. This activity is one of the important traditional economic activities, especially for the residents of Kampung Sungai Berua, Hulu Terengganu. In fact, it is said that through this activity, they began to be exposed to the use of money, that is, after the rotan was marketed. This activity has been actively carried out by the Orang Asli community in Terengganu because there is a lot of demand for commercialization. Therefore, this economic activity has become one of the most important economic activities and a financial source for them to buy other necessities of life.

Basically, this activity of looking for rattan is done in the forest area near the residence only, taking less than 20 minutes of walking time. However, due to the lack of resources as a result of forest exploration activities for commercial oil palm plantations, the Orang Asli community has to go to more distant areas. For the Orang Asli Community of Kampung Sungai Berua, most of them will look for reeds on the upstream of Tasik Kenyir. The areas they focus on are the Kerbat River, Lepar River, Kerom River, Lawit River, Genong River, Papan River, Chenah River, Lemar River, Biwah River, Taat River, Metong River, Cicir River, Perpek River, Cacing River, and Terenggan River. The distance between these areas and their residence is estimated to take 1 to 2 hours by boat through Lake Kenyir.

If the rattan spot is far from their village, they will camp in the area for a period one to two weeks. Therefore, they will bring their family members to the area. This action allows them to find rattan more comfortably and in large quantities. However, when the rattan resources in the area are reduced, they will move to other areas. Usually, the work of finding rattan is done in groups consisting of five to ten men. However, sometimes they will bring children to give them as a learning process to the way of life in the forest. However, it is very rare for women to participate in these activities. Women will be tasked with cleaning and splitting the reeds brought home.

The types of rattan that are sought are focused on those that have commercial value. Rattans that are commonly taken by the Orang Asli community in Kampung Sungai Berua are of the Manau (Calamus manan), Matang (Plectocomia elongata), Tanah (Calamus balingcusis), Kangkung/Sabong (Calamus potystachys), Kerai (Calamus conirostris), and Tawau (Daemonorops) types. Augustiflora), Batu (Calamus Insignis), Sega (Calamus Caeesius), Semambu (Calamus Scipionum), Duduk (Calamus Sedens), Riau/Tunggal (Calamus Laevigatus), and Shrimp (Korthalisa Lociniosa) san Jernang (Daemonorops Calicarpa).

The amount of rattan obtained is not constant and closely related to the factors of individual efficiency in doing work, skills and seriousness, physical strength, and rattan resources in the area. An area is considered to have a lot of rattan resources if they can obtain a total of around 25 to 30 rattans at a time. From the aspect of how the Orang Asli community works here, even though they go out looking for rattan in groups, the results obtained are according to individuals. An efficient individual will acquire a large amount of rattan, and vice versa.

As the hunting grounds for rattan extend farther from their village, the Orang Asli community incurs escalated costs, encompassing transportation and sustenance expenditures. These circumstances impede their capacity to generate adequate funds to defray travel expenditures like gasoline and essential provisions. Consequently, they are compelled to seek financial assistance from intermediaries. A portion of the proceeds from rattan sales is allocated to debt settlement. This situation exerts significant strain on the Orang Asli community, as they are left with minimal resources to cover family expenses.

CONCLUSION

In conclusion, the economic value of rattan within the Orang Asli community in Malaysia is notably significant, establishing itself as a pivotal non-timber forest product (NTFP). Not only does rattan serve as a source of economic sustenance for the community, but its extraction also necessitates judicious and sustainable forest management practices to uphold the ecological equilibrium and safeguard

the traditional lifestyle of the Orang Asli. The sustainable harvest and utilization of raw rattan are crucial elements in ensuring the preservation of forest resources while perpetuating the invaluable cultural heritage intertwined with its extraction. By meticulously attending to these intertwined aspects—economic viability, cultural importance, and ecological sustainability—the extraction and utilization of raw rattan can be sustained, providing ongoing economic benefits to the Orang Asli community while simultaneously conserving the intricate ecological balance of the forest and preserving the cultural heritage that is deeply rooted in this essential forest resource.

ACKNOWLEDGEMENT

This study was funded through the Fundamental Research Grant Scheme (FRGS) by the Ministry of Higher Education Malaysia, titled Pembinaan Model Pengukuran Kesejahteraan Hidup Masyarakat Orang Asli Berasaskan Pendekatan Indeks Kemiskinan Pelbagai Dimensi (RMI File No.: 600-RMC/FRGS 5/3 (058/2023). The authors gratefully acknowledge the use of the services and facilities of the Institute for Tropical Biodiversity and Sustainable Development, Universiti Malaysia Terengganu. Special thanks for the permission and cooperation of the village authorities, JAKOA Sungai Berua, Hulu Terengganu

REFERENCES

Abd Kadir, N. A., Azzeri, A., Noor, M. I. M., Kefeli, Z., Abdullah, M. F., Ramlee, M. N. A., & Jaafar, M. H. (2023*). Health literacy status among community in the protected area: A protocol for systematic review and meta-analysis. Medicine 102(17)*

Abdul Rahim, W. R. W. (2019). Socioeconomic local communities associated with forest product bamboo and rattan in Kelawat Kota Belud Sabah. *Asian People Journal (APJ), 2*(1), 32-44.

Abdullah, M. F., Ahmad, B. E., Noor, M. I. M., Jamru, L. R., & Yusoh, M. P. (2023). The socioeconomics support on indigenous community in Malaysia. *Jati-*

Abdullah, M. F., Othman, A., Edo, J., & Jani, R. (2019). Multidimensional Poverty Index of Marginalized Orang Asli in Terengganu, Malaysia. Pertanika Journal of Social Sciences & Humanities, 27(2), 1241-1259.

Abdullah, M. F., Othman, A., Jani, R., Bartholomew, C. V., Pesiu, E., & Abdullah, M. T. (2020). Traditional knowledge and the uses of natural resources by the resettlement of indigenous people in Malaysia. *JATI-Journal of Southeast Asian Studies, 25*(1), 168-190.

Abdullah, M. F., Othman, A., Jani, R., Edo, J., & Abdullah, M. T. (2021). Socio-economic development and sustainable livelihood of the Orang Asli., *Resource use and sustainability of Orang Asli: Indigenous communities in peninsular Malaysia* (pp. 201-214)..

Abdullah, M. F., Pesiu, E., Noor, M. I. M., Zaini, A. A., Azzeri, A., & Abdullah, M. T. (2021). Exploring Ethnomedicine Plants used by the Indigenous Communities in Terengganu, Malaysia: Human Health and the Environment. *Malaysian Journal of Public Health Medicine, 21*(2), 409-425

Curran, D., & M'gonigle, M. (1999). Aboriginal forestry: Community management as opportunity and imperative. *Osgoode Hall Law Journal, 37*, 711.

Diansyah, M. W., Abas, A., & Sakawi, Z. (2022). Exploring the relevance of engaging the Orang Asli in Malaysia's forest management. *Frontiers in Forests and Global Change, 5*, 1019994.

Forestry Department of Peninsular Malaysia. (2023). Rattan and bamboo. Retrieved from https://www.forestry.gov.my/my/buluh-dan-rotan

Hazlan, N. N., Fitri, Z. A., Sarmin, S. N., Kusin, M., Ariff, E. A. R. E., Ahmad, B. E., ..., & Latiff, A. (2022). Wild Fruit Trees in Kuala Keniam at Taman Negara, Pahang, Malaysia. In *IOP Conference Series: Earth and Environmental Science (Vol. 1019, No. 1, p. 012043)*. IOP Publishing.

JAKOA. (2023). Ethnic Distribution of Native People by Ethnicity/Sub-Ethnicity by State. Retrieved from https://www.jakoa.gov.my/orang-asli/taburan-etnik-orang-asli-mengikut-etnik-sub-etnik-mengikut-negeri/

Kodoh, J., Mojiol, A. R., & Lintangah, W. (2009). Some common non-timber forest products traded by indigenous community in Sabah, Malaysia. *Journal of Sustainable Development, 2*(2), 148.

LaFrankie, J. V. (1994). Population dynamics of some tropical trees that yield non-timber forest products. *Economic Botany, 48*, 301-309.

Lim, H. F., Vincent, J., & Woon, W. C. (1994). Markets for non-timber forest products in the vicinity of Pasoh Forest Reserve, Malaysia: preliminary survey results. *Journal of Tropical Forest Science, 502-507*.

Rahim, W. R. W. A., & Idrus, R. M. (2019). Importance and uses of forest product bamboo and rattan: Their value to socioeconomics of local communities. *International Journal of Academic Research in Business and Social Sciences, 8*(12), 1484-1497.

Ros-Tonen, M. A. (2000). The role of non-timber forest products in sustainable tropical forest management. *Holz als Roh- und Werkstoff, 58*(3), 196-201

Saifullah, M. K., Kari, F. B., & Othman, A. (2018). Income dependency on non-timber forest products: empirical evidence of the indigenous people in Peninsular Malaysia. *Social Indicators Research, 135*, 215-231.

Svarrer, K., & Olsen, C. S. (2005). The economic value of non-timber forest products—a case study from Malaysia. *Journal of Sustainable Forestry, 20*(1), 17-41.

Tedong, P. A., Abdullah, M. F., Jani, R., & Md Dali, M. (2022). Multidimensional poverty and wellbeing of Iban community in East Malaysia. *Asia Pacific Journal of Social Work and Development, 32*(2), 113-130.

Yusoh, M. P., Dering, N. F., Mapjabil, J., Abdul Latip, N., Kumalah, M. J., Mohd. Noor, H., & Hanafi, N. (2022). ASSESSMENT OF PAYMENT RATES AND WILLINGNESS TO PAY AT TOURIST DESTINATION - A COMPARISON BETWEEN KUNDASANG AND KOTA BELUD, SABAH, MALAYSIA. *PLANNING MALAYSIA*, *20*(23). https://doi.org/10.21837/pm.v20i23.1148

Yusoh, M. P., Abdul Latip, N., Hanafi, N., Hua, A. K., Zakaria, Z., & Mohamad Ridzuan, M. I. (2023). SOCIAL CARRYING CAPACITY AS A PLANNING TOOL FOR SUSTAINABLE TOURISM: A CASE OF PANGKOR ISLAND, PERAK, MALAYSIA. *PLANNING MALAYSIA*, *21*(28). https://doi.org/10.21837/pm.v21i28.1329

Received: 10th March 2024. Accepted: 17th July 2024

PLANNING MALAYSIA:
Journal of the Malaysian Institute of Planners
VOLUME 22 ISSUE 5 (2024), Page 495 – 509

COVID-19'S IMPACT ON FOOD STALL WORKERS: NIGHT MARKETS' RESILIENCE IN PENANG, MALAYSIA

Lim Lay Lm[1], Mohammad Javad Maghsoodi Tilaki [*2], Asyirah Abdul Rahim[3], Massoomeh Hedayati Marzbali[4]

[1]*Geography Section, School of Humanities,*
UNIVERSITI SAINS MALAYSIA
[2,3] *Geoinformatic Unit, Geography Section, School of Humanities,*
UNIVERSITI SAINS MALAYSIA
[4] *Department of Urban and Regional Planning, School of HBP,*
UNIVERSITI SAINS MALAYSIA

Abstract

The COVID-19 pandemic has left an enduring mark on Southeast Asia, with lasting repercussions on financial markets, employment, and gender equality in the workplace. Various activities were halted in order to curb the virus's spread, which dealt a severe blow to Malaysia's thriving economy. The informal sector, a cornerstone of the Asia-Pacific service industry, felt these effects acutely, as it heavily relies on informal workers. Given that more than three quarters of Malaysia's service sector comprises informal workers, the country's economic recovery is now significantly reliant on this workforce. Considering the contribution of the informal sector to Malaysia's food market, this study aims to explore the impact of social shocks and economic crises on the resilience of informal workers during the COVID-19 pandemic. Using a multistage probability sampling method, the study employed a questionnaire survey involving Penang's food stalls in night markets. Findings reveal significant variations in workers' lifestyles, attitudes, and family dynamics. Gender-related factors also exert a substantial influence on their behavior, attitudes, and engagement levels. While many studies have examined night markets as tourism spots in terms of how to increase sales or attract visitors, this study is among the first to focus on the vendors themselves, exploring the impact of COVID-19 on food stalls as an unseen vulnerable community.

Keywords: informal sector, food stall, night market, vulnerable communities, crisis preparedness, Malaysia

[1] Mohammad Javad Maghsoodi Tilaki, Email: maghsoodi@usm.my

INTRODUCTION

Malaysia's economy depends heavily on the informal sector, significantly contributing to employment. Despite economic advancements, informal employment remains substantial. The proportion of the workforce employed by unregistered firms slightly increased from 9.2% (1.0 million workers) in 2011 to 9.3% (1.3 million workers) in 2019. Informal employment, including jobs without social protection, constituted approximately 16.8% (2.5 million workers) of total employment in 2019, rising to 23.2% (3.5 million people) by 2021 (DOSM, 2022).

The retail trade and the food and beverage sectors are key components of Malaysia's economy, contributing 46.2% and 18.0%, respectively, to related activities (DOSM, 2020). Food stalls in streets and night markets, known as *pasar malam*, are vibrant elements of the informal sector, offering affordable venues for locals and tourists to explore local food, crafts, and culture. These markets are not just commercial centers but also cultural hubs that promote local heritage and community ties (Chan, 2023).

Unlike permanent shops, night markets typically operate once or twice a week, with vendors traveling between districts. These vendors, part of the informal economy, face unique challenges, especially during crises like the COVID-19 pandemic. While the pandemic accelerated the shift to remote work and the use of digital platforms, the lack of digital skills and social security protection for self-employed individuals and informal sector workers heightened their vulnerability. As of June 2021, the Social Security Organization reported that only 6.5% of the 2.5 million self-employed workers were registered under the Self-Employment Social Security Act 2017 [Act 789], underscoring the severity of the issue (Ministry of Finance Malaysia, 2021).

COVID-19 significantly impacted Malaysia's informal food sector, affecting restaurants, cafes, food stalls, and night market vendors. The Movement Control Order (MCO) disrupted supply chains and forced night markets to close, causing a dramatic drop in sales and considerable socio-economic vulnerabilities (Gerard et al., 2020; Ramli & Jamri, 2021). Although markets were allowed to resume on June 15, 2020, many vendors delayed reopening due to stringent Standard Operating Procedures (SOPs) and reduced customer turnout. Concerns about crowded spaces further declined attendance and sales (Ramli & Jamri, 2021). Post-pandemic, vendors face financial challenges as the cost of living has surged, with food prices rising by up to 20% (Aziz, 2023).

The lack of a crisis preparedness scheme exacerbated the challenges faced by informal workers, who received inadequate support during the pandemic. Limited access to job placement services, education, skill development, and insurance increased economic inequality, reduced incomes, and heightened poverty and indebtedness (Gururaja & Ranjitha, 2022; Martínez & Young, 2022; Samat et al., 2024). This financial strain elevated stress levels,

impacting vendors' ability to manage family affairs, their marketing, and customer relations (Mansourihanis et al., 2024). Night markets and food stalls foster social cohesion and contribute to informal economic vitality, creating entrepreneurial opportunities and enhancing food security (Halim, 2022). However, research on the resilience of vendors during crises is limited. Existing studies focused on night markets as tourist destinations, addressing sales enhancement and logistical management. This study aims to investigate the impact of COVID-19 on food stalls and night market vendors, examining their socio-economic and personal attitude preparedness, coping strategies, and potential for recovery post-crisis. By focusing on informal workers in the food industry, this research investigates the changes in the behaviors and attitudes of food stall vendors in the night markets of Penang during the COVID-19 crisis.

LITERATURE REVIEW

COVID-19 in Penang

Malaysia identified its first COVID-19 case on January 25, 2020. Despite early measures, the first confirmed local case appeared on February 4, 2020, and by March 2020, cases were reported in Penang and other states. Although international borders remained open, the government implemented travel warnings to China and health screenings at airports. A significant spike in cases followed a late February religious gathering, leading to nearly 5,000 infections by March 21, 2020. By March 17, 2020, Malaysia had recorded its first two COVID-19 deaths, with cases surging daily, making it the Southeast Asian country with the highest number of cases at that time. This led to strict movement control measures (Ministry of Health Malaysia, 2024).

Following the WHO's pandemic declaration on March 11, 2020, Malaysia imposed movement restrictions starting March 18, 2020. These included five stages: MCO, CMCO, RMCO, Restricted MCO, and FMCO, lasting until June 28, 2021 (Maghsoodi Tilaki et al., 2021). The prolonged restrictions heavily impacted the economy, particularly vulnerable groups. To address this, the government introduced economic stimulus packages totaling RM 530 billion from 2020 to 2021. RM 273.30 billion was allocated for business support through wage subsidies, special grants, loan moratoriums, and other relief measures (Ministry of Finance Malaysia, 2021).

The government also enforced strict SOPs to ensure public safety and reduce transmission risk. After 17 months, night markets and wet markets reopened in Phase 1 areas of the National Recovery Plan in August 2021. Vendors and visitors were required to follow SOPs, including wearing masks, maintaining physical distancing, using hand sanitizer, frequent cleaning, and having complete vaccination.

Night Markets in Malaysia

As mentioned earlier, in Malaysia, night markets are vital tourist attractions and significant economic activities. The authorities recognize them as revenue-generating businesses (Ramli & Jamri, 2021). These markets provide an accessible platform for starting small businesses with minimal capital investment, fostering community entrepreneurship. Despite their informal nature, vendors must register with local district councils to operate legally (Suhaimi et al., 2016). Vendors typically come from lower socio-economic backgrounds, including laid-off and unemployed individuals, as entry barriers are low and the markets offer a basic livelihood (Li et al., 2021).

The socio-economic status (SES) measures access to financial, social, cultural, and human capital resources. It is determined by education, income, occupation, and factors like neighborhood safety and community support, affecting an individual's quality of life (T. Y. Han et al., 2023; Rahman et al., 2021). Higher SES often correlates with better adaptation, access to care, and quality of life (Arpey et al., 2017; McMaughan et al., 2020). Night markets are crucial for Malaysia's economy, with Micro, Small, and Medium Enterprises (MSMEs) comprising 97.4% of all business institutions in 2021 and 78.6% being micro companies (SME Corporation Malaysia, 2021). Among these, night market traders provide essential retail services. These markets are popular among locals and tourists, offering budget-friendly necessities and unique cultural experiences, mainly through local food and crafts. Night markets vary in size, typically having 50 to 300 stalls (Ishak et al., 2012). Located in residential areas, they are accessible by walking, bicycles, cars, public buses, and taxis, operating from 5:00 pm to 10:00 pm, and the businesses are often run by family members (Ishak et al., 2012).

Night Market & COVID-19

The COVID-19 pandemic severely disrupted Malaysia's night markets, causing vendors to lose customers and income. They adapted by using digital platforms and cashless payments. Nevertheless, they still faced unemployment and income declines during closures and reopening, which were made worse by rising goods prices and increasing stress (Ramli & Jamri, 2021). Despite challenges, cashless payments boosted sales by eliminating physical contact (Mashuri, 2022). Digital platforms like WhatsApp, Instagram, and Facebook improved sales, but older B40 vendors struggled with new technologies. Lower SES vulnerability was evident during the pandemic, with higher SES individuals at lower risk of infection and mental distress (Wu et al., 2021). Lower SES individuals lacked healthcare access, suffered from misinformation, and neglected government warnings, leading to inequalities. Income reduction and job insecurity heightened stress, impacting community response (Coulombe et al., 2020).

Similar to informal workers in Vietnam, street vendors faced income shocks and lacked government support, leading to drastic consumption reductions (Thanh & Duong, 2022). SES highlights inequalities in resource access, with higher SES communities having better economic positions and education (Manstead, 2018). The pandemic widened SES gaps, increasing insecurity and emotional exhaustion among lower SES communities. In Bangkok, vendor stress levels rose by 42.6% due to financial constraints and quarantines (Pongutta et al., 2021). Viewing challenges as growth opportunities can lead to better outcomes.

Resilience

Resilience, as defined by various theorists, refers to an individual's ability to face adversity with a positive intent to overcome it. Research consistently highlights the pivotal role of family, neighborhood, and community settings in fostering stress resilience, rather than succumbing to risk factors. Numerous theories have attempted to explain the reasons for resilience and how it boosts communities during and after a crisis. Although resilience theories share similarities, they vary in scope and focus.

Rutter underscored protective factors like social competence and psychological coping processes in promoting resilience, while Garmezy broadened the perspective to include the impact of family and community environments (Rutter, 2013). Werner examined resilience development across the lifespan, emphasizing the role of family and community relationships (Werner, 2005). Benard advocated for nurturing resilience from childhood, highlighting the significance of positive environments in fostering resilience.

Walsh underscored the family's role in providing sustained support during adversity. Walsh applied resilience concepts to families and communities facing adversity, emphasizing social support and community involvement in resilience promotion (Walsh, 2016). Family resilience guides the understanding of various crises at individual, familial, community, and societal levels. Resilience, viewed from a sociocultural perspective, is influenced by individual, family, and societal factors. Considering diverse adversities, such as biological, psychological, and social challenges, necessitates examining broader systems and structures (Walsh, 2016).

CONCEPTUAL FRAMEWORK

This study aims to investigate the changes in the behaviors and attitudes of vendors in Malaysia subsequent to the COVID-19 crisis. The COVID-19 pandemic has significantly impacted communities worldwide, leading to lifestyle changes. This impact can be categorized into economic uncertainty, job uncertainty, social behavior, and psychological well-being.

Prior research has established that COVID-19 has exacerbated job loss, income instability, and economic downturns, patterns anticipated to persist after

the pandemic (Rahman et al., 2021). Social behaviors, such as hygienic practices, social distancing, remote employment, and online activities, persisted for nearly two years of implementation (Abolfotouh et al., 2021; Han et al., 2022). The pandemic has also worsened mental health, and increased stress, anxiety, and depression caused by fear, isolation, and uncertainties (Kumar & Upadhya, 2017; Li et al., 2021). Even post-pandemic, mental health vulnerabilities remain.

To address the research questions and aims, a conceptual framework based on the problem statement and literature review was constructed to examine the impact of the changes on vendors, as illustrated in Figure 1 below.

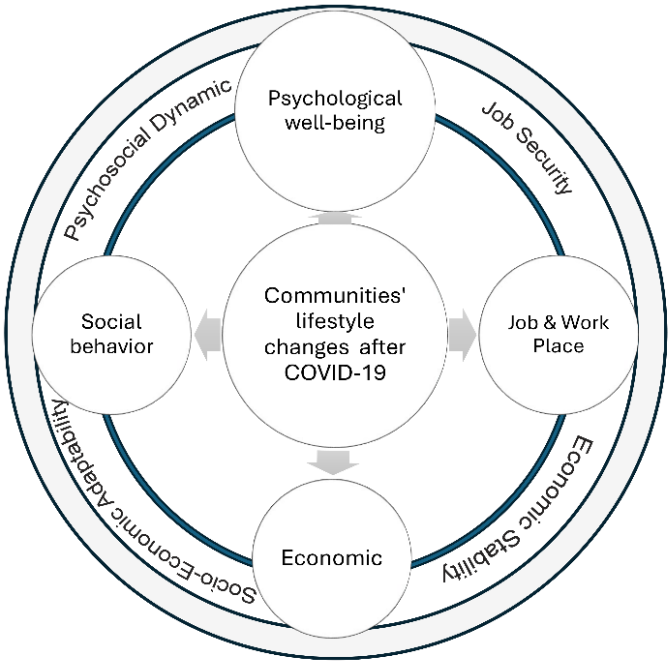


Figure 1: The study conceptual framework

RESEARCH METHODOLOGY

This study aims to explore how external shocks from social and economic crises impact their lives and whether government stimulus packages influenced their businesses during COVID-19. Employing a quantitative approach, the study employed a closed-ended questionnaire to address the research objectives in the nine-night markets of Penang, Malaysia, in 2023. This study used quantitative analysis methods such as correlational and descriptive methods to analyze the collected data. It is a descriptive-correlational study that examines the relationship between research variables. Using SPSS 24, the study evaluated

monotonic and linear relationships between study variables by statistical measurement.

Questionnaire

The data collection phase of the study included vendors aged 18 and above at the night markets in Penang who had been operating in the night market since January 2020 or earlier. Consequently, a face-to-face questionnaire survey was conducted in June 2023.

The data collection employed a stratified sampling method, wherein respondents were randomly selected from each night market. The total number of night market vendors was 735. Hence, the sample size was set at equal to or less than 253 to ensure the validity of the data collected. In the study, a total of 270 vendors participated in answering the questionnaire. After cleaning the data and removing incomplete responses, 263 questionnaires were considered for analysis.

Table 1: Questionnaire description

Variables	Questions	Description
Demographic	Q1-Q8	age, gender, ethnicity, educational level, occupation, monthly household income, number of occupants in the household, and type of housing
Economic uncertainty	Q9-Q15	Including a) The household and b) The individual levels. Indicators were adapted based on the work of (European Union Statistics, 2021) (1 = strongly disagree, 5 = strongly agree)
Job uncertainty	Q16-Q22	Including a) Job Insecurity and b) Job Satisfaction. Indicators were adapted based on the work of (Vander Elst et al., 2014) & (Spector, 1985) (1 = strongly disagree, 5 = strongly agree)
Social Behavioral	Q23-Q41	Including a) Social Participants, b) Healthcare Utilization, c) Precautionary Measures, d) Response strategies, and e) Self-Quarantine Activities. Indicators were adapted based on the works of (Abolfotouh et al., 2021; Coulombe et al., 2020; Montpetit et al., 2011) (1 = strongly disagree, 5 = strongly agree)
Psychological well-being	Q42-Q45	Including a) Mental health (anxiety and depression), b) Social support (family and friends), c) Hope in life, and d) Attitude changes. Indicators were adapted based on the works of (Abolfotouh et al., 2021; Kroenke et al., 2001)_ (1 = strongly disagree, 5 =Strongly agree)
Resilience	Q46-Q51	Including adaptation. Indicators were employed by Brief Resilience Scale (BRS) by (Smith et al., 2008)

Source: Authors

Participants were asked to provide their demographic characteristics in the initial section of the questionnaire. They were also tasked with responding to 47 statements designed to elucidate their experiences of economic suffering for

themselves and their families, job uncertainty, the impact of these conditions on their social participation and healthcare utilization, their levels of anxiety and depression, willingness to support family and friends, hope in life, and changes in attitudes over the COVID-19 period. Additionally, they were asked to respond to statements regarding their well-being and preparedness in crisis, which included precautionary measures, response strategies, and self-quarantine activities.

Based on 263 completed questionnaires, all the respondents were Malaysian. The majority were Malays (51.00%), followed by Chinese (47.90%) and Indian (1.10%). In terms of gender, 57.00% were males and 43.00% were females. The age distributions were 33.50% (25-32 years), 28.50% (32-40), 17.10% (40-50), 16.70% (18-25), and 3.80% (50-60).

Regarding employment, 80.60% worked full-time, while 19.40% were part-time vendors. Marital status showed that 65.00% were married, 34.60% single, and 0.40% were divorced or separated. Household sizes were 68.10% with 3-5 occupants, 22.10% with more than 5, and 9.90% with 1-2 people. For education, 68.80% had completed secondary education. Household income distributions were 30.00% (RM 3,001-RM 4,000), 10.30% (RM 2,501-RM 3,000), and 5.70% (RM 1,001-RM 2,500), with one respondent earning less than RM 1,000.

Reliability Test

A reliability test was employed to measure the accuracy of the selected variables. The value of Cronbach's Alpha is considered very strong when the alpha value is above 0.8. On the other hand, an alpha value below 0.6 is regarded as poor reliability (Malhotra, 2010).

Based on Table 2, the overall Cronbach's Alpha value is accepted as all the values are above 0.6.

Table 2: Reliability Analysis for each Variable

Variables	Number of Items	Cronbach's Alpha	Remarks
Dependent variable			
Resiliency	6	0.886	Very strong
Independent variable			
Economic uncertainty	7	0.949	Very strong
Job Uncertainty	7	0.776	Moderate
Social behavioral	19	0.847	Very strong
Psychological well-being	14	0.818	Very strong

Study Area

The study was conducted in Penang, Malaysia, located in the northwestern part of Peninsular Malaysia. It is the second smallest state in the country by land mass and ranks the second highest in tax collection behind Sarawak. As of 2021,

Penang's estimated population stands at 1.77 million, with a total area of 1,049 km^2 (DOSM, 2022).

Boasting industrial zones, technology parks, a vibrant heritage zone, diverse culinary offerings, and colonial architecture, Penang attracts a plethora of investors, enterprises, SMEs, and both local and foreign workers. Since being classified as a UNESCO World Heritage Site in 2008, it has become a popular destination for travelers, with night markets attracting both residents and tourists. The study focused on all nine-night markets in Northeast Penang Island: Batu Feringghi, Tanjung Bungah, Kimberley Street Food, Macallum Street, Pasar Malam Van Praagh, Paya Terubong, Farlim, Sungai Dua, and Pantai Jerjak. These markets were selected because the mean household income in the area dropped by RM 3,367, reaching RM 5,126 on average during the pandemic period of 2020-2022 (DOSM, 2022), severely impacting the economic well-being of the food stalls and night market vendors.

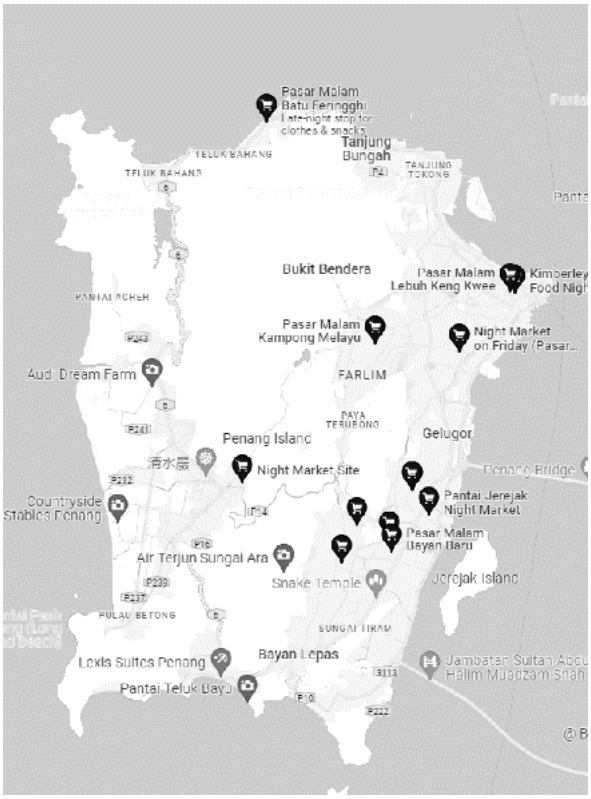


Figure 2: Distribution of night markets in Northeast Penang, Malaysia
Source: Google map (2024)

ANALYSIS AND DISCUSSION

Socio-economic Impact on Vendors' Resilience

In this study, the Pearson Correlation Coefficient was employed to assess the relationships between the independent variables (economic uncertainty, job uncertainty, social behavior, psychological well-being) and the dependent variable (resilience). This statistical measure was chosen for its ability to quantify the strength and direction of linear relationships between continuous variables. The Pearson Correlation Coefficient provides a straightforward interpretation, with values ranging from -1 to 1, where values closer to 1 or -1 indicate stronger relationships and values closer to 0 indicate weaker relationships.

In Table 3, Pearson's Correlation for each variable is displayed. The correlation coefficients range from 0.121 to 0.379, indicating that the relationships between the independent variables and the vendors' resilience are small but significant. This suggests that while the independent variables impact resilience, the strength of these relationships is relatively weak.

Table 3: Pearson's Correlation analysis

		EU	JU	SB	PWB	RS
EU	Pearson Correlation	1	.223**	.203**	.152*	.344**
	Sig. (2-tailed)		0	0.001	0.013	0
	N	263	263	263	263	263
JU	Pearson Correlation	.223**	1	-0.098	.379**	.234**
	Sig. (2-tailed)	0		0.113	0	0
	N	263	263	263	263	263
SB	Pearson Correlation	.203**	-0.098	1	-0.006	.121*
	Sig. (2-tailed)	0.001	0.113		0.925	0.049
	N	263	263	263	263	263
PWB	Pearson Correlation	.152*	.379**	-0.006	1	.303**
	Sig. (2-tailed)	0.013	0	0.925		0
	N	263	263	263	263	263
RS	Pearson Correlation	.344**	.234**	.121*	.303**	1
	Sig. (2-tailed)	0	0	0.049	0	
	N	263	263	263	263	263

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

Legend: EU- Economic uncertainty, JU- Job Uncertainty, SB- Social Behavioral, PWB- Psychological Well-being, RS- Resilience

Analysis of Variance (ANOVA) Results

This section presents the results of the ANOVA tests conducted to examine the differences in resilience scores across various levels of economic uncertainty, job uncertainty, social behavior, and psychological well-being.

Based on the ANOVA results presented in Table 4, social behavior ($F = 2.054$, $p = 0.130$) does not show a significant difference in the resilience of

night market vendors. Therefore, social behavior does not have a significant impact on their resilience. In contrast, the other independent variables—economic uncertainty ($F = 17.426$, $p = 0.000$), job uncertainty ($F = 8.441$, $p = 0.000$), and psychological well-being ($F = 15.273$, $p = 0.000$)—all show significant differences in resilience, indicating that these factors do affect the resilience of night market vendors.

Table 4: Summary of ANOVA result by independent variables and Resilience

	Source of Variation	SS	df	MS	F	Sig.
EU	Between Groups	13.228	2	6.614	17.426	0.000
	Within Groups	98.681	260	0.38		
	Total	111.909	262			
JB	Between Groups	6.823	2	3.412	8.441	0.000
	Within Groups	105.085	260	0.404		
	Total	111.909	262			
SB	Between Groups	1.741	2	0.87	2.054	0.130
	Within Groups	110.168	260	0.424		
	Total	111.909	262			
PWB	Between Groups	11.766	2	5.883	15.273	0.000
	Within Groups	100.143	260	0.385		
	Total	111.909	262			

Legend:
Sum of Squares (SS); Degrees of Freedom (df); Mean Square (MS); F-Statistic (F)
EU- Economic uncertainty; JU- Job Uncertainty; SB- Social Behavioral; PWB- Psychological Well-being; RS- Resilience

Based on the ANOVA results in Table 4, significant differences are found in economic uncertainty ($F = 17.426$, $p = 0.000$), job uncertainty ($F = 8.441$, $p = 0.000$), and psychological well-being ($F = 15.273$, $p = 0.000$), indicating that these factors influence resilience.

These findings align with previous research showing a strong relationship between economic instability and individual resilience, where high economic uncertainty correlates with lower recovery from stress (McMaughan et al., 2020; Rahman et al., 2021). Economic uncertainty, such as job market fluctuations and financial insecurity, can cause worries about job security and basic needs. Individuals with higher resilience can adapt their financial strategies, seek alternative income sources, or adjust their lifestyle to manage economic uncertainty effectively.

Job uncertainty also relates to resilience among night market vendors. Fear of job loss, changes in work conditions, and income reduction can increase stress. However, our findings suggest that vendors with high job uncertainty

possess better resilience, possibly due to proactive planning for future unemployment. This helps them develop a proactive mindset and remain motivated during job challenges (Coulombe et al., 2020).

Additionally, the study shows a positive relationship between psychological well-being and resilience, consistent with previous research. Individuals with better psychological well-being tend to have higher resilience (Dehnel et al., 2022; Pongutta et al., 2021). Good psychological well-being, encompassing mental and emotional health, helps individuals cope with economic and job uncertainties through self-care, social support, and positive coping mechanisms like exercise and hobbies.

In contrast, social behavior ($F = 2.054$, $p = 0.130$) does not show a significant difference with resilience. Resilience does not necessarily affect people's social behavior, as it depends on individual beliefs and decisions. Post-pandemic hygiene practices, social distancing, and online activities continue, but people's social behavior gradually returns to normal (Abolfotouh et al., 2021; S. Han et al., 2022). However, resilience may still be related to social interactions, as they play a significant role in coping with adversity. Resilience also depends on individual characteristics, coping strategies, personal beliefs, and external resources. Some individuals may naturally have higher resilience, while others may need to actively develop it over time.

CONCLUSION

This study focuses on informal workers in night markets, which serve as hubs for locals and tourists to explore local culture and find authentic food, crafts, entertainment, and souvenirs at affordable prices. The attitudes and behaviors of the vendors are crucial in shaping the residents and tourists' image of the community and state. Their reactions and attitudes significantly contribute to the transition from post-crisis to normalcy. However, there is limited research on the resilience of night market vendors, particularly during the pandemic.

This study examines resilience (the dependent variable) and its relationship with economic uncertainty, job insecurity, social behavior, and psychological well-being (the independent variables). Findings indicate that most vendors demonstrated resilience in normal conditions after the reopening of night markets post-pandemic but exhibited low compliance with COVID-19-related behaviors. This is likely due to the community's acclimation to COVID-19 and high vaccination rates, which increased confidence in participating in social activities without strict adherence to previous SOPs. Additionally, the study indicates that demographic factors such as ethnicity, employment status, and marital status influence individual behaviors, while ethnicity, marital status, educational level, and income affect attitudes.

FUNDING

This research was funded by the Malaysian Ministry of Higher Education through a Fundamental Research Grant Scheme (FRGS) Grant No. (FRGS/1/2021/SSI02/USM/02/5).

REFERENCES

Abolfotouh, M. A., Almutairi, A. F., Banimustafa, A. a., Hagras, S. A., & Al Jeraisy, M. (2021). Behavior responses and attitude of the public to COVID-19 pandemic during movement restrictions in Saudi Arabia. *International journal of general medicine*, 741-753.

Arpey, N. C., Gaglioti, A. H., & Rosenbaum, M. E. (2017). How socioeconomic status affects patient perceptions of health care: a qualitative study. *Journal of primary care & community health*, *8*(3), 169-175.

Aziz, A. (2023). *Cost of living issues to persist even as growth moderates*. The Edge Markets. Retrieved 9 March from https://www.theedgemarkets.com/node/649873

Chan, S. K.-L. (2023). The disappearance of Bangkok's Artbox: examining the challenges of sustaining a mobile night market during the COVID-19 pandemic. *International Journal of Social Economics*, *50*(1), 20-33.

Coulombe, S., Pacheco, T., Cox, E., Khalil, C., Doucerain, M. M., Auger, E., & Meunier, S. (2020). Risk and resilience factors during the COVID-19 pandemic: a snapshot of the experiences of Canadian workers early on in the crisis. *Frontiers in psychology*, *11*, 580702.

Dehnel, R., Dalky, H., Sudarsan, S., & Al-Delaimy, W. K. (2022). Resilience and mental health among Syrian refugee children in Jordan. *Journal of immigrant and minority health*, *24*(2), 420-429.

DOSM. (2020). *Tourism Satellite Account* Department of Statistics Malaysia (DOSM). Retrieved 20 June from https://www.dosm.gov.my/v1/index.php?r=column/pdfPrev&id=dEZ6N0dYUDJEWkVxMzdOalY3UUJSdz09

DOSM. (2022). *Household Income & Expenditure*. Retrieved 19 Oct from https://www.dosm.gov.my/portal-main/landingv2

European Union Statistics. (2021). *Glossary: Severe material and social deprivation rate (SMSD) Statistics Explained*. Retrieved 12 June from https://ec.europa.eu/eurostat/statisticsexplained/

Gerard, F., Imbert, C., & Orkin, K. (2020). Social protection response to the COVID-19 crisis: options for developing countries. *Oxford Review of Economic Policy*, *36*(Supplement_1), S281-S296.

Gururaja, B., & Ranjitha, N. (2022). Socio-economic impact of COVID-19 on the informal sector in India. *Contemporary Social Science*, *17*(2), 173-190.

Halim, H. (2022). *Penang International Food Festival 2022 is kicking off with "Street food Festival" on 20th & 21st August*. Singapore Foodie. Retrieved 23 May from https://singaporefoodie.com/penang-international-food-festival-2022-is-kicking-off-with-street-food-festival-on-20th-21st-august/

Han, S., Yoon, A., Kim, M. J., & Yoon, J.-H. (2022). What influences tourist behaviors during and after the COVID-19 pandemic? Focusing on theories of risk, coping, and resilience. *Journal of Hospitality and Tourism Management*, *50*, 355-365.

Han, T. Y., Isa, M. I., & Marzbali, M. H. (2023). INFLUENCING FACTORS OF NEIGHBOURHOOD ATTACHMENT: A CASE STUDY OF PENANG, MALAYSIA. *PLANNING MALAYSIA*, *21*.

Ishak, N. K., Aziz, K. A., & Ahmad, A. (2012). Dynamism of a night market. *Journal of Case Research in Business and Economics*, *4*, 1.

Kroenke, K., Spitzer, R. L., & Williams, J. B. (2001). The PHQ-9: validity of a brief depression severity measure. *Journal of general internal medicine*, *16*(9), 606-613.

Kumar, M., & Upadhya, A. (2017). Night shopping a tourist attraction: A study of night shopping in dubai. *Journal of Tourism and Services*, *8*(15), 7-18.

Li, R., Wang, X., & Wang, Y. (2021). Night market cultural transformation and upgrading. *Journal of Service Science and Management*, *14*(4), 412-428.

Maghsoodi Tilaki, M. J., Abooali, G., Marzbali, M. H., & Samat, N. (2021). Vendors' attitudes and perceptions towards international tourists in the Malaysia night market: Does the COVID-19 outbreak matter? *Sustainability*, *13*(3), 1553.

Mansourihanis, O., Maghsoodi Tilaki, M. J., Sheikhfarshi, S., Mohseni, F., & Seyedebrahimi, E. (2024). Addressing Urban Management Challenges for Sustainable Development: Analyzing the Impact of Neighborhood Deprivation on Crime Distribution in Chicago. *Societies*, *14*(8), 139.

Manstead, A. S. (2018). The psychology of social class: How socioeconomic status impacts thought, feelings, and behaviour. *British Journal of Social Psychology*, *57*(2), 267-291.

Martínez, L., & Young, G. (2022). Street vending, vulnerability and exclusion during the COVID-19 pandemic: the case of Cali, Colombia. *Environment and Urbanization*, *34*(2), 372-390.

Mashuri, M. A. (2022). Does COVID-19 stop night market's traders from losing their income? *Journal of Tourism, Hospitality and Culinary Arts*, *14*(2), 24-34.

McMaughan, D. J., Oloruntoba, O., & Smith, M. L. (2020). Socioeconomic status and access to healthcare: interrelated drivers for healthy aging. *Frontiers in public health*, *8*, 512143.

Ministry of Finance Malaysia. (2021). *Economic Outlook 2021*. Retrieved 12 May from https://belanjawan2021.treasury.gov.my/pdf/economy/2021/economic-outlook-2021.pdf

Ministry of Health Malaysia. (2024). *COVID-19*. Retrieved 25 Februray from https://data.moh.gov.my/dashboard/covid-19

Montpetit, K., Dahan-Oliel, N., Ruck-Gibis, J., Fassier, F., Rauch, F., & Glorieux, F. (2011). Activities and participation in young adults with osteogenesis imperfecta. *Journal of pediatric rehabilitation medicine*, *4*(1), 13-22.

Pongutta, S., Kantamaturapoj, K., Phakdeesettakun, K., & Phonsuk, P. (2021). The social impact of the COVID-19 outbreak on urban slums and the response of civil society organisations: A case study in Bangkok, Thailand. *Heliyon*, *7*(5).

Rahman, I., Jian, D., Junrong, L., & Shafi, M. (2021). Socio-economic status, resilience, and vulnerability of households under COVID-19: Case of village-level data in Sichuan province. *PloS one*, *16*(4), e0249270.

Ramli, M. W., & Jamri, M. H. (2021). The impact of COVID-19 pandemic: A closer look at the night market traders' experience in Penang, Malaysia. *International Journal of Academic Research in Business and Social Sciences*, *11*(1), 741-760.

Rutter, M. (2013). Annual research review: Resilience–clinical implications. *Journal of child psychology and psychiatry*, *54*(4), 474-487.

Samat, N., Tilaki, M. J. M., & Rahim, A. A. (2024). ASSESSING THE IMPACT OF INEQUALITIES ON RESIDENTS'PERCEPTION AND CRIME INCIDENTS IN URBAN AND PERI-URBAN NEIGHBOURHOODS. *PLANNING MALAYSIA*, *22*.

SME Corporation Malaysia. (2021). *MSME Statistics. SME Corporation Malaysia*. Retrieved 24 April from https://www.smecorp.gov.my/index.php/en/policies/2020-02-11-08-01-24/sme-statistics

Smith, B. W., Dalen, J., Wiggins, K., Tooley, E., Christopher, P., & Bernard, J. (2008). The brief resilience scale: assessing the ability to bounce back. *International journal of behavioral medicine*, *15*, 194-200.

Spector, P. E. (1985). Measurement of human service staff satisfaction: Development of the Job Satisfaction Survey. *American journal of community psychology*, *13*(6), 693.

Suhaimi, N., Al Mamun, A., Zainol, N. R., Nawi, N. C., Permerupan, Y., & Malarvizhi, C. (2016). Characteristics of informal micro-entrepreneurs in Malaysia. *Mediterranean Journal of Social Sciences*, *7*(2), 128-136.

Thanh, P. T., & Duong, P. B. (2022). The COVID-19 pandemic and the livelihood of a vulnerable population: Evidence from women street vendors in urban Vietnam. *Cities*, *130*, 103879.

Vander Elst, T., De Witte, H., & De Cuyper, N. (2014). The Job Insecurity Scale: A psychometric evaluation across five European countries. *European Journal of Work and Organizational Psychology*, *23*(3), 364-380.

Walsh, F. (2016). Applying a family resilience framework in training, practice, and research: Mastering the art of the possible. *Family process*, *55*(4), 616-632.

Werner, E. E. (2005). Resilience and recovery: Findings from the Kauai longitudinal study. *Focal Point: Research, Policy, and Practice in Children's Mental Health*, *19*(1), 11-14.

Wu, X., Li, X., Lu, Y., & Hout, M. (2021). Two tales of one city: Unequal vulnerability and resilience to COVID-19 by socioeconomic status in Wuhan, China. *Research in Social Stratification and Mobility*, *72*, 100584.

Received: 18th March 2024. Accepted: 17th August 2024

PLANNING MALAYSIA:
Journal of the Malaysian Institute of Planners
VOLUME 22 ISSUE 5 (2024), Page 510 – 526

IMPROVING ROAD SAFETY AT ACCIDENT-PRONE AREAS: A COMPARISON BETWEEN GLOW-IN-THE-DARK AND CONVENTIONAL ROAD MARKING

Hadi Farhan Semadi[1], Mohd Fairullazi Ayob[2*]

[1,2] *Department of Quantity Surveying,*
Kulliyyah of Architecture and Environmental Design,
INTERNATIONAL ISLAMIC UNIVERSITY MALAYSIA

Abstract

Driving at night is challenging due to poor vision, poor road visual guidance, and the need to encounter bright light sources. Factors like lack of street lighting, fading, and lack of reflectivity by road studs and retro-reflective materials affect road users' vision at night. Commentators have pointed out there is a critical demand to improve road safety in preventing road accidents and hazards that caused by the poor visibility of road markings and inadequacy lighting. Although road safety management has been given an important focus by the Ministry of Transportation Malaysia to achieve 50% reduction of road accidents by 2030, there is a critical demand to improve the present road markings method to overcome the issues of poor visibility or unclear road markings and inadequacy lighting that may trigger potential hazards to road users at night, with a new innovative road marking technology. Therefore, this paper is prepared with the objective to present the outcome of comparative study between the present conventional road markings and the newly innovative technology of glow-in-the-dark method with specific reference to the road safety management in Malaysia. This study employed a questionnaire survey to interview fifty-one (51) respondents that have experience of driving at night, with the objectives to get their opinions on present condition of road markings in Malaysia, and how the newly innovative technology glow-in-the-dark can improve road safety in Malaysia. The study outcome revealed that the glow-in-the-dark is deemed appropriate to enhance the visibility during low-light conditions as compared to the present conventional road markings. Although the initial cost is higher, the economic advantages of glow-in-the-dark in reducing the streetlight usage, lower electrical costs, and substantially extended lifespan have made this newly innovative road marking outweighed the downsides and economically wise choice to revolutionize road safety management practice at the accident-prone areas in Malaysia for achieving the SDG 3: Good Health and Well-being.

Keywords: Road markings, Glow-in-the-dark, Road Safety, Condition, Cost

[2] Corresponding email: fairullazi@iium.edu.my

INTRODUCTION

Around 1.3 million people die in road accidents (World Health Organisation, 2017, as cited in Babić et al., 2022), with Malaysia experiencing around 4600 deaths in 2020. These accidents cost the nation RM 56.15 million per day or RM 21 billion per year (MOT Malaysia, 2022). The lack of street lighting (Saleem & Hosoda, 2021), non-functional road studs (Anarkooli & Hosseinlou, 2016, as cited in Harun & Omar, 2022), and low luminance conditions at night (Stamatiadis et al., 2020) increase the risk of accidents and injuries. Although road safety management has been given an important focus by the Ministry of Transportation (MOT) Malaysia to achieve 50% reduction of road accidents by 2030, there is a critical demand to improve the present road markings to overcome the issues of poor visibility or unclear road markings and inadequacy lighting that have affected road users' vision and triggered potential hazards when driving at night (MOT, 2022; Harun & Omar, 2022). Driving at night has several challenges, as most the road users' vision is poor, and when this includes with poor road visual guidance, results in many deadly crashes at night (Ackaah et al., 2020). As advocated by the Malaysian Institute of Road Safety Research (MIROS) (as cited in MOT, 2022), the lack of vision by the road users is the third highest road accidents factors in Malaysia. Road marking is the application of lines, symbols, and other markings on the surface of a roadway to indicate traffic flow, lane direction, and additional information for road users. It is essential for defining roads, splitting opposing traffic strands, and separating the entire road into sub-areas for various road users (British Standard, 2022). In Malaysia, paint and thermoplastics are the most popular materials used for road line markings and glass beads as their retro-reflectivity material (PWD Malaysia, 2017a, 2017b). However, new innovative technology like glow-in-the-dark road line marking uses photo-luminescent technology has been invented to absorb energy from sunlight and artificial light, producing non-radioactive and non-toxic light that can make it visible for over 12 hours (Britannica, 2020, as cited in Saleem & Hosoda, 2021). There have been suggestions to explore and adopt a new innovative technology, i.e., Glow-in-the-dark method that has emerged as a promising solution to create safer and more sustainable transportation infrastructure in Malaysia towards achieving the United Nations' Sustainable Development Goals number 3, target 3.6, which is to halve global deaths and injuries from road traffic accidents by 2020 (United Nations, 2018). Therefore, this paper is prepared with the objective to present the outcome of comparative study between the present conventional road markings and the newly innovative technology method of glow-in-the-dark with specific reference to the road safety management in Malaysia.

REVIEW OF CURRENT ROAD MARKINGS IN MALAYSIA

Road markings are crucial for road safety in Malaysia that help to guide and regulate traffic movement. The choice of road marking materials depends on factors such as durability, visibility, and cost (PWD Malaysia, 2017a). Permanent markings should have a functional life as long as possible, while paint is less expensive (PWD Malaysia, 2017a, 2017b). The conventional road markings in Malaysia, specifically paint and thermoplastic, are based on PWD Malaysia (1988), which states that these materials are normally designed for 3 to 5 years' service life, and the performance is influenced by the road conditions.

Paint Road Marking

Paint road marking is a widely used technique for providing clear and visible guidance to road drivers. In Malaysia, the paint road marking is used as a temporary marking, and the colour is yellow (PWD Malaysia, 2017a, 2017b). It is cheaper compared to the thermoplastic road marking due to its simple application process that does not require heating or other unique technology (Babic´ et al., 2015). There are two types of paint road markings, i.e., solvent-borne paint and water-borne paint. Solvent-borne paint is cheaper and more environmentally friendly, as it has better drying control, better adhesion to asphaltic and oily surfaces, and is not affected by humidity (Babic´ et al., 2015). The average lifespan of solvent-borne paint road line marking is 12 months or 1 year, ranging from 6 months to 24 months, depending on various factors (Burghardt & Pashkevich, 2020). Water-borne paint is compatible with many surfaces, including bituminous and concrete materials, making it suitable for renewal road line marking. The average lifespan of solvent-borne paint road marking is 6 months, with a maximum of 12 months depending on various factors (Mohamed, 2019;). The total cost for paint road marking in Malaysia for both edges is RM 9.00 per m. This total cost will be only for materials, not including other costs such as labour and transportation (PWD Malaysia, 2021). The paint road marking is cost-effective and easy to apply, but it has limitations on durability and visibility. Its lifespan is short, with a maximum of 24 months. It has the lowest visibility and detection distance in wet conditions, causing difficulties for road users to detect potential hazards Gibbons & Hankey, 2007, as cited in Babic´ et al., 2020).

Thermoplastic Road Marking

Thermoplastic road marking is a popular material in many countries, including Malaysia, due to its effectiveness in providing clear guidance to road users and preventing collisions. The material is made from a combination of resins, pigments, and fillers, which are melted and mixed to create a hot molten plastic

material. The average lifespan of thermoplastic road line marking is around 3.6 years or 42 months (Dormidontovaa & Filatova, 2016; Babic´ et al., 2019;), ranging from 2 years to 7 years depending on factors like thickness, traffic volume, and frequency. Thicker markings are more durable, while heavy traffic and frequent heavy vehicles can cause faster deterioration. The total cost for thermoplastic road line marking in Malaysia for both edges is RM 36.30 per m^2. This total cost will be only for materials, not including other costs such as labour and transportation (PWD Malaysia, 2021). It is a popular material for creating durable and visible lines on roads, but it has some limitations. Its cost is higher as compared to other paint road marking methods. It is made from plastic resin, glass beads, and pigments, which requires specialized equipment and time for application (Dormidontovaa & Filatova, 2016). Additionally, the thermoplastic road marking has environmental concerns such as high-temperature emissions, toxic smoke, and hothouse gas, which can affect the environment (Dormidontovaa & Filatova, 2016). The process also leaves a carbon footprint due to the need to heat the thermoplastic up to 200°C (Burghardt et al., 2021a). Glass beads containing thermoplastic road line marking are also concerned about retro-reflectivity during rain or wet conditions, which can reduce visibility and increase potential hazards to road accidents (Harun et al., 2019).

Glass Beads

Standard glass beads are the most common type of glass beads in road marking due to the affordability and ease of manufacturing (Wenzel et al., 2022). The standard glass beads are typically made from recycled float glass and window glass, which are ground to the desired dimensions (Burghardt & Pashkevich, 2020; Burghardt et al., 2022; Wenzel et al., 2022). The lifespan of glass beads can be measured through the minimum requirement of retro-reflectivity for the road marking. Standard glass beads have a shorter lifespan due to lower durability and abrasion resistance (Burghardt et al., 2021b). The minimum retro-reflectivity requirement for road line marking that needs to be maintained is 300 mcd/m^2/lx in dry conditions and 75 mcd/m^2/lx in wet and rainy conditions (PWD Malaysia, 2019). The average lifespan of general paint road marking is 7 months, while thermoplastic road marking is 42 months. Glass beads' lifespan depends on the type of road marking applied, with the lifespan ending when the marking ends. The total cost for both edges of road marking using the standard glass beads in Malaysia are RM 11.50 per m^2 while the premium glass beads are RM 13.12 per m^2 (Made-in-China, n.d.a, n.d.b, n.d.c; Janio, 2020). This total cost includes the cost of material, shipping, and tax. The glass beads are used in road line marking to improve visibility, but the retro-reflectivity performance can be reduced during rain due to water film on the road surface. The service life span can be shorter due to high refractive index (Harun et al., 2019; Burghardt et al., 2021a).

REVIEW OF GLOW-IN-THE-DARK ROAD MARKING

Glow-in-the-dark road marking is a new promising solution to enhance road visibility, improve traffic safety, and reduce environmental impacts. This innovative technology, based on photoluminescence materials with longer afterglow, provides visible light for lane separation and edge detection, that addressing the challenges of poor nighttime visibility or low-light conditions (Li, Wang, and Wang, 2014, as cited in Sha et al., 2021; Saleem & Hosoda, 2021). Unlike the conventional road markings, it does not rely on external light sources, offering a self-sustaining, energy-efficient solution (Jiang et al., 2019, as cited in Sha et al., 2021). The roots of glow-in-the-dark road marking can be traced back to Studio Roosegaarde, a renowned Dutch design firm, and the ingenious expertise of the Heijmans infrastructure management group the invented the concept of a luminous highway as part of the Smart Highway Project (Sha et al., 2021). The technology involves a special "photoluminescent" powder integrated into road paint, which absorbs and stores solar energy during daylight hours, charging itself for a captivating nighttime glow. This innovative technology has been successfully implemented on a 500-meter stretch of highway in the Netherlands, reducing the need for streetlights (Bhujbal et al., 2022).

The glow-in-the-dark road markings absorb and store ambient light energy during the day, allowing them to emit a captivating glow when darkness descends (Saleem & Hosoda, 2021). The main material used is strontium aluminate (SrAl2O4), which is activated by europium, dysprosium, and yttrium (Sakhapov et al., 2020). The effective thickness of the luminous or glow-in-the-dark surface layer is between 3 to 5mm, which ensures both mechanical strength and luminous effect (Sha et al., 2021). The "glow time" or "luminous time" is a critical factor determining the efficacy of these markings, as it directly impacts road safety and driver awareness during night travel. The outcome of review presented in Table 1 below shows that the glow-in-the-dark road markings have an average glow time of around 9 hours, varying between 6 and 12 hours depending on internal and external factors. The retroreflected luminance (R_L) is crucial for visibility and guiding road users through darkness. In dry conditions, the minimum $R_L$is 300 mcd/m^2/lx, while in wet and rainy conditions, it should be 75 mcd/m^2/lx (PWD Malaysia, 2019).

Table 1: Glow time duration of glow-in-the-dark road line marking

No.	Paper Title	Author / Year	Glow Time Duration
1	Development and testing of glow-in-the-dark concrete based raised pavement marker for improved traffic safety	Saleem and Hosoda (2021)	12 hours
2	Invention of fluorescent pavement	Pavalarathinam et al. (2012)	12 hours
3	Towards the new concept of smart roads: Regulatory framework and emerging projects overview	Franzò, Latilla and Longo (2018)	10 hours
4	Study smart road with glowing lines	Bhujbal et al. (2022)	8 hours
5	Ways to avoid traffic congestion in India and make India smarter – A prelude	Deepashree and Radhika (2020)	8 hours
6	Strontium aluminate compound as road line materials application	Munikanan, Peng, Yahya and Yusof (2021)	6 hours

The glow-in-the-dark road markings also can be a promising solution for safer and more sustainable transportation systems. An optimum design lifespan is crucial for the effectiveness and long-term viability of the glow-in-the-dark. The markings emit a captivating glow at night, providing continuous visibility and reducing accident risks. The precise lifespan of glow-in-the-dark depends on several factors like strontium materials, environmental conditions, and maintenance practices. Despite the lack of long-term studies, several authors suggest that the service life of glow-in-the-dark material can last up to 5.5 years or 66 months (Deepashree & Radhika, 2020). Besides, the total cost of glow-in-the-dark markings, including materials and transportation, is crucial for evaluating their economic viability and long-term benefits. The application of glow-in-the-dark markings can help to eliminate the need for traditional streetlights, offering a cost-effective and eco-friendly alternative. For instance, the total cost of installing a new LED-type streetlight is RM 1,685.00, and the electricity cost for 1 month operation is RM 10.20 (PWD Malaysia, 2023). On the other hand, the total cost for strontium aluminate including the cost of shipping and tax for both edges of road is RM 16.28 per m^2 (Munikanan et al., 2021). Although the glow-in-the-dark is designed to enhance visibility during low-light conditions, using luminous materials to emit a radiant glow; however, their effectiveness depends on the surrounding lighting conditions, as the emitted light may be negligible in areas with ample external lighting (Bacero et al., 2015). Additionally, the high cost of materials used to create the luminous afterglow has become a limitation to glow-in-the-dark application in the road safety management (Steyn, 2008, as cited in Sha et al., 2021).

Current State of Glow-In-The-Dark Application in Malaysia

The Malaysia's first glow-in-the-dark road marking project was implemented by the Public Works Department (PWD) on 28th October 2023 at the intersection of Jalan Sg Lalang Batu 19 and Jalan Sg Tekali Batu 16 in Hulu Langat, Selangor. The project was carried out by the District PWD for the purpose piloting to investigate the overall performance effectiveness and implementation cost of glow-in-the-dark at a length of 245 metres with 490 metres of road marking (NST, 2023a; TST, 2023; Alexander Nanta Linggi, 2023). Subsequently, the application of glow-in-the-dark road marking received critical demand to be extended nationwide in other states like Kedah and Johor to improve road safety road safety in areas prone to road accidents that caused by poor visibility of road markings and inadequacy lighting. Kedah's first glow-in-the-dark road marking was applied at three kilometres road length in Padang Sanai of Padang Terap that was recognized as the longest glow-in-the-dark road marking application in Malaysia in the year of 2023 (Latest Malaysia, 2023; NST, 2023b). Whilst Johor's first glow-in-the-dark road marking was implemented at Masai River Bridge in Masai (Media Digital Johor, 2023; World of Buzz, 2023). The Johor's State Minister, Onn Hafiz Ghazi announced in January 2024 there are 31 roads in Johor that have been identified for road safety upgrading with the installation of newly innovative technology, i.e., glow-in-the-dark road marking (Media Digital Johor, 2024; World of Buzz, 2024).

Although the glow glow-in-the-dark road marking in these three states has received good impression and positive feedback from road users, the Malaysia Works Minister, Alexander Nanta Linggi suggested a comprehensive feasibility study should be carried to investigate the cost-effectiveness of glow-in-the-dark over the road service life rather before deciding to extend its application nationwide. The Minister observed the initial cost of applying photoluminescent paint for glow-in-the-dark is high at RM749 per sq. metre, that costed approximately nineteen times higher than the conventional road marking paint of RM40 per sq. metre (Berita Harian, 2024, The Star, 2024). Due to high initial cost and maintenance cost concern, suggestion given that the glow-in-the-dark appropriate for road marking application at short road stretch (PTAN, 2024; The Star, 2024). Besides, the substitute material, i.e., glass beads, has been suggested to be assessed to identify the performance and cost comparison with the photoluminescent paint for enhancing the performance and cost-efficiency of glow-in-the-dark road marking application (The Star, 2024).

METHODOLOGY

A quantitative research strategy was chosen rather than qualitative and mixed method research strategies because it is more suitable for obtaining measurable, generalizable, and objective data to compare the effectiveness of glow-in-the-

dark and conventional road line markings in enhancing road safety in Malaysia. The questionnaire survey approach was carried out to interview respondents that have driving experience at night, with the objectives to get their opinions on the present condition of road markings in Malaysia, and how the newly innovative technology, i.e., glow-in-the-dark can improve road safety in Malaysia. The questionnaire survey was chosen because it can be dispersed through various modes, such as online platforms, email, or in-person distribution (Young, 2016). This flexibility allows respondents to choose the mode that best suits their convenience, increasing the likelihood of participation. In addition, the data collection period can be significantly shortened compared to other data collection methods because the survey can be easily implemented using modern tools, such as Google Forms (Pozzo et al., 2019). The questionnaire survey for the study was designed with close-ended questions using Google Forms, which have two types of answers, where the respondents need to state the degree of agreement for the research question statement and choose either one of the answers given for the research question. The designed Google Forms of questionnaire survey was distributed to respondents through WhatsApp and Telegram.

The data collected was analysed using descriptive analysis, consists of mean, mode, and standard deviation. The questionnaire design uses close-ended questions with various answers from the respondents who need to use mean to find an average range of agreement, from strongly disagree to strongly agree (i.e., 5-point Likert scale). The standard deviation was calculated to find the amount of disagreement among the respondents and to indicate the measurement level of consensus achieved. According to Table 2 the standard deviation and consensus achieved are inversely related. The reason is that when the standard deviation has lower values, the level of consensus achieved will be higher. On the other hand, when the standard deviation has higher values, the level of consensus achieved will be lower (Grobbelaar, 2007 as cited in Ayob, 2014). For close-ended questions that are designed with only two or three answers, mode was calculated to determine the greatest frequency in a set of numbers or distribution (Fellows and Liu, 2008 as cited in Ayob, 2014).

Table 2: Standard deviation and consensuses (Grobbelaar, 2007 as cited in Ayob, 2014)

Standard deviation (SD)	Level of consensus achieved.
$0 \leq X < 1$	High level of consensus
$1 \leq X < 1.5$	Reasonable/ fair level of consensus
$1.5 \leq X < 2$	Low level of consensus
$2 \leq X$	No consensus

RESULTS

The questionnaire survey comprises of three sections, which are Section A – Demographic information, Section B – Malaysia's road line marking, and Section C – Retro-reflectivity of road line marking. Fifty-three responses (53) were collected, but only fifty-one (51) responses were valid, as the other two (2) responses were not valid due to no driving experience at night.

Section A – Demographic Information

Table 3 below shows a full review of the demographic of respondents that participated in the questionnaire survey. Based on the respondents' demographic, it is not misconception to conclude that all 51 out of 53 participants meet the specified criteria and are qualified to be respondents to provide their opinion and judgement to the questions in the questionnaire survey.

Table 3: Demographic of respondents in the questionnaire survey

Characteristics		Results	
		Frequency	**Percentage (%)**
Gender			
i.	Male	18	34
ii.	Female	35	66
Age (in years)			
i.	18-34	41	77.4
ii.	35-49	9	16.9
iii.	50 and above	3	5.7
Have you ever driven a vehicle on the road in Malaysia, especially at night?			
i.	Yes	51	96.2
ii.	No	2	3.8
If Yes, how frequently do you drive a vehicle on the road at night within a week?			
i.	Less than 2 times	16	31.37
ii.	3 times to 5 times	16	31.37
iii.	More than 6 times	19	37.26

Section B – Malaysia's Road Line Marking

In this section, the respondents were asked on their range of agreement on the present conventional road marking in Malaysia. They need to rate on scale from 'Strongly Disagree (1)' to 'Strongly Agree (5)' based on their perspective and opinion on the statements given. The range of agreement being categorized from 1 to 5 to simplify calculations. Table 4 presents the calculated mean and standard deviation values based on the respondents' feedback on Malaysia's road line marking condition statements.

Table 4: Respondents' feedback on Malaysia's road line marking

No	Condition Statement	Mean	SD
1	The condition of conventional road line markings usually found is faded or worn out.	4.02	0.79
2	The poor condition of conventional road line markings is caused by lack of retro-reflectivity	3.80	0.98
3	The conventional road line marking in Malaysia is quality.	3.12	0.91
4	The conventional road line marking in Malaysia is clear and visible at night.	3.00	0.92
5	The maintenance carried out on the conventional road line marking in Malaysia is good and on time.	2.43	0.90

Section C – Retro-Reflectivity of Road Line Marking

For Section C, the respondents were asked on their preference for the type of road line marking with better retro-reflectivity, either conventional or glow-in-the-dark road markings. Overall, the mode values in Table 5 show that the glow-in the dark obtained greater preference by the respondents on retro-reflectivity performance at night rather than conventional road line marking method.

Table 5: Respondents' feedback on retro-reflective performance at night

No.	Research Question	Convent. (Mode)	GITD (Mode)
1	Which road line marking can easily be seen better at night?	1	50
2	Which road line marking has better retro-reflectivity at night?	0	51
3	Which road line marking is better in helping to determine the corner of the road better at night?	1	50
4	Which road line marking is better in helping to maintain the lane better at night?	0	51
5	Which road line marking is better in improving lane changes at night?	2	49
6	Which road line marking is better in determining the potential hazards or objects at night?	4	47

DISCUSSIONS

Present Condition of Road Markings in Malaysia

The results in Table 4 have established that the majority of respondents believed the current conventional road markings are in poor condition, with faded or worn-out signs, with the scores of mean 4.02 and standard deviation 0.79. This is attributed to poor maintenance and lack of retro-reflectivity (mean score 3.80 and standard deviation 0.98). The invisibility of road markings is a common cause of accidents, as highlighted by Nikolaev (2016, as cited in Sakhapov et al., 2020). The current road markings in Malaysia can lead to accidents, and therefore there is a critical demand to address these limitations in prevent road accidents. The

findings suggest that immediate actions are needed to improve the condition of road markings for enhancing the safety management practice in Malaysia.

Glow-in the Dark: Improving Road Safety Performance

The results in Table 5 show that the glow-in-the-dark has a better retro-reflectivity to improve road management safety in Malaysia as compared to conventional road markings. It improves visibility and reduces fatal crashes at night due to poor vision and road visual guidance. According to Ackaah et al. (2020), the challenges of nighttime driving are poor vision and inadequate road visual guidance. To overcome this, the glow-in-the-dark road marking is recommended for application in road safety management to facilitate the nighttime drivers to determine road corners, maintain lane, improve lane changes, and identify potential road hazards at night.

Glow-in the Dark: Economical Standpoint Over the Long Term

The results in Table 6 show that the road markings in Malaysia are costed in average RM 36.60 per m^2 in 2021 (PWD 2021), and gradually increases to RM40 per m^2 in 2024 (Berita Harian, 2024; The Star, 2024) for both edges, including installation of retro-reflective glass beads (PWD 2021, Berita Harian, 2024). The average total installation cost of conventional (glass beads) thermoplastic road marking is RM 12.31 per m^2slightly lower compared to strontium aluminate at RM 16.28 per m^2 (Bacero et al., 2015; Munikanan et al., 2021). The total cost for glow-in-the-dark road marking is RM 40.57 per m^2, (RM749-Berita Harian, 2024) which is more expensive compared to current cost of conventional road marking at RM40 per m^2 (Berita Harian, 2024) Even though the cost of glow-in-the-dark materials is higher than the conventional road marking, it provides significant saving through reduced streetlight installation and operation costs, making it more cost-effective over the long term. The installation cost of LED-type streetlighting alone is RM 1,685.00, with the combination of electrical cost at RM10.20 per month can make a huge difference in cost savings when the glow-in-the-dark is economically applied for road safety over the long term (PWD Malaysia, 2023).

Table 6: Literature data compilation on the cost comparison between conventional and glow-in-the-dark road markings.

Items	**Thermoplastic Road Line Marking**	
Total Cost including glass beads (per m^2 for both edges)	i. **RM 36.60** (PWD, 2021) ii. **RM40** (Berita Harian, 2024)	
Two (2) competing road line marking	**Conventional Road Markings (Glass Beads)** per m^2	**Glow-In-The-Dark (Strontium Aluminate)** per m^2
Total Cost (per m^2 $for\ both\ edges$)	RM 11.50 (standard)	**RM 16.28**

Items	Thermoplastic Road Line Marking	
(Material + Shipping + Tax)	RM 13.12 (premium) (Made-in-China, n.d.a, n.d.b, n.d.c; Janio, 2020). Or **RM 12.31** (Average cost between standard and premium Glass Beads)	(Bacero et al., 2015; Munikanan et al., 2021).
Total Cost of Thermoplastic Road Line Marking including Retro-reflective Material	**RM 36.60**	**RM 40.57**
Streetlighting cost	i. Installation cost of LED-Streetlight type: RM 1,685.00 ii. Electricity cost: RM 10.20 per month (Source PWD Malaysia, 2023).	
Design lifespan (Babic´ et al., 2019; PWD Malaysia, 2019; Deepashree & Radhika, 2020)	**42 months**	**66 months**

Furthermore, the literature data reveals that the design lifespan of glow-in-the-dark (66 months) is longer than the conventional road markings (42 months). Hence, it is not misconception to state that although the upfront cost required for the glow-in-the-dark (RM 40.57 per m^2) is slightly higher than the conventional road marking (RM36.60 per m^2), it offers a lasting period of effectiveness before requiring replacement. Therefore, despite slightly higher on initial costs, the economic advantages of reduced streetlight usage, lower electrical costs, and extended lifespan make the glow-in-the-dark road line marking an economically wise choice over the long term.

United Nations (2018) has established the Sustainable Development Goals (SDGs), which include a specific goal SDG 3: Good Health and Well-being. One of the targets under this SDG3 goals, is target 3.6 that focuses on halving the number of global deaths and injuries from road traffic accidents by 2020. Although the deadline target date of 2020 for addressing SDG 3: Target 3.6 has passed, continuing efforts are needed to find ways to reduce road traffic accidents in order to ensure safe mobility for all. This innovative technology, glow-in-the-dark road marking, can be potentially revolutionized road safety management in Malaysia. With its ability to provide clear and consistent road markings during low-light conditions, glow-in-the-dark road line marking can significantly reduce the number of accidents and fatalities on the road to help achieving the target 3.6 under the SDG 3.

CONCLUSION

This paper has presented the outcome of comparative study between the present conventional road markings and the newly innovative technology of glow-in-the-

dark with specific reference to the road safety management in Malaysia. The results of the study have established that the glow-in-the-dark is more superior than the present conventional road markings for improving the road safety management practice at the accident-prone areas in Malaysia. Although the cost of glow-in-the-dark materials is higher than the conventional road marking, it is to misconception to state the economic and performance advantages of glow-in-the-dark for improving road safety at the accident-prone areas outweigh the downsides. Therefore, it could be deemed appropriate for consideration to extend the application of glow-in-the-dark road marking to revolutionize the road safety management practice at the accident-prone areas in Malaysia. The outcome of the study contributes to the understanding of road safety enhancement in Malaysia, that can be useful inputs for guiding towards promoting road safety standards that align with road accident cost reduction consideration for achieving the Sustainable Development Goals, i.e., Target 3.6 under SDG 3: Good Health and Well-being.

ACKNOWLEDGMENTS

This paper follows the other paper below that has been presented elsewhere by the first author from nearly 9 months of research under the second author supervision:

Hadi Farhan Semadi (2023). Enhancing Road Safety in Malaysia: A Comparative Analysis of Retro-Reflectivity in Glow-In-The-Dark and Conventional Road Line Marking. [Unpublished Degree's Dissertation], International Islamic University Malaysia.

REFERENCES

Ackaah, W., Apuseyine, B. A., & Afukaar, F. K. (2020). Road traffic crashes at night-time: Characteristics and risk factors. *International Journal of Injury Control and Safety Promotion*, *27*(3), 392–399. https://doi.org/10.1080/17457300.2020.1785508

Ayob, M. F. (2014). Development of Life Cycle Cost Strategy and Protocol on Cost Data Input in Malaysia. Unpublished doctoral dissertation for Doctor of Philosophy (Built Environment), International Islamic University Malaysia

Babić, D., Babić, D., Fiolic, M., & Ferko, M. (2022). Road markings and signs in road safety. *Encyclopaedia*, *2*(4), 1738–1752. https://doi.org/10.3390/encyclopedia2040119

Bacero, R., To, D., Arista, J. P., Cruz, M. K. D., Villaneva, J. P., & Uy, F. A. (2015). Evaluation of strontium aluminate in traffic paint pavement markings for rural and unilluminated roads. *Journal of the Eastern Asia Society for Transportation Studies*, *11*, 1726-1744. https://www.jstage.jst.go.jp/article/easts/11/0/11_1726/_pdf

Berita Harian (6th January 2024). Kos garisan jalan 'glow in the dark' hampir 20 kali ganda kaedah konvensional. Retrieved on 27 January 2024 from https://www.bharian.com.my/berita/nasional/2024/01/1196785/kos-garisan-jalan-glow-dark-hampir-20-kali-ganda-kaedah-konvensional

Bhujbal, S. A., Bhosure, A. G., Sonawane, G. S., Patel, P. R., Jadhav, V. R., & Dhivare, J. (2022). Study smart road with glowing lines. *International Journal for Research in Applied Science and Engineering Technology*, 10(4), 3238–3241. https://doi.org/10.22214/ijraset.2022.41965

British Standard. (2020). Road marking materials – Paint, thermoplastic and cold plastic materials – Physical properties (BS EN 1871:2020). *BSI Standard Limited*, 1-43.

Burghardt, T. E., Ettinger, K., Köck, B., & Hauzenberger, C. (2022). Glass beads for road markings and other industrial usage: Crystallinity and hazardous elements. *Case Studies in Construction Materials*, *17*, 1-14. https://doi.org/10.1016/j.cscm.2022.e01213

Burghardt, T. E., Maki, E., & Pashkevich, A. (2021a). Yellow thermoplastic road markings with high retro-reflectivity: Demonstration study in Texas. *Case Studies in Construction Materials*, *14*, 1-13. https://doi.org/10.1016/j.cscm.2021.e00539

Burghardt, T. E., Pashkevich, A., & Wenzel, K. M. (2021b). A study of premium glass beads for road marking materials. Roads and Bridges-Drogi i Mosty, 20(2), 125-138. https://doi.org/10.7409/rabdim.021.008

Burghardt, T., & Pashkevich, A. (2020). Materials selection for structured horizontal road markings: Financial and environmental case studies. *European Transport Research Review,* 1-10. https://doi.org/10.26226/morressier.5e4fe9c16bc493207536f715

Deepashree, R., & Radhika, K. N. (2020). Ways to avoid traffic congestion in India and make India smarter - A prelude. *International Journal of Engineering Research & Technology*, *8*(11), 310–314.

Dormidontova, T. V., & Filatova, A. V. (2016). Research of influence of quality of materials on a road marking of Highways. *Procedia Engineering*, *153*, 933-937. https://doi.org/10.1016/j.proeng.2016.08.256

Fellows, R. & Liu, A. (2008). Research Methods for Construction. Oxford, UK: Wiley-Blackwell

Grobbelaar, S. S. (2007). R&D in the National system of Innovation: a system dynamics model. Published doctoral dissertation, Faculty of Engineering, Built Environment and Information Technology, University of Pretoria, South Africa. http://upetd.up.ac.za/thesis/available/etd-07212007-130132/unrestricted/00front.pdf

Harun, M. H., & Omar, R. (2022). Kajian penggunaan perabot jalan raya dalam mengurangkan kemalangan jalan raya di Selangor, Malaysia. *Research in Management of Technology and Business*, *3*(1), 676-699. http://publisher.uthm.edu.my/periodicals/index.php/rmtb e-ISSN

Harun, M. H., Rosdi, S., & Rosmani, M. (2019). High performance thermoplastic and cold applied plastic road markings: How long do they last? *IOP Conference Series: Materials Science and Engineering*, *512*, 012002, 1-12. https://doi.org/10.1088/1757-899x/512/1/012002

Janio (2020). Retrieved May 13, 2023. Shipping from China to Malaysia. https://janio.asia/articles/shipping-from-china-to-malaysia/

Latest Malaysia (3 December 2023). The Longest Glow in the Dark Road Markings is Now Found in Kedah. Retrieved on 27 January 2024 from https://latestmalaysia.com/2023/12/03/glow-in-the-dark-road-kedah/

Linggi, Alexander Nanta, Malaysia's Works Minister, (16th November 2023). https://www.facebook.com/alexnantalinggi/posts/890830739071897?ref=embed_post

Made-in-China. (n.d.a). Retrieved May 13, 2023. *Aashto M247 Type2 standard glass beads for road marking from Chinese manufacturer*. https://love-gangde.en.made-in-china.com/product/KOMtvQDxZbRX/China-Aashto-M247-Type2-Standard-Glass-Beads-for-Road-Marking-From-Chinese-Manufacturer.html

Made-in-China. (n.d.b). Retrieved May 13, 2023. Glass beads for road marking paint from China factory. https://jinren.en.made-in-china.com/product/CFOfwtIzlgpX/China-Glass-Beads-for-Road-Marking-Paint-From-China-Factory.html

Made-in-China. (n.d.c). Retrieved May 13, 2023. Professional ocean shipping agent 20/40FT FCL from Shanghai to Malaysia. https://kapoklog.en.made-in-china.com/product/aFHfvTmGTlYA/China-Professional-Ocean-Shipping-Agent-20-40FT-FCL-From-Shanghai-to-Malaysia.html

Media Digital Johor (29th November 2023). Jambatan Sungai Masai Kini Miliki 'Roadline Glow in The Dark' Pertama Di Johor. Retrieved on 27 January 2024 from https://mediadigitaljohor.gov.my/jambatan-sungai-masai-kini-miliki-roadline-glow-in-the-dark-pertama-di-johor/

Media Digital Johor (5th January 2024). 31 Lokasi Bakal Guna 'Glow in The Dark'. Retrieved on 27 January 2024 from https://mediadigitaljohor.gov.my/31-lokasi-bakal-guna-glow-in-the-dark/

Ministry of Transport (MOT) Malaysia. (2022). Pelan Keselamatan Jalan Raya Malaysia 2022-2030. 1-68.

Mohamed, M. M. (2019). Evaluation and modelling of pavement marking characteristics based on laboratory and field data. *University of Idaho*, 1-156.

Munikanan, V., Peng, N. C., Yahya, M. A., & Yusof, M. A. (2021). Strontium Aluminate Compound as Road Line Materials Application. *Jurnal Kejuruteraan*, *4*(2), 17-21. https://doi.org/10.17576/jkukm-2021-si4(2)-03

New Straits Time (NST) (16 November 2023a). JKR Hulu Langat implements innovative pilot project: "Glow in the Dark" road paint. Retrieved 27 January 2024 from https://www.nst.com.my/news/nation/2023/11/978950/jkr-hulu-langat-implements-innovative-pilot-project-glow-dark-road-paint

New Straits Time (NST) (11 December 2023b). Glow-in-the-dark paint: More road tests needed [NSTTV]. Retrieved on 27 January 2024 from https://www.nst.com.my/news-cars-bikes-trucks/2023/12/988965/glow-dark-paint-more-road-tests-needed-nsttv.

Pavalarathinam, P., Satheesh, H., Vinoth, M., and Vishnubabu D. (2012). Invention of fluorescent pavement. *Anna University of Technology Tiruchirappalli*, 1-32. https://doi.org/10.1089/scd.2007.0088

Public Works Department (PWD) Malaysia. (1988). Standard specification for road works. *Cawangan Jalan*, 1-270.

Public Works Department (PWD) Malaysia. (2017a). Manual on traffic control devices: Temporary signs and work zones control (JKR 20400-0205-17). *Cawangan Jalan*, 1-135.

Public Works Department (PWD) Malaysia. (2017b). Standard specification for road works: Section 6: Road furniture (JKR 20400-0106-17). *Cawangan Jalan*, 1-33.

Public Works Department (PWD) Malaysia. (2019). Standard specification for road works: Section 19: Traffic management at work zones. *Cawangan Jalan*, 1-53.

Public Works Department (PWD) Malaysia (2021). Jadual kadar kerja kejuruteraan awam dan bangunan 2021 (JKR 20800-0236-21). *Cawangan Kontrak & Ukur Bahan*, 1-137.

Public Works Department (PWD) Malaysia. (2023). Jadual kadar kerja elektrik 2023 (JKR 20300-0113-23). *Cawangan Kejuruteraan Elektrik*, 1-146.

Sakhapov, R. L., Kashipov, R. F., & Gatiyatullin, M. H. (2020). Exploring the effect of thermoplastic composition on light emission. *IOP Conference Series: Materials Science and Engineering*, *786*(1), 012058, 1-7. https://doi.org/10.1088/1757-899x/786/1/012058

Saleem, M., & Hosoda, A. (2021). Development and testing of glow-in-the-dark concrete based raised pavement marker for improved traffic safety. *Journal Of Civil Engineering and Management*, *27*(5), 278–287. https://doi.org/10.3846/jcem.2021.14902

Sha, A., Liu, Z., Jiang, W., Qi, L., Hu, L., Jiao, W., & Barbieri, D. M. (2021). Advances and development trends in eco-friendly pavements. *Journal of Road Engineering*, *1*, 1–42. https://doi.org/10.1016/j.jreng.2021.12.002

Stamatiadis, N., Psarianos, B., Apostoleris, K., Taliouras, F., Montella, A., & Garofoli, G. (2020). A case for differentiating design consistency evaluation between day and night. *Transportation Research Procedia*, *45*, 643–650. https://doi.org/10.1016/j.trpro.2020.03.046

The Star (20 January 2024). Glow-in-the-dark markings spark buzz. Retrieved 1 February 2024 from https://www.thestar.com.my/metro/metro-news/2024/01/20/glow-in-the-dark-markings-spark-buzz

The Straits Time (TST) (16th November 2023). Malaysia rolls out first glow-in-the-dark road markings. Retrieved 27 January 2024 from https://www.straitstimes.com/asia/se-asia/malaysia-rolls-out-first-glow-in-the-dark-road-markings

United Nations. (2018). The 2030 Agenda and the Sustainable Development Goals: An opportunity for Latin America and the Caribbean (LC/G.2681-P/Rev.3), 1-94. *Santiago*.

Wenzel, K. M., Burghardt, T. E., Pashkevich, A., & Buckermann, W. A. (2022). Glass beads for road markings: Surface damage and retroreflection decay study. *Applied Sciences*, *12*(4), 1-21. https://doi.org/10.3390/app12042258

World of Buzz (30th November 2023). Johor's 1st Glow in the Dark Road Lines Installed in Masai, Will Be Expanded State-Wide in 2024. Retrieved on 27 January 2024 from https://worldofbuzz.com/johors-1st-glow-in-the-dark-road-lines-installed-in-masai-will-be-expanded-state-wide-in-2024/

World of Buzz (6th January 2024). Johor MB: Glow-in-The-Dark Markings Will be Used at 31 Roads in The State. Retrieved on 27 January 2024 from https://worldofbuzz.com/johor-mb-glow-in-the-dark-markings-will-be-used-at-31-roads-in-the-state/

Received: 6th July 2024. Accepted: 5th September 2024

PLANNING MALAYSIA:
Journal of the Malaysian Institute of Planners
VOLUME 22 ISSUE 5 (2024), Page 527 – 542

VISUAL TREE ASSESSMENT AND ESTIMATION OF TREE CARBON SEQUESTRATION FOR OUTDOOR STUDENT CENTRE

Atikah Fukaihah Amir[1], Norizan Mt Akhir[2], Nor Izana Mohd Shobri[3]
Foong Swee Yeok[4], Fatemeh Khozaei Ravari[5]

[1,2,3]*Department of Built Environment Studies and Technology,*
College of Built Environment,
UNIVERSITI TEKNOLOGI MARA, PERAK BRANCH, MALAYSIA
[4]*School of Biological Sciences,*
UNIVERSITI SAINS MALAYSIA, PENANG, MALAYSIA
[5]*Department of Architectural Engineering,*
DHOFAR UNIVERSITY, SALALAH, SULTANATE OF OMAN

Abstract

Environmental assessment is crucial for every project development, especially when the space is surrounded by many mature trees. Failing to understand the existing character and conditions of the site can result in design failures that may lead to the loss of ecosystem benefits. Many developments are constructed without consulting experts, leading to unstructured development. Therefore, this research aims to investigate the potential of a proposed outdoor space towards a better teaching and learning environment. This study analyses Visual Tree Assessment (VTA) and estimates the carbon sequestration of trees using qualitative and quantitative data. The objectives are to create a topographic layout map by assessing site conditions, examining tree species and their condition through limited VTA, and estimating the net carbon sequestration of the on-site trees. 59 trees were analysed, and a map was developed for overlay purposes. A composite map illustrates the correlation of comfort, movement, aesthetics, and social relations criteria for the Outdoor Student Centres. In conclusion, 82% of Pongamia pinnata trees are deemed unsuitable for the site and may be considered for removal for OSC development. The site's net tree carbon sequestration is estimated to sequester a minimum of 611 kg of carbon. Effective site planning is a crucial factor in this process to ensure optimal outcomes.

Keywords: Plant Identification, Visual Tree Assessment (VTA), Carbon Sequestration, Outdoor Learning, Mapping Overlay

[1] Senior Lecturer at Universiti Teknologi MARA Perak Branch. Email: atika250@uitm.edu.my

INTRODUCTION

The Outdoor Student Centre (OSC) is a proposed project for the UiTM Perak branch, providing outdoor learning spaces for both students and lecturers. Learning does not have to be confined to the classroom; it can happen anywhere, especially with online resources. According to Yaman (2018), a study among Landscape Architecture and Architecture students at Universiti Putra Malaysia (UPM), International Islamic University Malaysia (IIUM), and Universiti Teknologi MARA (UiTM) showed that outdoor learning spaces offer diverse experiences and improve students' performance, particularly in Problem-Based Learning (PBL). Additionally, learning outdoors offers health benefits and promotes healing through nature. O'Brien (2011) found that outdoor learning, whether through intensive hands-on activities or over the long term, enhances health and well-being. Overall, outdoor education provides valuable experiences and benefits to students.

According to Corel Mateo-Canedo (2023), an experimental study involving 273 undergraduate university students in Barcelona tested three learning exposures: indoors, outdoors, and online. The study evaluated the learning experience and conditions across six dimensions: learning impact, evaluative impact, hedonic experience, technical conditions, environmental conditions, and health security. Outdoor seminars were found to be more effective than indoor seminars with regards the learning experience, particularly in hedonic experience. However, indoor seminars received higher ratings than outdoor seminars in terms of learning conditions, with a significant difference observed in environmental conditions.

Based on the experimental study, university students achieved better scores in the online environment compared to face-to-face environments. Adapting to both outdoor and online contexts through active methodologies helps overcome technical, environmental, and teaching limitations, and improves health security. The approach also ensures a positive learning experience and adds flexibility to the teaching-learning processes. Teaching and learning in the university should be versatile, and providing outdoor spaces or green spaces for teaching and learning environments should be considered. The potential spaces for outdoor learning are proposed based on the existing features at UiTM Perak branch. According to Abdullah (2021), the analysis of significant design characteristics for outdoor learning in higher education emphasises safety, comfort, tranquillity, and proximity. Therefore, UiTM can utilize existing trees and the surrounding natural environment as key elements for outdoor education. UiTM Seri Iskandar campus, plans to develop an Outdoor Student Centre project at Dataran Usahawan. The proposed project encompasses a 3,600m² area with various tree species and a building known as Dataran Usahawan. Consequently, several phases are being strategized, including identifying tree species and assessing tree conditions through Visual Tree Assessment (VTA). This

identification is part of the site inventory and site analysis process, focusing on biological attributes. This phase also included a further ecological investigation to understand the basic ground need of many habitats around. The VTA method is internationally recognized for tree inspection, identifying hazard symptoms, confirming defects, and assessing criteria for failure. Since the site is slated for development, the researcher initiates identification of trees that can be either pruned or preserved. Thus, the research aims to investigate the potential of an outdoor space for a teaching and learning environment with a tree study before allowing any tree to be cut down.

The objectives are narrowed into three: Firstly, to produce the topographic layout map by measuring the site conditions. Secondly, was to investigate the tree species and their conditions in the site project by limited VTA. Lastly, to estimate the net carbon sequestration of the trees on site. These three stages of data are essential for the researcher to understand the character and potential of the site for an Outdoor Student Centre (OSC).

LITERATURE REVIEW

Student Outdoor Learning in Higher Education

According to Abdullah (2021), outdoor learning involves gaining knowledge outside of the conventional classroom or an enclosed learning space. The analysis of significant design characteristics for outdoor learning in higher education emphasises safety, comfort, tranquillity, and proximity. Maheran et al. (2017) concluded six design characteristics for proper outdoor learning spaces: flexibility and multiple use, comfort, movement, technology and ICT tools, aesthetics, and social relations. Therefore, to achieve a learning space that meets these design characteristics, UiTM needs to sacrifice several trees to develop a proper space. Trees grow over time and have a long-life cycle for replantation. Thus, initiatives to investigate tree conditions before cutting them down are indeed one of the necessary steps. UiTM can utilise existing trees and the surrounding natural environment as key elements for outdoor education.

The Existing Tree Conditions Assessment

A tree assessment task is specific information to present a tree condition's status. The task has been practised for over a century to sustain urban green initiatives. Landscape designers are also well aware of the success of the planting programs in the tree assessment task provided. It is mentioned that the assessment task for the existing tree in a particular site is the core component in the design process because it is premeditated to reveal the tree performance status for practical design solutions (Koeser et al., 2016). It guides the designer through realistic data obtained (Roman et al., 2013). This way, systematic design practices are ideal for ensuring outstanding tree performance and the continuity of the ecosystem services that existing trees provide.

According to Li (2022), tree health describes the growth condition of trees and focuses on protecting and restoring trees to a healthy state. The unhealthy tree is often related to primary stress factors, such as temperature, mineral deficiencies, and lack of watering. The attack by insects or disease is a secondary factor that attacks weakened trees. Diagnosing a tree on-site should consider six important keys as per suggested by Lily (2001), such as (a) accurately identify the plant, (b) look for a pattern or abnormality, (c) carefully examine the site, note the colour, size, and thickness of the foliage, (e) check the trunk and branches, and (f) examine the roots and root collar. The researchers should also built a checklist for general study when diagnosing trees on site.

According to Lily (2001), around 70-90% of tree health problems are caused by environmental conditions such as soil compaction, drought, moisture fluctuations, temperature extremes, mechanical injuries, or poor species selection on site. The cause is usually combined or complex with non-living stresses and living human/animal contributors. Thus, no direct or single solution can be suggested when analysing the tree health problems. When analysing the tree heath, the researchers look at the symptoms and signs to determine the cause. According to Lily (2001), a problem on the tree was rarely diagnosed with a single symptom. For example, the wilting symptoms might be caused by a lack of watering or root problems. Therefore, various tree assessment approaches have been created to aid professionals through the tree inspection process. The Basic Tree Assessment Method was developed in conjunction with the International Society of Arboriculture's (ISA) Tree Risk Assessment Best Management Practice (BMP) Manual (Smiley et al., 2017). Depending on the extent of the assessment, this tree assessment methodology is divided into three levels: Level 1 is a limited Visual Tree Assessment (eyes-only inspection, drive-by, or a walk-by assessment). Level 2 is a basic Visual Tree Assessment (ground-level inspection with simple hand tools). Level 3 is an advanced Tree Assessment (human climbing on a tree may involve together with a piece of diagnostic equipment).

The tree condition index contains a risk-rating assessment characterised by four levels - low, moderate, high, and extreme (Chuon et al., 2011), equivalent to tree health status into good, moderate, poor, and very poor. This assessment is being done especially in future development settings. It would help identify tree defects in the proposed areas, calculating the hazard of the existing trees and the possibilities of their failures. This likely damage rigorousness could happen due to their failures and, most importantly, recommending pre-incident preventive and corrective design solutions. This would help in preventing unnecessary losses due to future tree failures.

Measuring Tree and Carbon Sequestration

The carbon sequestration in a tree refers to capturing atmospheric carbon dioxide through photosynthesis and storing it in plants' parts like stems, leaves, and roots. The value of carbon sequestration of a tree is different based on the locality and precision of the date taken. This research paper cites a tropical tree in Singapore located on the roadside to be used in similarity to this research locality. However, the tree girths are measured on-site. According to Tan (2010), to obtain a net carbon sequestration, tree girth and carbon sequestration value are needed with simplified formula as shown in Figure 1.

Net Carbon Sequestration = Tree Girth x Per Tree Carbon Sequestration Rate
(kg C / year) (kg C / tree / year)

Figure 1: Formula for Net Carbon Sequestration Estimation.
Source: Tan (2010)

The age of a tree can be identified by its girth. According to Tan (2010), tree girth is classified into four types, as shown in Figure 2. Figure 2 summarises that the tree is categorised into four types based on the tree Diameter at Breast Height (DBH). It was measured quickly on the site by using a DBH tape.

Girth 1	Girth 2	Girth 3	Girth 4
DBH < 0.5m	DBH 0.5m to	DBH 1m to	DBH >1.5m

Figure 2: Four size categories of DBH of a tree based on Tan (2010)

Mapping Overlay

Ian McHarg (1920–2001) was a significant innovator and proponent of the map overlay method (Steiner, 2019). He studied how to design new roadways damaging as little as possible natural heritage and biodiversity to develop an eligibility analysis through a technique called 'overlay mapping,' consisting of overlapping different thematic maps. The map overlay is often used by landscape architects, planners, and geographers to analyse 'the green landscape pattern (Kuitert, 2013). In this study, the overlay map techniques identify two related programs: the tree's spatial program and the path circulation human behaviour program. The overlay is a GIS operation that superimposes multiple data sets to identify relationships between the data programs. In this study, overlaying techniques identify the plant species and tree condition with the human behaviour pattern circulation in the sites. Thus, the overlay techniques create a composite map by combining the geometry (circulation behaviour) and attributes (plant identification and tree conditions) of the input data sets for the inventory and analysis data before the design development stage. Overlay features in a map in AutoCAD is a simple technique to identify the critical features being considered.

It can also make the comparison of spatially related. According to Autodesk (2018), overlays compare two feature classes or spatially related layers, while according to Vemuri (2016), the transparency of layers is reduced and controlled to allow the researcher to compare each piece of data visually.

METHODOLOGY

The site proposal for OSC has been selected by Bahagian Pengurusan Fasiliti (BPF), UiTM Perak branch, based on the nearby existing building named Dataran Keusahawanan, which already focuses on student entrepreneurship development. This study employed a mixed-method approach, and the researcher analysed both qualitative and quantitative data. There were two types of data collection techniques: first, a topographic survey, and second, a tree health condition assessment. A topographic survey was considered quantitative data. As a measurement tool, a unit of theodolite was used to GPS log the location of any structure and levelling found on site. It is an optical instrument for measuring angles between designated visible points in the horizontal and vertical planes. Site surveys completed by licensed surveyors will typically include the locations of existing trees. The site was calculated with a 3,600m2 area, and the measurement was done in approximately a week when the sky was clear. The GPS log was then transferred into AutoCAD drawing and presented quantitative data in the form of drawing.

Tree health condition assessment as a second collection of data is part of qualitative data. Before the tree and site environment were assessed, the drawing from the topographic survey was used to highlight the different tree species on site carefully. The tree identification was made by understanding the different colours, forms, and patterns on leaves, trunks, flowers, fruit, and tree shapes. Tree health assessments are narrowed into four quality levels: good condition to represent a low tree risk rating, moderate condition to represent a medium risk, bad condition to represent high risk and very bad condition to represent extreme tree risk rate. This quality data was collected in approximately a week of observation. Other site qualities being assessed are human behaviour patterns, which were conducted in roughly a week. The total observation was approximately two months, from February until April 2022. Site observations for quantitative and qualitative data were needed, as the data obtained in this phase will guide the design proposal of the OSC project. The inventory and analysis data attributes highlighted in this proposal are cultural, physical, and biological attributes, including human movement, topography, hydrology, climate, and vegetation. The site analysis summarises the site's suitability based on the attributes that influence the project under consideration. Therefore, the opportunities associated with a site are unique natural resources that warrant protection. In this context of site projects, the opportunities that may enhance the

site's aesthetic and environmental quality are the existing trees that have contributed to a pleasing ambience and comfortable environment.

Based on the initial study made for carbon sequestration, the researcher found limited data for several species. The value of the carbon sequestration rate of trees is limited to *Cinnamomum iners, Mimusops elengi, Pongamia pinnata, Swietania macrophylla*, and *Syzigium campanulatum* only. The value used in this research is cited from Tan (2010) as shown in Table 1. This value is secondary data obtained from the citation work conducted on the tropical Singapore tree.

Table 1: Net Carbon Sequestration (kg C year/tree)

Tree species	Girth 1	Girth 2	Girth 3	Girth 4
Annona muricata	-	-	-	-
Cinnamomum iners	5	10	16	29
Mimusops elengi	4	5	14	16
Michelia champaca	-	-	-	-
Pongamia pinnata	3	9	-	-
Swietania macrophylla	5	10	17	30
Syzigium campanulatum	4	9	17	49

Source: Table modification from Tan (2010), page 12-13

RESULTS

Topographic Survey

Due to the minimal data of the existing base map that the clients have provided, the topographic survey needs to be mapped and the distance of the existing trees and the contour of the existing sites needs to be located. Data from the topographic survey was produced, as in Figure 3. The outcome of the survey is presented in Table 2. With the data, a Certified Arborist and a Landscape Architect have identified and investigated the tree's location and conditions by observing the site and digitally recording the boundaries and elements on site. Taking a colour photograph and specimens of leaves to investigate the conditions of trees' health and recording in a comprehensive notebook can help orient the analysis and make the digital mapping process more efficient.

Table 2: Site data conveyed on a topographic survey

Category	Site data conveyed
Topography	Elevation contours, Spot elevations for high points and low points
Vegetation	Location, species, VTA and Carbon Sequestration of trees
Hydrology	Surface water and stormwater flow
Structures	Buildings
Circulation	Streets, Curbs, and gutters Parking areas

(Source:) The authors

Based on the topographic map in Figure 3, the site has a high potential for an outdoor learning space due to its proximity to Dataran Usahawan and other facilities. Additionally, the tranquil environment, provided by the surrounding trees, supports this potential.

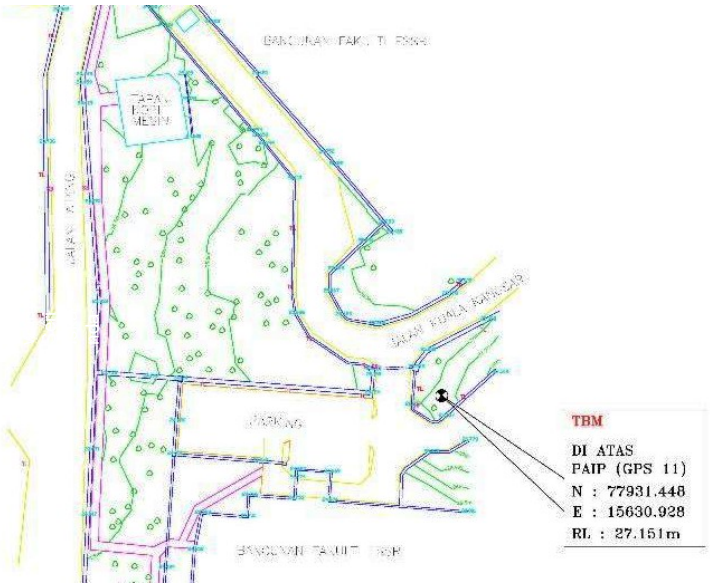


Figure 3: Topographic Survey Plan
Source: The authors

Plant Collecting and Identifying

Data of plant identification was conducted from the 24th to the 25th of February 2022 and was recorded in a comprehensive notebook. Elements of trees, such as leaves, branches, flowers, and fruit, were recorded. The purposes of collecting plants are to obtain records and specimens of the plant for personal collection and a dataset of UiTM's tree collection. It can also have a great value as a reference for identification (Bowles, 2004). Another purpose of plant collecting is for the researcher to identify an unknown species during fieldwork later. According to Bowles (2004), the researcher should collect at least one specimen of each species. For example, during the fieldwork study, the researcher found that modification leaves appeared in several leaves and specimens were collected and studied for possible causes on site.

A knife was used to obtain leaves from the stem during plant sampling. According to Bowles (2004), twigs should always be cut off cleanly with a sharp knife or pruners, and breaking the twig can ruin a specimen or cause unnecessary harm to the tree. However, the research is limited to the on-ground sampling and not until the underground portion, like roots, trailing, or underground stems. The researchers could still identify the plants from the above-ground sampling, so

they did not go further underground, as Bowles (2004) suggested. During plant tree sampling, the researcher took comprehensive note of the collection number, the plant's name (if the researcher can be identified on-site), description of the tree, specific details of the micro-habitat, and date of sampling.

Plant Identification and Tree Health Conditions

The researchers identified seven tree species with 59 numbers in the designated plot. *Swietenia macrophylla* tree is the highest number (30 nos) of trees found on the site. Followed by *Pongamia pinnata* (11 nos), *Syzigium companulatum* (7 nos), *Cinnamomum iners* (5 nos), *Mimusops elengi* (4 nos), *Michelia champaca* (1 nos), and one new tree that just has been planted Annona muricata. The basic tree assessment method (Smiley et al., 2017) was used in this study to investigate tree health conditions. These showed a diverse tree vigorousness, foliage size and colour, pests or biotic affection, abiotic effects, and species failure profiles in the branches, trunk, or roots. Table 2 presents the health profiles of the trees in the study. Most trees in this study had a high vigour classification, accounting for 84.7% (N = 50) of the total trees. This was followed by trees with standard vigour classification, which comprised 11.9% (N = 7), and only 3.4% (N = 2) had low vigour classification. This study discovered that most trees have a standard foliage profile of 96.6%, which accounted for 57 trees. However, two species, namely *Pongamia pinnata* (Mempari), have chlorotic and necrotic problems. Only 15.3% of the trees had problems with biotic effects, which came to 9 trees. This situation only involved nine *Pongamia pinnata* (Mempari) species affected by the competition for sunlight from an adjacent tree and compacted soil. This causes the trees to be prone to failure in the branches and roots.

An analysis of the tree health profiles discovered three health condition classifications: good, moderate, and poor (Figure 4). The trees with poor health conditions were less than 4% of the total, only 3.4% (N= 2) from 59 trees. 11.9% (N = 7) were in moderate health condition, and the majority, 84.7% (N = 50) of trees, were in good health condition. Trees identification and location plans, as in Figure 4 and Figure 5.

Overlaying Composite Maps

The analysis of topographic layout map and existing tree health conditions were mapped together in Figure 6 to produce overlaying composite maps. A total of nine (9) out of 11 trees (82%) from *Pongamia pinnata* species were categorized in moderate and poor conditions health are not suitable on the site. Sustainable or 'green' development respects the natural environment and ensures, for example, that the trees are protected and incorporated into the site plan (Petit et al., 2004). After considering all the attributes and the site analysis process, especially on the tree's identification and analysis, the proposal design vision narrows down to the sustainable design planning paradigms for building a better student centre

community on campus. Sustainable in this proposal design has three fundamental precepts: 1. Design with nature which are existing natural resources such as trees, 2. Design with campus culture where the more outdoor classroom centre, and 3. Design a place for students to interact and recreational.

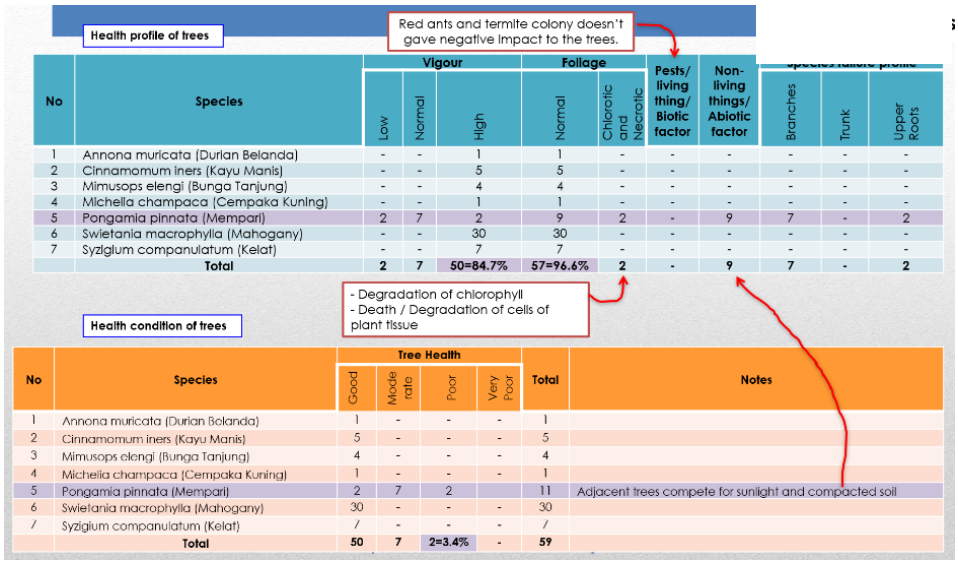


Figure 4: The tree health profile and conditions for limited VTA.
Source: The authors

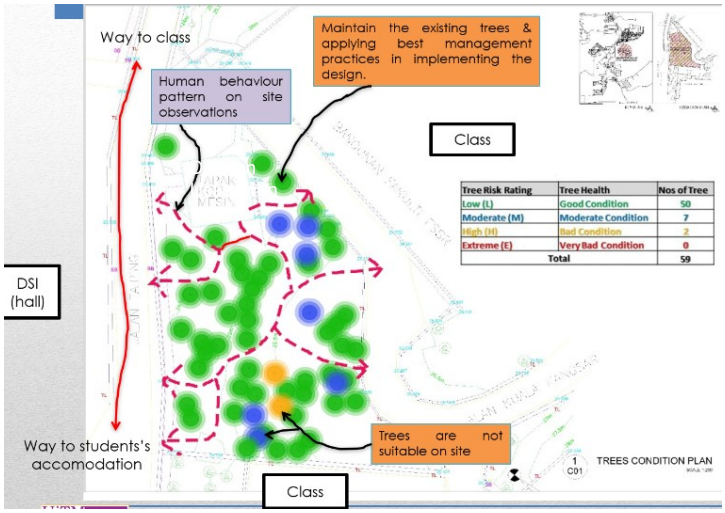


Figure 5: Overlaying composite maps. A total of 82% of *Pongamia pinnata* fall under poor and moderate health conditions, highlighted in blue and yellow.
Source: The authors

According to John Sawhill, former president of The Nature Conservancy, in the end, our society will be defined not only by what we created but also by what we refuse to destroy. Thus, the idea of the proposal is more on mitigating the impacts of the previous site uses, such as maintaining the existing tree and applying the best management practices in implementing the design through sustainable site design planning.

Estimation of Tree Carbon Sequestration

A variety of methods can be used to estimate carbon sequestration in trees. If more precise data can be obtained such as diameter and height of biomass if available, they can be fairly accurate for estimation. However, trees on the site are assessed based on VTA and girth only for estimating the net carbon sequestration. The researcher also measured the girth of trees on the site and found that the trees fall into Girth 1 until Girth 3 category. A simple method is used to explain how the trees were influenced in offsetting atmospheric carbon.

Table 3: Estimation of Net Carbon Sequestration

Tree species	Girth (A)	Tree count (B)	Per Tree Carbon Sequestration Rate (kg C/tree/year) (C)	Net Carbon Sequestration (kg C / year) (D = B X C)
Annona muricata	G1	1	NA (1)	1
Cinnamomum iners	G2	2	10	20
	G3	3	16	48
Mimusops elengi	G1	1	4	4
	G2	3	5	15
Michelia champaca	G1	1	NA (1)	1
Pongamia pinnata	G1	10	3	30
	G2	1	9	9
Swietania macrophylla	G2	10	10	100
	G3	20	17	340
Syzigium campanulatum	G1	4	4	16
	G2	3	9	27
			Total	**611 kg C/year**

Source: The authors

Based on the formula in Figure 1 and the index shown in Table 1, the researcher estimated the net carbon sequestration of the tree in a 3600m^2 plot site. The carbon sequestration rate of *Anona muricata* and *Michelia Champaca* is unavailable in Tan (2010); thus, the researcher made a minimum estimation of 1 kg C/tree/year for each species. The trees also have one tree count for each species; thus, the minimum net tree carbon sequestration of the site was generated in Table 3. The net carbon sequestration of trees in the plot area of 3600m^2 is at least 611 kg C / year.

According to Donev (2023), 1 kg of Carbon equals to 3.67 kgCO_2. Thus, 611 kg of Carbon equals to 2,242.37 kg of CO2 or 2.24 ton of CO_2

equivalent. According to a carbon footprint calculator, Carbon Footprint (2023), 2.24 ton of CO_2 equivalent is like the offset of an average car petrol driving for approximately 13,000 km, and a car usually travels 10,000 km per year. In summary, a total of 59 trees in a 3600 m2 area are able to sustain more than a year for capturing the emission of a single car driving approximately 13,000 km distance.

To conclude, the proposed project of OSC must take into account the significant value of carbon that has been sequestered over the years by the existing trees. To ensure sustainable development, it is crucial to implement a strategic replantation plan that not only compensates for the loss of carbon storage but also aims to increase the overall carbon sequestration capacity by planting an equal or greater number of trees. This approach will help maintain the ecological balance and contribute positively to the environment in the long term.

DISCUSSION

This study has addressed the subject of proper outdoor learning centres for university students by examining the existing physical element (Maheran et al., 2017). The study contributes to the field by presenting a composite map overlayed based on the topographic study and existing tree condition factors, which may be a concealed but crucial guide in the design proposal. The outcomes of this study will assist and extend the understanding of preparing outdoor learning centres for university students. The findings of this study are consistent with the outcomes of previous research. Many studies from the literature review consider existing physical elements, including campus trees, a significant subject for outdoor learning centres (Abdullah et al., 2022; Maheran et al., 2017; Mann et al., 2021; Mirrahmi et al., 2011).

Based on a review, Maheran et al. (2017) concluded with the six criteria for proper outdoor learning spaces: flexibility and multiple-use, comfort, movement, technology and ICT tools, aesthetics, and social relation. This study presents the overlaid composite map, which is strongly associated with relaxation in the space with surrounding trees (comfort), good accessibility of the site with surrounding facilities (movement), strong visual appeal (aesthetic), and good community interaction (social relation). While other two criteria, flexibility and multiple-use, and technology and ICT tools, are not analysed in this research, thus, limiting the study. The consideration of comfort, movement, aesthetic and social relation criteria in this project has been thought in the form of appreciating existing trees as a ‘comfortable’ space for a learning environment, ‘movement’ in the form of human behaviour patterns on-site, ‘aesthetic’ in the form of space function or arrangement in the site, and ‘social relation’ in the form of connectivity space between existing building. Trees are identified, examined, and acknowledged throughout the site analysis as assets that can yield multiple ecological, economic, and social benefits. Trees on site provide shade, reduce

heat, and give a cooling effect near the Dataran Usahawan building. Trees serve multiple design functions that directly benefit users. The environment where they can provide shade serves as windbreaks, with the significant shape of trees also giving an aesthetic value and providing a spatial enclosure for an outdoor classroom.

Tree spatial programs focus on data tree conditions collected from the site observation and photographs. Tree structures are considered on the root/formation, trunk condition and branch assembly and arrangement. Meanwhile, tree health considers the crown indicators, including vigour, density, leaf size, quality, and stem shoot extension. In addition, the circulation of the human pathway was analysed in its movement pattern to emphasise the effect of tree conditions and species influencing the behaviour pattern.

CONCLUSION AND RECOMMENDATIONS

In conclusion, the researcher summarises the first objective which is to produce the topographic layout map by measuring the site conditions. The result of the topographic layout was presented using a unit of theodolite, and the location of each structure or object was logged by GPS. The map was generated using AutoCAD in Figure 3. For the second objective which is to investigate the tree species and their condition in the site project by limited VTA, the research is limited to Level 1 and Level 2 only. Level 3, which involves climbing the tree to check the crown, is not being conducted. The health and profile of the trees are presented in Figure 4. 82% of *Pongamia pinnata* are unsuitable for the site and can be considered eliminated for the OSC design stage. Lastly, the third objective was to estimate the net carbon sequestration of the trees on site. The site's net of tree carbon sequestration is estimated to sequester a minimum of 254 kg C in a year. 59 trees in the plot area are needed to sustain for one year to capture the emission of a single car of approximately 13,000 km.

For the OSC design stage, the overlaying composite map in Figure 6 shows the area that needs to be considered when designing for future development. This data is vital for the researcher and designer to design the outdoor space for students that meets the needs of a quality environment and the convenience-walking ambience for the student to occupy the whole area as the outdoor classroom. In the context of future design development, the data on tree conditions and species existing is essential and significant to help the landscape architect design the area with the objective of sustainable development. As most of the areas were considered to receive good tree health conditions, thus, this area has a potential for core area space development of outdoor learning classrooms.

However, the area or tree locations of *Pongamia pinnata* that were categorised in moderate and poor tree conditions can also be considered if the designer plans to improvise the site area. For future reference, the tree selections must be chosen wisely before planting, as *Pongamia pinnata* is unsuitable for

growing on-site based on abiotic factors (the competition for sunlight from an adjacent tree and compacted soil). This is shown by the symptoms of failure in the branches and roots.

In summary, for future site planning at a larger scale, it is recommended to use Unmanned Aerial Vehicle (UAV)-based GIS technologies to obtain data on tree coverage percentages, as this technique provides faster results (Abdullah, 2021). However, due to potential limitations in precision for detailed studies, human engagement remains essential. UiTM administration and management should be fully aware of the design space and function, making careful decisions about which trees to cut for future development. Effective site planning is crucial to ensure optimal outcomes, which includes conducting thorough environmental impact assessments, collaborating with environmental experts and local communities, and implementing continuous monitoring and evaluation mechanisms. By integrating these recommendations, OSC can achieve a harmonious balance between development and environmental sustainability.

ACKNOWLEDGEMENTS

The acknowledgement is made to certified arborist of CA LAr Dr Helmi Hamzah, and project consultant of LAr Ruwaidah Borhan. Special thanks to certified land surveyor Sr Gs Izrahayu Che Hashim, Sr Gs Haslina Hashim, Sr Gs Noorsazwan Ahmad Pugi, and Sr Gs Azlizan Adila Mohamed for providing the topographic survey map in this research paper.

REFERENCES

Abdullah, M., Teh, M. Z., Hamzah, H., & Hassan, K. (2022). Exploring Children Preferred Outdoor Landscape Elements for Education. In J. Jamaludin, H. A. Azizan, N. A. Mohamed Salim, N. Hassan, & A. Md. Hashim (Eds.), *2nd International Conference on Design Industries & Creative Culture*, DESIGN DECODED 2021. EAI. https://doi.org/10.4108/eai.24-8-2021.2315049

Abdullah, S., Abdul Rashid, M. F., Tahar, K. N., & Osoman, M. A. (2021). Tree Crown Mapping Based on Unmanned Aerial Vehicle (UAV) Towards A Green-Sustainable Residential. *Planning Malaysia*, *19*(16). https://doi.org/10.21837/pm.v19i16.955Autodesk. (2022). Retrieved from https://knowledge.autodesk.com/support/autocad-map-3d/learn-explore/caas/CloudHelp/cloudhelp/2019/ENU/MAP3D-Use/files/GUID-DEECDAFF- E5C8-4900-975E-E793808CF939-htm.html.

Abdullah, F., Yaman, M., Sanusi, A. N. Z., Asif, N. Salim, F., (2021). Significant Design Attributes for Outdoor Learning Environment in Higher Learning Institutions. *Journal Of Architecture, Planning & Construction Management*. Volume 11 Issue 1, 2021. Retrieved June 3, from https://www.researchgate.net/publication/353729689_SIGNIFICANT_DESIGN_ATTRIBUTES_FOR_OUTDOOR_LEARNING_ENVIRONMENT_IN_HIGHER_LEARNING_INSTITUTIONS.

Carbon Footprint. (2023). Retrieved June 22, 2023, from https://www.carbonfootprint.com/calculator.aspx

Chuon, J. T. Y., Sood, A. M., Yaman, A. R., Malek, I. A. A., & Ibrahim, K. (2011). Hazard-Rating Assessment of Roadside Trees at UPM using Geospatial Tool. *Journal of Sustainability Science and Management*, 6(1), 118–125.

Chih Min Boo; Kartini Omar-Hor; Chow Lin Ou-Yang; Cheow Kheng Ng; National Parks Board (Singapore), (2020). 1001 Garden Plants in Singapore: A New Compendium. [Singapore]: National Parks Board

Corel Mateo-Canedo, Neus Crespo-Puig, Ramon Cladellas, Jorge Luis Méndez-Ulrich, Antoni Sanz. (2023). MOTEMO-OUTDOOR: Ensuring Learning and Health Security During the COVID-19 Pandemic Through Outdoor and Online Environments in Higher Education. *Learning Environments Research* (2023) 26:823–841. Retrieved from https://doi.org/10.1007/s10984-023-09456-y

Donev, J., et all. (2023). Retrieved June 22, 2023, from https://energyeducation.ca/encyclopedia/C_vs_CO2#:~:text=Carbon%20has%20an%20atomic%20mass,3.67%20kg%20of%20CO2

Jane M. Bowles, 2004. Guide to Plant Collection and Identification. UWO Herbarium Workshop in Plant Collection and Identification.

Koeser, A. K., Hasing, G., Mclean, D., & Northrop, R. (2016). Tree Risk Assessment Methods: A Comparison of Three Common Evaluation Forms (pp. 1–8). Environmental Horticulture Department, UF/IFAS Extension. http://edis.ifas.ufl.edu.

Lily, S. J., (2010). Arborists' Certification Study Guide, Third Edition. International Society of Arboriculture. Illinois, USA.

Li, H., Zhang, X., Li, Z., Wen, J., & Tan, X. (2022). A Review of Research on Tree Risk Assessment Methods. *Forests*, 13(10), 1556. MDPI AG. http://dx.doi.org/10.3390/f13101556

Maheran, Y., Fadzidah, A., Nur Fadhilah, R., & Farha, S. (2017). A Review of Criteria for Outdoor Classroom in Selected Tertiary Educational Institutions in Kuala Lumpur. *IOP Conference Series: Materials Science and Engineering*, 291. https://doi.org/10.1088/1757-899X/291/1/012014

Mann, J., Gray, T., Truong, S., Sahlberg, P., Bentsen, P., Passy, R., Ho, S., Ward, K., & Cowper, R. (2021). A Systematic Review Protocol to Identify the Key Benefits and Efficacy of Nature-Based Learning in Outdoor Educational Settings. *International Journal of Environmental Research and Public Health*, 18(3), 1–10. https://doi.org/10.3390/ijerph18031199

Steiner F. (2019). Design with Nature Now. Lincoln Institute of Land Policy. Cambridge, United States.

Mirrahmi, S. Z., Tawil, N. M., Abdullah, N. A. G., Surat, M., & Usman, I. M. S. (2011). Developing Conducive Sustainable Outdoor Learning: The Impact of Natural Environment on Learning, Social and Emotional Intelligence. *Procedia Engineering*, 20, 389–396. https://doi.org/10.1016/j.proeng.2011.11.181

O'Brien, Liz & Burls, Ambra & Bentsen, Peter & Hilmo, Inger & Holter, Kari & Haberling, Dorothee & Pirnat, Janez & Sarv, Mikk & Vilbaste, Kristel & McLoughlin, John. (2011). Outdoor Education, Life Long Learning and Skills

Development in Woodlands and Green Spaces: The Potential Links to Health and Well-Being. 10.1007/978-90- 481-9806-1_12.

Petit, J., D.L. Bassert and C. Kollin. (2004). Building Greener Neighborhoods: Trees as Part of the Plan, 2nd ed. Washington, D.C.: American Forests and Home Builders Press.

Roman, L. A., McPherson, E. G., Scharenbroch, B. C., & Bartens, J. (2013). Identifying Common Practices and Challenges for Local Urban Tree Monitoring Programs across the United States. *Arboriculture and Urban Forestry,* 39(6), 292–299. Retrieved from https://www.fs.fed.us/nrs/pubs/jrnl/2013/nrs_2013_roman_001.pdf

Smiley, T., Matheny, N., & Lilly, S. (2017). Tree Risk Assessment. In Best Management Practices (Second). *International Society of Arboriculture*. https://doi.org/10.1108/02621711111098398

Tan Puay Yok, Bryan Yeo, Yip Wen Xi, Lua Hock Keong (2010). Carbon Storage and Sequestration by Urban Trees in Singapore. Centre of Urban Greenery and Ecology (CUGE). National Park Board.

Vemuri S. H. (2016). Evaluation of Rapid Scanning Techniques for Inspecting Concrete Bridge Decks with Asphalt Overlay. Colorado State University.

Wybe Kuitert. (2013). Urban Landscape Systems Understood by Geo-History Map Overlay. *Journal of Landscape Architecture,* 8:1, 54-63, DOI: 10.1080/18626033.2013.798929

Yaman, Maheran & Abdullah, Fadzidah & Rozali, Nur & Salim, Farha. (2018). The Relevancy of Outdoor Classroom for PBL Approach in Selected University in Kuala Lumpur. *Planning Malaysia Journal*. 16. 10.21837/pmjournal.v16.i6.473.

Received: 30th June 2024. Accepted: 10th September 2024

PLANNING MALAYSIA:
Journal of the Malaysian Institute of Planners
VOLUME 22 ISSUE 5 (2024), Page 543 – 557

THE APPLICATION OF CHOICE MODELLING FOR A SANITARY LANDFILL IN KOTA BHARU, KELANTAN, MALAYSIA

Nik Nor Rahimah Nik Ab Rahim[1*], Jamal Othman[2], Mohd Rusli Yacob[3]

[1,3]*Faculty of Forestry and Environment,*
UNIVERSITI PUTRA MALAYSIA
[2]*Faculty of Economy and Management,*
UNIVERSITI KEBANGSAAN MALAYSIA

Abstract

Environmental impacts from poor landfilling practices have long been a concern in Kota Bharu, a densely populated city in Peninsular Malaysia. Addressing this issue requires a sustainable disposal solution, such as a sanitary landfill. However, such a project can fail without understanding household demand. This study examined households' willingness to pay for a sanitary landfill using a survey-based method known as Choice Modelling. This method was employed to determine households' willingness to pay for the environmental benefits of a sanitary landfill, characterized by attributes like controlled leachate discharge, reduced bad odour, reduced disease vectors, and pleasing views. The results indicated a positive willingness to pay for each attribute, ranging from RM2.37 to RM12.08 per month. This information aids policymakers in making decisions that align with household demands, thereby minimizing opposition and enhancing project feasibility.

Keywords: Non-Market Valuation, Choice Modelling, Sanitary Landfill, Solid Waste Disposal

[1] Senior lecturer Email: rahimah_rahim@upm.my

INTRODUCTION

The twentieth century saw a rapid increase in solid waste (SW) generation due to population growth and greater consumerism, particularly in developing countries experiencing unprecedented economic development (Yaacob, et. al, 2019; Bowan, et al., 2020). This has led to poor solid waste management (SWM), with infrequent SW collection and excessive demand for SW disposal, exacerbating environmental issues due to the inefficient disposal activities (Haron et al., 2023). Landfilling, the most common disposal method, often remains unattended, causing problems like gas emission, leachate discharge, and land use issues (Edwards et al., 2018; Martinez-Sanchez et al., 2017; Sahariah et al., 2015; Suandi, et. al, 2023). Sustainable SW disposal methods, such as sanitary landfills or incineration, and SW reduction approaches like recycling and composting are essential (Shekdar, 2009). Different nations have varying SW disposal schemes based on land availability, expertise, and financial capacity. Developed countries have optimal schemes for SW reduction, unlike developing countries where sustainable SW disposal is hindered by resource and capacity constraints (World Bank, 2012; Anik, et al., 2018). A holistic SW disposal facility with SW reduction technologies is often infeasible in developing countries, making sanitary landfills a more viable option (Rodic and Wilson, 2017). Gradual implementation, adapting to available resources, local SW composition, and creating public awareness are key (Subhasish, et al., 2019).

In Malaysia, over 90% of SW is landfilled (Kamaruddin, et al., 2017; Fauziah and Agamuthu, 2010). The reliance on landfilling for waste disposal leads to significant space constraints, health problems, and environmental issues (Shakil et al., 2023). There are 166 operating landfills, 92% of which lack a clear operational concept, often being mere "dump sites" (NSWMD, 2018; Kamaruddin, et al., 2017). The outdated SW disposal method struggles to accommodate the increasing SW generation rate, which grows by 18% every three years, necessitating the development of SWM policies (Zainu and Songip, 2017; NSWMD, 2018). The Solid Waste Management and Public Cleansing Act (Act 672) promotes sustainable SWM by implementing SW reduction strategies and advancing disposal methods. Post-enactment, 14 sanitary landfills, four incinerators, and the shutdown of 135 dump sites have been achieved (NSWMD, 2018). Despite Act 672's progress, only 8% of operating landfills are sanitary due to high construction and operational costs, ranging from RM128 million to RM198 million for 20 years. Public opposition to SW disposal facility projects, especially incinerators, further hinders implementation (Khee and Othman, 2011).

These challenges jeopardize SW disposal quality, resulting in poorly managed landfills and dump sites. Addressing these issues requires an approach to alleviate the situation. Non-market valuation, a technique to assess public willingness to pay (WTP) for goods or services, is increasingly used in SWM,

especially in developing countries, to measure preferences for SWM from various aspects. Non-market valuation studies support the need to enhance the SWM scheme as evidenced by the increasing number of recent non-market valuation studies, including those by Huynth et al. (2023) and Rahman and Bohara (2022). Moreover, the non-market valuation studies are aligned with the need to improve the SWM scheme. Proposing a sanitary landfill to support sustainable SWM policy requires eliciting the value of the landfill's disposal service and its indirect environmental benefits. This involves WTP elicitation among households likely to benefit from the SW disposal service.

The Necessity of a Sanitary Landfill in Kota Bharu, Kelantan

The focus of this study was Kota Bharu, located in the northeast of Peninsula Malaysia. Undesirable impacts from solid waste (SW) disposal have long been a concern, necessitating the execution of a sanitary landfill. Since 1976, landfilling in Kota Bharu has harmed the environment and caused health hazards to nearby residents and SWM workers. The current Beris Lalang landfill has led to river and groundwater pollution and vector-borne diseases. Leachate from degraded SW mixes with rainwater, contaminating nearby rivers and groundwater. Landfilling also increases the breeding of disease vectors like flies and mosquitoes, spreading diseases such as Malaria, Dengue, and Leptospirosis (Nazri et al., 2012).

Efforts to implement basic sanitary landfill requirements have been discontinued due to financial constraints and a lack of expertise. The local authority, facing excessive SW generation and financial limitations, resorted to crude dumping methods. This has exacerbated environmental problems at Beris Lalang, jeopardizing public health. Given the financial constraints and lack of household demand data, the study aimed to investigate household preferences and their willingness to pay (WTP) for a sanitary landfill using a non-market valuation technique called Choice Modelling (CM). This survey-based method will gauge household demand for the environmental benefits offered by a sanitary landfill, focusing on attributes like leachate discharge, odour intensity, disease vectors, and aesthetics.

Understanding household WTP for improved environmental attributes will help policymakers design SWM policies that align with public preferences and support sustainable landfill projects. This information is crucial to avoid public discontent and potential project failure when implementing improved SW disposal policies in the future.

MATERIALS AND METHOD

Choice Modelling (CM) is a survey-based methodology by presenting the respondents with alternatives for a sanitary landfill. Each choice is a bundle of attributes differentiated by varying attribute levels. The respondents were asked

to choose their most preferred alternative. By including a monetary feature in the form of an additional SWM fee as one of the attributes, WTP estimates could be obtained from the marginal value estimates from a probabilistic choice model for changes in attribute levels (Hanley et al., 2005).

CM relies for its theoretical basis on Lancaster's theory of value and random utility theory (RUT) characterising utility function into two parts of choice probability, namely observable component (V) and error term (ε), representing unobservable components on the choice of the respondent (Manski, 1977). This assumes the utility of an individual ***j*** for an option ***c*** depends on environmental attribute (**X**):

$$U_{jc} = V(X_{jc}) + \varepsilon(X_{jc}) = \beta X_{jc} + \varepsilon_{jc} \quad (1)$$

The chance that individual ***j*** will pick option ***c*** over option ***k*** is:

$$P(c|C) = \text{Prob}\{V_{jc} + \varepsilon_{jc} > V_{jk} + \varepsilon_{jk},\ all\ j \in C\} \quad (2)$$

Where **C** is the entire choice set. Approximation of Equation (2) needs assumption over the distribution of the error terms. The assumption is that the error terms are independently and identically distributed (IID), leading to the property of independence of irrelevant alternatives (IIA). According to the IIA, the likelihood of choosing between two alternatives remains unchanged regardless of the introduction or elimination of other options. This implies that the probability of choosing alternative ***c*** is given by:

$$\text{Prob}(c) = \frac{exp^{uv_c}}{\sum_{j \in C} exp^{uv_k}} \quad (3)$$

Where $V_c = V(X_c)$ is the indirect utility function, X_c is a vector of the attributes and ***u*** is a scale parameter which is inversely proportional to the standard deviation of the error distribution assumed to be equal to 1 (implying constant error variance). Equation (3) is estimated by means of a Multinomial Logit (MNL) regression with assumption that the choices must obey the rule of the IIA property which can be tested by using a procedure suggested by Hausman and McFadden (1984).

The most basic form of indirect utility function, V_c as in terms of Equation (1) is as follows:

$$V_c = ASC + \sum \beta_q Z_q \quad (4)$$

Where ***ASC*** is an alternative specific constant, ***β*** is a coefficient and ***Z*** are attributes in the choice set. ***ASC*** captures the unexplained effect of systematic

variations of the choices of respondents, reflecting the differences in the error terms. It is possible to include other variables into the utility function by interacting with the variables either with the ***ASC*** or with any of the attributes of the choice set as follows:

$$V_c = ASC + \sum \gamma_l ASC * S_l + \sum \beta_q Z_q \qquad (5)$$

Where S_l indicates the sociocultural variable for the lth individual. The estimation of Equation (1) can be used for implicit prices estimation. Basically, implicit prices are the marginal rate of substitution between the coefficients of the environmental attributes, β_x and the coefficient of the monetary attribute, β_m as shown in Equation (6). The implicit price of an environmental attribute reveals the WTP of individuals for an additional unit of the attribute. Estimates of the implicit prices can be used for better comprehension of the monetary values of the attributes.

$$Implicit\ price = \frac{-\beta_x}{\beta_m} \qquad (6)$$

Techniques in Choice Modelling

Table 1: Attributes and levels for a sanitary landfill

Attribute	Definition	Levels
Leachate	Discharge of toxic liquid formed from degraded waste and rainwater	1: Untreated discharge *(Status Quo)* 2: Half treated discharge 3: Fully treated discharged
Bad odour	Presence of bad odour due to disposed waste in the landfill	1: Strong *(Status Quo)* 2: Distinct 3: Weak 4: No odour
Disease vector	Breeding of vectors (e.g.: rats, mosquitoes, flies) in the landfill	1: Uncontrolled *(Status Quo)* 2: Controlled
View	Aesthetic surrounding of the landfill	1: Non-pleasing *(Status Quo)* 2: Pleasing
Additional fee	Additional fee for sanitary landfill incorporated into annual assessment payment	1: No payment *(Status Quo)* 2: RM3 per month 3: RM5 per month 4: RM7 per month

CM is a questionnaire-based method with eight compulsory steps. First, a valuation scenario and welfare change criterion were defined to familiarize respondents with the good or service, ensuring their true WTP. The scenario included four aspects: landfill conditions (comparing Beris Lalang landfill with the proposed sanitary landfill), the need for additional payment, the payment method, and glossaries of attributes.

Next, in-depth literature reviews and focus groups identified relevant attributes. Two focus groups, including local authority officers and household representatives from Kota Bharu, identified three environmental attributes (leachate, bad odour, and disease vectors) to describe the sanitary landfill's benefits, along with levels indicating attribute improvement. The monetary attribute was an additional SWM fee currently included in the annual assessment payment.

In a subsequent session, the attribute identification and levels were revised. "Leachate" was simplified to "toxic liquid" for data collection purpose for easier comprehension among respondents. An additional environmental attribute, "view," was added, with specific levels defined. The final attributes included four environmental (leachate, bad odour, disease vectors, and view) and one monetary (additional fee) attributes. Higher attribute levels indicate better environmental problem mitigation, as shown in Table 1.

The third step was the experimental design and choice set construction. The experimental design created combinations of attributes with varying levels into alternatives for the sanitary landfill. These alternatives were assigned into choice set questions, each with three options: Alternative One (Sanitary Landfill), Alternative Two (Sanitary Landfill), and the Status Quo (Current Condition). The status quo represented the Beris Lalang landfill with “Level one” attributes: untreated leachate discharge, strong bad odour, uncontrolled disease vectors, non-pleasing view, and no additional SWM fee. The study used the standard L^{MN} design to generate 48 choice sets with varying attribute combinations. Table 2 provides an example of these choice set questions where respondents select their preferred alternative.

Table 2: An example of choice set questions

	30km from Kota Bharu **CURRENT LANDFILL**	***50 km from Kota Bharu*** **SANITARY LANDFILL**	
		ALTERNATIVE 1	**ALTERNATIVE 2**
Leachate	Untreated discharge	Untreated discharge	Untreated discharge
Bad odour	Strong	Strong	Weak
Disease vectors	Uncontrolled	Controlled	Uncontrolled
View	Non-pleasing	Pleasing	Pleasing

	30km from Kota Bharu	***50 km from Kota Bharu***	
Additional fee	No payment	RM5 per month	RM5 per month
CHOICE			

Table 3: The variables for the models

Variable		**Definitions**
ASC_0	Alternative specific constant for status quo	1= Status quo *(Current landfill)* 0= Improved alternatives *(Sanitary landfill)*
ASC_1	Alternative specific constant for sanitary landfill	1= Improved alternatives *(Sanitary landfill)* 0= Status quo *(Current landfill*
DD_1	District Kota Bharu	1= Respondents from Kota Bharu 0= Respondents from Bachok
LC	Leachate discharge	1= Improved *(Half and fully treated)* 0= Status quo *(Untreated)*
OD	Intensity of bad odour	1= Improved *(No odour, weak and distinct)* 0 = Status quo *(Strong)*
DI	Propagation of disease vectors	1= Improved *(Controlled)* 0= Status quo *(Uncontrolled)*
VI	View	1= Improved *(Pleasant)* 0= Status quo *(Unpleasant)*
FEE	Additional fee for sanitary landfill	Monthly fee
INC	Household income (ratio data)	
FAM	Number of household members (ratio data)	
DIS	Distance from the current landfill	1= Above 20 km 0= Below or equal to 20 km
EMP	Employment	1= Employed 0= Unemployed
HOM	House ownership	1= Self-owned 0= Others
ALAND	Aware of problems in landfill	1= Aware 0= Unaware
APAY	Aware of SWM fee	1= Aware 0= Unaware

The fourth step involved designing the questionnaire, which included choice set questions, the valuation scenario, and questions on knowledge and socio-demographic background. A pre-test with 60 respondents assessed comprehension before the actual survey, which was conducted with 624 respondents. To avoid cognitive burden, each respondent answered only four choice set questions. The 48 choice sets were divided into four blocks, with each block containing 156 respondents. Each respondent in a block was presented with a specific set of four choice sets, ensuring coverage of all 48 sets across the sample.

Data from the questionnaire survey was used for descriptive analysis, modelling, and WTP estimations. The models measured respondents' preferences for the three SW disposal options: Alternative One (Sanitary Landfill), Alternative Two (Sanitary Landfill), and Current Condition (Status Quo). The models were estimated using MNL, with theoretical backgrounds explained in subsequent equations. WTP calculations were made in terms of implicit prices from the estimated models, considering socio-cultural factors. These calculations indicated the marginal rate of substitution (MRS) between each environmental attribute and the monetary attribute.

The Research Areas and Sampling

The research focused on Kota Bharu, the state capital of Kelantan with a population of 314,964, and the adjacent town of Bachok, which has one-third of Kota Bharu's population. These areas were selected because they both used the current "crude dumping" disposal site in Bachok, allowing the study to describe variations in household preferences for the projected sanitary landfill. The sanitary landfill served both areas and had a buffer zone from residential areas. The sampling followed the choice set blocking, with 624 respondents divided into four blocks, stratified by economic activities and population density. Each block had 156 respondents randomly selected from 12 pre-planned residential areas, using the rule of "every third house approached." This sample size was based on recommendations that a block should have at least 50 respondents and previous studies on SWM in Malaysia. Target respondents were household heads or family representatives aged over 18. The survey, conducted over two months, involved eight trained enumerators. They were trained to approach and assist respondents without bias and used diagrams of the current and proposed landfills to reduce respondents' cognitive load when answering CM questions.

RESULTS AND DISCUSSION

Table 4 shows the analysed data concerning the socio-demographic backgrounds of the respondents. The mean age of the respondents interviewed was 42 years old with a balanced gender composition. They were mostly self-employed, proving that they had a strong mercantile culture. Some 74 % of the respondents

self-owned their house with an average household having five members. Majority of them live 20 kilometres away from the current landfill site. The mean household income was RM2674.07 which was below the state mean income.

Choice Modelling

The results from the CM revealed the demand of the households for the proposed sanitary landfill project in terms of their preferred environmental benefits of the sanitary landfill along with their WTP and what factors influenced their decisions. The results provided information in two ways, namely for the policy makers to make decisions that align with households' demand and to address triggering factors that caused an increase or decrease in WTP. For the purpose, the estimated models explained the preferences of the respondents for three different SW disposal options which were Alternative One for Sanitary Landfill, Alternative Two for Sanitary Landfill and the Current Condition (Status Quo).

Table 4: Socio demographic profile of the respondents

Variables		Total respondents =624	
		Mean	**%**
Age		42	
Gender	Male		46.6
	Female		53.4
House-ownership	Self-owned		74
	Rented		25
	Parents' house		1
Employment	Government/private sector		31.6
	Self-employed		38.1
	Not employed		30.4
Distance from landfill	Below 10km		10.4
	10km to 20 km		14.6
	Above 20 km		75
Household size		5	
Household income		RM 2674.07	

Table 5: The results of Multinomial Logit models

Variable	Basic MNL	MNL with socio-cultural factors
ASC_0	-0.690***	-9.5397***
	(0.121)	(2.1820)
ASC_1	-	-
ASC_1DD1	-	-
LC	0.382***	0.3810***
	(0.037)	(0.0369)
OD	0.274***	0.2912***
	(0.0314)	(0.0320)
DI	1.447***	1.4823***
	(0.072)	(0.0734)
VI	0.481***	0.4873***
	(0.064)	(0.0646
FEE	-0.116***	-0.1227***
	(0.012)	(0.0124)
ASC_0INC	-	-0.00083***
		(0.98D-04)
ASC_0FAM	-	0.1666***
		(0.0330)
ASC_0DIS	-	3.0860***
		(0.7039)
ASC_0EMP	-	-0.7634***
		(0.2649)
ASC_0HOM	-	0.3785**
		(0.1855)
ASC_0ALAND	-	0.7420***
		(0.1817)
ASC_0APAY	-	-0.01744
		(0.18932)
Log likelihood	-1868.390	-1739.246
Pseudo-R^2	0.16	0.22
Iterations completed	6	10
Observations	2496	2496

Note: MNL=Multinomial Logit
: Parentheses indicate the standard errors of the respective coefficients. *Significant at 10 % level ** Significant at 5 % level *** Significant at 1 % level.

Basic Multinomial Model

Column I in Table 5 displays the results for the model. The attributes encompass significant coefficients at the 1 % level with the expected signs. The environmental attributes had positive signs, depicting that improvements in these

attributes might lead to positive utility among the respondents. The coefficient value for ***DI*** was the highest in comparison to the coefficients of the other environmental attributes (***LC***, ***OD***, ***VI***). This implies the most demanded environmental benefits of sanitary landfill by the respondents are controlled propagation of the disease vector. Meanwhile, the monetary attribute, ***FEE*** had a negative sign, suggesting a decline in utility as the additional fee was raised for sanitary landfill.

The Hausman and McFadden test showed that this model estimation violated the IIA assumptions at the 1 % level indicating a biased estimation. This may be explained from the literature, whereby the inconsistency of the MNL model with respect to the IIA is a frequent outcome in CM due to situations where some alternatives are qualitatively like others or there are heterogeneous preferences among the respondents (Mogas, et al., 2006; Jamal, et al., 2004; Hanley, et al., 2002).

Extended Multinomial Models

Column II in Table 5 shows the results of the extended MNL model with socio-cultural factors. All the environmental attributes and socio-cultural interacted variables were significant except for $\boldsymbol{ASC_0}$***APAY** in explaining the choices of the respondents. The Hausman and McFadden test also showed IIA violation from this model estimation at the 1 % level, similar to the basic MNL model.

The environmental attributes have positive signs depicting demand for improvements in these attributes. The results of the socio-cultural interacted variables showed that the respondents with lower income, larger household size, a greater distance from the landfill site, unemployment, homeowners and familiar with the problems in the landfill tended to choose the status quo. This draws attention to the fact that when there is house ownership and familiarity about landfill problems, this leads to the tendency to opt for the status quo. Perhaps, the fact that they actually have to pay an additional amount in the annual assessment for the sanitary landfill discourages them to opt for sanitary landfill alternatives. In addition, familiarity makes an individual more cautious due to their anticipation of the effectiveness of the sanitary landfill.

Implicit Prices

The estimations of implicit prices from the extended MNL with socio-cultural factors is as shown in Table 6. The implicit prices in the model did not differ significantly which was consistent with the outcomes observed by Jamal (2007) who noted the little effect on the estimates of implicit prices due to heterogeneity of preference among respondents. The implicit price for the disease vector was significantly higher with RM12.08. This result suggested that when the propagation of disease vectors was controlled through provisions in the sanitary landfill (e.g., provision of cover soil mitigates breeding of rats, flies and

mosquitoes), the households would be made better-off by RM12.08. This result was also significantly higher compared to previous SWM evaluations in Malaysia (Khee and Jamal, 2011 and Jamal, 2007). However, a high implicit price placed for controlling the disease vector was not surprising since it matched the situation where landfilling activities in Beris Lalang landfill has escalated the breeding of vectors, thus risking disease dispersion among landfill workers and the nearby households.

Table 6: Implicit prices in MNL model with socio-cultural factors

Attribute	**MNL with socio-cultural factors (RM per month)**
LC	RM3.11
OD	RM2.37
DI	RM12.08
VI	RM3.97

Note: MNL=Multinomial Logit, LC=leachate, OD=bad odour, DI=disease vector, VI=View

CONCLUSIONS

This study has implemented a non-market valuation technique, CM to gather demand side information for a circumstance of improving SW disposal into a sanitary landfill. The economic value of the sanitary landfill was described by the environmental attributes of leachate discharge, intensity of bad odour, vector-borne diseases and the view. A monetary attribute, additional SWM fee was included for welfare estimation for the improvement of given environmental attributes. This study was carried out on 624 households representing households that would benefit from the SW disposal service. The SWM fee (including SW disposal fee) would be paid through a yearly annual assessment payment to the local authority. The WTP for the sanitary landfill would be an increase in SWM fee described on a monthly basis.

The outcomes of the study indicate a positive WTP for improvement of leachate discharge, intensity of bad odour and the view ranging from RM2.37 monthly to RM3.97 monthly. The attribute for vector-borne disease has a high outcome of WTP (RM12.08 monthly) surpassing the WTP results for non-monetary attributes in other relatable SWM studies in Malaysia.

This study aimed to assist SWM policymakers in reducing the inequality of SW disposal across Malaysia, addressing financial disparities among state governments. While fast-developing states have adopted sanitary landfills, this study provides insights into household demand for improved SW disposal in the northeastern state of Kelantan. The implicit prices for the sanitary landfill are comparable to those in other states, indicating a consistent WTP for improved facilities nationwide. Effective policy implementation requires public, state, and federal commitment.

A sanitary landfill includes provisions like daily cover soil, bunds, drainage, and leachate treatment systems to minimize environmental and health impacts. The study highlighted household demand for minimizing disease vector problems, emphasizing the need for daily cover soil to prevent vector propagation (e.g., rats, mosquitoes, and flies). According to the Ministry of Housing and Local Government guidelines, a Level 2 sanitary landfill requires sufficient cover soil to alleviate this issue.

ACKNOWLEDGEMENTS

This work was supported by the Ministry of Higher Education, Malaysia, and Universiti Putra Malaysia under GP-IPM [9713300].

REFERENCES

Anik, M. A. H., Shishir, A. R., Islam, P., Naila, S. N. & Chowdhury, I. M. (2018). Sustainable solid waste management through 3R strategy in Gazipur City. *International Journal of Environment and Waste Management.*

Bowan, P.A., Kayaga, S. & Fisher, J. (2020). A baseline scenario of municipal solid waste management. *International Journal of Environment and Waste Management, 26*(4), 438-457.

Chen, Z., Santha, C. & Fauziah, S. H. (2012). Environmental evaluation of sanitary landfills establishment: Malaysian case studies. *Journal of Advanced Materials Research*, 599, 224-228

Edwards, J., Burn, S., Crossin, E., & Othman, M. (2018). Life cycle costing of municipal food waste management systems: the effect of environmental externalities and transfer costs using local government case studies. *Resources, Conservation and Recycling*, 138, 118–129.

Gebreeyosus, M.A & Berhanu, W. (2019). Households' preferences for improved solid waste management options in Aksum city, North Ethiopia: An application of choice modelling. *Cogent Environmental Science 5*.

Hanley, N., Adamowicz, W. & Wright, R.E. (2005). price vector effects in choice experiments: an empirical test. *Journal of Resource and Energy Economics*, 27, 227-234.

Haron, N. F., Kamaludin, M., Mahmood, S. & Noor, N.A.A.M. (2023). Analysis of households' willingness to pay for solid waste management services in Kuala Nerus, Terengganu. *Journal of Sustainability Science and Management*, *18*(10), 35-48.

Hausman, J. & McFadden, D. (1984). A specification test for the multinomial logit model. E*conometrica*, 52, 1219-1240.

Huynh, X.T.D., Khong, T.D. & Loch, A. (2023). Solid waste management program in developing countries: contingent valuation methodology versus choice experiment. *Environ Dev Sustain*, 25, 12395–12417.

Jamal, O. 2007. Economic valuation of household preference for solid waste management in Malaysia: A choice modeling approach. *International Journal of Management Studies*, *14*(1), 189-212.

Kamaruddin, M. A., Yusoff, M. S., Rui, L. M., Isa, A. M., Zawawi, M. H., & Alrozi, R. (2017). An overview of municipal solid waste management and landfill leachate treatment: Malaysia and asian perspectives. *Environmental Science and Pollution Research*, *24*(35), 26988–27020.

Khee, P.C. & Jamal, O. (2011). A choice experiment analysis for solid waste disposal option: a case study in Malaysia. *Journal of Environmental Management*, *92*(11), 2993-300.

Ko, S., Kim, W., Shin, S. & Shin, J. (2020). The economic value of sustainable recycling and waste management policies: the case of a waste management crisis in South Korea. *Waste Management*, 104, 220–227.

Ku, S. J., Yoo, S. H. & Kwak, S. J. (2009). Willingness to pay for improving the residential waste disposal system in Korea: a choice experiment study. *Journal of Environmental Management*, 44, 278–287.

Manski, C. F. (1977). The Structure of Random Utility Models. *Journal of Theory and Decisions*, 8, 229-254.

MHLG (Ministry of Housing and Local Government Malaysia). (2004). The Technical Guideline for Sanitary landfill, Design and Operation.

Martinez-Sanchez, V., Levis, J. W., Damgaard, A., DeCarolis, J. F., Barlaz, M. A., & Astrup, T.F. (2017). Evaluation of externality costs in life-cycle optimization of municipal waste management systems. *Environmental Science and Technology*, *51*(6), 3119–3127.

Nazri, M.S., Rahim, M.S., Azwany, N.Y., Habsah, H., Zahiruddin, W.M., Aziah, D., Zaliha, I. & Rusli, M.A. (2012). Seroprevalence of Leptospirosis among town service workers in northeastern state of Malaysia. *International Journal of Collaborative Research on Internal Medicine & Public Health*, *4*(4), 395-403.

NSWMD (National Solid Waste Management Department). (2015). http://www.data.gov.my/data/ms_MY/dataset/statistik-bil-insinirator-tapak-pelupusan-sisa-pepejal-yg-beroperasi-dan-yg-ditamatkan-operasi-2015/resource/7536a273-ab95-4e26-b89d-7b1b93cef90c. Accessed December 2018

NSWMD (National Solid Waste Management Department). (2018). http://www.data.gov.my/data/ms_MY/dataset/944874c9-6fec-41f4-a574-23550adf5596/resource/ce713428-2a65-422a-b2b4-cd43f9c15995/download/anggaran-penjanaan-sisa-pepejal-di-malaysia-pada-tahun-2012---2017.xlsx. Accessed January 2019

Rahman, M.M & Bohara, A.K. (2022). Assessing the preference and spatial dependence of a solid waste management system in Nepal: A choice experiment approach. *Journal of Environmental Management,* 357.

Rodić, L., & Wilson, D. (2017). Resolving governance issues to achieve priority sustainable development goals related to solid waste management in developing countries. *Sustainability, 9*(3), 404.

Sahariah, B., Goswami, L., Farooqui, I.U., Raul, P., Bhattacharyya, P. & Bhattacharya, S., (2015). Solubility, Hydrogeochemical Impact, and Health Assessment of Toxic metals in municipal wastes of two differently populated cities. J. *Geochem. Explor,* 157, 100-109.

Sasao, T., (2004). Analysis of the socioeconomic impact of landfill siting considering regional factor. *Journal of Environmental Economics and Policy Studies,* 6, 147-175.

Shakil, N. S. M., Azhar, N. A. Z. M., & Othman, N. (2023). Solid Waste Management in Malaysia: An overview. *Information Management and Business Review*, *15*(1), 86-93.

Shekdar, A.V. (2009). Sustainable solid waste management: an integrated approach for Asian countries. *Journal of Waste Management*, 29, 1438-1448

Suandi, I. S., Zainuddin, M. F., Abdul Manaf, L., & Mohd, S. M. (2023). Community knowledge and perceptions towards illegal waste disposal: a case study of sungai besar coastline mangroves forest In Selangor, Malaysia. *Planning Malaysia*, *21*(29).

Subhasish, D, Lee S.H, Kumar, P., Kim, K.H., Lee, S.S. and Bhattacharya, S.S. (2019). Solid waste management: scope and the challenge of sustainability. *Journal of Cleaner Production*, 228, 658-678.

Yaacob, N. N. F., Abd Manaf, L., & Ash'aari, Z.H. (2019). Quantifying the organic waste generated from the fresh market in Kundasang Town, Sabah. *Planning Malaysia*, *17*(10).

World Bank. (2012). What a Waste: A Global Review of Solid Waste Management. Washington D.C. World Bank.

Zainu, Z.A. & Songip, A.R. (2017). Policies, challenges and strategies for municipal waste management in Malaysia. *Journal of Science, Technology and Innovation Policy*, *3*(1)

Received: 19th March 2024. Accepted: 3rd September 2024

PLANNING MALAYSIA:
Journal of the Malaysian Institute of Planners
VOLUME 22 ISSUE 5 (2024), Page 558 – 568

THE IMPACT OF NATIONALITY ON THE PERCEPTION OF PROJECT MANAGEMENT AND ITS SUCCESS AMONG CONSTRUCTION PROJECT MANAGERS IN SAUDI ARABIA

Mohammed Alabbad[1], Roziha Che Haron[2]

[1] *College of Architecture and Planning,*
KING SAUD UNIVERSITY
[2]*Department of Quantity Surveying,*
Kulliyyah of Architecture and Environmental Design,
INTERNATIONAL ISLAMIC UNIVERSITY MALAYSIA

Abstract

Cultural differences in project teams within the construction industry are a recognized phenomenon in the Kingdom of Saudi Arabia (KSA). This study investigates the crucial role culture plays and how cultural differences among project managers influence their perceptions of two key aspects: project management practices and project success in the context of the Saudi construction industry. A custom questionnaire was used to gather the perceptions of 150 Saudi and non-Saudi project managers from Riyadh city. The statistical tests applied include frequencies, percentages, descriptive statistics, independent t-tests, and univariate analysis of variance (ANOVA). The findings reveal that the nationality of the managers significantly impacts their perceptions of cultural differences, which in turn influences the two aforementioned aspects.

Keywords: Saudi Arabia, culture perception, construction, project management practices, project success

[2] Corresponding Author: roziharon@iium.edu.my

INTRODUCTION

The Kingdom of Saudi Arabia (KSA) is undergoing significant transformations in its construction sector, influenced by efforts to diversify its economy away from oil dependency. This transition involves a substantial influx of foreign labor, which introduces a diverse cultural landscape within the workplace. Despite the apparent similarities in Arab culture from an external viewpoint, the internal dynamics are complex and often challenging to navigate, particularly for foreign workers. Foreign laborers in KSA frequently face difficulties in adapting to local cultural norms and expectations, primarily due to insufficient training provided by both international and local construction organizations. This lack of cultural acclimatization leads to feelings of alienation among foreign workers, negatively impacting their performance and overall contribution to project success. The existing cultural barriers contribute to a disconnection between diverse teams, ultimately hindering operational efficiency in construction project management.

The research investigates the intricate cultural dynamics influencing construction project management in KSA, emphasizing the challenges foreign workers encounter in acclimating to the local environment. While Arab culture may appear homogenous externally, it encompasses complex variations that complicate integration for non-Saudi laborers. The lack of investment in cultural training by organizations further exacerbates the challenges faced by these workers, fostering a sense of isolation that undermines their contributions. Numerous studies indicate that cultural barriers significantly impact project outcomes and worker satisfaction, with nationality playing a critical role (Müller & Jugdev, 2012). As KSA seeks to diversify its economy, the private sector's ability to recruit and retain skilled labour is increasingly crucial. The study advocates for a proactive approach to address cultural differences, highlighting the need for a contextual understanding of KSA's unique cultural landscape. By improving cultural inclusivity and fostering synergy within the construction sector, organizations can enhance project management practices and optimize outcomes.

Project Management Practices

In Saudi Arabia, Project Management Practices (PMp) are not fully embraced unless required by clients (Alotaibi, 2019). There is a clear connection between project management and culture, with cultural differences posing challenges in aligning business objectives and ensuring tolerance among project stakeholders. The six key dimensions of PMp include human resource management, quality management, knowledge management, communication management, negotiation, and safety management (HRSD, 2020 and Eröcal, 2016).

Human Resources

Cultural factors and employee capability are the main challenges in Human Resource Management (HRM) Abdullah & Qudah (2019), Al-Emad & Rahman (2017), Alghadeer (2012) and Alotaibi (2019), Trust between project managers and workers is a critical issue, often influenced by the nationality of workers. Poor working conditions and wage issues are significant barriers to efficiency and project success. Cultural misunderstandings between managers and workers further complicate HRM in Saudi construction projects.

Quality Management

Cultural differences affect the ability to identify customer needs, disrupt unity between leaders and employees, and hinder project planning and execution. These issues also result in delays in data analysis and project delivery. Building strong workplace relationships is essential for overcoming these challenges in quality management.

Knowledge Management

Knowledge sharing and learning are key aspects affected by cultural differences. Training programs are needed to address the knowledge gaps and promote effective knowledge transfer within the Saudi construction industry. The lack of awareness of knowledge management benefits is a critical issue, leading to inefficiencies in project execution. (Alhajri & Alshibani (2018), Alosaimi (2019), Alsaudi, Kaka, & Carter (2016). Alosaimi, Renukappa & Surech (2018) identify a lack of awareness regarding knowledge management benefits and the presence of cultural barriers in the KSA construction industry

Communication Management

Communication issues, such as language barriers and differing cultural values, are common in Saudi construction projects. These barriers affect decision-making, problem-solving, and motivation among workers. Effective communication is necessary to foster teamwork and prevent project delays. Moonesar & Thibaud (2018) suggest an equal mix distribution of workers in project teams for effective communication. Cultural differences significantly impact communication, PMp, and project success, influencing language, interpersonal relationships, regional arguments, problem-solving speed, and employee motivation. Franklin (2009) notes the learnability of interaction skills, and Fisher, Ury & Patton (1991) stress the importance of negotiation when seeking agreements amid differing perceptions.

Negotiation

Cultural differences significantly influence negotiation practices in Saudi Arabia. Saudis prefer group negotiations to minimize risks, and prolonged negotiations can delay projects. Lack of planning and material delivery conflicts, often rooted in cultural disparities, can lead to project failures. Alotaibi (2019) highlights the common practice of continuous negotiation with suppliers or subcontractors in the KSA construction sector.

Safety Management

Cultural differences impact the implementation of safety policies, communication of safety measures, and the performance of qualified safety personnel. Safety management practices are essential for ensuring project success, and cultural understanding is vital for effective safety compliance and execution. Table 1 provides a summary of the construct Project Management Practices' identified dimensions and items, to maintain a clear picture throughout the discussion.

Table 1: 1st Construct: Project Management Practices' identified dimensions & items

Dimension	Item	References
1) Human Resource Management	1) Capability of employees 2) Worker's trust 3) Efficiency of staff 4) The requirement of staff 5) Understanding the culture of staff	Abdullah & Qudah (2019); Abuhantash (2018); Al-Emad & Rahman (2017); Alghadeer (2012); Almahmoud, Doloi & Panuwatwanich (2012); Alotaibi (2019); Alsanoosy, Spichkova & Harland (2018); Eröcal (2016); HRSD (2020); Kumar (2016); Rahman & Al-Emad (2018)
2) Quality Management	1) Identifying costumers needs 2) Leaders uniting employees 3) Planning & executing projects 4) Efficient data gathering and analysis 5) Timely delivery of the project	Abazid, TRNC, & Gökçekuş, (2019); Alhajri & Alshibani (2018); Alsanosy, Spichkova, & Harland (2018); Alsaudi, Kaka, & Carter (2016); Antoniadou & Gruner-Buckley (2019); Baumann (2013); Sarhan et al (2017)
3) Knowledge Management	1) Learning 2) Knowledge transfer 3) New business methods 4) Training 5) Project data bank	Alosaimi (2019); Alosaimi, Renukappa & Surech (2018); Alotaibi (2019); Renukappa, Suresh, & Alosimi (2019); Shuaib (2016).

Dimension	Item	References
4) Communication Management	1) Communication language 2) Interpersonal relationships 3) Regional differences arguments 4) The speed of problem-solving tasks 5) Motivation of employees	Aldhobaib (2017); Alhwairini & Foley (2012); Gadelrab et al; (2018); Mahamid (2017); Moonesar & Thibaud (2018); Shuaib (2016).
5) Negotiation	First contact with customers Communication with customers Delays in projects Profit of organization Future projects	Alhajri & Alshibani (2018); Alhrabi & Alsoliman (2019); Alkharmany (2017); Alomari (2006); Alotaibi (2019); Mohamid (2017); Moonesar & Thibaud (2018).
6) Safety Management	1) Implementation of safety policies & procedures 2) Safety communication 3) Performance of qualified safety employees 4) Employees involvement	Azmat & Saad (2018); Moosa (2018); Sanni-Anibire et al (2018)

Project Success

Moonesar & Thibaud (2018) suggest that success in KSA involves adapting to cultural differences and developing patience. Adaptation, starting at early stages and customized for local markets, is crucial for success (Moonesar & Thibaud, 2018; Chan, 2001). Success is debatable, with time, cost, and quality traditionally considered basic criteria (Chan, 2001). However, the last decade has seen emerging ideas about success. KSA faces challenges in the quality of construction practices (Alshihre & Chinyio, 2016). Cultural challenges unique to KSA hinder the proper management of quality (Al-Hazim & Alkhateeb, 2020; Jin, Almousa & Kim, 2018). Therefore, quality is identified as the first dimension of project success.

Quality

Quality management in construction projects involves preparatory work before project commencement, a crucial aspect often overlooked by some Saudi project managers (Al-Sedairy, 1985). The successful delivery of a project in line with

client needs is essential for success, indicating the impact of cultural differences on quality deliverance (Al-Sedairy, 1985). Antoniadou & Gruner-Buckley (2019) note that while many organizations have plans for quality, few have formal implementations. Alotaibi, Yusoff, & Islam (2013) found a strong connection between quality conditions and project outcomes in KSA, with certain organizations taking precautions against bankruptcy risks due to the lack of official regulations (Alghamdi, 2016). Thus, cultural differences can influence quality and significantly impact project success. Key dimensions influenced by cultural differences include: (1) Quality deliverance aligned with customer needs; (2) Quality assurance in project planning and execution; and (3) Quality assurance with reasonable cost, emphasizing the importance of timely project delivery.

Time Delivery

The success of construction projects in Saudi Arabia is significantly influenced by the way project teams conduct and perform tasks, with a focus on the construction phase, which is highly impacted and prone to time delays (Alhajri & Alshibani, 2018; Almahmoud, Doloi & Panuwatwanich, 2012; Alotaibi, Sutrisan, & Chong, 2016; Raslan & Kapogiannis, 2018).

Table 2: 2nd Construct: Project Success's identified dimensions & items

Dimension	Item	Reference
1) Quality	1) Quality deliverance with reference to the customers' needs helps to achieve success 2) Quality guarantee in the planning and execution of the project helps to achieve success 3) Quality assurance with reasonable cost helps to achieve success	Al-Hazim & Alkhateeb (2020); Alghamdi (2016); Alotaibi, Yusoff, & Islam (2013); Al-Sedairy (1985); Alshihre & Chinyio (2006); Antoniadou & Gruner-Buckley (2019); Jin, Almousa & Kim (2018)
2) Timely Delivery	1) Timely delivery helps to achieve project success 2) Timely service response helps to achieve project success	Alhajri & Alshibani (2018); Almahmoud, Doloi & Panuwatwanich (2012); Alotaibi, Sutrisan, & Chong (2016); Raslan & Kapogiannis (2018)

Cultural differences contribute to scepticism about foreign organizations' ability to coordinate effectively and meet deadlines in Saudi Arabia's construction sector, particularly for small organizations. Delays have been a persistent issue since the 1980s, causing disputes and challenging collaboration. The lack of a common vision and high uncertainty in project delivery highlight the negative impact of cultural differences on project success.

Key aspects affected by these differences include timely project delivery and responsive service, both of which are crucial for achieving project success in KSA.

Research Method

The study's sample was drawn from the Saudi Agency of Contractors Classification database, with participants required to be registered construction organizations under the Saudi Contractors Authority. Project managers from various nationalities were selected based on their official registration and valid MOMRA licenses. A total of 150 project managers participated, exploring the impact of cultural differences on project management practices and organizational strategies in Saudi Arabia.

Data was collected via a custom questionnaire divided into four sections: demographics, cultural differences' influence on project management practices, effects on organizational strategies, and views on project success (quality and timely delivery). Responses were measured using a 5-point Likert scale, and reliability was confirmed using Cronbach's alpha, with all sub-scales exceeding 0.7, indicating high internal consistency (Ritchie et al., 2013).

Data Analysis

The data obtained from the questionnaire were analyzed statistically using the SPSS (Statistical Package for the Social Sciences) statistic tool. Tests utilized were frequencies and percentages, descriptive statistics, independent t-test, and univariate analysis of variance.

RESULT AND DISCUSSION

Demographic Profile of the Project Managers

The study's participants consisted of project managers from various nationalities, levels of experience, and types of organizations. According to Table 5, 62.7% of the project managers were non-Saudi, while 37.3% were Saudi. Among the non-Saudi managers, 40.7% were from other Asian countries, 10.7% from Africa, 6.7% from Europe, and 4.7% from America. This reflects the common practice in the Middle East of recruiting and managing construction projects with foreign labor (Dulaimi & Hariz, 2011). The significant presence of Saudi managers suggests that participants came from both public and private firms, as public firms tend to have more Saudi nationals in higher management roles. Additionally, 70.7% of the managers had over five years of experience, and 84.7% were from regional or national firms, most of which were owned by the Saudi government or Saudi nationals.

Perceptions Regarding the Influence of Cultural Differences on Project Management Practices

The independent t-test was conducted to assess the significance of differences in perceptions between Saudi and non-Saudi project managers regarding the impact of cultural differences on project management practices, as outlined in Table 6. Nationality served as the grouping variable, creating two distinct groups. The results of the t-test indicated statistically significant differences ($p < .01$) in the perceptions of project managers concerning human resources management, knowledge management, safety management, negotiation, and quality management practices. Surprisingly, there was no significant difference in perceptions related to Communication Management ($p = – .57$), contrary to expectations. This suggests that project managers perceived cultural differences in their teams to influence project management practices.

Table 4: Comparison of perceptions of influence of culture differences on practices of project management between Saudi and non-Saudi project managers

PMp	Nationality	*N*	Mean	*SD*	*t*	Sig. (2-tailed)
Human Resource Management	*Saudi*	56	2.8750	0.8908	-10.388	0.000
	non-Saudi	94	4.089	0.5421		
Knowledge Management	*Saudi*	56	2.1857	0.6148	-22.154	0.000
	non-Saudi	94	4.2404	0.5068		
Communication Management	*Saudi*	56	2.4357	0.4960	-0.573	0.567
	non-Saudi	94	2.4894	0.5863		
Safety Management	*Saudi*	56	3.3080	0.6431	-7.722	0.000
	non-Saudi	94	3.9734	0.4123		
Negotiation	*Saudi*	56	3.7536	0.8312	5.989	0.000
	non-Saudi	94	3.1255	0.4534		
Quality Management	*Saudi*	56	2.8821	0.8310	-5.221	0.000
	non-Saudi	94	3.4239	0.4393		

The mean values for Saudi project managers ranged from 2.1857 (±0.6148) to 3.7536 (±0.8312), while non-Saudi managers' means ranged from 2.4894 (±0.5863) to 4.2404 (±0.5068). Generally, non-Saudi project managers tended to lean towards "agree" and "strongly agree" options for various statements on project management practices. In contrast, Saudi project managers' perceptions tended towards a "neutral" opinion or an "agree" option. The most substantial difference between the groups was observed in knowledge management (2.0547), followed by human resources management (1.2144), safety management (0.6654), quality management (0.5418), communication management (0.0536), and negotiation (-0.6280). This indicates that non-Saudi project managers expressed a stronger agreement than Saudi project managers on

the influence of cultural differences on all explored project management practices, except for negotiation.

Perceptions regarding the Influence of Cultural Differences on Project Management practices and Project Success

Univariate analysis of variance was employed to examine project managers' perceptions regarding the influence of project management practices on project success. This statistical test, chosen for its ability to analyze the distribution of a single variable in a single sample aimed to understand the impact of cultural differences on project management practices and, consequently, project success. Table 6 displays descriptive statistics for the impact of project management practices on project success, with nationality considered as a controlling factor. The mean values for both Saudi and non-Saudi project managers were very close, indicating strong agreement that cultural differences influence project management and, by extension, project success.

Table 5: Descriptive statistics for impact of project management practices on project success controlled by nationality

Nationality	Mean	*SD*
Saudi	4.0607	0.52904
Non-Saudi	4.0266	0.53565

In Table 5, the univariate analysis of variance revealed a significant outcome when considering nationality as a controlling factor for two project management practices: human resources management and negotiation. This suggests that project managers' perceptions of the influence of cultural differences on project success differed for human resources management and negotiation. However, statistical significance was not observed for other project management practices. This lack of significance may be attributed to both Saudi and non-Saudi project managers aligning and strongly agreeing that cultural differences impact project management practices and, consequently, project success. Furthermore, Table 6 reveals that the univariate analysis of variance demonstrated a statistically significant difference in project managers' perceptions regarding the influence of cultural differences on organizational strategy and, therefore, project success when nationality is considered as the control variable ($F(1,3) = 8.690$, $p = .004$, R Squared .063).

Table 6: Tests of Between-Subjects Effects for the impact of organization strategy on project success controlled by nationality

Source	Type III Sum of Squares	*df*	Mean Square	*F*	*Sig.*
Corrected Model	2.646a	3	0.882	3.262	0.023
Intercept	98.300	1	98.300	363.595	0.000
Nationality * Strategy	2.349	1	2.349	8.690	0.004
Nationality	2.338	1	2.338	8.648	0.004
Strategy	0.713	1	0.713	2.637	0.107

Note. a. R Squared = .063 (Adjusted R Squared = .044)

CONCLUSION

The study explored how cultural differences impact project management practices and success from the perspectives of Saudi and non-Saudi project managers in Saudi Arabia (KSA). It found significant differences in perceptions, especially regarding human resources management and negotiation practices. The research highlights the complexity of Arab culture and its connection to business practices in KSA. It emphasizes the need for construction organizations to proactively address these cultural differences by aligning human resource development with organizational needs. Future research could focus on the challenges Saudi organizations face when international firms enter the KSA market.

REFERENCES

Abazid, M., TRNC, M., & Gökçekuş, H. (2019). Application of total quality Management in Saudi Arabia construction project. *Journal of Advanced Research in Dynamical & Control Systems, 11*(3), 38-43.

Al-Hazmi, N., & Alkhateeb, T. (2020). Obstacles to implementing total quality management in Saudi Arabia marketing tourism. Services. *Management Science Letters, 10*(3), 507-514.

Alhrabi, A., & Alsoliman, T. (2019). Identification of ethical issues in building construction: A case study in Saudi Arabia. *Journal of Architecture and planning, King Saud University (JAP), 29*(2), 203-235.

Alosaimi, H. (2019). Embedding knowledge management strategies in the Kingdom of Saudi Arabia construction industry. [Doctoral dissertation, University of Wolverhampton]. UK.

Barclay, C., & Osei-Bryson, K. (2016). Strategic project management: contemporary issues and strategies for developing economies. New York: CRC Press.

Burnett, J. (2011). Introducing Marketing. Global Text Project.

Drucker, P. (2017). PMBoK 6th ed. Project Management Institutions (PMI). p.p 72. USA.

Eröcal, D. (2016). UNESCO Science Report: Towards 2030. UNESCO Publishing. Paris.

2nd ed.

Fallatah, R., & Syed, J. (2017). Employee motivation in Saudi Arabia: An investigation into the higher education sector. Springer.

Ferrer, M., & Santa, R. (2017). The mediating role of outsourcing in the relationship between speed, flexibility and performance: a Saudi Arabian study. *International Journal of Productivity and Quality Management, 22*(3), 395-412.

Gadelrab, Hesham F., Othman Alkhadher, Said Aldhafri, Saad Almoshawah, Yahya Khatatba, Fares Zine El Abiddine, Mohammed Alyetama, Said Elmsalak, Nabha Tarboush, and Sarah Slimene. (2020). Organizational Justice in Arab Countries: Investigation of the Measurement and Structural Invariance. *Cross-Cultural Research, 54*(1), 3-27.

GaStat. (2020). KSA Labour market Statistics. 1st Quarter (Q1). General Authority for Statistics. Online at https://www.stats.gov.sa/en/814 , accessed 05 Jun 2020.

HRSD. (2020). The ministry of Human Resource and Social Development. Online at https://hrsd.gov.sa/ , accessed 07 July 2020.

Khahro, S., ul Hassan, S., & Javed, Y. (2020). Workers protection in Saudi law: an awareness assessment of construction industry. *Journal of Legal, Ethical and Regulatory Issues, 23*(3), 1-7.

Sanni-Anibire, M., Mahmoud, A., Hassanain, M., & Almutairi, F. (2018). Health and safety perception of construction workers in Saudi Arabia. *Architecture Civil Engineering Environment, 11*(3). 107-118.

Sarhan, J., Xia, B., Fawzia, S., & Karim, A. (2017). Lean Construction Implementation in the Saudi Arabian Construction Industry. *Construction Economics & Building, 17*(1), 46-69.

SCA. (2020). Statistics. The Saudi Contractors Authority, online at: https://muqawil.org/ar/information_center/statistics, accessed 06 July 2020.

Srour, F., Srour, I., & Lattouf, M. (2017), A survey of absenteeism on construction sites, *International Journal of Manpower, 38*(4), 533-547.

Vargas, V., Conforto, C., & Oumarou, A. (2020). Why Great Ideas Fail and How to Make Sure They Do not. Paper presented at PMI Global Congress North America-2019, Philadelphia, PA, USA. Newtown Square, PA: Project Management Institute.

Received: 6th July 2024. Accepted: 5th September 2024

NOTES TO CONTRIBUTORS AND GUIDELINES FOR MANUSCRIPT SUBMISSION

INTRODUCTION

The Journal of the Malaysian Institute of Planners or PLANNING MALAYSIA is a multidisciplinary journal related to theory, experiments, research, development, applications of ICT, and practice of planning and development in Malaysia and elsewhere.

The objective of the journal is to promote the activity of town planning through dialogue and exchange of views concerning professional town planning practice. PLANNING MALAYSIA will welcome any news, feature articles, or peer reviewed (including book reviews, software review, etc.) articles for publication. All articles should be original work by the authors. **Articles, views and features will not be taken to be the official view of the Malaysian Institute of Planners (MIP) unless it carries the name of MIP as the author.** This is to encourage open discussion on diverse issues and opinion for the advancement of town planning practice. Articles and contributions will be accepted from MIP members and non-members worldwide.

In year 2010, PLANNING MALAYSIA Journal has been indexed in SCOPUS. Previous issues of PLANNING MALAYSIA Journal can be viewed on the MIP website.

SUBMISSION OF MANUSCRIPTS

Manuscript should be emailed to pmjournal@gmail.com. Manuscript should ideally be in the range of 8-10 pages long. Each manuscript should have a title page and an abstract of about 150 words. The title page should contain the title, full name(s), designation(s), organizational affiliation(s), a contact address, and an email address. All manuscripts are received on the understanding that they are not under concurrent consideration at another journal. One copy of the current Journal will be provided for each article. Additional reprints of article can be ordered, at cost, by the author(s). PDF format of the article (if available) can be obtained from the Publisher.

LAYOUT

Manuscript should be typed in single spacing (including footnotes, endnotes and references) on one side of the paper only (preferably A4) with the following margins: right and left - 4.25 cm, top - 5.5 cm and bottom - 5.2 cm (including header – 4.5 cm and footer – 4.3 cm) in 11-point Times New Roman font. Footnotes should be numbered consecutively and placed at the end of the manuscript. Footnotes should be kept to a minimum. Tables and diagrams should be provided in the text. References should follow the APA (6th Edition) referencing format. All foreign words must be typed and transliterated. The Editorial Board reserves the right to change the transliteration of all historical names, titles and non-English terminology to bring them into conformity with its own style.

USE OF FORMULA, FIGURES AND TABLES

Formula (mathematical formula) should be used only when necessary and the CONCLUSION derived must be explained and made intelligible to a non-mathematical reader. Wherever possible, authors are encouraged to place the mathematical parts of the article in an appendix. In cases of empirical articles, authors are expected to make readily available a complete set of data and any specialized computer programs to interested readers.

All illustrations, figures and/or tables in the manuscript must be captioned, in clear black and white (grayscale) and ready for reproduction.

REFEREEING PROCEDURE

Manuscripts will be acknowledged upon receipt. Only selected (preferred) manuscripts will be **reviewed by two (or three) referees** in addition to the editors. Editorial decision will normally be made within **two to six months**, but circumstances beyond control occasionally dictate a longer cycle. If authors are invited to prepare a revision for further consideration, the major issues to be resolved will be outlined and will be forwarded to them as quickly as possible.

ACCEPTED ARTICLES

Authors of accepted articles will be requested to provide a digital copy of the manuscript, preferably in Microsoft Word to the MIP (the Publisher) via email at pmjournal@gmail.com. MIP will not be responsible for the loss or damage of the digital copy.

COPYRIGHT

Contact:

Editor-in-Chief
PLANNING MALAYSIA
Journal of the Malaysian Institute of Planners
B-01-02, Jalan SS7/13B, Aman Seri, Kelana Jaya,
47301, Petaling Jaya, Selangor Darul Ehsan, MALAYSIA
Tel: +603 78770637 Fax: +603 78779636
Email: pmjournal@gmail.com
Homepage: www.planningmalaysia.org

ETHIC STATEMENT

The Journal of the Malaysia Institute of Planners or **PLANNING MALAYSIA** is a peer-reviewed journal. This statement spells out ethical behaviour of all parties involved in the act of publishing an article for this journal, i.e. the author, the peer-reviewer, the chief editor and editors, and the publisher. This statement is based on COPE's Best Practice Guidelines for Journal Editors. URL: http://publicationethics.org/files/u2 /Best_Practice.pdf

DUTIES OF AUTHORS

Reporting Standards

Authors of original research should present an accurate account of the work done as well as an objective discussion of its significance. Data of the research should be represented accurately in the article. An article should contain sufficient detail and references to permit others to replicate the work. Fraudulent or knowingly inaccurate statements constitute unethical behaviour and are unacceptable.

Data Access and Retention

Authors may be asked to provide the raw data in connection with an article submitted for editorial review, and should be prepared to provide public access to such, if practicable, and should in any event be prepared to retain such data for a reasonable time after publication.

Originality and Plagiarism

Authors should ensure that they have written entirely original works, and if the authors have used the work and/or words of others this must be appropriately cited or quoted. Such quotations and citations must be listed in the Reference at the end of the article.

Multiple Publication

An author should not in general publish manuscripts describing essentially the same research in more than one journal or primary publication. Submitting the same manuscript to more than one journal concurrently constitutes unethical publishing behaviour and is unacceptable.

Acknowledgment of Sources

Proper acknowledgment of the work of others must always be given. Authors should cite publications that have been influential in determining the nature of the reported work.

Authorship of the Paper

Authorship should be limited to those who have made a significant contribution to the conception, design, execution, or interpretation of the study, and should be listed as co-authors. Others who have participated in certain substantive aspects of the research project, they should be acknowledged or listed as contributors.

Corresponding Author
Corresponding author is the author responsible for communicating with the journal for publication. The corresponding author should ensure that all appropriate co-authors and no inappropriate co-authors are included on the paper. All co-authors have seen and approved the final version of the paper and have agreed to its submission for publication.

Acknowledgment of Funding Sources
Sources of funding for the research reported in the article should be duly acknowledged at the end of the article.

Disclosure and Conflicts of Interest
All authors should disclose in their manuscript any financial or other substantive conflict of interest that might be construed to influence the results or interpretation of their manuscript.

Fundamental Errors in Published Works
When an author discovers a significant error or inaccuracy in his/her own published work, it is the author's obligation to promptly notify the journal editor or publisher and cooperate with the editor to retract or correct the paper.

DUTIES OF REVIEWERS

Contribution of Peer Review
Peer review assists the chief editor and the editorial board in making editorial decisions while editorial communications with the author may also assist the author in improving the paper.

Unqualified to Review or Promptness
Any reviewer who feels unqualified to review the assigned manuscript or unable to provide a prompt review should notify the editor and excuse himself/herself from the review process.

Confidentiality
Manuscripts received for review must be treated as confidential documents. They must not be shown to, or discussed with, others except as authorized by the chief editor. Privileged information or ideas obtained through peer review must be kept confidential and not used for personal advantage.

Standards of Objectivity
Reviews should be conducted objectively. There shall be no personal criticism of the author. Reviewers should express their views clearly with supporting arguments.

Acknowledgment of Sources
Reviewers should identify relevant published work that has not been cited by the authors. Any statement that had been previously reported elsewhere should be accompanied by the relevant citation. A reviewer should also call to the chief editor's attention any

substantial similarity or overlap between the manuscript under consideration and any other published paper of which they have personal knowledge.

Conflict of Interest
Reviewers should decline to review manuscripts in which they have conflicts of interest resulting from competitive, collaborative, or other relationships or connections with any of the authors.

DUTIES OF EDITORS

Decision on the Publication of Articles
The chief editor of the PLANNING MALAYSIA is responsible for deciding which of the articles submitted to the journal should be published. The chief editor may be guided by the policies of the journal's editorial board subjected to such legal requirements regarding libel, copyright infringement and plagiarism. The chief editor may confer with other editors or reviewers in making this decision.

Fair play
Manuscripts shall be evaluated solely on their intellectual merit.

Confidentiality
The chief editor/editors and any editorial staff must not disclose any information about a submitted manuscript to anyone other than the corresponding author, reviewers, potential reviewers, other editorial advisers, and the publisher.

Disclosure and Conflicts of Interest
Unpublished materials disclosed in a submitted manuscript must not be used by anyone who has a view of the manuscript while handling it in his or her own research without the express written consent of the author

PLANNING MALAYSIA
JOURNAL OF THE MALAYSIAN INSTITUTE OF PLANNERS

B-01-02, Jalan SS7/13B, Aman Seri, Kelana Jaya,
47301, Petaling Jaya, Selangor Darul Ehsan, MALAYSIA
Tel: +603 78770637 Fax: +603 78779636
Email: pmjournal@gmail.com or mip@mip.org.my
Website: www.planningmalaysia.org

ISSN 16756215
9 771675 621005