

JOURNAL OF THE MALAYSIAN INSTITUTE OF PLANNERS

PLANNING MALAYSIA



MALAYSIA INSTITUTE OF PLANNERS
PLANNING MALAYSIA VOLUME 21 ISSUE 4 (2023)
[ISSN 1675-6215] e-ISSN 0128-0945]
www.planningmalaysia.org



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B-01-02, Jalan SS7/13B, Aman Seri, Kelana Jaya
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Published By
Malaysian Institute of Planners

ISSN Number

1675-6215

e-ISSN

0128-0945



Date Published: 1st September 2023

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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

Joanna Marie L. Acierto¹, Susane Marie H. Quilla², Bobby Joel N. Valencia³, Geoffrey L. Cueto⁴, Cris Edward F. Monjardin⁵, Wan Mazlina Wan Mohamed⁶

^{1,2,3,4,5}*School of Civil, Environmental, and Geological Engineering, MAPÚA UNIVERSITY*

⁶*Malaysia Institute of Transport (MITRANS), College of Engineering, UNIVERSITI TEKNOLOGI MARA (UiTM)*

Abstract

Carbon emissions from vehicles contribute significantly to carbon footprint production, which is one of the primary causes of climate change. In Caloocan City, increasing air pollution is observed despite the drastic decrease in air pollutants in major Metro Manila cities. This study primarily aims to provide strategies to reduce carbon dioxide emissions in Zapote St., Caloocan City, through a Comparative study on Urban Transport and the Environment (CUTE) Framework. The study identified that the hourly average carbon footprint contributed by private and public vehicles along Zapote Street is 686.27 and 243.71 kg CO₂e on weekdays and 634.65 and 212.97 kg CO₂e on weekends. The exploratory data analysis via Python shows that only the vehicle and fuel types affect the emissions volume. Accordingly, the Unified Vehicular Volume Reduction Program (UVVRP) was ineffective. It only resulted in additional private vehicles and increased congestion, indicating the need for an improved public transport system to encourage Filipinos to shift to public transport. Furthermore, the Traffic Volume Emission Projection (TVEP) model projects a decrease of 87.19 kg CO₂e per hour in 2023 and 164.72 kg CO₂e per hour by 2052, resulting from the 20% reduction in volume upon the implementation of the "no exemption of motorcycles" in the number coding scheme of Caloocan city.

Keywords: Carbon Footprint, Traffic Volume Projections, Traffic Policies, Transport Emission Model, Sustainable Transportation

⁶ Wan Mazlina Wan Mohamed Assoc Prof at UiTM: wmazlina@uitm.edu.my

INTRODUCTION

Carbon emission is one of the leading causes of climate change and the increasing amount of carbon emissions from vehicles significantly contribute to global carbon footprint production (Ritchie, 2021). The accumulated amount of *carbon footprint* raises the global temperature and results in global warming and climate change, consequently affecting the environment and public health.

In a special report by the Center for Research and Energy on Clean Air (2020), a drastic decrease in NO_2 and $\text{PM}_{2.5}$ levels is seen in major Metro Manila cities during the Enhanced Community Quarantine (ECQ). However, there was no sustained decrease in $\text{PM}_{2.5}$ in Caloocan City. Instead, pollution increased throughout April and saw the slightest improvement in overall concentrations of the two pollutants. Due to this, the study takes place on Zapote Street, a four-lane 1.41-kilometer collector road in North Caloocan City, Philippines as shown in **Figure 1**. It is one of the routes leading to well-known malls like Ayala Fairview Terraces and SM Fairview, and along this road is the Caloocan City Hall North. Thus, public utility vehicles (PUVs) and private vehicles commonly traverse this road.

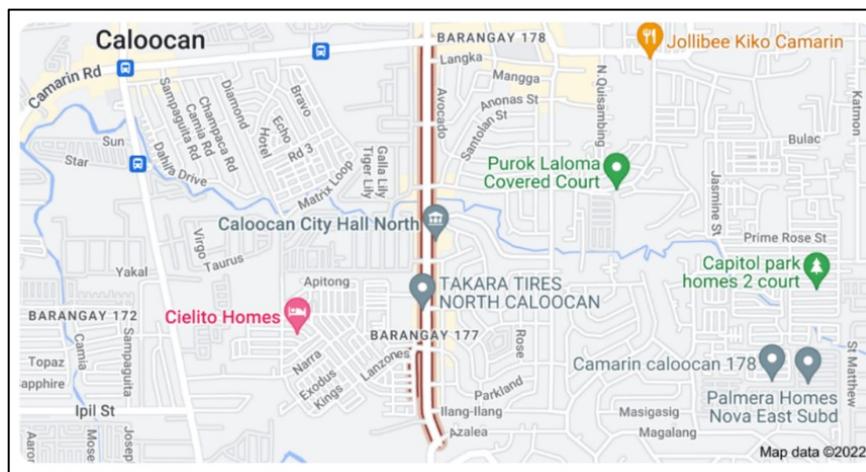


Figure 1: Map of Zapote Street (Google, 2022)

The main objective of this study is to provide strategies to reduce carbon dioxide emissions in Zapote St., Caloocan City, through the development of a Comparative study on Urban Transport and the Environment (CUTE) Framework and Traffic Volume Emission Projection (TVEP) Model. Specifically, it aims to: (1) determine the average amount of carbon footprint emissions per hour by private and public vehicles during a weekday and a weekend, (2) analyze the amount of carbon footprint emissions by motor vehicles, and (3) formulate

recommendations to existing traffic and environmental laws and ordinances and design a structure as solutions to reduce carbon emissions. The outcome of this study will help determine whether the existing laws and policies implemented to reduce carbon footprint in Zapote St., Caloocan City is effective.

LITERATURE REVIEW

Transportation

Transportation is one of the driving forces behind economic and social development (Gnap et al., 2020), but also one of the significant contributors to greenhouse gases and CO₂ emissions (Andong & Sajor, 2015). In the Philippines, road transport is the most dominant mode of transportation primarily served by private vehicles and PUVs such as jeepneys, buses, taxis, pedicabs, and tricycles.

Zapote Street, Caloocan City

Caloocan City, located in the northern part of the National Capital Region is divided into North and South Caloocan. Zapote Street is a 1.41 km road located in North Caloocan where the city hall complex is located, attracting investments in the area for future developments. Furthermore, it is part of the growth corridors of the comprehensive land use plan based on the increasing rate of economic and business transactions thriving in the road right-of-way.

Carbon Emissions of Vehicles

The principal greenhouse gas (GHG) emitted by vehicles is CO₂. The level of this emission is associated with the amount and type of fuel vehicles consume. Fuel consumption is directly proportional to the production of pollutants (Gnap et al., 2020). In 2018, the entire transport sector accounted for 21% of global CO₂ emissions. Road transport alone accounts for 75% of this emission corresponding to 15% of global CO₂ emissions (Ritchie, 2020). In the Philippines, the Climate Transparency (2020) report shows that transport emissions represent 26% of direct CO₂ emissions.

Impact of Carbon Emissions and Climate Change

EcoLife Dictionary defines *carbon emissions* as the release of carbon into the atmosphere. The increase in GHGs and atmospheric concentrations over the past 150 years warms the planet, contributing to changes in precipitation patterns, storm severity, and sea level and causing climate change (United States Energy Information Agency, 2021). In 2018, transportation sector emissions were the second largest contributor to global CO₂ emissions, next to the energy sector. In the Philippines, the transportation sector contributes to 34% of the total emissions, where 80% of it comes from road transport (TRANSfer, n.d.).

The Philippines, highly vulnerable to climate change and its impacts, is struck by around 20 tropical cyclones yearly and experiences daily seismic shocks and extreme flooding (Monjardin et al, 2019), affecting resources and livelihoods of many. These climate-related hazards had incurred an estimated USD 10 billion of losses from year 2010 to 2020 despite contributing only 0.3% of the total global GHG emissions (Philippine News Agency, 2021). A flood risk assessment focusing to both people (Gacu et al, 2022) and structures (Gacu et al, 2023) shows how vulnerable we are in the effect of climate change. Another study of (Realo et al, 2021) presented a lifeloss analysis during extreme weather events in a rural community which is basically a result of the effect of climate change.

Reducing Transportation Carbon Footprint ***Local Sustainable Transportation and Modification of Vehicles***

Metro Manila, one of the busiest regions in the country, corresponds to high carbon footprint production coming from the countless vehicles traversing the region. Effective land-use city planning should promote the use of public transit with more direct routes through common public destinations to allow less reliance on private vehicles. Creating transport infrastructure and implementing carbon dioxide standards in vehicles can improve fuel efficiency and mitigate more than half of transportation emissions. An alternative is substituting electric or biofuel-running vehicles for vehicular movement.

The Philippine government implemented the PUV Modernization Program (PUVMP), which replaces the old combustion public vehicles that contribute to around 94% of the soot particle mass, with electric-powered vehicles for sustainable emissions in the country's transport sector and to mitigate the poor air quality and reduce GHGs (Guno et al., 2021). The Department of Transportation (DOTr) also issued a project to convert old jeepneys into minibuses as part of the modernization program for better efficiency and model in the transport sector (Climate Action Tracker, 2019). Electric tricycle was also implemented in General Santos city to reduce gas emission which have been very effective in the region (Cueto et al, 2022).

The Paris Agreement

On December 12, 2015, the 21st Conference of the Parties (COP21) in Paris was held to reach a planned action to combat climate change. The United Nations Framework Convention on Climate Change (UNFCCC) Parties agree to invest in mitigations and projects for a sustainable low-carbon future. Its main goal is to prevent the irreversible consequences of the increasing global temperature by keeping the global temperature rise below 2°C above the pre-industrial levels.

United Nations Sustainable Development Goals

The United Nations (UN) has listed 17 Sustainable Developments Goals (SDGs). The goals were adopted during the UN's general assembly in 2015 as a call to action to end poverty, protect the planet, and achieve peace and prosperity by 2030. Specifically, SDG 13, "Climate Action," focuses on combatting climate change and its impact on the planet.

RESEARCH METHODOLOGY

This study is divided into five phases. Phase 1 accounts for the 12-hour traffic count at three stations along Zapote Street, Caloocan. The gathered data is then classified according to their purpose (public/private transport) and fuel type (gasoline/diesel). Phase 2 accounts for quantifying the average daily amount of carbon emissions of public and private transport using Equations 1 and 2 (Climate Change Commission, 2017).

$$\text{Part 1: Activity data} \times \text{Emission Factor} = \text{Tons of Emissions} \quad (1)$$

$$\text{Part 2: Tons of Emissions} \times \text{GWP} = \text{CO}_2 \text{ emissions} \quad (2)$$

The activity data is measured in terms of the liters (L) of fuel used, whereas fuel efficiency rates of 5 km/L of diesel and 8 km/L of gasoline were utilized. The study used 2.27 kg CO₂e/L of gasoline and 2.63 kg CO₂e/L of diesel (Cueto et al., 2022) as the emission factors and 1 as the global warming potential value of CO₂ based on the Intergovernmental Panel on Climate Change (IPCC).

Phase 3 accounts for analyzing the amount of carbon footprint emitted by vehicles through exploratory data analysis using Python. Multiple regression and correlation analysis is performed to investigate the relationship of the volume of emissions with the vehicle type, fuel type, and time of the day and how these predictor variables affect the volume of emissions. For multiple regression analysis, the study used the following null and alternative hypotheses:

H₀: The predictor variables (vehicle type, fuel type, and time of the day) do not affect the volume of emissions emitted into the atmosphere.

H_A: The predictor variables (vehicle type, fuel type, and time of the day) affect the volume of emissions emitted in the atmosphere.

Phase 4 accounts for formulating recommendations to reduce carbon emissions and integrate a sustainable transportation system in Zapote Street. CUTE framework describes different strategies and policies and determines the best action to reduce carbon emissions. It consists of three strategies: 1) reducing unnecessary trip demand (AVOID); 2) shifting travel to low-carbon modes of

transport (SHIFT); 3) improving the intensity of carbon-based transport (IMPROVE) (Nakamura & Hayashi, 2013). Existing transportation laws and policies for carbon emission reduction were reviewed and analyzed to design sustainable transport solutions that are more effective for the current environmental situation in Caloocan City.

Phase 5 then accounts for modeling transport emissions to assess the validity and efficiency of the formulated recommendations from Phase 4. The transport emission model was integrated with various frameworks that accounted for variable and policy changes for long-term forecasting.

ANALYSIS AND DISCUSSION

Classified Traffic Count

The accumulated traffic count in Zapote Street on a weekday and a weekend are shown in **Figures 2a** and **2b**. As seen in both figures, motorcycles account for the highest traffic count, followed by passenger cars and by jeepneys. Meanwhile, heavy trucks have the lowest traffic count, followed by UV Express and by bus.

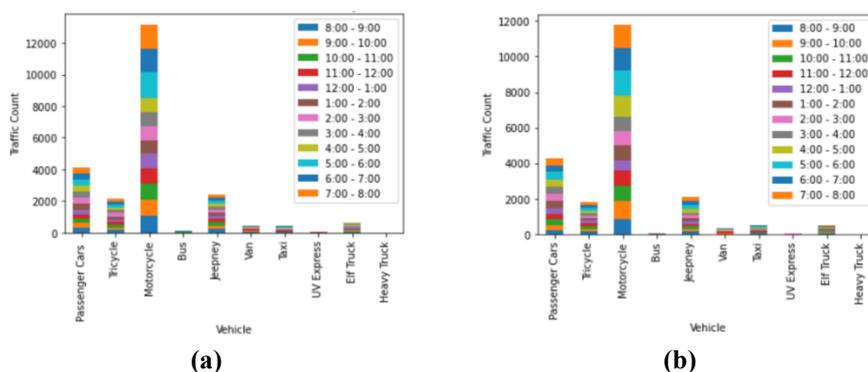


Figure 2: 12hr-Accumulated Traffic Count for a Weekday (a) and a Weekend (b)

Carbon Footprint of Vehicles

The 12-hr accumulated CO₂e emissions from private and public vehicles on a weekday and a weekend are shown in **Figures 3a** and **3b**. On weekdays, private vehicles contribute 686.27kg CO₂e per hour while public vehicles only contribute 243.71kg CO₂e. On weekends, private vehicles contribute 634.65kg CO₂e per hour while public vehicles only contribute 212.97 kg CO₂e. This depicts a vast difference between the emissions by private and public vehicles. Specifically, emissions from private vehicles are 281.59% and 298% higher than public vehicles' emissions on weekdays and weekends, respectively.

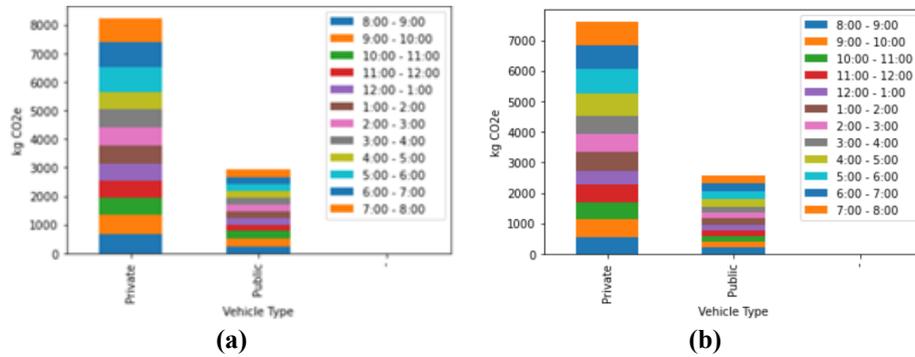


Figure 3: 12hr-Accumulated CO₂e Emissions on a Weekday (a) and on a Weekend (b)

Multiple Regression Analysis

To model transport emissions, the vehicle type, fuel type, and time of the day are used as predictors. Results of multiple regression analysis show that the Total Emissions can be predicted using Equation 3 and 4 for weekdays and weekends.

$$\text{Total Emission} = (203.1260) - (222.8488)X_{\text{Vehicle Type}} + (140.8395)X_{\text{Fuel Type}} + (4.7675)X_{\text{Time of the Day}} \quad (3)$$

$$\text{Total Emission} = (148.7002) - (210.2552)X_{\text{Vehicle Type}} + (134.3197)X_{\text{Fuel Type}} + (7.1682)X_{\text{Time of the Day}} \quad (4)$$

For both the weekday and the weekend, the vehicle type and fuel type have p-values less than 0.05 indicating that they affect the volume of emissions. Most vehicles passing through Zapote Street are private vehicles constituting approximately 78% of the total traffic count on both weekdays and weekends. Along with this, 77% of the vehicles passing the street are gas-powered vehicles. In contrast, the time of the day does not affect the volume of emissions.

Multiple Correlation Analysis

The correlation matrix of all the variables in the study is shown in **Figure 4**. This shows a strong association between the total emissions and vehicle type on a weekday and a weekend indicating that the rise in total emissions is strongly associated with the dependence on private vehicles. Moreover, a moderate and weak association is observed between the total emissions and fuel type on a weekend and a weekday respectively indicating that the number of total emissions is associated with using gas-powered vehicles. In contrast, a very weak to no association is observed in all other variables.

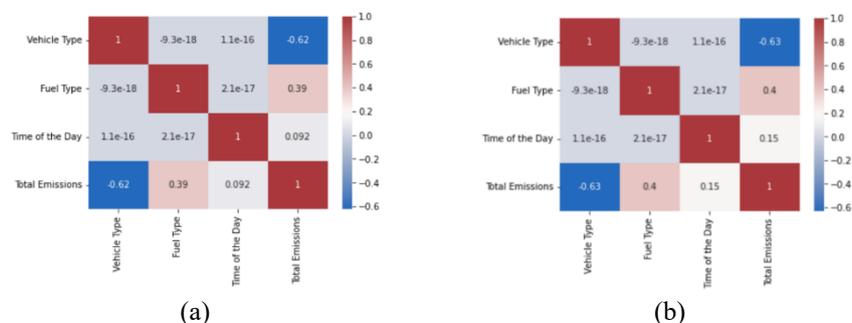


Figure 4: Correlation Matrix of Predictors for a Weekday (a) and Weekend (b)

Comparative study on Urban Transport and the Environment (CUTE) Framework

Table 1 shows the CUTE Framework, a review, analysis, and formulated recommendations for the existing traffic and environmental laws and ordinances in the Philippines.

Table 1: CUTE Framework

Existing Ordinance/Law	Flaws/Remarks	Recommendations
Section 141, Prohibited License Plate Ending under Article XXIV and Section 44, Vehicles Not to Be in Certain Areas under Article X of Ordinance No. 0391, s. 2005 – An Ordinance Providing for the Adoption of the New Traffic Management Code (North Caloocan City Hall, n.d.)	Adoption of Vehicular Volume Reduction Scheme was deemed ineffective in easing the traffic flow in Caloocan City as it only resulted in the addition of more private-owned cars on the road, contributing even more to the congestion. As for stopping and parking of vehicles, some PUVs take their time unloading, especially when not caught by the traffic enforcer, taking advantage of the situation, to wait and board more passengers. Private vehicles sometimes take their time also to unload passengers at <i>palengke</i> (wet market) and stores along the streets/roads that usually do not have parking spaces. Hence, disrupting the vehicular flow, leading to delays and traffic congestion.	Encourage the use of public and active transportation by i. including motorcycles in the implementation of the vehicular volume reduction scheme; ii. considering initiatives that will discourage Filipinos from purchasing private vehicles; iii. assigning specific roads/streets exclusive for public and active transport during peak hours; iv. integrating Intelligent Transport Systems for bus operations; v. building train infrastructure; vi. applying road congestion charging on major roads; vii. ensuring sufficient and well-designed loading/unloading stops, and viii. observing strict implementation of loading/unloading at designated stops.

Existing Ordinance/Law	Flaws/Remarks	Recommendations
RA 8749 – The Philippine Clean Air Act (DENR-EMB, 1999)	RA 8749 penalizes drivers violating the anti-smoke belching act by imposing fines ranging from Php 2,000 to Php 6,000. Still, 72.7% of the 282 vehicle emission standard violations from 2018 to 2019 were recorded by the Land Transportation Office (Lu, 2022). 88.3% of the apprehended drivers fell under the driving professional license category and violated the anti-smoke belching during daytime working and rush hours between 6 a.m. to 5 p.m.; In Cagayan de Oro City, reports state that more than 50% are non-compliant with the anti-smoke belching requirements (Philippine News.net, 2022)	Reduce the amount of smoke emitted by motor vehicles through regular maintenance and smoke emission tests. Since maintenance costs and other unexpected expenses can be financially burdensome for PUV drivers and operators, the government might consider providing financial aid for jeepney and bus operations (e.g., allowance for fuel and vehicle maintenance) Regarding penalties, impose progressive punishment and penalties by setting fines relative to the net worth of the offender and the severity of the offense committed.

Transport Emissions Model

The 'Traffic Volume Emission Projection' (TVEP) is a static transport emission model system with a top-down emission structure that strategically projects the estimated amount of CO₂e emission to determine the efficiency of implemented local laws and policies in reducing the CO₂e emission in the area. It relies on adjustment parameters and only covers motor land vehicles running on fuel. It also projects the average kg CO₂e per hour emission from the given traffic count data and uses user-supplied inputs depending on the mitigations and changes to be applied for the projections. Furthermore, the transport model can be adapted nationally to project future conditions onto a larger area.

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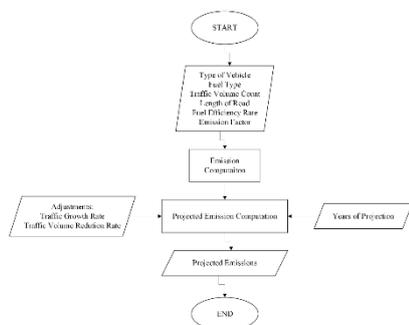


Figure 5: Traffic Volume Emission Projection (TVEP) Algorithm

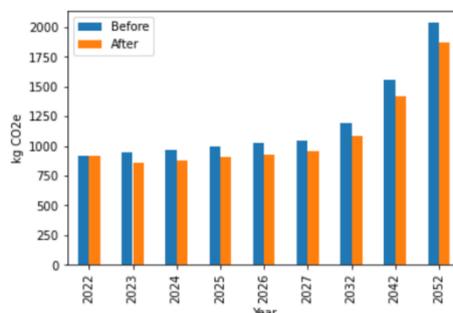


Figure 6: Projected CO₂e Emission in Zapote Street Before and After Implementing the Recommendation of No Exemption of Motorcycles in the Number Coding of Caloocan

Figure 5 shows the algorithm of TVEP and accordingly, the amount of CO₂e emission before and after implementing the recommendation of “no exemption of motorcycles in Caloocan” in the number coding scheme is projected. As shown in **Figure 6**, there will be a decrease of 87.19, 106.34, 132.59, and 164.72 kg CO₂e per hour corresponding to 9.68, 9.33, 8.91, and 8.43 percentage difference in 2023, 2032, 2042, and 2052 respectively, after implementing the recommended policy changes.

CONCLUSION

This study was able to determine the average hourly amount of carbon footprint contributed by private and public vehicles along Zapote Street to be 686.27 and 243.71 kg CO₂e, respectively, on weekdays, and 634.65 and 212.97 kg CO₂e respectively on weekends through a 12-hr traffic count and carbon footprint calculation. Accordingly, exploratory data analysis showed that only the vehicle type and fuel type affect the volume of emissions, and that there is a strong association between the total emissions and vehicle type and a moderate to weak association between the total emissions and fuel type. Through the CUTE Framework the UVVRP in Caloocan City was deemed ineffective as it only resulted in additional private vehicles on the road and increased road congestion. This raises a great need for an improved public transport system to encourage Filipinos to shift to using public transportation services. Furthermore, the Traffic Volume Emission Projection model projects a decrease of 87.19 kg CO₂e per hour in 2023 and 164.72 kg CO₂e per hour by 2052 resulting from the 20% reduction in volume upon the implementation of the "no exemption of motorcycles" in the number coding scheme of Caloocan city.

From the conclusions drawn, future researchers are recommended to conduct air quality testing or choose a location where a CO₂ analyzer is available to provide supplementary data. Moreover, for easy and efficient data gathering, the researchers recommend using or developing a program that enables the determination of the age and model of the vehicles for fuel type classification, and whether they follow Euro 4 standards.

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Received: 24th Jan 2023. Accepted: 20th July 2023



PLANNING MALAYSIA:

Journal of the Malaysian Institute of Planners

VOLUME 21 ISSUE 4 (2023), Page 13 – 23

VEHICLE DETECTION AND CLASSIFICATION USING FORWARD SCATTER RADAR (FSR) FOR TRAFFIC MANAGEMENT USING CONVOLUTIONAL NEURAL NETWORK

**N. N. Ismail¹, N. E. A. Rashid², M. N. F. Nasarudin³, W.M. W. Mohamed⁴,
S. Zainuddin⁵, Z. I. Khan⁶**

^{1,2,6}Microwave Research Institute,

UNIVERSITI TEKNOLOGI MARA, SHAH ALAM, MALAYSIA

³School of Electrical Engineering, College of Engineering,

UNIVERSITI TEKNOLOGI MARA, SHAH ALAM, MALAYSIA

⁴Malaysia Institute of Transport (MITRANS),

UNIVERSITI TEKNOLOGI MARA, SHAH ALAM, MALAYSIA

⁵Faculty of Electrical and Electronic Engineering Technology,

UNIVERSITI TEKNIKAL MALAYSIA, MELAKA

Abstract

The importance of automatic vehicle detection and classification has grown significantly in recent years, as it has become a crucial component of traffic management and monitoring systems. To overcome the limitations of traditional video vehicle detection, this paper proposes the use of forward scatter radar (FSR) technology. The FSR system is tested for the classification of four different vehicle types, each with distinct sizes. To improve the classification accuracy of the FSR system, the paper utilizes a well-established neural network known as a convolutional neural network (CNN). Two time-frequency analyses, continuous wavelet transform (CWT) and short-time Fourier transform (STFT), are used to evaluate the classification performance of the FSR system. The study demonstrates that the CNN classifier significantly improves the classification accuracy of the FSR system in vehicle detection and classification. This finding is supported by the evaluation of the time-frequency analyses, CWT and STFT. Overall, the proposed approach has the potential to enhance traffic management and monitoring systems, thereby improving road safety and traffic efficiency.

Keywords: Vehicle Classification, Forward Scatter Radar (FSR), Convolutional Neural Network (CNN), Continuous Wavelet Transform (CWT), Short-time Fourier Transform (STFT)

² Assoc. Prof. Ir. Dr. at UiTM. Email: emileen98@uitm.edu.my

INTRODUCTION

Vehicle detection and classification technologies are crucial in various civilian and military applications, including transportation planning and highway traffic monitoring (Abdul Ghapar Othman & Kausar Hj Ali, 2020). Formerly, vehicle identification, segmentation, and tracking technologies were utilized to compute the fee for different types of vehicles for the automated toll levy system using a vision-based supervision system (Lai, Fung, & Yung, 2001)(Nahry Yusuf, 2018). Recently, researchers have used the vehicle recognition system in detecting vehicles or traffic lanes (Lim, Ang, Seng, & Chin, 2009)(Gomaa, Minematsu, Abdelwahab, Abo-Zahhad, & Taniguchi, 2022). The system has also been used in classifying various vehicle types on roads such as automobiles, motorcycles, vans, and busses, to name a few (Kato, Ninomiya, & Masaki, 2002)(Chetouane, Mabrouk, Jemili, & Mosbah, 2022)(Ahmed et al., 2023).

Nevertheless, the success of the system is contingent on excellent traffic image processing methodologies to detect and classify the vehicles, which may be hindered when the vehicles are obscured by other vehicles or by background barriers. Furthermore, the system is also susceptible to unfavorable weather conditions and its efficacy degrades in severe situations such as rain, snow, and fog (Bijelic, Gruber, & Ritter, 2018). As a result of those constraints, researchers have begun to explore alternative methods for the past few years besides the vision-based system. One of the reliable systems that are more resilient under weather circumstances is a radar system (Müller, 2017), which has been found in widespread use in autonomous vehicle systems (Caesar et al., 2020)(Bijelic et al., 2020).

Forward scattering radar (FSR), a specialized kind of bistatic radar with a detection angle of 180° , has been studied extensively in recent years in detecting and classifying ground targets, including humans and vehicles (N. E. A. Rashid et al., 2008)(Gashinova, Sizov, Zakaria, & Cherniakov, 2010)(Hafizah Abdul Aziz & Firdaus Hussain, 2020)(Nur Emileen Abd Rashid et al., 2021)(Mamat & Aziz, 2022) due to its number of peculiarities, especially robust to stealth technology (Hiatt, Siegel, & Weil, 1960). Classification of FSR ground targets has been studied since at least 2005 (Cherniakov, Raja Abdullah, Jančovič, & Salous, 2005). In the study, principal component analysis (PCA) is utilized as an automated feature extraction method, and the suggested FSR system uses solely k-nearest neighbor (KNN) as its classifier. The combination techniques have also been utilized in (R. S. A. R. Abdullah & Ismail, 2006)(R. S. A. R. Abdullah, Saripan, & Cherniakov, 2007)(Raja Abdullah, Abdul Aziz, Abdul Rashid, Salah, & Hashim, 2016)(Aziz, Hadi, Rahman, Alias, & Al-Hiealy, 2022), where the combination produces an excellent classification performance, which offers an accuracy of greater than 90%. In (Nur Fadhilah Abdullah, Rashid, Musirin, & Khan, 2015), the authors utilized the PCA and Z-score for the feature extraction

process in the FSR system to investigate which feature extraction technique would be the most effective when it comes to classifying ground vehicles. The work continued in (Nur Fadhilah Abdullah, Rashid, Othman, Khan, & Musirin, 2017)(N. F. Abdullah, Rashid, Ibrahim, & Abdullah, 2017) as the authors developed more methods for enhancing classification accuracy by using the combination of Z-score and neural network (NN), where it was found that the combination provides an excellent classification pattern. An artificial neural network (ANN) technique called feed-forward back-propagation (MPL) architecture is used in (Ibrahim, Abdullah, & Saripan, 2009)(M., Kanona, & Elsid, 2014) for classifying the FSR target signal. At the end of the study, the ANN provides a greater rate of accurate classification than the KNN classifier.

In recent years, a convolutional neural network (CNN) has seen widespread use in the vehicle classification process vehicleried out by radar systems (Zhang, Xu, & Li, 2022)(Saranya, Archana, Reshma, Sangeetha, & Varalakshmi, 2022)(Garcia, Aouto, Lee, & Kim, 2022). This is due to the fact that CNN is able to automatically recognize important characteristics without the need for any kind of human intervention compared to its predecessors (Gu et al., 2018). In order to explore its potential applications, in this study, the CNN classifier is proposed in vehicle classification for the FSR system, and to the best of the authors' knowledge, this is the first time that the CNN classifier is demonstrated to the FSR system. Two types of time-frequency analysis are applied in this study to evaluate the classification accuracy, which are continuous wavelet transform (CWT) to create a scalogram and short-time Fourier transform (STFT) to create a spectrogram. An AlexNet architecture with eight layers and an Adam optimizer with a 0.0001 initial learning rate are implemented in this study.

RESEARCH METHODOLOGY

Data Collection

In this study, a pair of sensors comprising a transmitter and a receiver with operating frequencies of 64, 151, and 434 MHz are employed for transmitting and receiving. The sensors are placed facing each other, forming an FSR configuration, with a separation distance of 50 m. The data are gathered on a parking lot devoid of foliage in order to acquire the least amount of muddled information. The signal transmitted from the transmitter is a continuous wave (CW) signal and the receiver will capture the signatures of four different vehicles moving one at a time perpendicularly in the middle of the baseline between the transmitter and the receiver at a constant pace of roughly 10 km/h. In order to guarantee that the signals are reliable, the measurement of each vehicle is vehicleried out 40 times, with 20 s passing between each set of data. Table 1 provides a tabular overview of the vehicles' dimensions.

Table 1: Vehicle Dimensions

Vehicle	Dimensions (height (m) x length (m))
A	4.8 x 2.1
B	4.5 x 1.4
C	4.4 x 1.5
D	4.0 x 1.4

Data Signal Processing

The collected data consists comes in the form of three Doppler channels, each of which represents a different operating frequency, ranging from 64 to 151 to 434 MHz. The signals are captured with a frequency sampling rate, f_s of 20 Hz over a period, d of 20 s. The gathered signals are filtered with a low-pass filter at a cut-off frequency of 60 Hz before being subjected to further processing. Two time-frequency analyses are applied, namely CWT and STFT to the data to create a scalogram and spectrogram, respectively. A Gaussian window size of 0.5 s and a number of overlaps of 0.4 s are applied as the parameters of the STFT. The training-to-testing ratio across all courses is 80:20. An AlexNet architecture with eight layers is utilized for the image classification task with an Adam optimizer. The learning rate is set to 0.0001 with a minibatch size of 512.

Table 2: Signal Processing Algorithm

Signal initialization		
1	i.	Sampling frequency, $f_s = 20$ Hz.
	ii.	Duration, $d = 20$ s.
	iii.	3 frequencies: 64, 151, and 434 MHz.
Filtering and time-frequency analysis		
2	i.	Apply a low-pass filter with 60 Hz.
	ii.	Apply CWT to create a scalogram.
	iii.	Apply STFT to create a spectrogram with a Gaussian window size of 0.5 s and overlaps of 0.4 s.
Data classification		
3	i.	Divide data with a ratio of 80:20 for training and testing.
	ii.	Apply AlexNet architecture with 8 layers, as well as an Adam optimizer, 0.0001 initial learning rate, and 512 minibatch size.
	iii.	Classification percentage accuracy.

EXPERIMENTAL RESULTS AND DISCUSSIONS

The four vehicles' Doppler signatures captured with the operating frequency of 64 MHz are represented in Figure 1. Vehicle A which comprises a bigger size than the other three vehicles produces more signatures as can be seen in Figure 1(a). Vehicle B in Figure 1(b) generates a similar Doppler signature as vehicle A, however with a lesser amplitude as vehicle B is smaller than vehicle A. On the other hand, vehicles (c) C and (d) D produce different Doppler signatures. On the basis of the data, it is shown that the FSR system is capable of capturing various

kinds of vehicles since the target Doppler signature created by the system is distinct from one another.

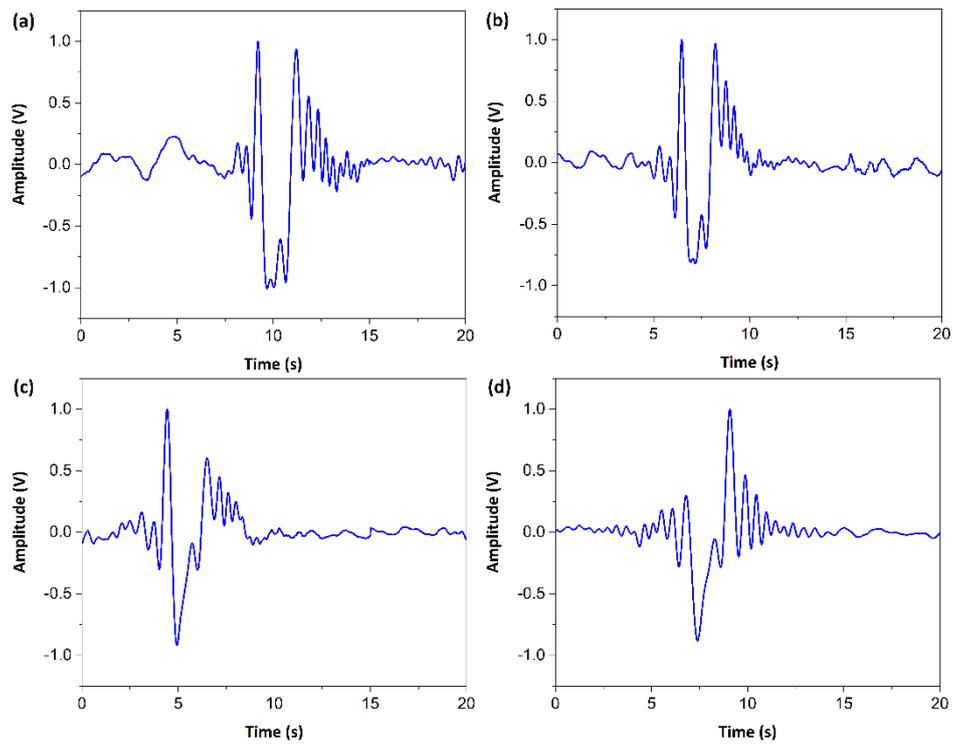


Figure 1: Target Doppler signature with 64 MHz operating frequency for vehicle (a) A, (b) B, (c) C, and (d) D

The clearer differences in vehicle signatures for all four vehicles, A, B, C, and D, are expressed in the frequency domain signal for the first 1.5 Hz with normalized to 0 dB as depicted in Figure 2 with the operating frequency of (a) 64 MHz, (b) 151 MHz, and (c) 434 MHz. From the figures, the difference can be seen in the main and side lobes of the target signature. Each vehicle generates a unique signature for each frequency at which it operates, which suggests that various targets will each create their unique signature.

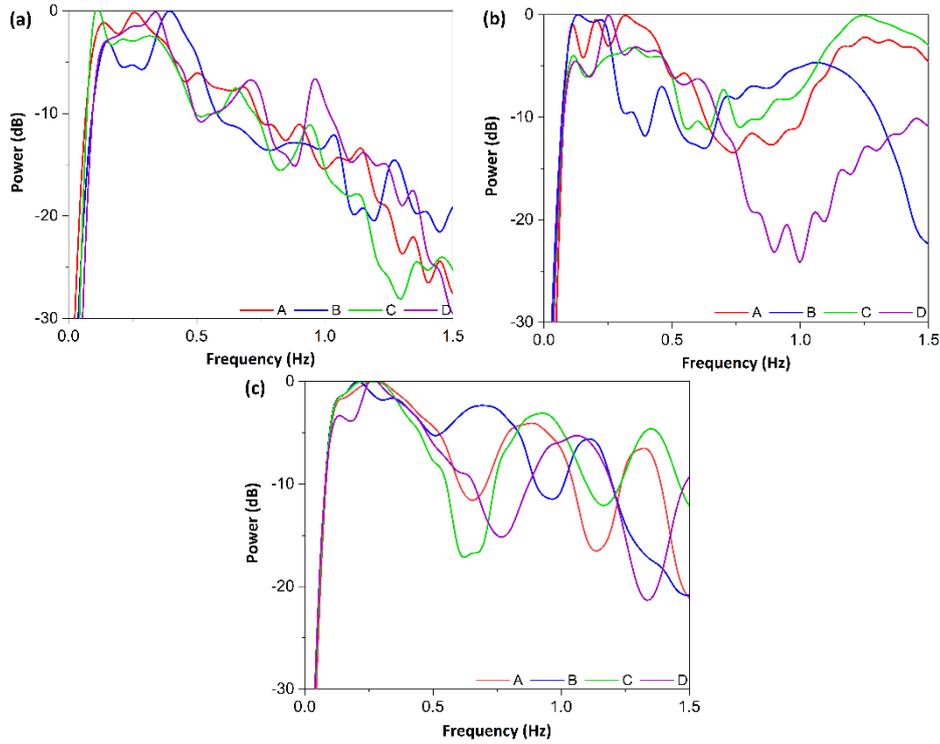


Figure 2: Spectra for vehicles A, B, C, and D with the operating frequency of (a) 64 MHz, (b) 151 MHz, and (c) 434 MHz

Figure 3 compares the source image with the image of the scalogram and spectrogram of the vehicle (a)(b) A, (c)(d) B, (e)(f) C, and (g)(h) D, respectively, with an operating frequency of 434 MHz. From the figure, it can be seen that the representation of the heat map between the scalogram and spectrogram is different. The spectrogram represents more intensities than the scalogram. This is because the spectrogram heat map offers more comprehensive information about the strength of the signal inside each frequency bin, but the scalogram heat map provides more detailed information about the distribution of frequencies over time. In every single composited picture, the four vehicles can be distinguished from the other by a substantial and obvious visual gap that exists between them. The brighter intensities (warmer colors) in the figures represent the crossing vehicles to the baseline of the transmitter and receiver, which reflects the Doppler signature in Figure 1. The heat map for vehicle A in both the scalogram (Figure 3(a)) and spectrogram (Figure 3(b)) is expected to be clearer because of the presence of energy due to a bigger dimension size compared to the other three vehicles.

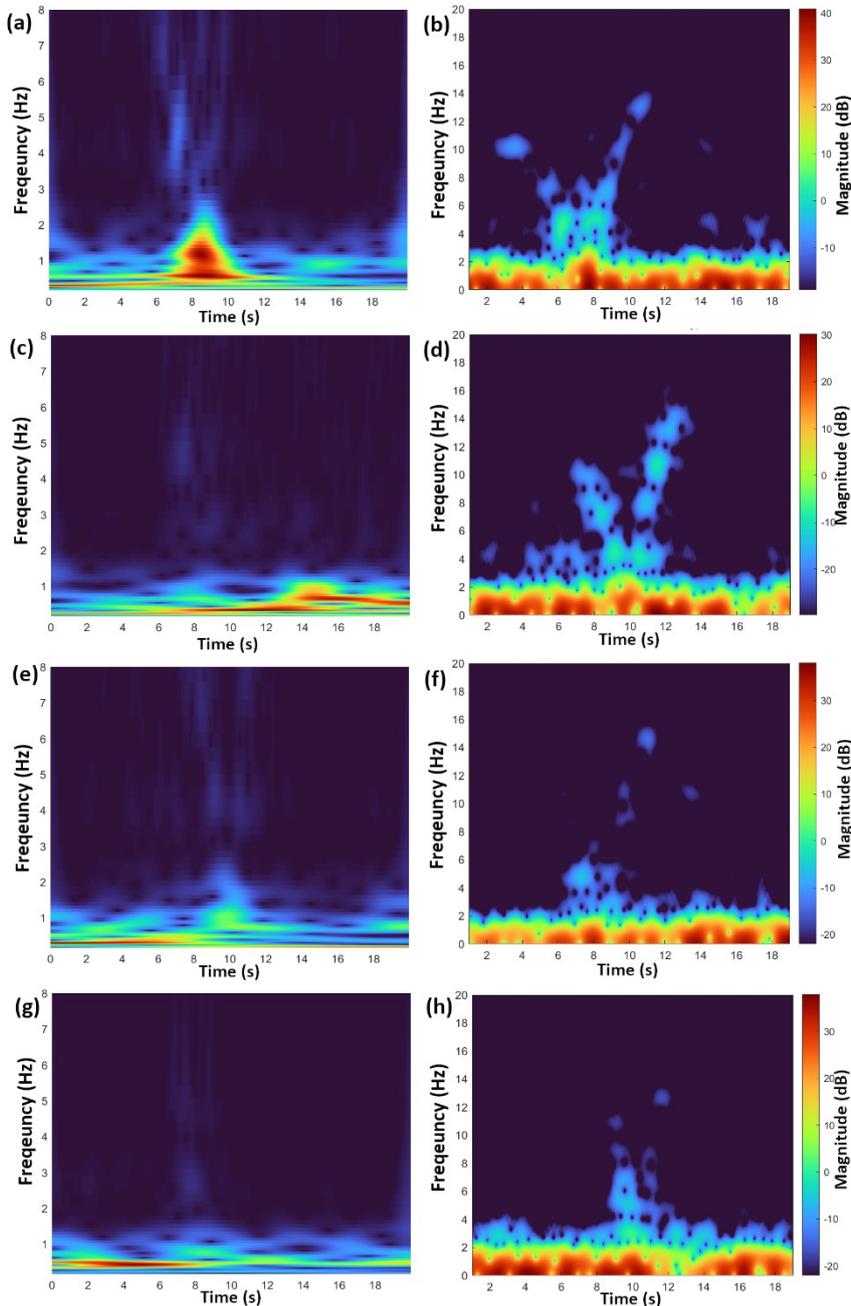


Figure 3: Scalogram and spectrogram of the vehicle (a)(b) A, (c)(d) B, (e)(f) C, and (g)(h) D, respectively, with an operating frequency of 434 MHz

The classification percentage accuracy with scalogram and spectrogram techniques for 64, 151, and 434 MHz operating frequencies are tabulated in Tables 3, 4, and 5, respectively. In Table 3, only vehicle D is misclassified with a classification accuracy of 97.5% for the scalogram technique, while only vehicle C is misclassified with a classification accuracy of 95.0% for the spectrogram technique. The classifier with an operating frequency of 64 MHz has an overall accuracy of 99.4% and 98.8% for the scalogram and spectrogram techniques, respectively. However, there is no misclassification occurs using the scalogram technique for operating frequencies of 151 and 434 MHz as shown in Tables 4 and 5, respectively, resulting in an overall classification accuracy of 100%. On the other hand, there is only one vehicle that is misclassified for the operating frequency of 151 MHz using the spectrogram technique, which is vehicle B with a classification accuracy of 97.5%. The same classification accuracy of 97.5% also occurs for the operating frequency of 434 MHz with the spectrogram technique, which occurred by vehicle A. This yields an overall classification accuracy of 99.4% for both 151 and 434 MHz operating frequencies. Overall, classification accuracy with the scalogram technique produces a higher percentage than the spectrogram techniques for all three operating frequencies. Based on the classification accuracy from both types of techniques, this indicates that the CNN classifier is suitable to perform vehicle classification in the FSR system.

Table 3 Classification percentage accuracy for 64 MHz

Vehicle	Accuracy (%)	
	Scalogram	Spectrogram
A	100	100
B	100	100
C	100	95.0
D	97.5	100
Overall	99.4	98.8

Table 4 Classification percentage accuracy for 151 MHz

Vehicle	Accuracy (%)	
	Scalogram	Spectrogram
A	100	100
B	100	97.5
C	100	100
D	100	100
Overall	100	99.4

Table 5 Classification percentage accuracy for 434 MHz

Vehicle	Accuracy (%)	
	Scalogram	Spectrogram
A	100	97.5
B	100	100
C	100	100
D	100	100
Overall	100	99.4

CONCLUSION

The study utilized a CNN classifier that incorporated both scalogram and spectrogram techniques to classify four types of vehicles. These vehicles were captured by an FSR system that operated at three different frequencies: 64, 151, and 434 MHz. Based on the results obtained, it can be concluded that the CNN classifier is capable of accurately classifying vehicles when used in conjunction with the FSR system. This finding has significant implications for traffic management and monitoring systems in real time.

ACKNOWLEDGEMENT

This research is fully supported by MITRANS grant, 600-RMC/MITRANS_IRES 5/3(002/2020). The authors would like to thank Universiti Teknologi Mara, Malaysia Institute of Transport and Microwave Research Institute for all the supports.

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Received: 24th Jan 2023. Accepted: 20th July 2023



VALUATION OF TRANSPORTATION POLICY IN MAKASSAR CITY BASED ON VEHICLE EMISSION POLLUTION FOR SUSTAINABLE ZONE PLANNING

Umar Mansyur¹, Santun R.P. Sitorus², Marimin³, Lilik Budi Prasetyo⁴

*¹Lecturer of Urban and Regional Planning Department,
UNIVERSITAS PAKUAN-BOGOR-INDONESIA*

*^{2,3,4}Lecturer of Post Graduate School,
IPB UNIVERSITY-BOGOR-INDONESIA*

Abstract

City expansion, vehicle growing number, fossil fuel consumption as non-renewable energy, and highest carbon emission has increased green house effect with potentially expanding global warming. Global warming has negative impacts on citizen quality of life as well as economic growth. Makassar City as one of the metropolitan in Indonesia with the high number of vehicle has a potential to endure global warming. This is exacerbated by the decreasing environmental carrying capacity caused by household and industrial pollution and greater vehicle emission. This study aims to (1) identify the vehicle emission gas using descriptive analysis, (2) evaluate ambient air quality in several locations within Makassar City based on field measurement, and (3) formulate the zone plan with potential vehicle-sourced high pollution using AHP. It can be concluded from this study that 99% of Makassar City's pollution is caused by vehicle emissions with specifically refers to vehicle ages, car engine types, and low maintenance. It is found that high pollution level occurs in the suburbs, while medium pollution level happens in the transition zone and low level of pollution in city center. Urban infrastructure improvement is carried out by Makassar City Development Agency (Bappeda) with consistency ratio between 0.05 and 0.06.

Keywords: Ambient Air Quality, Vehicle Emission, Zone Planning

¹ Lecturer at University of Pakuan, Indonesia. Email: umarmansyur@unpak.ac.id

INTRODUCTION

Transportation problems and challenges are multi-dimensional in the transportation system and urban system. These include in the planning, management and operational aspects as a policy framework and based on the dimensions of economic, social and environmental aspects. Makassar City as one of the metropolitan cities with a high number of vehicles has the potential to experience conditions like the one above. In addition, the reduced carrying capacity of the environment caused by pollution from industry and households as well as from vehicle emissions which are far greater than other sources of pollution. This is in line with the basic concept of sustainable development (Fauzi, 2004), where the sustainable transportation needs is the embodiment of safe, comfortable and affordable transportation. Bus services include timely and accurate information to ease users to plan their journey and providing comfortable bus stops (Min, 2022). While Chavarria (2002) used AHP for modelling the management of the transportation system.

The spatial planning of urban areas based on the level of vehicle pollution emissions originating from non-bus passenger public transport is still very limited in Indonesia, but if it is carried out it will be very useful in spatial planning, especially aspects of transportation-based area planning. Air pollution has become a serious threat to public health due to the rapid economic development globally, and urban air pollution is thought to cause 1.3 million deaths annually (Sahrir, 2022a). This is due to the increasing expansion of pollution-prone areas which are characterized by high lead levels of up to 60 micrograms per deciliter found in children in seven sub-districts in Makassar City. Several previous studies have described the development of models of air pollution from motorized vehicles (Santosa, 2005). Therefore, this paper is important due to the lack of integration of policies in the management of non-bus passenger public transport with urban spatial planning policies.

This paper aims to (i) identify the level of vehicle exhaust emissions (non-bus passenger public transport), (ii) assess the ambient air quality in several urban areas, and (iii) formulate policies for structuring areas that are potentially prone to pollution from vehicles.

LITERATURE REVIEW

Sustainable Urban Transport System Approach

The approach to a sustainable urban transportation system based on the user's perspective is intended to obtain an in-depth view of the technical parameters and conditions of official regulations to suit the expected goals and cannot be separated from sustainable urban development (Miyamoto et al.,1996). The problem formulation of the urban transportation system can be viewed from environmental, social, and economic parameters. These are represented by

several indicators, namely identification of land use and environmentally friendly alternative vehicles, equity of access and health, as well as the capability and affordability of public transportation (Deakin, 2001). These problems are closely related to the time horizon, environmental influences, and their nature and are based on rational and gradual logic of thinking (Sujarto, 2001).

Spatial planning and transport interaction modeling

Transportation and spatial interaction modeling or land use and transportation integration model is a model that allocates each land use based on its interaction and uses accessibility variables (facilities and infrastructure factors) as a link between the two. The integration model can be divided into predictive models and optimization models that consider factors: accessibility, land attractiveness, and city government policies (Najid et al., 2001).

A predictive model is a model that will explain changes in land use to transportation and vice versa or is a dynamic model based on demand behavior. While the optimization model is a mapping of land use patterns to optimize the utility of travelers or optimize city efficiency which is determined by travel and development costs (Tamin, 1997).

Environment as a Function of the Transportation Environment

The new paradigm in development that aims to improve human welfare also considers ecosystem aspects (Zubair, 2000). For this study, several transportation and environmental factors that need to be considered are unlimited emissions and waste in the form of air, land, and water pollution (natural environment), vehicle innovation from renewable energy sources (sunlight), not using natural resources for recycling, and the design of a transportation system that minimizes land use. Some of the main environmental and transportation issues are air quality, greenhouse gas emissions, noise, impact on biodiversity and land use. The main components of transportation emissions include CO₂, CO, HCs, VOCs, NO_x, SO₂, PM, and other products that are harmful to living things (Hensher et al., 2003).

Although important, little is known about how the general public views the risk of air pollution it implies that the authority might provide a significant contribution by creating strategies to lessen the effects of air pollution on people, particularly in cities where air pollution is a problem (Sahrir, 2022b).

City ambient air quality and vehicle exhaust emission levels mutually influence each other, where high vehicle emission levels are due to age, engines, and lack of vehicle maintenance in large quantities and for a long time and have an effect on decreasing city ambient air quality.

Analytical Hierarchy Process in Transportation Management

Analytical Hierarchy Process (AHP) is a flexible model and decision-making by combining considerations and personal values logically (Saaty, 1993). The Principle of AHP is an effort to simplify a complex problem that is unstructured, but strategic, and dynamic into parts and arranges them in a hierarchy. The level of importance of each variable is assigned a numerical value subjectively representing its urgency when compared to other variables. Synthesis was done based on various consideration to set up the highest priority and role to influence the system (Marimin, 2004).

A strategic decision in the management of sustainable transportation is carried out based on actors, namely users, entrepreneurs, and the government in order to achieve various alternatives (Chavarria, 2002).

RESEARCH METHODOLOGY

This study performs qualitative research, where the analysis of data in the form of documents, based on objectives. For data analysis, several methods including descriptive analysis was described in this article using frequency. Emission data and ambient air quality based on primary and secondary data using units of ug/Nm³ and percentages for each measurement parameter using Excel for Windows. Furthermore, the policy for structuring pollution-prone areas with AHP with an overall inconsistency (consistency index value) of 0.05-0.06 means that the paired weighting value of each matrix is consistent, or in other words the respondents' answers are carried out consistently (See Figure 1 Land Use Map of Makassar City)

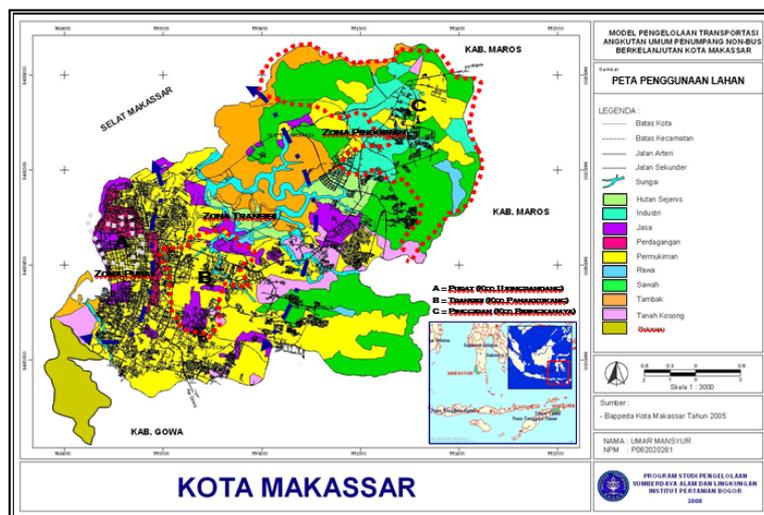


Figure 1: Land Use Map of Makassar City

It was analyzed with the help of Expert Choice 2000 with seven respondents (stakeholders) who are involved in or directly related to the objectives of policy formulation, namely:

- 1) representatives of the regulators (City Development Planning Agency, Public Works Service, Environment and Sanitation Service, Transportation Service, and City Police Agency),
- 2) operator representatives (transportation entrepreneurs), and
- 3) user representatives (transport users).

ANALYSIS AND DISCUSSION

From a macro perspective, the ambient air quality for Makassar City was measured over a period of 5 to 6 years (2001-2005) at several locations as samples representing each land use, namely (1) downtown in Karebosi Field and in front of the Mattoangin Stadium, (2) residential zone in Panakkukang, (3) services and education zone on Jalan Urip Sumohardjo, (4) trading zone in Central Market and Pannampu Market, and (5) industry area in front of PT. Berdikari and Makassar Industrial Zone (KIMA).

The results of these measurements concluded that the air condition based on pollutant parameters and indications of their sources (Environmental Impact Control Agency of Makassar City, 2001-2005) is as follows:

- The parameter of Carbon Monoxide (CO) with 24-hour quality standard = 150 ug/Nm³ is the highest although it has not exceeded the quality standard at Pannampu Market and Jalan Urip Sumohardjo; and the lowest was in Karebosi Field which was caused by heavy traffic or came from vehicles and dense settlements.
- Nitrogen Dioxide (NO₂) with a 24-hour quality standard = 150 ug/Nm³ is the highest, although it has not exceeded the quality standard at PT. Berdikari, Panakkukang, KIMA, and Central Market; and the lowest was at the Mattoangin Stadium caused by industry, settlements and heavy traffic.
- Oxidant (O₃) with a quality standard of 1 hour = 235 ug/Nm³ is the highest although it has not exceeded the quality standard in the Central Market, and Panakkukang; and the lowest in the Market Pannampu which is caused by heavy traffic or comes from vehicles and settlements.
- Sulfur Dioxide (SO₂) with a 24-hour quality standard = 365 ug/Nm³ is the highest although it has not exceeded the quality standard at Jalan Urip Sumohardjo and Karebosi Field; and the lowest in Panakkukang caused by heavy traffic or from vehicles.

- Dust (TSP) with a 24-hour quality standard = 230 ug/Nm³ is the highest and has exceeded the quality standard on Jalan Urip Sumohardjo and Karebosi Field; and the lowest at KIMA caused by heavy traffic or coming from vehicles.
- Lead (Pb) with a 24-hour quality standard = 2 ug/Nm³ is the highest and has exceeded the quality standard in Pannampu Market and Jalan Urip Sumohardjo and the lowest in Karebosi Field which is indicated due to high concentrations of Lead by heavy traffic or from vehicles.

Based on the monitoring results over the 5-year period above, it can be concluded that the source of air pollution or pollution in Makassar City is emissions from vehicles. Because based on observation locations with the highest pollutant levels are locations with heavy traffic and densely populated settlements. Air quality in other locations that are not heavily trafficked has not yet exceeded environmental quality standards.

The emission level of vehicles using gasoline or premium (gasoline) fuel in Makassar City is based on secondary data from testing with the AVL Emission Tester Series 4000 which was carried out for 3 days of observation at the research location, namely Makassar City Hall Jalan Ahmad Yani (Ujungpandang District), Center Regional Ministry of Environment Sumapapua Perintis Kemerdekaan Street (Biringkanaya District), and Ruko Yanti Jalan Sultan Alauddin (Panak-kukang District) (see Table 1).

Table 1: Vehicle Emission Test Result in Makassar City in 2006

No	Testing point	Vehicle number	Emission Test Result and Vehicle System						Ket.
			System	CO (%)	CO ₂ (%)	O ₂ (%)	HC (ppm)	Lambda (λ)	
1	City Hall Ahmad Yani Street (Ujungpandang)	161	Carburator 90 vehicles	Total 506.8	Total 1855.02	Total 314.46	Total 110.722	Total 61.431	Public 5.6 %
		Private=85 Agencies=66 Public=9 Taxi=1	Injection 71 vehicles	Average 3.15 (unideal)	Average 11.52 (unideal)	Average 1.95 (ideal)	Average 688 (unideal)	Average 0.38 (unideal)	
		2	Carburator 41 vehicles	Total 183.6	Total 574.69	Total 98.54	Total 20.070	Total 9.641	
2	Pusreg KLH Sumapapua Office, Perintis Kemerdekaan Street (Biringkanaya)	52	Carburator 41 vehicles	Average 3.53 (unideal)	Average 11.05 (unideal)	Average 1.895 (ideal)	Average 720 (unideal)	Average 0.367 (unideal)	Public 17.3 %
		Private =29 Agencies =14 Public =9 Taxi =0	Injection 11 vehicles	Total 673.02	Total 1395.32	Total 512.73	Total 121.998	Total 103.319	
		3	Carburator 107 vehicles	Average 4.71 (unideal)	Average 9.76 (unideal)	Average 3.59 (unideal)	Average 835 (unideal)	Average 0.725 (unideal)	
3	In front of Ruko Yanti, S.Alauddin Street (Panakkukang)	143	Carburator 107 vehicles	Total 673.02	Total 1395.32	Total 512.73	Total 121.998	Total 103.319	Public 25.2 %
		Private=89 Agencies=9 Public=42 Taxi=3	Injection 36 vehicles	Average 4.71 (unideal)	Average 9.76 (unideal)	Average 3.59 (unideal)	Average 835 (unideal)	Average 0.725 (unideal)	
		3	Carburator 107 vehicles	Average 4.71 (unideal)	Average 9.76 (unideal)	Average 3.59 (unideal)	Average 835 (unideal)	Average 0.725 (unideal)	
Total / Average		356 / 119	238 (K) / 118 (I)	11.39 / 3.79	32.33 / 10.78	7.435 / 2.48	2 243 / 748	1.472 / 0.49	48.1 / 16

Remarks: ideal emission values CO ≤ 2,0%; CO₂ ≥ 12,0%; 0,5% ≤ O₂ ≤ 2,0%; HC ≤ 200 ppm; and Lambda 0,950 ≤ λ ≤ 1,050; C = carburator dan I = injection

Based on the results of the three-day test at the three locations above, it can be concluded that of the number of vehicles tested, 356 vehicles and an average of 119 vehicles per test day with a vehicle system using carburetors, 238

vehicles and 118 vehicles injection. The vehicle exhaust emission levels tested on average per type of pollutant source and their parameters are as follows: (i) Carbon monoxide in unideal level around 3,79%; (ii) Carbon dioxide in unideal level around 10,78%; (iii) Oxygen in unideal level around 2,48%; (iv) Hidro carbon in unideal level around 748 ppm; dan (v) Lambda in unideal level around 0,49.

These results indicate that the vehicle carburator system in large quantities compared to injection and is more prone to causing gas emissions that are not ideal and is evidenced by the average test results for each pollutant parameter, all of which are in non-ideal conditions. Based on various types of vehicle use, namely private vehicles by 57 percent, service 25 percent, city transportation 17 percent, and taxis 0.8 percent, it has been indicated that the level of vehicle emissions in general is not fully influenced by this type of use but is highly dependent on the level of vehicle maintenance. In addition, the results of vehicle emission tests based on the type and year of manufacture were on average with 1500 CC type engines and were produced in 1998.

In general, these conditions have the potential to generate emissions and produce conditions that are not ideal for each pollutant parameter. The results of emission tests on non-bus passenger public transport vehicles, amounting to 48.1% of all tested vehicles, indicate vehicles with a very high potential to generate emissions.

The detailed results of emission tests indicate that 99% of city transportation was in critical condition. It occurred because all emission test parameters were not ideal either due to the age of the vehicle, type of engine, or due to lack of vehicle and engine maintenance. Vehicle emissions and ambient air quality in Makassar City directly influence each other, because the higher the level of vehicle emissions in cumulative amounts on the highway will affect overall air quality.

Based on the conditions mentioned above, it can be concluded that at the research location the average emission level of vehicles in the city center zone (Ujungpandang District) was identified as low, while in the urban transition zone (Panakkukang District) is moderate, and finally in the periphery zone (District Biringkanaya) is high. In addition, the quality of ambient air at the study site is strongly influenced by the level of activity of the population and the pattern of land use in the area and the level of vehicle traffic density.

This condition explains that although there is a relationship between increased vehicle emissions and decreased city ambient air quality, this situation is more due to the condition of the types of vehicles and the volume of vehicles in each of these zones. Vehicle condition is related to type, age, and maintenance factors, while vehicle volume is related to traffic density and low vehicle speed

on a road section in an area. City ambient air quality in the long term will continue to decline in line with increasing vehicle emission levels.

Based on these calculations, it can be concluded that the amount of carbon monoxide (CO) emissions based on the type of vehicle at the study site was dominated by sedans/jeeps, deer and pick-ups by 38%, buses by 36%, mini buses and city transportation by 34.2 %, and mini trucks 20%.

Analysis of the description of emission levels at the study sites can be concluded based on the average vehicle emission levels in the 2006 test. Fuel consumption based on the average volume of vehicles at each study location as shown in Table 2.

Table 2. Total Vehicle Emission in Study Location

No	Vehicle type	Vehicle emission testing point			Emission Factor CO (%/volume)	Fuel consumption (Volume)	Total Emission (%)
		Ahmad Yani	Perintis Kemerdekaan	Sultan Alauddin			
1	Sedan/Jeep	5188	3973	2460	3.8	10	38
2	Kijang	11243	9195	6220	3.8	10	38
3	Mini Bus	105	262	248	3.8	9	34.2
4	Bus	1811	99	194	4.0	9	36
5	Pick-up	568	220	1652	3.8	10	38
6	Truk mini	135	872	1191	4.0	5	20
7	Publictransport (Angkot/pete2)	16202	4391	4796	3.8	9	34.2
Total		35252	20997	16761	27	62	238.4
Vehicle		5036	2999	2394	3.8	8.8	34.06

Remarks: diesel engine type vehicle and motorcycle has not analyzed

In general, the research location has the potential to be an area prone to pollution from four-wheeled vehicles that use gasoline with one type of parameter, namely carbon monoxide, which is an average of 116% and for a total average of 389,871%. For more details, the condition of the vehicle emission test results at the research location can be seen in Figure 2.

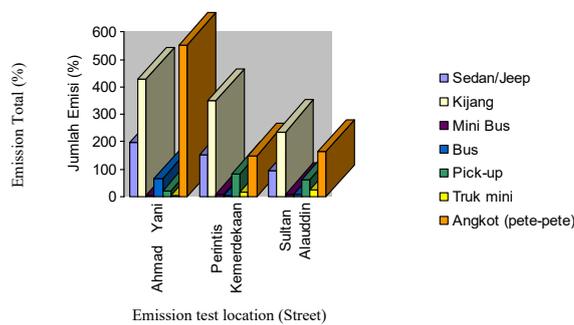


Figure 2: Vehicle Emission in Study Location

Identification of ambient air quality and vehicle emission levels as part of planning pollution-prone areas is part of the environmental parameters in the management of sustainable non-bus passenger public transport. The level of vehicle emissions, especially those caused by large numbers of public transportation passengers (angkot) or pete-pete, has caused the quality of city ambient air to improve in the medium and long term. Differences in the ambient air quality at the study sites are influenced by differences in land use and the area of open space as well as geographical and weather conditions such as wind speed at each location.

The results of the third study are the weighting values of the tabulations and questionnaire analysis of experts or actors related to the field of transportation and the environment (see Figure 3), while based on the hierarchical structure has alternative strategies based on priority from the first is environmental facility improvement with 0.323. The objectives of spatial planning in pollution-prone areas based on priority is location arrangement with a weight of 0.289. Prioritized actors from first is Bappeda with a weight of 0.219. The priority factors or criteria in the arrangement are city spatial plans with a weight of 0.241.

Spatial planning of areas in prone to pollution due to vehicle emissions with alternative priorities for improving environmental facilities as part of the location planning objectives to be carried out by Bappeda actors and based on factors or criteria for urban spatial plans with a valid ratio consistency value between 0.05-0.06.

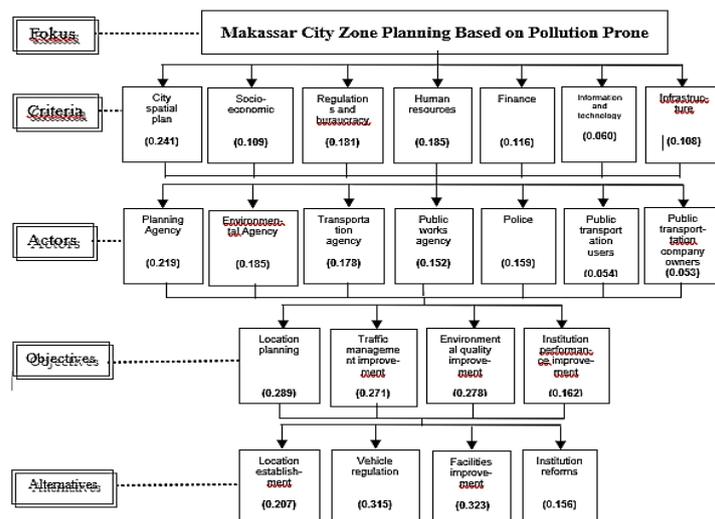


Figure 3: Hierarchy Structure of Zone Planning in Pollution Prone Area

CONCLUSION

This study seeks to formulate policies for structuring areas prone to pollution due to vehicle emissions that are in line with the concept of energy-efficient urban development. It can be concluded that minimizing the type, length, and frequency of trips can change driving behaviour and thus modify urban development patterns. Therefore, this policy that is very concerned with the concept of transportation demand management. Efforts to organize the area as part of the environmental parameters are expected to synergize with other programs and be sustainable, especially for future generations in Makassar City. In addition, policies to structure the area have a sustainable dimension with various alternative approaches, with environmental aspects: limiting vehicle emissions, implementing environmentally friendly vehicles, and improving quality of life and health. While economic aspects consist of: providing access justice for residents, having funding, and operational and economic. As for the social aspect is minimizing land use.

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Umar Mansyur, Santun R.P. Sitorus, Marimi, Lilik Budi Prasetyo
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Received: 24th Jan 2023. Accepted: 20th July 2023



PLANNING MALAYSIA:

Journal of the Malaysian Institute of Planners

VOLUME 21 ISSUE 4 (2023), Page 35 – 46

ROAD CRASH DATA VISUALISATION AND ANALYTICS USING TABLEAU FOR MOUNTAINOUS ROADWAY AREAS IN CAMERON HIGHLANDS, MALAYSIA

Fatin Najwa Mohd Nusa¹, Siti Zaharah Ishak², Rusdi Rusli³, Che Maznah Mat Isa⁴, Muhammad Marizwan Abdul Manan⁵, Sonya Sulistyono⁶

^{1,2}Malaysia Institute of Transport (MITRANS),

UNIVERSITI TEKNOLOGI MARA (UiTM), SELANGOR MALAYSIA

^{1,2,3}School of Civil Engineering, College of Engineering,

UNIVERSITI TEKNOLOGI MARA (UiTM), SELANGOR MALAYSIA

⁴Centre of Studies for Civil Engineering,

UNIVERSITI TEKNOLOGI MARA (UiTM), PULAU PINANG, MALAYSIA

⁵Malaysian Institute of Road Safety Research (MIROS),

SELANGOR, MALAYSIA

⁶Department of Civil Engineering, Faculty of Engineering,

UNIVERSITAS JEMBER (UNEJ), EAST JAVA, INDONESIA

Abstract

Despite government efforts and enforcement, alarming statistics in road crashes with high fatality rates in mountainous roadways are a significant concern to the authorities and community. This research has aimed to produce road crash profiling of Cameron Highlands based on secondary data using Tableau software. Results show that 66 cases involving motorcycles less than 251cc are the most dominant type of vehicle involved in road crashes, followed by tour or excursion vehicles, lorry trailers, four-wheel drive, and cars. The most frequent crash locations in Cameron Highlands are at the boundary of Jalan Keramat Pulai (45 cases) and Jalan Ringlelet – Kg. Raja – Blue Valley (50 cases). These cases involved hitting pedestrians, sideswipe collisions, forced collisions, hitting the roadside animal, head-on collisions, vehicles out of control, and right-angle side, which lead to fatal injuries. These findings may assist in identifying intervention planning to control and manage road crashes in mountainous areas.

Keywords: Road Accident, Accident Profiling, Road Traffic Injury, Tourism City, Secondary Data

¹ Lecturer at UiTM. Email: fatinnajwa@uitm.edu.my

INTRODUCTION

The aspiration, new plan, and vision of the United Nations Decade of Action on Road Safety in the year 2021-2030 is to cultivate road safety for the well-being of the nation and to focus on implementing zero death for each country in Malaysia (Idris et al., 2019; Ishak et al., 2020; UNCTAD, 2017). A vision zero of fatalities aspiration caused by road crashes was relatively not new as a global issue (Varhelyi, 2016). According to UNCTAD (2017), Sweden and Netherlands proclaimed that road safety is a safety system that originated in the 1980s and 1990s at the United Nations General Assembly. During that time the United Nations Decade of Action on Road Safety 2011-2020 was established in March 2010 by the United Nations General Assembly (UNGA). This initiative objectively stabilized and subsequently reduced the predicted numbers of road traffic fatalities worldwide by promoting road safety campaigns and awareness at the national, regional, and global levels (Ishak et al., 2020). The road safety strategy was mapped into TWO (2) Sustainable Development Goals (SDGs) targets, namely: SDG target 3.6 on halving the number of global deaths and injuries from road traffic crashes; and SDG target 11.2 on providing access to safe, affordable, accessible and sustainable transport systems as well as improve road safety for all.

Jain et al. (2020) and Shrestha & Kumar Shrestha (2018) reveal there are various reasons associated with frequent road crashes that happen in mountainous roadway areas. Factors such as transport demand and unsafe operation during unpredictable weather conditions can be the causes of road crashes in mountainous roadway areas road networks (Jawi et al., 2009). Other than that, road networks in mountainous roadway areas also faced problems such as difficulties in upgrading road networks and higher cost of road rehabilitation and maintenance (Hamednia et al., 2018; Zhang et al., 2020). Concerning road crash issues, few studies were conducted using secondary data focusing on the mountainous road network (e.g. Shaadan et al., 2021; Sunkpho & Wipulanusat, 2020). A study comparing mountainous and non-mountainous crash characteristics in Sabah, Malaysia found among factors that increase the odds of crashes along mountainous roads compared with non-mountainous roads including horizontal curve sections, single-vehicle crashes and weekend crashes (Rusdi et al., 2017). Past studies usually discuss qualitative factors, forecasting models, predictive models, cause, impact, and social influence of road crashes. However, limited studies examined specific area road crashes and crash characteristics. Therefore, user-friendly and efficient analysis techniques are essential for understanding big data and gaining meaningful insights regarding data structure, trends, causes, impact, and patterns (Sunkpho & Wipulanusat, 2020). Thus, this research uses data analytics and visualization technique to explore road crash data in Cameron Highlands compared to non-mountainous

areas to increase knowledge and understanding about road crash scenarios and patterns, particularly in rural and urban areas.

RESEARCH METHODOLOGY

Sources of Secondary Data

Cameron Highlands has been chosen as the research area for this study. It is located within the district of Pahang, Malaysia, and occupies a total area of 712.18 square kilometers. Cameron Highlands is one of the tourist cities to the North of Pahang and its boundaries touch Kelantan, and to the West, Cameron Highlands shares a part of its border with Perak in Peninsular Malaysia. This research obtained four years (2015 – 2018) crash data from the Malaysian Royal Police (PDRM) and the Malaysian Institute of Road Safety Research (MIROS) using the Road Accident Analysis and Database System (M-ROADS). This research exploits recorded crash data in four (4) roads, namely (i) Jalan Gua Musang – Lojing (rural and urban areas), (ii) Jalan Keramat Pulai (rural areas), (iii) Jalan Ringlet – Kampung Raja – Blue Valley (rural and urban areas) and (iv) Jalan Tapah (rural areas).

Framework for Data Analysis

This research followed a methodology framework from Shaadan et al. (2021) and the flow of the data analytics process are presented in Figure 1.

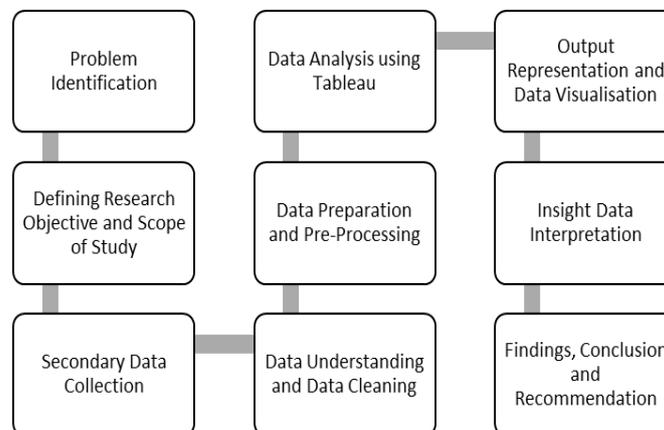


Figure 1: The Methodology Framework of the Data Analytics Process

The data analysis starts with the problem identification stage, followed by the definition of the research objective, and the scope of the research will be executed at the following stage. Next, the secondary or raw crash data gathered

in this research was filtered and arranged according to research categories in Table 1 using Microsoft Excel. The research categories and variables' names are compared to the standard POL27, a road traffic crash form used by the Malaysian Royal Police. Generally, POL27 form contains more than 63 variables of information, including a detailed road traffic crash report such as time of the crash, road information, environmental information, crash location, vehicle information, driver information, comments from the police officer in charge, the sketch of the crash incident with its location (Rusli et al., 2017). However, the variables of information filtered from the M-ROADS system may be subject to record and raw data available in the system at that particular time.

Table 1: Variables Name and Level of Measurements for Raw Data.

No.	Variable Name	Description	Level of Measurement
1	Crash Severity	The four types of crashes are fatal injury, serious injury, slight injury, and property damage only.	Nominal (category)
2	Crash Location	Road Type: The road type is divided into five categories: expressway, federal road, state road, municipal road, and others. Route No.: Each of the gazette roads in Malaysia has its unique route number.	Nominal (category)
3	Type of Collision by Year	There are thirteen collision types: head-on, rear-end, right angle side, angular, sideswipe, forced, hitting the animal, hitting an object off-road, hitting an object on the road, hitting pedestrian, overturned, out-of-control, and others.	Nominal (category)
4	Type of Collision (Urban or Rural Areas)	There are four categories of location types: city, urban, built-up area, and rural area.	Nominal (category)
5	Traffic System by Year	Four traffic systems categories are one-way, two-way, three-lane, and dual carriageways.	Nominal (category)
6	Road Geometry	There are seven categories of road geometry, including straight, bend, roundabout, cross-section, T/Y junction, staggered junction, and interchange.	Nominal (category)
7	Light Condition	There are four categories of lighting conditions: day, dawn/dusk, dark with street lighting, and dark without street lighting.	Nominal (category)
8	Type of Weather	Three categories of weather conditions are available: clear, foggy, and rain.	Nominal (category)

Note: Variables of information filtered from secondary data may be subject to raw data available. Some data is missing and incomplete. Therefore only consistent data for selected years were chosen to be analysed using Tableau software.

This research employs frequency and descriptive analysis by utilizing a data analytics methodology focusing on a data visualization tool using Tableau

software. In total, only eight (8) variables were identified for the selected study locations in this research, namely, (i) crash severity, (ii) crash location, (iii) type of collision by year, (iv) type of collision (urban or rural areas), (v) traffic system by year, (vi) road geometry, (vii) light condition and (viii) type of weather. The data was then transferred to Tableau software and arranged to the desired sequence and suitable visuals and figures. Tableau software allows the researcher to explore data preparation and to pre-process using limitless visuals such as spatial distribution patterns, graphical visuals, tables, bar charts, interactive histograms, and summary statistics. After that, data understanding and data cleaning can be done simultaneously using Tableau software to get a quick and interactive data visualisation presentation for research purposes. In addition, this value-added Tableau software will give the reader a better understanding and insight into data interpretation. Finally, the researcher discussed the research findings for each data presented in the conclusion and recommendation section.

ANALYSIS AND DISCUSSION

Research findings are presented in the following section for better insight and discussion. Sunkpho & Wipulanusat (2020) identified that many transport agencies adopt Tableau software as the visual analytics platform. The following indicate five (5) descriptive and frequency analysis types analysed in this research using Tableau software.

Descriptive and Frequency Analysis

Between years 2015 and 2018, there are 145 crashes occurred along the main road in Cameron Highlands, Pahang. Figure 2 shows the most dominant type of vehicle involved in road crashes in Cameron Highlands during data period.

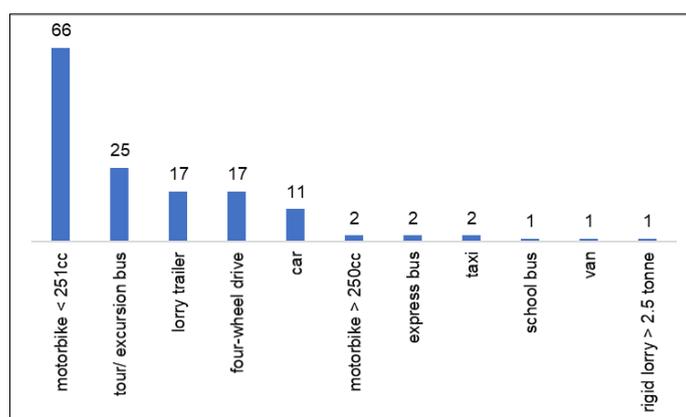


Figure 2: The Most Dominant Type of Vehicles involved in Road Crashes.

Results show that motorcycles less than 251cc are the most dominant type of vehicle involved in road crashes at the selected location with 66 cases. Then, it is followed by a tour or excursion vehicle (25 cases), lorry trailer (17 cases), four-wheel drive (17 cases), and car (11 cases). This finding is in line with finding from research by Idris et al. (2019), where 45.89% of motorcyclist and pillion fatalities crash cases occur in Malaysia. Most probably, the main factors that may cause fatality crash cases among motorcyclists and pillions are human behaviour; age; gender; anger and aggression; speeding; improper ways of wearing a helmet; poor road infrastructure and surrounding and vehicle (Abdul Manan et al., 2016; Idris et al., 2019; Rusli et al., 2017; Yusoff et al., 2022)

Category-by-Category Line Plot Chart

This research identified three (3) types of crash severity available in the secondary data, namely (i) fatal injuries, (ii) serious injuries, and (iii) slight injuries. In this research context, fatal injuries define as at least one person (driver or passenger) being killed (within 30 days) by injuries sustained in the crash (Elshamly et al., 2017; Peng et al., 2018). Serious injuries are defined as at least one person injured and admitted to hospital, but no fatalities and at least one person requiring medical care but no fatalities or injuries requiring hospitalisation, and slight injuries define as at least one person injured which having minor abrasion or bruises but no medical attention needed and no other more serious injuries (Elshamly et al., 2017; Peng et al., 2018). Crash severity cases concerning the collision type for the respective year in Cameron Highlands can be visualised and addressed in Figure 3.

Figure 3 visualises that that head-on collisions are the main factors contributed to all types of injury. The line plot chart pattern analysis shows the decreasing result of fatal injuries from 2015 to 2018. The most frequent fatal injuries collision is related to head-on collisions. The result indicates that in 2015, the line plot chart recorded a high number of fatal injuries involving head-on collisions (7.483%), out-of-control collisions (4.762%), hitting pedestrian collisions (0.680%), and sideswipes collisions (0.680%) respectively. Meanwhile, in 2016, the analysis shows that head-on collisions (6.803%), out-of-control collisions (5.442%), angular collisions (1.361%), forced crashes (0.680%), hitting objects on road collisions (0.680%), hitting pedestrian collisions (0.680%), rear-end collisions (0.680%) and sideswipes collision (0.680%) recorded as the reason of fatal injuries in that particular year. In 2017, the analysis revealed that head-on collisions (4.082%), out-of-control collisions (3.401%), rear collisions (1.361%), sideswipes collisions (1.361%), and angular collisions (0.680%) were recorded as fatal injuries. High cases involving serious injuries were recorded in 2016 compared to the remaining years. Analysis of the

line plot chart pattern shows the combination of hitting pedestrian collisions, right-angle side collisions, out-of-control collisions, rear collisions, and sideswipe collisions as the most frequent type of serious injuries in the year 2015, 2017, and 2018. Meanwhile, high cases of slight injuries occurred in 2015 and 2016 due to head-on collisions. The results reveal evidence that most road crashes that happen due to a head-on collision cause fatal injuries. This result aligns with findings from studies by Peng et al., (2018), where head-on collision is usually associated with fatal injuries under the mountainous roadway areas category.

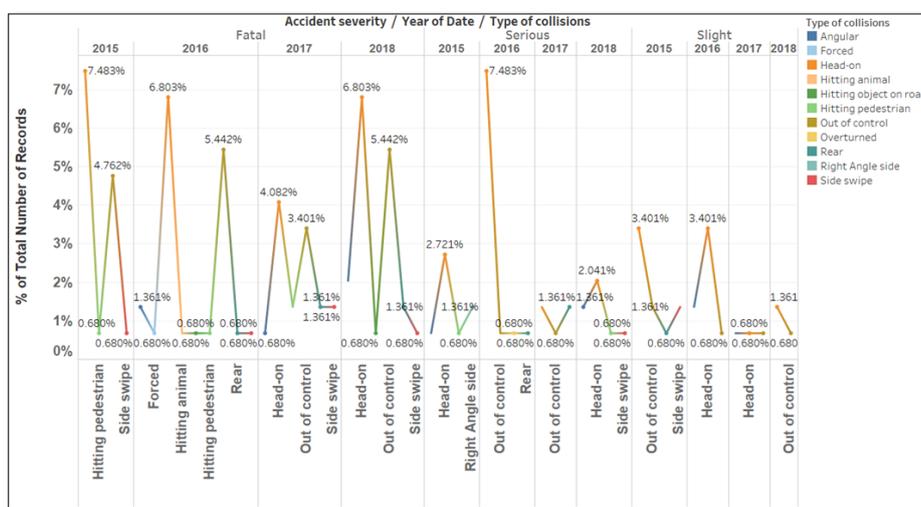


Figure 3: Crash Severity versus Type of Collision by Year (2015 – 2018)

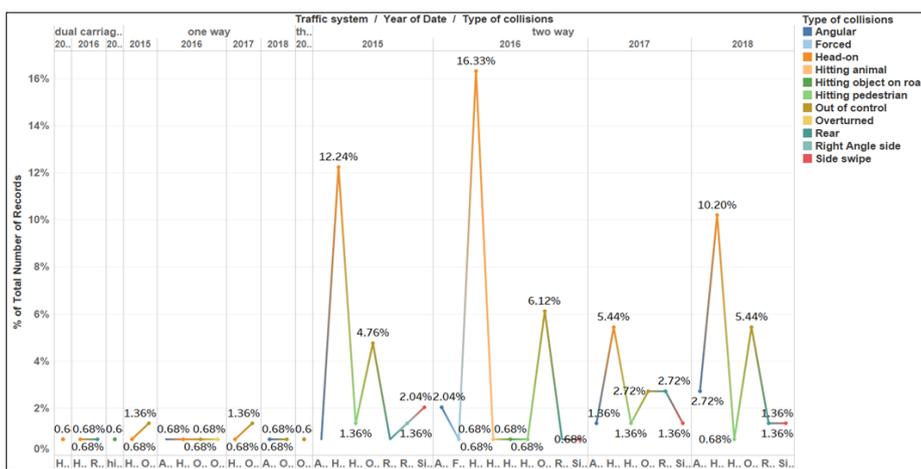


Figure 4: Traffic System versus Type of Collision by Year (2015 – 2018).

Figure 4 shows the area pattern chart with multiple categories that aim to visualize the traffic system according to the type of collision by year (2015 – 2018) in Cameron Highlands. There are four types of traffic systems in Cameron Highlands, namely (i) dual carriageway, (ii) one-way, (iii) three-lane, and (iv) two-way. From this table, the highest head-on collision cases occur in two-way rural road traffic systems where vehicles can travel in both directions. A study by Cáceres et al., (2021) and Maksid & Hamsa (2014) identified that head-on collisions are associated with geometric design factors where roads section of 7 meters or wider; road sections with curves; narrowing or drop changes; on wet or snowy roads surfaces; in twilight condition; incorrectly overtaking another vehicle and measurement of medians and paved shoulders not to the correct specification.

Area Pattern Chart with Multiple Categories

The area pattern chart with multiple categories in Figure 5 visualises the highest number of crash records (14 cases) in rural areas. A study by Shallam et al., (2022) has stated that safety criteria and geometric design consistency of undivided roadways in rural areas will give significant to high number of crashes.

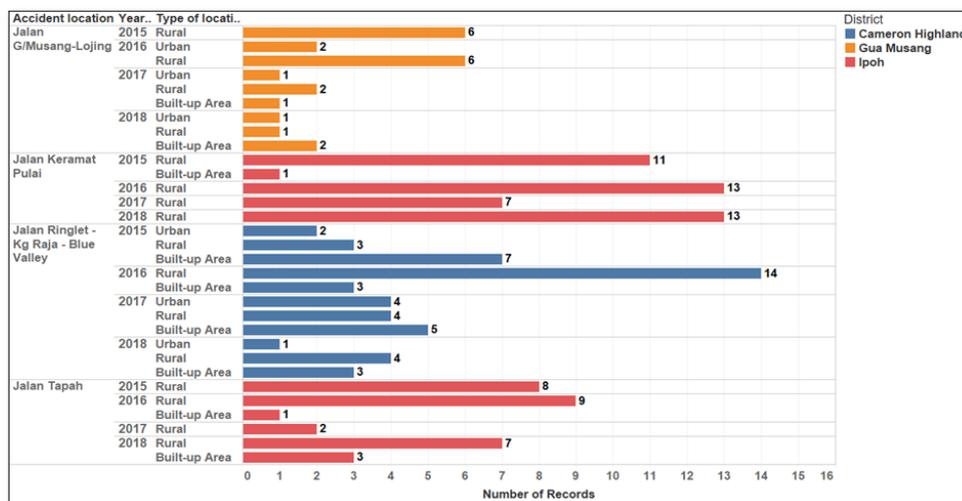


Figure 5: Crash Location and Type of Location (Urban and Rural Areas).

Figure 6 shows the ranking distribution of light conditions versus the type of weather. The most dominant vehicle crash happens during good light conditions and clear weather, with the highest record (31 cases) in 2016. Duddu et al., (2020) conducted a research in United States also found single-vehicle

crashes more likely to occur during clear weather compared to cloudy, rainy, and snowy weather. Driver behaviour was identified among the main factors of this scenario, where they give extra precaution during bad weather.

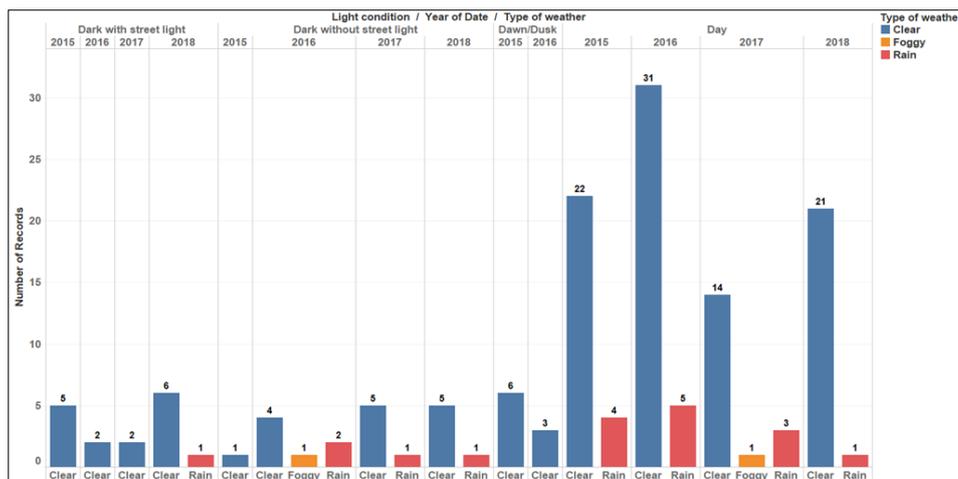


Figure 6: Light Condition versus Type of Weather.

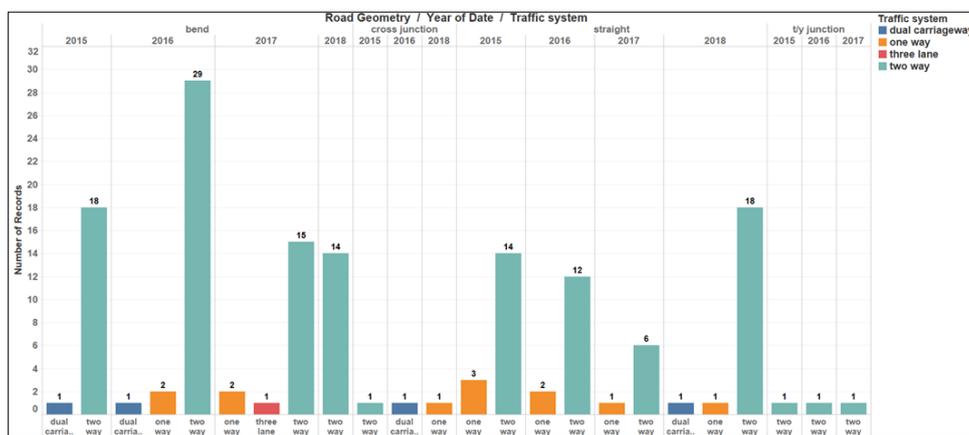


Figure 7: Road Geometry versus Traffic System by Yearly.

Regarding road geometry and traffic system, Figure 7 shows that high crash cases occurred in a two-way traffic system located at bend or curve (29 cases), T or Y junction (18 cases), and straight road (14 cases). This finding is consistent with previous research conducted by Ingle & Gates, (2023) and Joseph et al., (2023), where inconsistency in roadway geometry can lead to vehicle

crashes in rural areas with the two-way type of location. However, in this research data of curve combination, radius, gradient, sight distance, lane width and operating speed were missing valuable parameters to support research findings.

Spatial Distribution Pattern of Total Road Crash Cases

Based on the spatial map distribution pattern of total road crash cases in Figure 8, analysis shows that the most frequent crash locations in Cameron Highlands are located at the boundary of Jalan Keramat Pulai (45 cases) and Jalan Ringlet – Kg. Raja – Blue Valley (50 cases). Most cases involved hitting pedestrians, sideswipe collision, forced collision, hitting the roadside animal, head-on collision, vehicle out of control, and right angle side, which lead to fatal injuries.

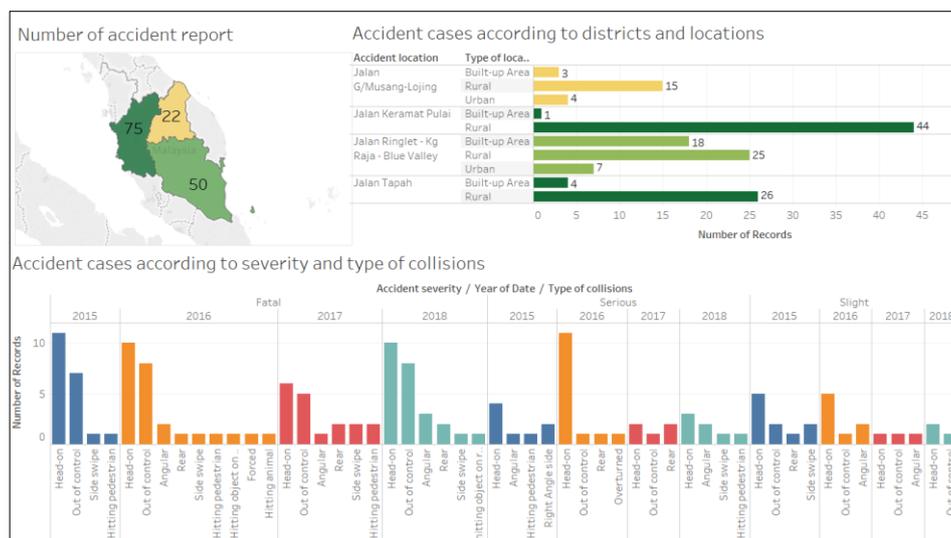


Figure 8: Spatial Distribution Pattern of Total Road Crash Cases.

CONCLUSION

This study has explored the visualisation and crash characteristics for Cameron Highlands roads between year 2015 and 2018. Result shows that head-on collisions contributed to all types of injuries. The highest head-on collision cases occur in two-way rural road traffic systems where vehicles can travel in both directions. High crash cases occurred during clear weather in a two-way traffic system located at bend or curve, T or Y junction, and straight road. The specific location approach may help gain insight as this initiative can improve road safety criteria and geometric design consistency roadways in mountainous terrain to reduce the injury severity significantly.

ACKNOWLEDGEMENT

The researcher would like to thank the Vanguard Research Grant (600-MITRANS 5/4/91) from the Malaysia Institute of Transport (MITRANS), Universiti Teknologi MARA (UiTM), for supporting this study. Hopefully, this initiative may encourage more publications from scholars in the future.

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Received: 24th Jan 2023. Accepted: 20th July 2023



PLANNING MALAYSIA:
Journal of the Malaysian Institute of Planners
VOLUME 21 ISSUE 4 (2023), Page 47 – 60

TRAFFIC ACCIDENTS AND ROAD SAFETY ANALYSIS IN BOGOR CITY, INDONESIA

Gde Ngurah Purnama Jaya¹, Lilis Sri Mulyawati², Zaharah Mohd Yusoff³

*^{1,2}Urban and Regional Planning Department, Faculty of Engineering,
PAKUAN UNIVERSITY BOGOR, INDONESIA*

*³Malaysia Institute of Transport (MITRANS),
UITM SHAH ALAM, MALAYSIA*

Abstract

Bogor City is experiencing rapid development; one of the reasons is its strategic location, which is close to the capital city of Jakarta. As a developing city, transportation is one of the sectors that has an important and strategic role in supporting development in all fields, but in everyday life transportation also has an impact on traffic safety. Therefore, it is felt that there is a need to mitigate traffic accidents to reduce the rate of traffic accidents that occur on highways, especially secondary arterial roads in Bogor City. To make it easier to analyze areas prone to traffic accidents, GIS (Geographic Information System) approach is used, which can integrate various databases, be it spatial data such as maps, photos, and satellite images, or non-spatial or better known as textual data such as attribute and numeric data, thus allowing the location prone to traffic accidents to be described in a two-dimensional form that can be edited and revised quickly so that it can always produce actual information that can be used as a basis for analysts in decision making. Based on the results of the analysis, the highest number and distribution of traffic accidents are in Central Bogor District and North Bogor District, while West Bogor District has a moderate accident rate and South Bogor, North Bogor, and Tanah Sareal Districts have a low accident rate. Most accident-prone points are located in locations that are the center of community activities. With the land use plan in Bogor City in the form of converting green open spaces into residential, trade, and service areas, as well as education and office areas, population growth and the need for transportation will increase. In line with that, the number of accidents will also increase, so it is necessary to mitigate traffic accidents to prevent or suppress the surge in the number of accidents that will occur.

Keywords: Road Safety, Transport, Urban

² Lecturer at Pakuan University Bogor Indonesia: lilissrimulyawati@unpak.ac.id

INTRODUCTION

Bogor City is one of the cities that has experienced rapid development in its development. The area of Bogor City is recorded at 11,850 Ha or 0.27% of the area of West Java Province. As a developing city, transportation is one of the sectors that have an important and strategic role in supporting development in all fields. In carrying out transportation activities, one of the things that must be considered is the problem of traffic accidents. The problem of traffic accidents is an interesting discussion in terms of humanity and the economy. Billions of rupiah have been spent due to traffic accidents. Based on the results of a secondary survey compiled by the Bogor City Police, in the last five years, namely, from 2004 to 2008, there have been material losses of Rp. 859,500,000, with a total number of accidents of as many as 466 cases, with a total of 87 fatalities, 157 serious injuries, and 430 minor injuries. While in 2009 there has been an increase in the number of accidents from the previous year, whereas in 2008 there were 57 incidents which increased to 127 incidents the following year.

Given that the number of traffic accidents is increasing in Bogor City, it is felt necessary to know locations that are prone to traffic accidents so that they can be used as a means of handling road traffic safety to reduce the rate of traffic accidents that occur on highways, especially secondary arterial roads because most accidents in Bogor City occur on secondary arterial roads¹. In the case study of identifying locations prone to traffic accidents, a vulnerability analysis approach was carried out, based on physical aspects. The economic aspect is also influential but its contribution to an accident prone compared to the other two aspects (Sembiring, 2000). Physical aspects that can affect the vulnerability of traffic accidents are also referred to as environmental factors, both natural and built environments (Warpani, 2003). In this case, some of the physical factors referred to are population density, rainfall, slope and land use.

RESEARCH AIM AND OBJECTIVES

The purpose of this study is to identify areas prone to traffic accidents on the secondary arterial roads of Bogor City, while the targets of this study are:

- i) To study the number and distribution of traffic accidents.
- ii) To identify the location that is prone to traffic accidents in Bogor City.
- iii) To analyse the relationship between land use patterns and traffic accidents.

OVERVIEW OF THE STUDY AREA

The details about the administrative area of Bogor City according to the district by year 2020 can be seen in Table 1.

¹ Result Interview with Polresta Bogor in January 2020

Table 1: Bogor City Administration by District

No	District	Area (Ha)	%
1	North Bogor	1,772	14.95
2	West Bogor	3,285	27.72
3	East Bogor	1,015	8.57
4	South Bogor	3,081	26.00
5	Central Bogor	813	6.86
6	Tanah Sareal	1,884	15.90
Bogor City		11,850	100.00

Source: Bapeda Kota Bogor, 2020

The average rainfall in the Bogor City area ranges from 4,000 to 4,500 mm/year. Bogor is a rainy city. Bogor City has an area of 118.50 km² with a total population density in Year 2020 is 7,638 people / km², with a medium density category. The road network in Bogor City has a concentric radial pattern with the following characteristics: In the downtown area, there is a road network around the Bogor Botanical Garden (ring). The circular road network is a merger of Jalan Ir. H. Juanda, Jalan Otista, part of Jalan Pajajaran, and Jalan Jalak Harupat. Road networks originating from other regions are concentrically connected to this circular road network. Some of these roads include Jalan Surya Kencana, Jalan Sudirman, Jalan Pajajaran, Jalan Veteran, and Empang. In the eastern part of Bogor City bordering Bogor Regency, there is Jagorawi Toll Road, which connects the center of Bogor and Ciawi with Jakarta.

At the northern part of Bogor City (Tanah Sareal and West Bogor Districts), there is a ring road. This ring road connects Sindang Barang (in West Bogor District) with Bogor Highway (in Tanah Sareal District). The Bogor City Government has also planned the construction of a ring road from the western part to the southern part of the city, namely the ring road connecting Jalan Sindang Item to the Rancamaya area, then continuing to Ciawi (part of this planned ring road passes through Bogor Regency). In addition, the construction of ring roads in the northern part is also planned, which connects the Bogor Highway with the Jagorawi toll road. The road network with a concentric radial pattern has the consequence of accumulating all movement towards the city center because this area is the only access to reach other areas. The road width capacity profile is lane width (3-3.5m) and road width (6-18.5 m). Bogor City has six sub-districts crossed by National Roads that stretch for a total of 34,199 m, with Jalan Soleh Iskandar the status of the longest national road in Bogor City with a length of 7,946 m, then followed by Jalan Pajajaran along 6,400 m (Dinas Bina Marga Kota Bogor, 2020). Based on the results of the primary survey, according to data compiled by the Bogor City Police Traffic Administration section, the number of accidents recorded on secondary arterial roads in Bogor in the last five years has experienced ups and downs every year. Table 2 shows the number of traffic accidents in Bogor City.

Table 2: Number of Traffic Accidents in Bogor City by 2016-2021

Year	2016	2017	2018	2019	2020	2021
Sum	14	178	104	113	57	127

Source: Bogor City Police 2021

LITERATURE REVIEW

Road Traffic Safety

Based on Law Number 22 of 2009 concerning road traffic and transportation, the Government is responsible for ensuring the safety of road traffic and transportation, therefore a national general plan for road traffic and transportation safety was established. This includes the compilation of a national program for road traffic safety and transport activities, the provision and maintenance of traffic and road transport safety facilities and equipment, the document of assessment of traffic and road transport safety issues and the traffic and road transport safety management.

Traffic Accidents

Traffic accidents can be defined as a series of events that usually result in accidental death, injury, or property damage and occur on roads or places that are open to the public and used for vehicular traffic (Miro, 2005).

Traffic Accident Factors

Based on the results of an interview with the Head of the Bogor Police Traffic Accident Unit in 2020, the factors that cause land traffic accidents are classified into 2 parts, that is

- Natural factors: accident factors caused by natural factors, some of which are heavy rainfall, slope, and humans.
- Artificial factors: accident factors caused by human creation, such as vehicle damage, vehicle design, driver defects, road surface, and road design.

Prevention of Traffic Accidents

In the implementation of traffic management and engineering, one can use 3 (three) basic strategies to reduce traffic accidents, namely:

- Single Sites (Black Spot Program): namely handling certain types of accidents on one road.
- Mass Action Plans: The use of previous coping patterns for locations that have common problems.
- Route Action Plans: Use of varied treatment patterns covering large areas (cities).

Traffic Management

Traffic management is an urgent and short-term plan to improve traffic conditions. Four objectives of traffic management have been set up which is first; is to gain efficiency and overall traffic movement with a high level of accessibility by balancing demand with available supporting facilities, secondly is to increase and improve safety levels as best as possible, thirdly; to protect and improve the environmental conditions where the traffic flow is located and fourthly is to promote efficient use of energy or the use of other energy which has a less negative impact than another energy. Traffic management can be sorted into three types that are closely related to basic strategic goals (Morlok, 1985), namely: the Management of Capacity; relating to traffic management measures to increase infrastructure capacity, so that it is an approach from the Supply side. Secondly is the Management of Demand; relating to the act of regulating and controlling traffic requests, which are generally regulatory and restrictive to travel requests. Finally, is the Management of Priority; related to giving priority to certain traffic that can improve efficiency and or traffic safety.

Meanwhile, in Tamin (1997), these types of handling can be grouped as traffic management, where in principle emphasizing the utilization of existing roads, such as effective utilization of road width, adequate completeness of road markings and signs so that roads can be optimally utilized both in terms of capacity and traffic safety which includes the system one way, parking, setting the location of turn signs, sidewalks, and turning. This type of treatment is carried out when the degree of saturation is between 0.6-0.8. The improvement of road reactions, including physical changes to road sections in the form of widening or adding lanes so that the capacity of road sections can be significantly increased. Performed when the degree of saturation is greater than 0.80. The construction of new roads is the last alternative. This type of handling is carried out when widening the road and adding lanes is no longer possible, especially due to limited land and the condition of the degree of saturation which is much greater than 0.8.

Secondary Arterial Road Requirements

Secondary Arterial Road is a road that connects the primary area with the first secondary area, connects the first secondary area with the first secondary area, or connects the first secondary area with the second secondary area (Sembiring, 2000). The requirements that must be met by the secondary artery area are:

- Design speed >30 km/h
- Road body width >8 m
- Road capacity is equal to or greater than the average traffic volume.
- Must not be disturbed by heavy traffic.
- The surface index is not less than 1.5.

The Relationship of Transportation Systems to Land Uses

According to (Miro, 2005) basically, the variables of Land Uses, transportation system, and the amount of traffic flow are variables that are interrelated and affect each other. The general goal of transportation planning is to make interactions between land uses as easy and efficient as possible. Ways of transportation planning to achieve general goals include the setting of policies on the following:

- Activity System. A good land-use plan (correct location of shops, schools, housing, jobs, etc.) can reduce the need for long commutes and make interaction easier.
- Network System. Things that can be done for example increasing the capacity of existing infrastructure services: widening roads, adding new road networks and others.
- Movement System. Things that can be done such as regulating traffic engineering and management (short term), better public transport facilities (short and medium term), or road construction (long term)

This research is done using the Geographic Information Systems (GIS). It is a system that is designed to work with the reference geographic or spatial coordinates and also non-spatial (Star, 1990; Ismail et al., 2023). GIS is the most popular technology because it provides suitable information in the spatial and temporal domain and intricate database (Mustaffa, et. al., 2023).

POSITION AND FUNCTION OF BOGOR CITY REGIONALLY

In the Regional Spatial Plan of West Java Province in 2010 and the Jabodetabek Regional Spatial Plan, Bogor City functions as a counter magnet for the development of DKI Jakarta. Later this area is directed as a regional activity centre which has main activities as a regional trade, service, settlement, and industrial city with a capacity of 1.5 million people in 2005. The direction of physical development of Bogor City is:

- The southern part tends to be a potential residential area with a low KDB (Basic Building Coefficient) and green open space.
- The northern part tends to have potential as a non-pollutant industrial area and as a support is settlements along with trade and services.
- Tanah Sareal sub-district tends to have potential as a residential area, trade and service area, and city service facility area.
- The western part tends to have potential as a residential area supported by tourist attractions.
- The eastern part tends to be a potential residential area.
- The Central Part tends to have the potential as a center of trade and services supported by offices and scientific tourism.

The geographical condition of Bogor City as a crossing route between *Provinsi DKI Jakarta* and *Provinsi West Java* has placed Bogor City as a city that has strategic value directed as:

- The center of activity for the development of the surrounding area with the main activity is Urban.
- A city that can accommodate population activities under the planned capacity in the Jabodetabek development system.
- A city that can serve residents in and around the region, especially those concerning the needs of residential land and trade in services and supporting facilities.
- Agricultural production collector and distribution center to accommodate and market agricultural products from the surrounding area.
- One of the buffers for the City of Jakarta in realizing the direction of the development of Bogor City in the regional scope, Bogor City functions as a regional service city, residential city, and industrial city.

RESEARCH METHODOLOGY

Time and Location of Research

Research on the identification of traffic accident-prone locations in Bogor City, conducted on all secondary arterial roads, for more details can be seen in Table 3.

Table 3: Research Location

No	District	Street Name
1	North Bogor	Jakarta-Bogor; Pajajaran; KH. Abdullah bin Nuh/BORR; Pandawa; Bangbarung
2	East Bogor	Pajajaran; Surya Kencana; Silwangi
3	South Bogor	Surya Kencana; Siliwangi; Bogor-Ciawi/Tajur
4	Central Bogor	Ir.H. Juanda; Merdeka; Pajajaran; Jendral Sudirman; RE. Martadinata, Jalak Harupat; Surya Kencana
5	West Bogor	Merdeka; Dr. Semeru; Semplak
6	Tanah Sareal	Jendral Ahmad Yani; Dadali; Pemuda; KH. Abdullah Bin Nuh/BORR

Source: DLLAJ, 2020

Data Collection Methods

- **Literature Study:** This literature study is taken from reading books, documents, theses, laws, and regulations as well as thoughts related to the research theme.
- **Agency Survey:** An agency survey is a data collection technique carried out by collecting data from related agencies, such as the Bogor City Police,

Bogor City Government, and the Bogor City Transportation Office (DLLAJ).

- **Observation:** Observation is a direct observation of the field of the object of study studied, namely by observing physical road factors in the form of the location of secondary arterial road networks and the slope of the road slope as well as the impact of rainfall on road conditions.

Methods of Analysis

- Quantitative Analysis Methods:** Quantitative analysis methods are forms of analysis carried out using mathematical models and equations. The quantitative analysis method used in the object of this study, namely an analysis of the number of traffic accidents using traffic accident data for the last 5 years (2004-2009).
- Geographic Information System (GIS) Approach:** The GIS is used to determine the location prone to traffic accidents and the relationship between accidents and the physical condition of the road. GIS approach method consists of several stages namely map editing and map overlay as in Figure 1.

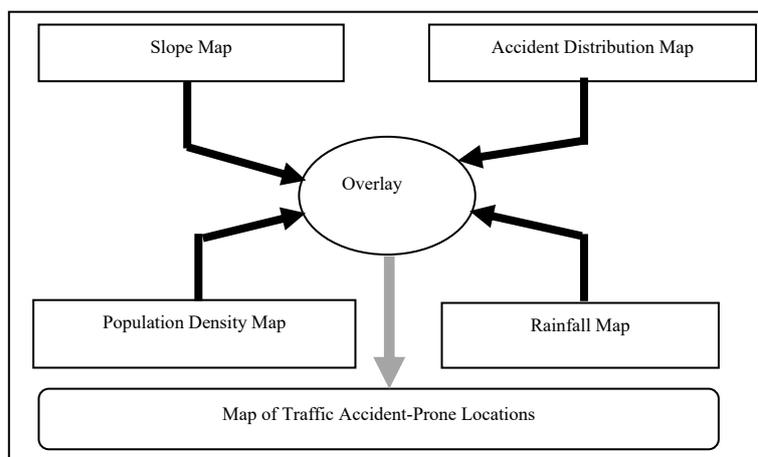


Figure 1: The flow of Identification Traffic Accident-Prone Locations

The weight value of each indicator used to determine areas prone to traffic accidents in Bogor City and it is used to conduct interviews with experts, namely the Head of Sub Highway, DLLAJ Bogor City, Kanitlaka Polresta Bogor and Head of Sub-Directorate of Physical and Prasarana Bappeda Bogor City. In addition, questionnaires were also distributed to road users, which contained questions related to traffic accident problems. The results of the interview were Traffic accidents that occur in Bogor City are mostly caused by human factors

(60-80%), followed by natural factors (10-20%) after that driver negligence/vehicle damage (5-10%) factors. Thus, to determine locations that are prone to traffic accidents, the ranking values used are obtained by approaching:

Total Value of Accident-Prone Locations =

$$\frac{(2. CH) + (1. KL) + (3. KP) + (1. KLL)}{4}$$

Remarks: CH = Rainfall KP = Population Density
KL = slope KLL = Traffic Accident

Weighting is divided into 3 parts, namely:

- a. Weight 1: given to a condition that has the fewest factors causing accidents based on the results of the interview.
- b. Weight 2: given to a condition that has a moderate accident causative factor based on the results of the interview.
- c. Weight 3: given to a condition that has the fewest factors causing accidents based on the results of the interview.

Information about the formula for finding locations that are prone to traffic accidents in Bogor City is as follows:

- i. Rainfall is an important factor and has a major influence as one of the causes of traffic accidents. The presence of high rainfall can cause:
 - a. The visibility of the driver of the vehicle becomes limited,
 - b. In rainy conditions, asphalt becomes more slippery.
 - c. The braking distance of the vehicle becomes difficult to predict,
 - d. In addition, high levels of rainfall can cause the life of road pavements in the form of both asphalt and concrete to be shorter, causing damage to roads which then have the potential to cause higher traffic accident rates.

Rainfall has 4 factors causing traffic accidents; therefore, rainfall gets a weight 2 times higher than the slope and the number of accidents. Rainfall is further divided into:

- a. High rainfall (4,501-5,000 mm/yr) multiplied by weight 2.
- b. Moderate rainfall (4,001-4,500 mm/yr) multiplied by weight 2
- c. Low rainfall (3.5000-4000 mm/yr) multiplied by weight 2

- ii. The slope is quite an important factor in traffic accidents, with uneven road conditions, it can cause vehicle traction to be more difficult to control, potentially causing traffic accidents. The slope of the slope has 1-factor causing traffic accidents; therefore, the slope of the slope gets a weight of 1. The slope is divided into:
 - a. Flat (0-2 %) multiplied by weight 1
 - b. Ramps (2-15%) multiplied by the weight of 1
 - c. Rather steep (15%-25%) multiplied by a weight of 1
 - d. Steep (25-40%) multiplied by weight 1
 - e. Very steep (>40%) multiplied by a weight of 1
- iii. Population density is the highest cause that has the potential to cause traffic accidents, including:
 - a. The increasing number of vehicles, so that traffic activities are getting denser and causing vehicle movement to be more limited.
 - b. The increasing number of pedestrians, so that more conflicts are caused between vehicles and pedestrians.
 - c. Increased traffic density in a road network.
 - d. The increasing number of vehicles with heavy loads has the potential to quickly damage the condition of the road pavement surface so that the road becomes uneven and quickly damaged.
 - e. Increased community activities on the roadside, such as street vendors, so that sidewalks that should be placed for pedestrians have changed their functions.
 - f. The high number of vehicles if not adjusted to parking facilities, causes many vehicles to park not in the right place, thus potentially causing traffic conflicts.

Population density has 6 factors that have the potential to cause traffic accidents. Therefore, population density has weight 3 times higher than the slope and the number of traffic accidents. Density is divided into:

- a. Height (>12,000 people/Ha) multiplied by weight 3.
- b. Medium (5,000-12,000 people/Ha) multiplied by the weight of 3
- c. Low (<5,000 people/Ha) multiplied by the weight of 3.

The number of traffic accidents is a real factor where traffic accidents are now occurring, thus used as comparison material to find out the location of traffic accidents. The weight given is only 1 time compared to other factors.

- a. **Modeling:** Identification of areas prone to traffic accidents with a GIS approach using an analog model, where quantitative descriptive data is mapped into thematic maps, and then thematic maps containing specific information are overlaid to produce a *composite map*. This analog model of travel planning uses a digital database system.

- b. **Limitations and Assumptions:** The identification of areas prone to traffic accidents with GIS approach is limited to covering 6 sub-districts within Bogor City and uses assumptions in the form of factors, categories, and weighting factors based on the level of traffic vulnerability.

TRAFFIC ACCIDENT-PRONE LOCATIONS IN BOGOR CITY

i. Analysis of Physical Condition Affected Traffic Accident

This analysis is intended to determine the level of traffic accident proneness along with the state of the physical condition of the study location (Table 4).

Table 4: Physical Condition of Bogor City in Each District

No	District	Rainfall (mm/year)	Slope (%)	Density Category
1	North Bogor	3500-4500	0 - >40	Keep
2	East Bogor	3500-4500	0 - >40	Keep
3	South Bogor	3500-4500	0 - >40	Keep
4	Central Bogor	4000-4500	0 - >40	Tall
5	West Bogor	3500-5000	0 - >40	Keep
6	Tanah Sareal	3500-4500	0 – 40	Keep

Source: Analysis Results, 2020

ii. Analysis of Traffic Accident Distribution by District

Analysis of the distribution of traffic accidents by sub-district is carried out by determining the location of traffic accidents in each sub-district based on Bogor Police data so that the number and percentage of accidents in a sub-district traversed by secondary arterial roads can be known. More details can be seen in Table 5.

Table 5: Distribution of Traffic Accidents in Bogor City

No	District	Number of Accidents	Area (%)
1	Central Bogor	34	26,6
2	East Bogor	15	11,7
3	South Bogor	10	7,8
4	West Bogor	23	18
5	Tanah Sareal	12	9,4
6	North Bogor	33	27,3
	Total	127	100

Source: Analysis Results, 2020

iii. Identification of Traffic Accidents on Secondary Arterial Roads

The identification process is carried out by determining the number of locations prone to traffic accidents, namely by determining the number of traffic accidents that are more than 1 time in the same location and giving weights/scores on physical factors that cause accidents, then overlaying road network maps and road physical condition maps that have been weighed in the form of rainfall maps (weight/score 2), population density maps (weight/score 3), and slope maps (weight/score 1), with traffic accident distribution maps (weight/score 1), then the results are divided by 4 to get a total traffic accident prone level score. The combination maps as shown in Figure 2 are the process in obtaining the information about the level of traffic accident vulnerability of each sub-district in Bogor City along with the condition of population density, rainfall, and slope in the study location.

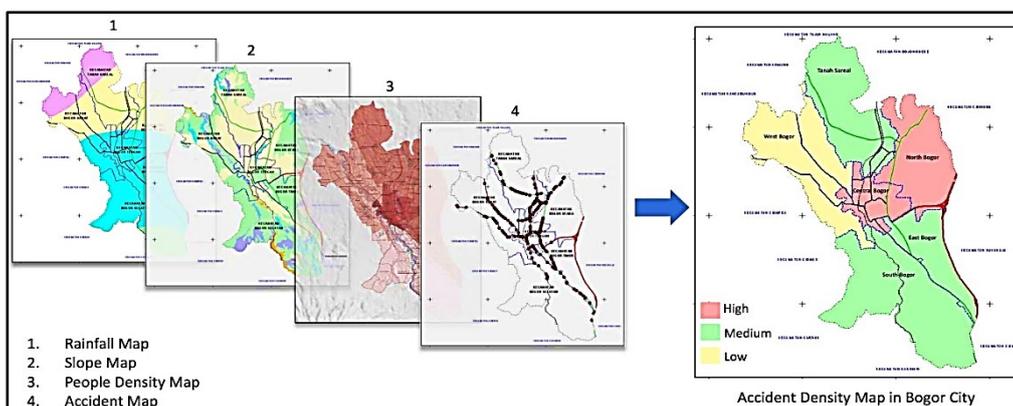


Figure 2: Traffic Accident Vulnerability in Bogor City

Traffic accident-prone locations have an average rainfall of 4000 mm/year, with an average slope of 20% and high population density. Reducing the number of accidents caused by the influence of rainfall can be done by installing traffic signs. Reducing the number of accidents caused by slopes, it can be done by providing road markings while reducing the number of accidents caused by population density, it can be done by adding zebra crossings, crossing bridges, or underpasses.

CONCLUSION

Based on the results of the analysis, it can be seen that there is a correlation between the incidence of traffic accidents with rainfall, population density, and slope. The number of traffic accidents throughout 2009 amounted to 127 incidents with the highest distribution of traffic accidents in Central Bogor

District, with several accidents of as many as 34 incidents. The Central Bogor District has 13 accident-prone points, namely on Jalan Ir. H. Juanda as many as 3 vulnerable points. Jalan Jendral Sudirman has 4 vulnerable points and Jalan Pajajaran has 2 vulnerable points. East Bogor District has 2 vulnerable points on Jalan Pajajaran, South Bogor District has 1 vulnerable point, Tanah Sareal District there are 3 vulnerable points, North Bogor District has 8 accident-prone points. The Linkage of Traffic Accident-Prone Areas with the RTRW of Bogor City. The highest number of traffic accidents is in Central Bogor District, following the pattern of the Bogor City road network which has a *concentric radial* pattern, which makes Central Bogor District the center of traffic movement where the flow of vehicles gathers both inside Bogor City, and from outside to inside / inside out of Bogor City.

In order to ensure the availability of transportation services and infrastructure, strict supervision efforts are needed. A safety audit is a part that needs to be applied to all sectors of transportation modes, this safety audit is a formal process to ensure that the operational scheme of traffic can run well. Traffic accident-prone locations in the study area require comprehensive, integrated, and sustainable transport management to minimize and avoid various transportation problems, especially traffic accidents, such as placing traffic signs, reducing or eliminating conflict points, increasing the freedom of view of motorists, reducing vehicle speed and adding Zebra Crossing, pedestrian bridges, and underpasses.

ACKNOWLEDGEMENTS

The authors would like to thank the Malaysia Institute of Transport (MITRANS), Universiti Teknologi MARA for funding this publication under the Vanguard Grant 3.0.

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Received: 24th Jan 2023. Accepted: 20th July 2023



PLANNING MALAYSIA:
Journal of the Malaysian Institute of Planners
VOLUME 21 ISSUE 4 (2023), Page 61 – 72

VIDEO CAMERA TECHNOLOGY FOR VEHICLE COUNTING IN TRAFFIC CENSUS: ISSUES, STRATEGIES AND OPPORTUNITIES

Khairul Khaizi Mohd Shariff¹, Megat Qamarul Zaffi Megat Ali², Aisyah Hartini Jahidin³, Megat Syahirul Amin Megat Ali⁴, Ahmad Ihsan Mohd Yassin⁵

^{1,4,5}*Microwave Research Institute,*
UNIVERSITI TEKNOLOGI MARA

²*ITS Division,*

ZAF TRAFFIC PLANNERS

³*Centre for Foundation Studies in Science,*
UNIVERSITY OF MALAYA

Abstract

This study provides an overview of the sensor technologies commonly used for automated vehicle classification and counting, with a focus on non-intrusive sensors. Video cameras are found to be the most feasible solution for data collection in traffic census as it can operate in portable mode and used at any location. Several factors must be considered to ensure accurate counting. These involve optimum placement of the camera to ensure that all vehicles can be observed, and the lighting conditions must be considered to ensure good video quality. These further contributes to accurate classification and counting of vehicles by dedicated deep learning algorithm. As the data collection may involve location with poor access to cloud computing and storage, offline processing is therefore recommended. The study also revealed opportunities for solving issues related to strategic placement of video cameras, and development of dedicated deep learning algorithms.

Keywords: Video Cameras, Portable, Vehicle Classification, Vehicle Counting, Traffic Census

⁴ Associate Professor at Universiti Teknologi MARA. Email: megatsyahirul@uitm.edu.my

INTRODUCTION

Traffic census is a vital tool used in road planning as it provides information on the volume and composition of traffic on roads and highways. Through a thorough analysis of traffic census data, road planners can identify areas of congestion and develop strategies to improve traffic flow (Lam et al., 2006). Moreover, the data can be used to inform decisions on the development of new roads and highways, and the placement of roadside facilities such as rest stops and gas stations (Gibbons et al., 2019). Data collection is an essential part of traffic census. It is an important process that allows researchers to gather a wide range of information related to traffic and road transportation. This information can then be used to create models, draw conclusions, and make decisions about traffic patterns and congestion (Mohd Yusoff et al., 2022). Traffic census data collection methods involve the use of both manual and automated methods.

Manual methods involve the use of direct observation and field surveys to collect data (Ogunyemi et al., 2021). This includes using traffic counters to count the number of vehicles at an intersection, observation of traffic patterns and speeds, and surveys of drivers and pedestrians. There is no need for costly equipment such as cameras or sensors, and the data collection process is relatively simple. Personnel can be stationed at a given location for a predetermined amount of time and record the number of passing vehicles (Sharma, 1981). This method can be used to measure traffic volumes on urban and rural roads. The accuracy of manual counting is dependent on the efficiency and consistency of the data collection process. Personnel must be adequately trained to accurately observe and record the passing vehicles and must be cognizant of any discrepancies or errors in their data collection. In addition, the data must be recorded in a timely manner to ensure that the count is accurate (Prabha et al., 2016).

Generally, manual counting is labour-intensive, time-consuming, and can be unreliable. Fortunately, there are several ways to overcome these limitations. Automated traffic counters can be used to collect more accurate and comprehensive data than manual counting (Hoxha et al., 2023). Specifically, both intrusive and non-intrusive sensor technologies can be used to automatically measure traffic volumes. Intrusive sensors are embedded in the road surface and use physical means, such as piezoelectric transducers and inductive loops. These sensors require physical installation and are best suited for measuring traffic volumes in a single location. Non-intrusive sensors are typically used to measure traffic volume over a larger area. These sensors use radar, cameras, and other devices to detect the presence of vehicles, which are then counted and converted into traffic volume data (Balid et al., 2018).

Different sensor technologies offer a wide range of options for traffic counting. Each technology has its own advantages and disadvantages, so it is important to consider the specific requirements of the application and the

environment to choose the most suitable one. Ultimately, the most suitable sensor technology should be selected to achieve the best results for automatic traffic counting. This paper aims to compare and analyse the feasibility of intrusive and non-intrusive sensor technologies for vehicle counting in traffic census. Based on the current practice of vehicle counting practices, the most practical technology is proposed. These involve potential study on development of portable vehicle counting system based on video camera technology.

SENSOR TECHNOLOGIES

This paper has short-listed four intrusive sensors, and five non-intrusive sensors for traffic control. The respective technologies are summaries in terms of its working principles, and applications. Subsequently, the most suitable sensors are selected for use in vehicle classification and counting.

Intrusive Sensors

The installation of intrusive sensors on pavement surfaces has been demonstrated to provide a high degree of accuracy, although the associated costs for installation and maintenance are considerable. These sensors can be divided into three distinct categories, namely passive magnetic sensors connected to processing units via wired or wireless connection, pneumatic tube sensors transmitting data to processing units through wired or wireless media, and inductive loops composed of wire coils buried beneath the road and linked to processing units (Tasgaonkar et al., 2020).

The implementation of road sensors is advantageous due to their technology maturity and accuracy in detecting vehicles. However, their installation is costly and can cause disruption to traffic during installation, maintenance, or repairs. To address this issue, wireless battery-powered sensor nodes have been introduced to replace the intrusive sensors and are installed over the pavement. This technology is expected to revolutionize transportation sensors and improve the quality, quantity, accuracy, and trustworthiness of data collected from roads and avenues, while being more cost-effective compared to current solutions (Zhou et al., 2017). Table 1 summarizes the applications of pneumatic road tube, inductive loop detector, magnetic, and piezoelectric sensors.

Table 1: Intrusive Sensors and Applications

Sensor Type	Applications
Pneumatic Road Tube	Track the number of vehicles, vehicle classification and counting.
Inductive Loop Detector	Detect presence, count, movement, and lane occupancy.
Magnetic Sensors	Detect presence of vehicle and whether it is moving or stationary.
Piezoelectric Sensors	Vehicle classification, counting, measures weight and speed.

The use of pneumatic road tube sensors, which involve the placement of one or more tubes across traffic lanes, has been developed to enable the accurate counting and classification of vehicles. When a vehicle passes over the tube, the pressure exerted on the tube produces an electrical signal that is transmitted to a processing unit. Meanwhile, the inductive loop detector is a widely utilized sensor in traffic management, employed for data collection on vehicle flow, occupancy, length, and speed. This detector consists of a wire which is wound in a loop and installed into or beneath the surface of the road. The inductive loop detector works by measuring the change in the electrical properties of the circuit when a vehicle passes over the sensor, thereby generating an electrical current that is sent to the processing unit. Comparatively, magnetic sensors are utilized to detect vehicles by detecting a shift in the earth's magnetic field. They can be used to obtain flow, occupancy, vehicle length and speed data, and are appropriate for implementation on bridges. Likewise, piezoelectric sensors detect vehicles travelling at high speeds over a sensor via a change in the sensor's voltage and can monitor up to four lanes. Piezoelectric systems are most often composed of piezoelectric sensors and inductive loop detectors (Guerrero-Ibanez et al., 2018).

Non-Intrusive Sensors

Non-intrusive sensors are deployed in various locations off roads to detect vehicles, their speed, and the lane they are travelling on. Due to their cost and vulnerability to environmental conditions, they are primarily employed in applications that provide information on a particular site, such as traffic congestion at a traffic light, road weather conditions, and the condition of the pavement. For example, some sensors are mounted on masts to monitor a particular area, while others are placed on bridges with their monitoring area directly beneath. Other sensors are situated at ground level, using a beam that traverses the road and is primarily used for single lane traffic with unidirectional flow, as they are highly susceptible to interference from other objects (Zhou et al., 2017). Table 2 summarizes the applications of video cameras, radar sensors, infrared sensors, ultrasonic sensors, and acoustic array sensors.

Table 2: Non-Intrusive Sensors and Applications

Sensor Type	Applications
Video Cameras	Multi-lane vehicle detection, vehicle classification, presence, flow rate, occupancy, and speed.
Radar Sensors	Measurement of volume, speed, and direction of vehicle for managing traffic lights.
Infrared Sensors	Measurement of speed, length, and volume of vehicle, as well as lane occupancy.
Ultrasonic Sensors	Track the number of vehicles, vehicle presence and lane occupancy.
Acoustic Array Sensors	Track vehicle passage, measurement of vehicle presence and speed.

Non-intrusive sensors offer many of the same capabilities as intrusive sensors, yet with fewer difficulties. However, their performance is highly dependent on environmental conditions such as snow, rain, and fog. Accurate traffic data is essential to making informed decisions regarding traffic management. Additionally, non-intrusive sensors are more visible to drivers, resulting in quicker responses, such as slowing down, when detected. The biggest challenge, however, is not just in the installation of these sensors, but in reducing driver reaction times, based on the collected data, and providing drivers with a more accurate view of the context and reality of the road (Guerrero-Ibanez et al., 2018).

A video image processor system comprises of numerous video cameras, a computer for the processing of images and a sophisticated algorithm-based software for the interpretation and translation of those images into traffic data. Specifically, the cameras located at the roadside capture and evaluate video images of the traffic scene to detect the variations between consecutive frames using traffic parameters such as flow volume and occupancy (Zhang et al., 2007). A limitation of video image processor systems is their susceptibility to decreased efficiency due to unfavourable weather conditions.

Radar sensors can transmit low-energy microwaves that reflect off objects within their detection range. Examples of radar sensor systems include Doppler systems that measure the frequency shift of the returned signal to track the number of vehicles and accurately calculate speed, as well as frequency-modulated continuous wave radar that utilizes a continuous transmission power to measure flow volume, speed, and presence (Yang et al., 2022). Generally, radar sensors are precise, easy to install, and can operate in most conditions. However, they are also highly susceptible to electromagnetic interferences.

Infrared sensors can detect the energy produced by vehicles, road surfaces, or other objects. These sensors work by transforming the reflected energy into electrical signals that are sent to a processing unit. There are two types of infrared sensors: passive infrared, which detects vehicles through the emission or reflection of infrared radiation to collect data such as flow volume, presence of vehicles, and occupancy; and active infrared, which utilizes light emitting diodes or laser diodes to measure the reflection time and collect data such as flow volume, speed, classification, presence of vehicles, and traffic density (Hussain et al., 1993).

Ultrasonic sensors are employed to measure the distance between two objects by calculating the amount of time which elapses between a sound wave at frequencies ranging from 25 kHz to 50 kHz being transmitted and reflected by the object back to the sensor. The electrical energy generated from the received energy is transmitted to the processor. These sensors are used to collect data related to vehicle flow and velocity (Appiah et al., 2020). However, one of the

major drawbacks of this type of sensor is its high susceptibility to external factors. Acoustic array sensors, which are composed of several microphones, are also used to detect sound energy produced by a vehicle entering their detection area (Chen et al, 2001). This is replacing magnetic induction loops as a method to determine traffic volume, occupancy, and average speed of vehicles.

Considerations

Both methods have their own strengths and weaknesses, which should be considered when deciding which technology to use. Intrusive sensors are installed in the road surface and directly measure the presence and passage of vehicles. They are reliable and accurate, making them suitable for measuring the exact number of vehicles passing through a given area. However, they are expensive to install and require ongoing maintenance. Furthermore, the installation process is disruptive to traffic, as the sensors are inserted into the road surface. Based on the review, pneumatic road tubes and piezoelectric sensors have been short-listed as suitable for vehicle classification and counting.

Meanwhile, non-intrusive sensors are placed above the road surface and measure the presence of vehicles using video cameras, radar, infrared, ultrasonic or acoustic technologies. They are relatively inexpensive to install and require minimal maintenance. Additionally, they can be used to measure the speed of vehicles, as well as the number of vehicles passing through an area. However, they are not as accurate as intrusive sensors and may be affected by environmental conditions, such as rain or snow. Generally, only video camera can perform both vehicle classification and counting.

Both intrusive and non-intrusive sensors require installation, although the former in the road surface and the later above it. These are usually installed at traffic hotspots throughout the city. However, for planners who perform feasibility studies, these may not be suitable as the data collection may involve new road locations that are not equipped with these fixed technologies. Therefore, an alternative solution that is portable, but can perform vehicle classification and counting efficiently should be considered. In this case, intrusive sensors are not practical as the technology is fixed to the road or pavements. Hence, video cameras are deemed the most feasible as it can also function in portable mode.

VIDEO CAMERA BASED VEHICLE COUNTING

A portable system for vehicle counting will greatly improve the efficiency of data collection for traffic census. These should be based on suitable placement of video cameras and the use of intelligent algorithms for counting vehicles offline.

Placement Strategies and Device Specifications

The placement of video cameras on the road for vehicle counting is an important factor for efficient and accurate data collection. It is important to ensure that camera placement is optimal to ensure that the vehicles passing by are not obscured or misrepresented in the footage (Grant et al., 2000). An example of a vehicle that is potentially obscured by another vehicle is shown in Figure 1.



Figure 1: An Example of Vehicle that is Potentially Obscured by Another Vehicle

The most important factor to be considered is the type of road and lane configuration. On a multi-lane road, the camera should be placed on the shoulder of the lane. Another factor to consider is the angle of the camera (Zhang et al., 2007). A wide-angle lens can be used to capture a large area, while a narrow-angle lens can be used to focus on specific lanes. It is important to ensure that the camera is not obstructed by foliage or other objects, and that its field of view is not too wide or too narrow. Figure 2 shows an example of video recording with tree branches covering the later end of the road.



Figure 2: An Example of Tree Branches Covering the Later End of the Road

It is also important to consider the lighting conditions when determining the best placement for the camera. A camera placed in an area with direct sunlight will produce higher quality footage than one placed in a shaded area (Kamkar et al., 2016). Additionally, placing the camera in an area where there is minimal vehicle traffic will reduce the risk of the footage being obscured by passing vehicles. Finally, the location of the camera should be chosen to ensure that the footage collected is representative of the local traffic patterns. For example, if the camera is placed too close to a traffic light or intersection, the footage may not accurately reflect the overall traffic patterns in the area.

Deep Learning Algorithms for Vehicle Counting

Video camera placement can have a significant impact on the performance of deep learning algorithms used for vehicle counting. The placement of the camera affects the quality of the image data that is collected and used for training, and thus affects the accuracy of the model. For example, if the camera is placed too high or too low, the resulting images may not capture the full view of the vehicles, making it difficult for the deep learning algorithms to accurately identify and count the vehicles. Additionally, if the camera is placed too far away from the area of interest, the images may be too blurry or have insufficient resolution, leading to misclassified objects and inaccurate vehicle counts.

To maximize the accuracy of deep learning models for vehicle counting, the camera should be placed in an ideal location in terms of height, angle, and distance. The camera should be placed at a height that is tall enough to capture the entire view of the vehicles, yet not too high to cause a loss of detail and resolution. The angle should be chosen so that it provides the best view of the vehicles, while avoiding any obstructions or shadows. Hence, the camera

should be placed close enough that the resolution is sufficient to properly identify and count the vehicles.

Vehicle counting from video is a challenging task, as it requires the algorithm to be able to detect and track vehicles over multiple frames and make accurate predictions about their number. This task is typically performed using convolutional neural networks (CNN), which can extract features from images and videos and learn to recognize vehicles in a scene across frames. CNN can be trained on large datasets of videos with labelled images of vehicles to learn how to recognize and count them. This is done by providing the network with several examples of vehicles, and then training it to recognize their presence in different scenes. Once trained, the CNN can be used to detect and count vehicles in a video by analysing each frame of the video. The algorithm can then use its knowledge of the vehicles' features to accurately identify them and track them across frames. This allows the algorithm to accurately count the number of vehicles in a scene, even if there are multiple vehicles present (Liang et al., 2020).

You Only Look Once (YOLO) is a state-of-the-art convolutional neural network-based approach that can detect objects in an image and classify them into different categories. YOLO has been applied to a wide range of applications, including vehicle classification, and counting. In vehicle classification and counting, YOLO is used to detect vehicles in an image or video and then classify them into different categories, such as cars, trucks, buses, and motorcycles. YOLO uses a single deep neural network to simultaneously detect objects and classify them into the specified categories. It can detect objects of various sizes and shapes and can be used to count the number of vehicles in each image or video (Lin et al., 2021).

Access to Cloud Computing and Processing Issues

Cloud computing has become a critical tool for vehicle classification and counting in recent years. By providing access to big data, the cloud has enabled more accurate and efficient analysis of vehicle data. This has resulted in improved accuracy and precision for vehicle classification and counting. The cloud provides access to vast amounts of data that can be used for vehicle classification and counting. With the ability to store large amounts of data, the cloud can be used to aggregate multiple data sources from different locations and enable real-time analysis. This in turn enables the development of predictive models for vehicle classification and counting, which can be used to identify patterns in vehicle behaviour. This can be used to improve the accuracy of vehicle classification and counting (Qiao et al, 2018).

However, the use of video data for vehicle classification and counting poses some significant challenges when it comes to sending this data to the cloud. As video is typically high resolution and can involve large volumes of data, it

may require a high bandwidth connection with a fast upload speed to send it to the cloud. This can be a problem in places with limited internet access or in areas with a low population density, where the available connection speeds may be slow or even non-existent. In addition, the process of transferring the video data may introduce latency, which can be an issue when it comes to gathering accurate data in real-time. This delay can cause problems with the accuracy of the data and make it difficult to capture vehicles moving at high speeds. Furthermore, the cost associated with sending large volumes of video data to the cloud can be prohibitive for some applications.

A feasible approach to solve this is to perform offline processing of the video data. In addition, deep learning algorithms can be used to process video recordings even when the recording is offline. This makes it possible to count vehicles in recordings even if they were made in the past. This enables long-term vehicle counting and monitoring of traffic patterns and congestion. The advantages of using offline processing for vehicle counting are numerous. First, it is much more cost-effective than traditional methods of vehicle counting, as it does not require the use of expensive equipment and personnel. Additionally, the data collected is much more accurate, as the software can detect subtle differences in the video recordings. Additionally, the data collected is much more comprehensive, as it can provide a detailed analysis of the vehicles travelling on a given stretch of road.

WAY FORWARD

This study provides an overview on the sensor technologies commonly used for vehicle classification and counting. The intrusive type provides more variation in sensor technology. However, for the non-intrusive sensor type, only video camera is considered feasible. Meanwhile, a more specialized data collection for traffic census requires reconsideration on the technologies used since it may involve roads that do not have access to the conventional sensing devices. Therefore, intrusive sensors are ruled out as it requires installation with high maintenance cost. This leaves video cameras which can also operate in portable mode. To ensure accurate count of the vehicle types, several additional factors must be considered.

The placement of video camera by the roadside has to be optimized so that every vehicle can be observed by the recording video frames. Hence, installation of the portable device on a pole of optimum height angle will minimize the risk of a vehicle being obscured by another vehicle. Furthermore, a strategically placed video camera should avoid foliage of other objects covering the camera view. Furthermore, the lighting conditions that can also affect the quality of video being recorded. These are important as a good quality video data will result in accurate vehicle classification and counting by the deep learning

algorithms. In this situation, access to cloud for real-time computing and storage is also considered not feasible as this requires large bandwidth and fast upload speed. Hence, offline processing by dedicated machine is recommended.

The strategies to be adopted will result in optimum use of resources. However, optimum settings can further be assessed through extended research. Based on the discussed strategies, two of issues can potentially be solved through a structured study. The first involves optimum placement of video camera by the roadside. The scopes to be considered include the elevation and angle of the device, as well as impact of lighting conditions on the quality of the video data. Meanwhile, the second issue can be solved through a dedicated study on the development of deep learning algorithm for accurate vehicle counting.

ACKNOWLEDGEMENT

The study is supported by Universiti Teknologi MARA through the Sustainable Research Collaboration Grant (600-RMC/SRC/5/3 (049/2020)).

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Received: 24th Jan 2023. Accepted: 20th July 2023



RISKY BEHAVIOURS AMONG DELIVERY RIDERS AT SIGNALIZED INTERSECTIONS IN MALAYSIA

Munirah Malik¹, Rusdi Rusli², Fatin Najwa Mohd Nusa³, Yusuf Adinegoro⁴

*^{1,2}School of Civil Engineering, College of Engineering,
UNIVERSITI TEKNOLOGI MARA (UiTM), SELANGOR, MALAYSIA*

*³Malaysia Institute of Transport (MITRANS)
UNIVERSITI TEKNOLOGI MARA (UiTM), SELANGOR, MALAYSIA*

*⁴Directorate General of Highway,
MINISTRY OF PUBLIC WORKS AND HOUSING OF REPUBLIC OF INDONESIA,
INDONESIA*

Abstract

The increasing number of food delivery riders, known as P-hailing riders, has increased the number of traffic crashes involving this group. The high demand for online orders and delivery time constraints causes the delivery riders to engage in risky riding behaviours during delivery. Thus, there is a need to study this alarming problem before it becomes more serious. This study aims to determine factors influencing risky behaviours among delivery riders at signalized intersections. A roadside observation was conducted in the month of October 2022 at Subang Jaya, Selangor. A total of 19,803 delivery riders were observed for four days observations at two signalized T- and two cross-signalized intersections. A bivariate analysis (logistic regression) was applied to determine the relationship between seven risky behaviours (unfastened helmet, not wearing shoes, incomplete set of side mirrors, red light running, mobile phone use, stopping after stop lines, and abrupt lane change) with five explanatory variables including the day of the week, time of the day, weather condition, type of intersection and approach road. The result shows that red light running, and mobile phone use is more likely to occur during the weekend. Clear weather increases risky behaviours such as red light running, using a mobile phone, and abrupt lane changes. The findings of this study are useful as input to the related authorities in developing programs to decrease the number of crashes involving food delivery riders.

Keywords: Risky Behaviour, Delivery Riders, Traffic Crashes, Motorcycle, P-Hailing

² Senior Lecturer at UiTM. Email: rusdirusli@uitm.edu.my

INTRODUCTION

Electronic commerce, or known as e-commerce, is the process of buying and selling goods and services or transmitting funds or data through an electronic network, most commonly the Internet. Over the past ten years, e-commerce has expanded significantly as many consumers have shifted to online shopping. The main factors creating this trend include the customer's disposable income increasing, electronic payments becoming more secure, and the range of suppliers and the size of their delivery networks expanding (Li et al., 2020). Statistics from Global Data show that the e-commerce sector in Malaysia will increase by 19.9% to USD 9.2 billion in 2022, which is supported by a fast-expanding shift from offline to online shopping (GlobalData, 2022). Malaysia also was identified among the fastest-growing e-commerce markets in Southeast Asia (Dong, 2022). The growth is supported by the rapid adoption of smartphones, growing internet usage, and the availability of safe online payment systems. In addition, due to the rapid growth of e-commerce, specialization delivery services are important for delivering goods to consumers.

One of the most popular delivery services nowadays is P-Hailing services. P-Hailing refers to the delivery of parcels, food, or documents using motorcycles. In Malaysia, many food service providers offer food delivery services to customers, including Food Panda, DeliverEat, Uber Eats, Grab Food, Lalamove, Honestbee, and Running Man Delivery (Rusli et al., 2022). Food Panda and Grab are among the well-known food delivery service providers and are regularly used by customers to order and deliver their food (Nayan & Hassan, 2020).

The COVID-19 pandemic has had some impact on the business environment around the globe. A study by Sopian et al. (2022) in Malaysia identified the Movement Control Order (enforced Malaysian Government during the COVID-19 pandemic) has a substantial impact on commercial activities. Among the industries growth during this pandemic period is food delivery service. Consumers are more likely to choose to take away food in conjunction with the standard government practice during the COVID-19 pandemic (Nayan & Hassan, 2020). The demand for food delivery has tremendously increased, especially since the Malaysian Government announced a lockdown in response to the COVID-19 pandemic (Rahim & Yunus, 2021). During the COVID-19 pandemic period, food delivery services become more trending when it is allowed to operate as it falls under essential services. In addition, the spread of the COVID-19 pandemic also causes many people to have been laid off and choose to work as food delivery riders (The Star, 2021).

The increase in the number of food delivery riders and demand for food delivery services increased the number of road traffic crashes involving this group. Statistics from the Royal Malaysian Police reveal that a total number of 321 road traffic crashes involving delivery riders were reported, with 36 accidents

resulting in fatalities between January 2020 and August 2020 (Samuel, 2021). In Kuala Lumpur, 1,242 road traffic crashes involving food delivery drivers were reported from 2018 to May 2021 (Carvalho et al., 2022). Out of these, 1,048 cases cause light injuries, 82 cases cause serious injuries, and 112 cases cause deaths. Fauzi et al. (2022) reveal 17 fatalities, 10 serious injuries, and 64 minor injuries were reported among P-Hailing riders while on delivery runs in Malaysia during various stages of lockdown during the COVID-19 pandemic where the figure is constantly growing for these reasons.

This study aims to investigate food delivery riders' behavioural issues at signalized intersections in Malaysia. Seven risky behaviours were targeted: unfastened helmet, not wearing shoes, incomplete set of side mirrors, red light running, mobile phone use, stopping after stop lines, and abrupt lane change. A study by Sultan et al. (2016) targeting young motorcyclists in Malaysia found human attitude is one of the main factors that cause motorcycle crashes. The results from this study could help related authorities prepare safety programs focusing on food delivery riders.

RESEARCH METHODOLOGY

Study Setting

The site observation for this study was conducted in the month of October 2022 at four signalized intersections in Subang Jaya. Subang Jaya is the sixth largest city in Malaysia, with a population of approximately 968,930 people in 2020 (Urbanice Malaysia, 2021).

Data Collection

Data were collected at the approach's intersections by the appointed two enumerators at each intersection and supervised by the authors. Enumerators were positioned at locations that were not visible to the riders. This is important to ensure their presence was not influencing the rider's behaviours. The seven risky behaviours observed during this process include an unfastened helmet, not wearing shoes, incomplete set of side mirrors, red light running, mobile phone use, stopping after the stop line, and abrupt lane change. The contextual characteristics included the day of the week (weekdays or weekends), time of the day (peak or non-peak hours), weather conditions (clear or rain), type of intersections (cross junction or T-junction), the approach of delivery riders to the intersection (from a major or minor road). Gender has been dropped from the list of variables due to no observation has been made during the observation period.

The data collection process was held for seven hours a day on two days, weekdays (Monday and Wednesday) and two days weekends (Saturday and Sunday). Data was collected at peak hours from 11.00 AM to 1.00 PM and 5.00 PM to 7.00 PM, whereas for non-peak hours from 10.00 AM to 11.00 AM and

3.00 PM to 5.00 PM. Data was collected from those delivery riders who crossed the intersections using the manual method.

Data Analysis

A binary logistic regression model was adopted in this study to explore factors influencing seven risky behaviour (unfastened helmet, not wearing shoes, incomplete set of side mirrors, red light running, mobile phone use, stopping after stop line, and abrupt lane change) in regards to five explanatory variables (day of the week, time of the day, weather condition, type of intersections and approach road). The coefficient of determination, Cox and Snell's R^2 , and Nagelkerke's R^2 have been calculated to measure the appropriateness of the regression models (Rusli et al., 2020). All data analysis process was conducted using the Statistical Package for Social Science (SPSS) Version 20.

RESULTS

Descriptive Statistics

A total of 19,803 food delivery riders were observed throughout the observation period. All of them were male and observed wearing a helmet. It is found that about 8,733 (44.1%) riders stopped after the stop line, 6,403 (32.3%) were found not wearing proper shoes during delivery, 2,118 (10.7%) were involved in red light running, 545 (2.8%) were recorded for use a mobile phone, 198 (1.0%) of riders observed perform an abrupt lane change, 110 (0.6%) were recorded had an incomplete set of side mirrors either left or right, and 73 (0.4%) were observed unfastened their helmet.

Out of 19,803 food delivery riders observed, 10,865 of them were observed at the cross junction, and 8,938 were observed at the T-junction. A greater percentage of riders were observed at peak hours (54.1%), during clear weather (66.0%), on weekdays (74.0%), and approaching from a major road (74.9%).

Logistics Regression for Risky Behaviour

To examine the relationship between risky behaviours and explanatory variables, seven binary regressions were developed for each of the risky behaviours. Further sub-sections have presented the results of binary regression for each risky riding behaviours. Table 3 presented the risky riding behaviours among food delivery riders at signalized intersections by explanatory variables. Table 4 shows the model estimation for seven risky riding behaviours among this type of rider at signalized intersections.

Modeling results show that the value for Cox & Snell R^2 is 2% and 36% for Nagelkerke R^2 , indicating the amount of variance explained by the unfastened helmet. Junction type has been found as only one of the variables statistically significant in this model (OR: 3.323, $p < .001$, 95% CI: 1.931-5.719). However,

the other variables are found not statistically significant in influencing the unfastened helmet behaviour. The odds ratio for the unfastened helmet is 3.3 times higher at the T-junction compared to the cross junction.

The model predicting not wearing shoes was significant (Cox & Snell $R^2 = 2.5\%$, Nagelkerke $R^2 = 3.5\%$). The intersections type also only the variables associated with this risky behaviour (OR: 0.485, $p < .001$, 95% CI: 0.453-0.520). The other variables are found not to be significantly influencing not wearing shoe behaviours. The odds ratio of not wearing shoes decreased by 0.485 times at the T-junction compared to the cross-junction.

The model shows that there are no variables found statistically significant for having an incomplete set of side mirrors. Even though the results show insignificant value, the traffic crash might be happened due to a human blind spot. The side mirrors are required for viewing objects from the sides and rear.

The value for Cox & Snell R^2 and Nagelkerke R^2 is 0.3% and 0.6%, respectively. There are four variables that influenced the red light running, which is the day of the week (OR: 1.132, $p < .05$, 95% CI: 1.014-1.264), weather (OR: 0.830, $p < .001$, 95% CI: 0.740-0.930), type of intersections (OR: 1.331, $p < .001$, 95% CI: 1.203-1.472) and type of approach road (OR: 0.766, $p < .001$, 95% CI: 0.686-0.856). The odd ratio to red light running increased 1.3 times at T-junction and 1.1 times during the weekend. However, the odds decreased 0.830 times during the rainy day and 0.766 times lower for riders approaching from the minor road.

The model has predicting mobile phone use was significant to three variables, including the day of the week (OR: 1.293, $p < .05$, 95% CI: 1.057-1.581), weather (OR: 0.741, $p < .01$, 95% CI: 0.594-0.925) and type of approach road (OR: 0.683, $p < .001$, 95% CI: 0.551-0.848). The value for Cox & Snell R^2 is 0.1% and 0.6% for Nagelkerke R^2 . The analysis on an odds ratio of mobile phone use shows a significant increase in risky behaviour with respect to the day of the week ($p < 0.05$). The odds ratio increased by 1.293 times higher during the weekend compared to weekdays, slightly less by 0.741 times during rainy days, and 0.683 times lower for riders approaching from the minor road.

The model explained risky behaviour for stopping after the stop line was significant, with 3.5% and 4.8% for Cox & Snell R^2 and Nagelkerke R^2 values, respectively. Time of the day (OR: 0.927, $p < .01$, 95% CI: 0.875-0.981) and type of intersections (OR: 0.457, $p < .001$, 95% CI: 0.428-0.487) were significant variables associated with this risky behaviour. The odds ratio slightly decreased by 0.927 times during non-peak hours and 0.457 times lower at T-junction.

Finally, logistic regression was undertaken to determine the associations between risky behaviour for abrupt lane change with three significant variables, which are the day of the week (OR: 0.661, $p < .05$, 95% CI:

0.463-0.945), weather (OR: 1.572, $p < .01$, 95% CI: 1.121-2.205) and type of intersections (OR: 0.304, $p < .001$, 95% CI: 0.212-0.435). The value for Cox & Snell R^2 is 0.3% and 2.7% for Nagelkerke R^2 . The odds ratio increased by 1.572 times higher during clear weather compared to rainy conditions, slightly less by 0.661 times during weekends, and 0.304 times lower at T-junction.

DISCUSSION

The influencing factors of seven risky behaviour among food delivery riders are investigated in this study (i.e., unfastened helmet, not wearing shoes, incomplete set of side mirrors, red light running, mobile phone use, stopping after stop line, and abrupt lane change). Association with explanatory variables was examined, including the day of the week, time of the day, weather conditions, type of intersections, and approach road. The results showed that there are explanatory variables found associated with risky riding behaviours except for the incomplete set of side mirrors model, where there are no explanatory variables found statistically significant.

Out of seven risky riding behaviours observed, the highest recorded is stopping after the stop lane. The second highest risky riding behaviours observed in this study is not wearing proper shoes during delivery. Then, red light running becomes the third risky riding behaviours the food delivery riders perform. Based on statistics from the Road Transport Department Malaysia, during Ops Merah 2021 operation between 8th October to 6th November, the highest offense involving food delivery riders was violating red light signals with 902 offenses (The Star, 2021a). Mobile phone use and abrupt lane changes are the four and fifth risky riding behaviours observed in this study. Incomplete side mirrors for both sides become the next risky riding behaviours observed in this group of riders. The enforcement of motorcycles to install complete side mirrors shows success. This study found that only a minority of food delivery riders observed have not complete side mirrors for both sides. Lastly, the unfastened helmet is the lowest risky riding behaviours observed in this study. Even though this risky behaviour is not discussed seriously among the researcher, the impact of unfastened helmet straps is quite serious. A study by Arif et al. (2019) revealed the number of injuries was significantly higher in the unfastened helmet group as compared with fastened helmet group.

Table 3: Descriptive analysis of risky riding behaviours by explanatory variables

Variable	Fastened helmet		Wearing shoes		Complete set of side mirrors		Red light running		Mobile phone use		Stopping after the stop line		Abrupt lane change	
	Yes (%)	No (%)	Yes (%)	No (%)	Yes (%)	No (%)	Yes (%)	No (%)	Yes (%)	No (%)	Yes (%)	No (%)	Yes (%)	No (%)
Day of week														
Weekdays	14594(99.6)	59(0.4)	9856(67.3)	4797(32.7)	14575(99.5)	78(0.5)	1546(10.6)	13107(89.4)	393(2.7)	14260(97.3)	6487(44.3)	8166(55.7)	158(1.1)	14495(98.9)
Weekend	5136(99.7)	14(0.3)	3544(68.8)	1606(31.2)	5118(99.4)	32(0.6)	574(11.1)	4576(88.9)	161(3.1)	4989(96.9)	2242(43.5)	2908(56.5)	41(0.8)	5109(99.2)
Time of day														
Peak hours	10677(99.7)	28(0.3)	7212(67.4)	3493(32.6)	10644(99.4)	61(0.6)	1111(10.4)	9594(89.6)	287(2.7)	10418(97.3)	4812(45.0)	5893(55.0)	96(0.9)	10609(99.1)
Non-peak hours	9053(99.5)	45(0.5)	6188(68.0)	2910(32.0)	9049(99.5)	49(0.5)	1009(11.1)	8089(88.9)	267(2.9)	8831(97.1)	3917(43.1)	5181(56.9)	103(1.1)	8995(98.9)
Weather														
Clear	13028(99.6)	47(0.4)	8583(65.6)	4492(34.4)	13000(99.4)	75(0.6)	1410(10.8)	11665(89.2)	392(3.0)	12683(97.0)	6122(46.8)	6953(53.2)	138(1.1)	12937(98.9)
Rain	6702(99.6)	26(0.4)	4817(71.6)	1911(28.4)	6693(99.5)	35(0.5)	710(10.6)	6018(89.4)	162(2.4)	6566(97.6)	2607(38.7)	4121(61.3)	61(0.9)	6667(99.1)
Type of Intersections														
Cross junction	10844(99.8)	21(0.2)	6624(61.0)	4241(39.0)	10813(99.5)	52(0.5)	1062(9.8)	9803(90.2)	320(2.9)	10545(97.1)	5708(52.5)	5157(47.5)	153(1.4)	10712(98.6)
T-junction	8886(99.4)	52(0.6)	6776(75.8)	2162(24.2)	8880(99.4)	58(0.6)	1058(11.8)	7880(88.2)	234(2.6)	8704(97.4)	3021(33.8)	5917(66.2)	46(0.5)	8892(99.5)
Approach														
Major	14772(99.6)	61(0.4)	10035(67.7)	4798(32.3)	14744(99.4)	89(0.6)	1679(11.3)	13154(88.7)	450(3.0)	14383(97.0)	6573(44.3)	8260(55.7)	158(1.1)	14675(98.9)
Minor	4958(99.8)	12(0.2)	3365(67.7)	1605(32.3)	4949(99.6)	21(0.4)	441(8.9)	4529(91.1)	104(2.1)	4866(97.9)	2156(43.4)	2814(56.6)	41(0.8)	4929(99.2)

Table 4: Logistic regression results for risky behaviour among delivery riders at the signalized intersection

Variable	Reference category	Unfastened helmet			Not wearing shoes			Incomplete set of side mirrors			Red light running			Mobile phone use			Stopping after stop lines			Abrupt lane change	
		Odds Ratio	Confidence Interval (95%)		Odds Ratio	Confidence Interval (95%)		Odds Ratio	Confidence Interval (95%)		Odds Ratio	Confidence Interval (95%)		Odds Ratio	Confidence Interval (95%)		Odds Ratio	Confidence Interval (95%)	Odds Ratio	Confidence Interval (95%)	
Day of week	Weekend	0.741	0.386-1.421	0.917	0.852-0.987	1.364	0.863-2.157	1.132*	1.014-1.264	1.293*	1.057-1.581	0.972	0.907-1.042	0.661*	0.463-0.945						
Time of day	Non-peak hours	1.919	1.194-3.084	0.974	0.912-1.035	0.939	0.644-1.370	1.078	0.985-1.180	1.096	0.926-1.299	0.927**	0.875-0.981	1.294	0.978-1.712						
Weather	Clear	0.769	0.437-1.354	1.070	0.992-1.154	0.663	0.406-1.082	0.830***	0.740-0.930	0.741**	0.594-0.925	1.022	0.951-1.098	1.572**	1.121-2.05						
Type of Intersections	T-junction	3.323***	1.931-5.719	0.485***	0.453-0.520	1.594	1.045-2.432	1.331***	1.203-1.472	0.994	0.802-1.204	0.457***	0.428-0.487	0.304***	0.212-0.435						
Approach Road	Minor	0.573	0.308-1.067	0.985	0.919-1.056	0.715	0.444-1.153	0.766***	0.686-0.856	0.683***	0.551-0.848	0.951	0.890-1.016	0.751	0.532-1.061						
Constant		0.002***		0.658***		0.005***		0.111***		0.031***		1.166***		0.014***							
Log likelihood		929.565		2447.516		1353.786		13418.485		5028.795		26459.160		2169.826							
Cox & Snell R²		0.02		0.025		0.00		0.003		0.001		0.035		0.003							
Nagelkerke R²		0.36		0.035		0.006		0.006		0.006		0.048		0.027							

* p < 0.05
 ** p < 0.01
 *** p < 0.001

The present study found that red light running, and mobile phone users are more likely to occur during a weekend delivery. An observation study by Rusli et al. (2020) on motorcyclists in Kuala Terengganu, Malaysia, found helmet non-use and turn signal neglect are more frequent on weekends than on weekdays. They explain that less traffic volume might be the reason behind this observation. Another possible explanation for this is also due to the higher demand for delivery during weekends compared to weekdays. Hirschberg et al. (2016) reveal that most orders placed through online platforms were on weekends, accounting for 74% of all orders compared to weekdays. A study in Germany by Heiland (2021) also found weekend evenings among the time when online order exceeds the supply of riders. Byun et al. (2020) also found food delivery in the Republic of Korea is usually higher during the weekend than on weekdays. However, there is no study in Malaysia to compare the number of food delivery orders between weekends and weekdays. On the other hand, abrupt lane change is less likely to happen during weekends compared to weekdays. This also might be due to less traffic volume during the weekend, decreasing the abrupt lane change behaviours among the riders.

Stopping after the stop line behaviour was found to decrease during non-peak hours compared to peak hours. This finding is in line with previous research by Chen et al. (2015). They found early-start manoeuvres among motorcyclists in Taiwan more likely to increase during off-peak hours. However, a study conducted by Rusli & Salam (2021) among motorcyclists in Kuala Terengganu, Malaysia, found there is no statistically significant difference between weekdays and weekends regarding stopping after stop-line behaviours. This shows the difference in riding behaviours among food delivery riders and general motorcyclists. However, these finding merits further discussion and exploration due to contrary evidence.

The present study found that food delivery riders are less likely to engage in red light running and mobile phone use during rainy conditions. This might be a result of the food delivery riders being more cautious in bad weather, such as rain. Riders who deliver food are more likely to use self-control or risk-compensating techniques when it's raining. Papakostopoulos & Nathanael (2021) discover that weather conditions are among the main concern of food delivery riders during work in Athens, Greece. A study among motorcycle couriers in the Republic of Korea also identified that the rate of traffic violations during rain or snow is less (3.9%) compared to clear weather (12.0%) (Shin et al., 2019). A study by Faria et al. (2020) explained that average driving speeds were found to drop by 22% and 13% during heavy and light precipitation, respectively, suggesting a change in driving behaviour and patterns. This finding is also consistent with the acceleration change, with average positive and negative acceleration dropping by 8% and 11%, respectively. Additionally, the percentage of time spent on hard braking or hard acceleration is also less compared to dry

weather (Bakhshi et al., 2022). On the other hand, abrupt lane change behaviours were found to increase during rainy conditions. Waiting at the front of the queue at a signalized intersection might be one of the possible explanations for this observation. Riders need to be among the first to cross the intersection when a green light is, especially during rainy conditions. A study by Paimana et al. (2020) found that 87% of motorcyclists prefer to maneuver in a queue when there is a red light.

The type of intersection plays a vital role in influencing risky riding behaviors among food delivery riders at signalized intersections in Malaysia. It was found an unfastened helmet and red-light running are more likely to happen at the T-junctions compared to cross junctions. This is in line with research by Rusli et al. (2020), which found motorcyclists were more likely to reduce red light running at cross junctions. The previous literature has explained that motorcyclists engage more frequently in risky riding behaviours when the traffic volume is low (Rusli et al., 2020). However, Nguyen-Phuoc et al. (2020) found both riders and drivers tend to use turn signals more frequently on roads with less traffic volume. They explain that riders or drivers are more careful during riding or driving along the road with lower traffic volume because vehicles are likely to drive at in fast speed under this condition. This contradictory finding might be due to the locations of the study. The present study mostly observed the food delivery riders at the signalized intersections, whereas the previous study observed riders and drivers along the light traffic volume.

On the other hand, not wearing shoes, stopping after the stop line, and abrupt lane change more frequently happens at cross junctions. Therefore, the improvement of having an Advance Stop Line (ASL) is needed to reduce the conflict between a motorcycle and other road users, such as pedestrians and motor vehicles. Ramli et al. (2021) revealed that the implementation of ASL has proven significant in reducing the rate of traffic conflict and increasing safety among all motorcyclists, including delivery riders. The result showed that the average percentage of motorcycles stopping before or behind stop space at an intersection without ASL was 46.2% compared with the implementation of ASL at 11.4%. The provision of ASL gives more space for motorcyclists to stop during the red traffic phase without stopping between other vehicles.

As mentioned before, food delivery riders engage more frequently in risky riding behaviours when the traffic is low. However, this current study also found that food delivery riders are less likely to run a red light and use a mobile phone on minor roads approach, which generally have less traffic volume. This finding is consistent with a previous study conducted among motorcyclists (Rusli et al., 2020). This contradicting finding merits further investigation to explain the specific factors in the study locations.

CONCLUSION

This study aims to determine factors influencing risky behaviours among delivery riders at signalized intersections. A total of 19,803 food delivery riders were observed for four days observations at four signalized intersections in Subang Jaya, Malaysia. This study develops seven risky riding behaviours (i.e., unfastened helmet, not wearing shoes, incomplete set of side mirrors, red light running, mobile phone use, stopping after a stop line, and abrupt lane change). This study confirms that some factors influencing risky riding behaviours among food delivery riders differ from general motorcycle riders. Findings showed that some of the explanatory variables were found statistically in certain risky behaviours models except for the incomplete set of side mirrors, where no explanatory variables were statistically significant in this model. Unfastened helmets increased at T-junctions compared to cross-junctions, whereas not wearing shoes was recorded to be significant at cross-junctions. The tendency of delivery riders to run a red light higher on weekends, during a clear day, on the T-junctions, and approaching from the major road. The use of the mobile phone is most likely to occur on weekends, during a clear day, and riders' approach from a major road. Stopping after stop line behaviours increase during peak hours and at cross junctions. Finally, abrupt lane change behaviour is more likely to happen on weekdays, during a clear day, and at cross junctions. The results from this study could help related authorities in preparing safety programs focusing on food delivery riders.

ACKNOWLEDGEMENT

The researcher would like to thank the Vanguard Research Grant (600-MITRANS 5/4/91) from the Malaysia Institute of Transport (MITRANS), Universiti Teknologi MARA (UiTM), for supporting this study. Hopefully, this initiative may encourage more publications from scholars in the future.

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Received: 24th Jan 2023. Accepted: 20th July 2023



ROAD ACCESSIBILITY AND SAFETY ANALYSIS IN GATED AND NON-GATED HOUSING COMMUNITIES

**Nor Aizam Adnan¹, Zarith ‘Aqilah Mahadzir², Hasranizam Hashim³,
Zaharah Mohd Yusoff⁴, Abdul Rauf Abdul Rasam⁵, Ernieza Suhana Mokhtar⁶**

*^{1,2,4,5,6}College of Built Environment (CBE),
UITM SHAH ALAM, MALAYSIA*

³Royal Police Department, Bukit Aman Branch, Kuala Lumpur, Malaysia

*⁴Malaysia Institute of Transport (MITRANS),
UITM SHAH ALAM, MALAYSIA*

Abstract

The relationship between crime and the built environment has been extensively investigated in the field of urban design and planning. Gated housing area refers to a physical personal area with limited access and is governed by special rules, restricting or controlling access to and outside of the homeowner (via electronic devices or with the safety of workers). Therefore, gated housing communities are assumed to be safer than non-gated housing communities in relation to crime occurrence with limited road point accessibility which is deemed reliable to prevent undesirable property crime. The purpose of this research is to analyse the property crime incidents in gated and non-gated housing communities of Subang Jaya, Selangor with regards to road accessibility points. Three years of crime surveillance data from 2014 to 2016 was obtained from the Royal Malaysian Police Department. Findings indicated that crime incident is less at the gated community as compared to non-gated with the most of the hot spot area are located at the multiple road points access such as Subang Perdana Good Year Court 7 and few USJ, Subang Jaya housing areas and also the residential area which located nearest to the above stated locations as opposed to the gated housing community.

Keywords: Gated, Non-Gated, Housing Community, Geospatial, Hot Spot Analysis

¹ Associate Professor at Universiti Teknologi MARA: nor_aizam@uitm.edu.my

INTRODUCTION

Crime is an act in which the act is in violation of criminal law. Crime is not capped by a single factor wherever it occurs, there are various factors that influence criminal activity. Major factors that indicate potential criminal behaviour including employment, poverty, poor governance and weaknesses in law enforcement or crime control agencies. Property crimes involve theft of property with or without bodily harm, such as burglary, larceny, fraud, theft, and arson. Gated community is a term that refers to any type of neighbourhood that has access to it and where it uses no more than two gates to be accessible to the visitor. Some even have guard huts with security guards to ensure that only residents or guests pass through the gates with authorised permission. While others use an automatic entrance barrier that residents must open with a registered access card. Usually, the gated community has a geographical name and definition that is obscured by the barriers and gates that control access to the area. Gated communities can be located in any location, either urban or rural areas (Samsuddin, 2016).

In Malaysia, gated and guarded communities are commonly known as a group of residents or communities who reside in landed properties with Strata Titles. The guideline also explains that a guarded neighbourhood refers to a residential area controlled in whole or in part in the scheme of the existing housing or new landholdings with individual land titles. The schemes also provide security services (Bachok, Mohammed Osman, & Rabe, 2011). Domestic burglaries or robberies are common nowadays and it seems to be an alarming trend especially in the urban cities with high population. Gated community is a residential area that has a good level of security and should be safe and less prone to robbery crime (Mokhtar et al., 2023). A geographic information system (GIS) integrates hardware, software, and data for capturing, managing, analysing, and displaying all forms of geographically referenced information. One of the products of GIS is a mapping crime. Mapping crime, using GIS methods, allows crime analysts to identify crime hot spots, along with other trends and patterns (Othman et al., 2020; Zandbergen and Hart, 2013). With GIS software, it is possible to map crime by type and also be able to indicate which crime is prevalent in a particular area. It is also a key component in crime analysis and police strategies to secure community safety. Accuracy in identifying these hot spots will provide significant benefits to the police force in crime detection and control (Zakaria and Rahman, 2014).

Therefore, the aim of this research is to evaluate crime incidence within gated and non-gated housing communities using geospatial analysis for the Subang Jaya area. Road accessibility and safety will also be linked to understand the possibility factor of crime hotspots within the study area. The analysis will involve the types of property crimes as well as the hotspot map using Kernel

density estimation (KDE) method for determination whether property crime has more prevalence within gated or non-gated housing communities, thus safeness of gated housing communities can be proven.

RESEARCH STUDY AREA AND METHODS

The data collection can be categorised into two which are GIS layer for Subang Jaya area data consisted of 'Blok Perancangan Kecil' (BPK) and 'Blok Perancangan' (BP) from Subang Jaya Municipal Council (MPSJ) as well as road network for road accessibility and safety assessment (Figure 1(a)). Crime data cases from the Royal Malaysian Police Department from years 2014 to 2016 was also obtained. The area involved in each BPK and BP as shown in Table 1. The GIS layer of Subang Jaya housing area is classified into two; either it is gated community or non-gated community housing as shown in Figure 1 (b) with red line polygon.

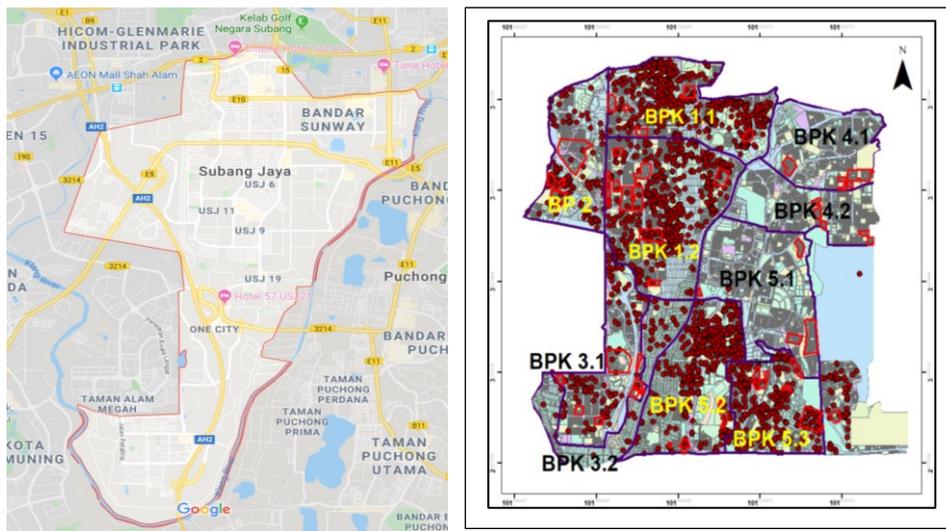


Figure 1: (a) The Subang Jaya boundary and (b) gated and non-gated housing communities in each BPK.

Table 1: ‘Blok Perancangan Kecil’ (BPK) and ‘Blok Perancangan’ for Subang Jaya area

BPK/BP No.	Area Coverage
BPK 1.1	SS12 – SS19, Bandar Sunway
BPK 1.2	USJ 1 – USJ 21, Subang Perdana Goodyear Court 7-10
BP 2	Taman Batu Tiga, Subang Height West, USJ Heights
BPK 3.1	One City, USJ 23 – USJ 27, Putra Heights
BPK 3.2	Kg. Tengah, Kg. Kuala Sg Baru, Kg. Bkt Lanchung
BPK 4.1	Bandar Puchong Jaya, Impian Heights, Kg. Lembah Kinrara
BPK 4.2	Bandar Kinrara5, Vistana Residence
BPK 5.1	Taman Perindustrian Puchong, Bandar Puteri Puchong, Taman Mutiara Puchong
BPK 5.2	Taman Puchong Perdana, Taman Puchong Prima, Taman Puchong Intan, Taman Puchong Indah, Taman Puchong Permai, Kg. Sri Langkas.
BPK 5.3	Taman Puchong Utama, Puchong Perdana, Bandar Bukit Puchong, Taman Maju Jaya.

Table 1 represents the coverage area of each BPK/BP in Subang Jaya with 10 BPK/BP areas. BPK 1.1 coverage for residential area of SS12 until SS19 and residential area in Bandar Sunway. BPK 1.2 coverage for residential area of USJ 1 until USJ 21, and residential area in Subang Perdana Goodyear Court 7 until Court 10. BP 2 stands for “*Blok Perancangan*” coverage for the residential area of Taman Batu Tiga, Subang Heights West and USJ Heights. BPK 3.1 coverage for residential areas of One City, USJ 23 until USJ 27 and Putra Heights. BPK 3.2 coverage for residential areas of Kg. Tengah, Kg Kuala Sg. Baru and Kg. Bukit Lanchung. Meanwhile, BPK 4.1 covers the residential area of Bandar Puchong Jaya, Impian Heights, and Kg. Lembah Kinrara. The BPK 4.2 covers the residential area of Bandar Kinrara 5 and Vistana Residence. BPK 5.1 covers the residential area of Taman Perindustrian Puchong and Bandar Puteri Puchong, and Taman Mutiara Puchong. BPK 5.2 covers the residential area of Taman Puchong Perdana, Taman Puchong Prima/Intan/Indah and Permai and Kg. Sri Langkas. Furthermore, BPK 5.3 covers the residential area of Taman Puchong Utama and Bandar Bukit Puchong.

Meanwhile, crime data was obtained from the Royal Malaysian Police Department of Subang Jaya. The data given in excel file and then converted to shapefile format for GIS. Each of the data collections in MPSJ and PDRM has some attributes such as year happened, types of crime (property or violence), and the location coordinates for georeferenced processes in GIS software. The crime types are an assertive crime which is relating to the crime against a person such as violent crime, and simple assault. The crime against property is bribery, burglary, theft from a motor vehicle, robbery and stolen property. The analysis of point patterns appears in many different areas of research (Sohn, 2016) such as crime incident points as investigated in this research. Point patterns are only deemed not enough since it is utilising basic statistical analysis such as data mean,

maximum, standard deviation and unable to highlight valuable information for the pattern analysis. Therefore, better analysis in exploring point patterns, such as density analysis or statistical operations of KDE (Garson and Vann, 2001) is adopted in this research to visualise and analyse the spatial data for pattern events prediction (Boessen and Hipp, 2015). KDE is specifically useful due to the pattern estimations are made over a grid placed on the entire point pattern and able to provide certain crime location intensity and finally detecting the highs and lows of crime point pattern densities (Kalinic and Krisp, 2018). Furthermore, according to Zakaria and Rahman (2014) KDE is also considered to be the most accurate of these common hotspot mapping techniques.

ANALYSIS AND DISCUSSION

Property Crime Incident Cases for the years of 2014, 2015 and 2016.

The property crime data used in this research study were obtained from the PDRM. The data were given in excel format then it is converted into a point shapefile format to be used in the ArcGIS software. Figure 2 shows the number of crime cases that occur in Subang Jaya in the year 2014, 2015 and 2016. In 2014 the crime cases were recorded at 2385 incidents, 2071 in 2015 and in the year 2016 is only 1319 cases, which clearly indicated decreasing pattern of crime cases based on data statistics.

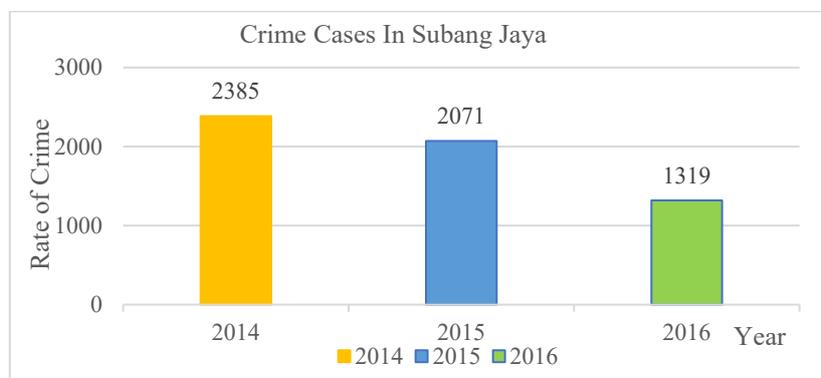


Figure 2: Crime Cases in Subang Jaya for the years 2014, 2015 and 2016.

Two types of crime data are provided by the PDRM for Subang Jaya, known as property crime and violence crime. Figure 3 shows property crime is higher compared to violence crime. In 2014, recorded 2094 cases of property crime as opposed to violence crime with only 291 cases. Meanwhile, in 2015, recorded 1692 cases of property crime as opposed to violence crime of 379 cases and finally in 2016, 1084 cases of property crime were recorded as opposed to violence crime with only 235 cases.

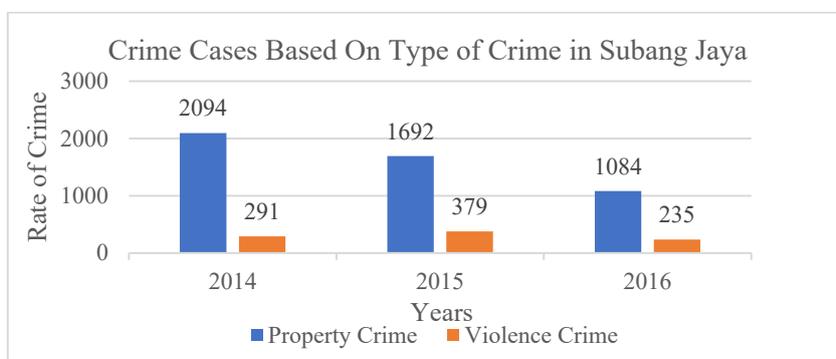


Figure 3: Type of crime cases in Subang Jaya from 2014 – 2016.

Crime Cases Occurrence at Residential Area Subang Jaya

Crimes that occurred from 2014 to 2016 are shown in the form of a point distribution map using GIS (Figure 4). Not much difference in crime point distribution from 2014 to 2016, with 2014 showing higher distribution of crime incidence in Subang Jaya housing areas as compared to the years 2015 and 2016. Most of the crime cases point distribution map occurred in non-gated housing areas as compared to the gated community type housing (red polygon). The point distribution of crime cases from 2014 to 2016 indicated some of the crimes that happened in the same area such as at BPK 1.1, BPK 1.2, BKP 5.2 and BKP 5.3. However, it can be seen that in the year 2016 significant differences with lower point crime cases as compared to the year 2014 was observed.





Figure 4: Point distribution map for crime cases in 2014, 2015, and 2016

Figures 5 show randomly selected gated residential in Subang Jaya area of Bandar Bukit Puchong. The type of housing of this residential area is double-storey terrace house area with 931 total units. The area for this residential area is 184929.9 m² equivalent to 12% of the selected residential area. The criminal incidents that occurred in 2014 were 24 cases, of which a total of 21 criminal cases involved property crimes, and a total of 3 criminal cases involved violent crime. In 2015, an increase of 9.23% or 28 cases in the gated residential area where 17 criminal cases were property crime cases and 11 criminal cases involving violent crimes. However, in 2016 there was a decreased trend of 23.08% where 13 cases were recorded in total with property crime and violence cases of 10 cases and 3 cases respectively. Again, from the analysis conducted, the number of criminal cases that occur in the gated housing community area is decreasing from 2014 to 2016 which indicated positive impact.



Figure 5: Gated Residential area Bandar Bukit Puchong with limited road access

Figure 6 shows another gated housing community of the USJ Pinggiran Park where it is close to Sri Kayan Apartments and Sri Nipah Apartments. The total area is 68648.19m² with double-storey terrace housing. Criminal cases are lower if compared to the other gated housing areas as shown in Figure 5. The criminal cases that occurred in 2014 are only 10 cases, of which 7 cases were

from property crimes and 3 cases involving violent crime cases. Meanwhile, 2015 recorded decreased cases by 50% (5 cases) with 3 cases of property crime and 2 cases of violent crime. While in 2016 again showing decreased trend with only 4 criminal recorded cases, where violent and property crimes have 2 cases each.



Figure 6: Gated Residential area Taman Pinggiran USJ with limited road access

Hotspot Mapping of Crime Occurrences in Subang Jaya

The hotspot analysis was done using bandwidth or search radius of 500 metres only since it provides a significant impact on the crime spatial patterns prediction (Chainey, 2013). The KDE method was used to assess crimes hotspots that occur in a gated and non-gated housing community in Subang Jaya area based on individual point crime data occurrence and later the link of road access point as a cause of crime was also analysed.

Figure 7, shows the hotspot maps of 3 years (2014 – 2016) using KDE method with lowest hotspot (dark green colour) to the highest hotspot (red colour). The maps indicated that the highest hotspot of crime cases happened on the same location for all three of years with highest hotspot within BPK 1.1, BPK 1.2 and BPK 5.2 of a non-gated area which has multi point road accessibility to the housing area. The red polygons are the gated housing community. The result reveals that the gated area with limited road access point showing lower crime hotspot than non-gated residential area as shown in BPK 4.1 and 4.2. The hotspot area for the crime cases for the years 2014, 2015, and 2016 were identified in Subang Jaya Flat and Bandar Puchong (BPK 5.2).

The location with high density of crime cases is located at residential of Subang Perdana Goodyear Court 10, Subang Perdana Good Year Court 7, USJ 1, USJ 2, USJ 3, USJ 6, USJ 7, USJ 8 and the residential area which are nearest to the above stated locations (Figure 8). These areas are the crowded areas where it

is located within the industrial area (Ultramine Industrial Park) close to the housing location. The types of housing areas consist of single-storey terrace housing and double-storey terrace housing. While Subang Perdana Goodyear Court 10 and Subang Perdana Goodyear Court 7 are flat houses. Furthermore, this area with high density occurrence of crime cases is also located within a double-storey office shops area located at the USJ 10, and USJ 11 which also have multiple road access and deemed less safe in regard to criminal activity accessibility to the housing area.

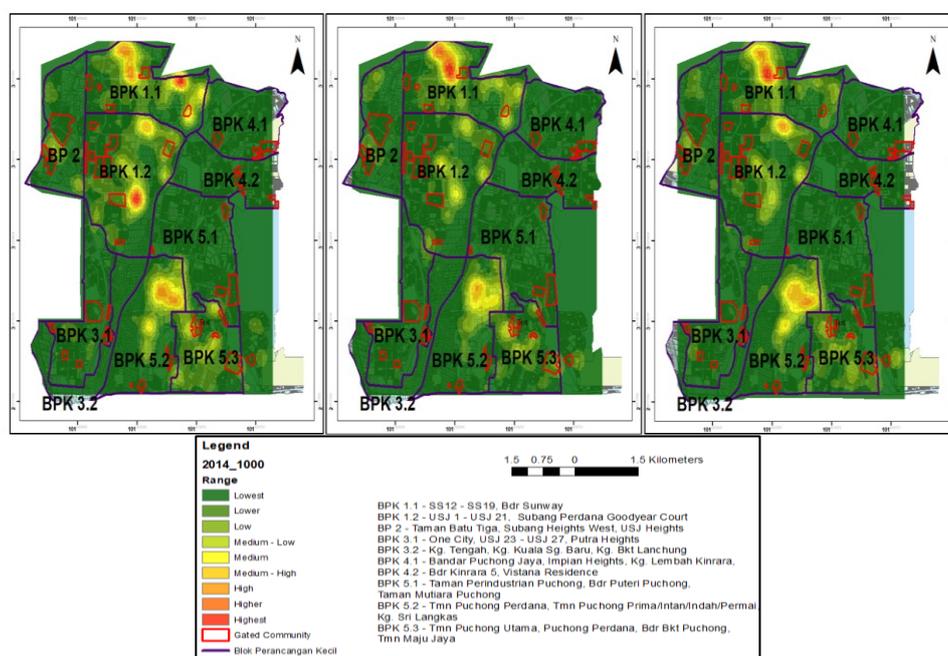


Figure 7: KDE Crime Hot Spot of Subang Jaya for 2014, 2015, and 2016

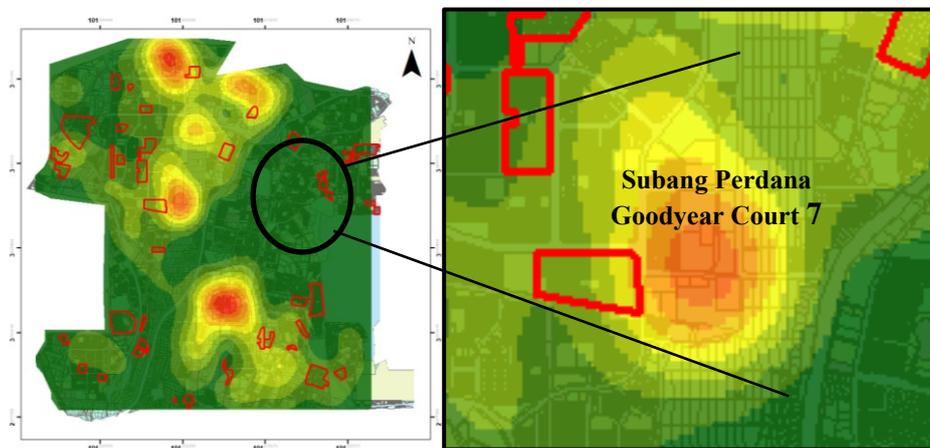


Figure 8: Hotspot Crime Map area near the Subang Perdana Good Year Court 7

Road accessibility to the residential area of the Subang Perdana Goodyear Court 7, 8, and 9 as shown in Figure 9 indicating multipoint accessibility which is possible to be used as an entrance and exit to the or out of the main road. The Subang Perdana Goodyear Court 7, 8 and 9 housing area is a part of the housing area in USJ 14 road accessibility with total area 423253.9m² which is equivalent to 27.47% of the selected study area. The Subang Perdana Goodyear Court area is adjacent to the USJ 14 housing. Goodyear Court flat housing type while the USJ 14 is a double-storey terrace house. However, at each entrance of the Subang Perdana Goodyear Court it has a security guard house and patrolling, but crime hotspot is still higher.

For the non-gated housing community such as located at the Bandar Bukit Puchong with high density population at the housing residential of Taman Puchong Indah, Taman Puchong Perdana, Taman Puchong Permai in Bandar Puteri Puchong. These areas consisted of single-storey and double-storey terrace houses with high accessibility points. Apart from that, Taman Puchong Indah, Taman Dahlia (single-storey and double-storey terrace houses) and Flat Taman Permai also have non-gated housing communities with high crime property incidents recorded. The accessibility road or way into the residential area is more than 10 accessibility which show less road safety accessibility for the resident when it relates to possibility of property criminal crime access.

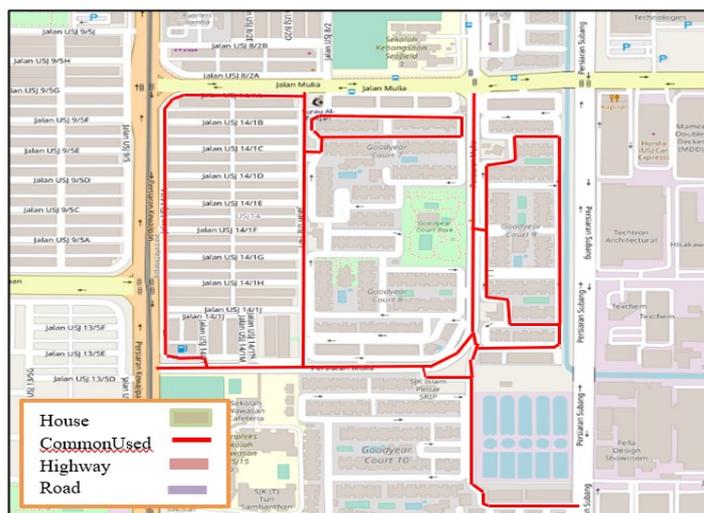


Figure 9: Accessibility Road Area Subang Perdana Goodyear Court Residential

Table 2: Property Crime Cases of Selected Residential Area (Gated and non-gated)

RESIDENTIAL	Area (m2)	Area %	Crime cases Record					
			2014	%	2015	%	2016	%
USJ Pinggiran Park (Gated)	68618.19	4.45%	10	2.1	5	0.96	4	0.90
USJ 13 (Gated)	128887.3	8.36	18	3.8	8	1.54	1	0.23
Bdr. Bkt. Puchong (Gated)	184929.9	12%	24	5.1	28	5.37	13	2.93
Subang Perdana	423253.6	27.47%	100	21.4	138	26.49	203	45.82
Taman Puchong Perdana	392288.1	25.46%	200	42.7	177	33.97	126	28.44
Flat Subang Jaya	343018.93	22.26	116	24.8	165	31.67	96	21.67
Total	1540996	100	468	100.0	521	100.00	443	100.00

Comparison of crime incident cases reported in gated and non-gated areas as presented in Table 2. Based on Table 2, the non-gated housing community contributed higher property and violence crime incidents as opposed to gated residential. Other than that, both gated and non-gated showing decreasing trend over 3 years periods of incident recorded. The analysis indicated that with the gated community and good security surveillance it has caused less property and violence crimes committed as compared to non-gated housing areas with the percentage of crime ranges from 8.36% to 12% only as compared to non-gated housing of between 21.4% to 45.82%.

Similar studies related to gated housing community with regards to housing robbery or crime were also reported in several studies in Malaysia, South Africa, North America and the United Kingdom (Atkinson et al., 2004; Mohit and Abdulla, 2011; Wilson Doenges, 2000; Blakely and Snyder, 1998). According to Wilson Doenges (2000) and Blakely and Snyder (1998) no significant difference in crime rates between gated and non-gated neighbourhoods. Meanwhile, other studies concluded that gated community is rather higher crime cases rate compared to non-gated communities in two low-middle income housing (Mohit and Abdulla, 2011) while Atkinson et al. (2004) stated that little evidence to support the common conception that crime is reduced in gated communities. More interestingly, a study by Breetzke, Landman and Cohn (2014) stated that smaller gated communities are less vulnerable to burglary as opposed to larger gated communities with higher number of land parcels. Similar findings of gated community housing units experience less burglary than their non-gated counterparts as reported by Addington and Rennison (2015) which have a similar pattern as in this study of the Subang Jaya area.

The road accessibility and road safety also provide a close link with the level of criminal activities such as house robbery and burglary as reported by Olajuyigbe et al. (2015). The study, based on Akure Metropolis, Nigeria, highlighted that the main road network in the city provides easy access and exit to criminals' activities such as armed robbery attacks or burglary. Furthermore, a study by Sohn (2016) found that improved streets connectivity, street density such as multi point access and diversity of adjacent land use near to housing areas has adverse effects on prevention of residential crime. Therefore, the findings from the study in Subang Jaya gated and non-gated communities are deemed important since it manages to highlight that gated communities are safer as compared to non-gated communities with almost 50% different. A local authority can use this finding as an alternative approach to understand better about a safe city concept especially when it relates to housing areas and crime such as burglary, robbery and violence. Many approaches can be adopted to achieve safe cities in residential communities such crime control known as 'crime prevention through environmental design' (CPTED) by modifying the built environment to reduce crime with four principles of territoriality, natural surveillance, activity support, and access control.

CONCLUSION

Geographic distribution and environmental factors determinants of crime have received high consideration in many fields such as criminology, environmental psychology, and urban design and planning. In spite of the theoretical importance in understanding crime based on criminal physiological behaviour aspects,

relatively less attention has been paid to whether areas near physical activity actually have more or less crime such as road accessibility.

This finding revealed that gated community housing types have fewer property crimes as compared to the non-gated community. The analysis indicated that with the gated community housing type and security surveillance less crime of property and violence occurred as compared to non-gated housing areas with the percentage of crime ranging from 8.36% to 12% only. No doubt that crime activities are more dominant in some parts of the city core due to physical and social boundaries. However local authorities related to land use or urban planning can enhance the city safety concept by integrating many relevant factors to reduce property crimes occurrence as investigated in this study, where highlighting about road accessibility and safety to gated and non-gated communities and its effects to property crime.

ACKNOWLEDGEMENTS

The study was funded by UiTM internal Geran Penyelidikan Khas (GPK) grant 600-RMC/GPK 5/3(054/2020). The authors wish to thank the lecturers and staff of the School of Geomatics Science and Natural Resources, Universiti Teknologi MARA, Shah Alam for suggestions and comments on the improvement of the research.

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Received: 24th Jan 2023. Accepted: 20th July 2023



PLANNING MALAYSIA:

Journal of the Malaysian Institute of Planners

VOLUME 21 ISSUE 1 (2023), Page 100 – 112

THE STRATEGIC HGVS PLANNING PRACTICES FOR SUSTAINABLE GREEN LOGISTICS IMPLEMENTATION

**Nur Farizan Tarudin¹, Muhammad Akmal Asyraf Adlan², Rudiah Md Hanafiah³,
Fatin Najwa Mohd Nusa⁴, Zaharah Mohd Yusoff⁵**

^{1,4,5}*Malaysia Institute of Transport (MITRANS), UiTM Shah Alam, Selangor*

¹*Faculty of Business and Management, UiTM Puncak Alam, Selangor*

²*Sime Darby Rent a Car Sdn Bhd, Petaling Jaya, Selangor*

^{1,3}*Faculty of Maritime Study, Universiti Malaysia Terengganu*

⁴*College of Engineering, UiTM Shah Alam, Selangor*

⁵*College of Built Environment (CBE), UiTM Shah Alam, Selangor*

Abstract

The Malaysian government is introducing a number of initiatives to try and reduce the effects of global warming. One of these is the road haulage industry, which contributes significantly as one of Malaysia's largest industries to the nation's effort to reduce its transportation emissions to 45% by 2030. However, the empty movement of trucks and improper transport planning by the management caused some delivery trucks to come back to the headquarters empty and did not fully utilise the space of the vehicles. Therefore, the researchers aimed to propose heavy goods vehicle (HGV) planning practice to solve the problems. This is a mixed-mode research paper in which data was gathered through interviews and estimated calculations. The data has been analysed by comparing the result of the simple estimation calculation with the operational cost and carbon emission. Based on the results, most of them agreed that by using the right strategy, operational costs and carbon emissions can be reduced. The researchers had introduced a few recommendations to enhance the firm's transport planning practices that could contribute to the field of green logistics as well as the road haulage industry in Malaysia.

Keywords: Transport Planning, Green Logistics, Optimization, Heavy Good Vehicles, Sustainability

¹ Lecturer at UiTM. Email: nurfarizan@uitm.edu.my

INTRODUCTION

Over the past few decades, people around the world have just realised that climate change and global warming issues have developed into serious problems for society and the environment. To tackle this issue, sustainable development is the key to achieving a better world with rich natural resources and a cleaner environment for upcoming generations. A revolutionary method is needed to mitigate climate change and global warming problems, which is green logistics. It is specifically designed to concentrate on reducing carbon emissions during the process of production and distribution, taking into account social, economic, and environmental factors (Dekker et al., 2012; Homayouni et al., 2021). The best approach to green logistics is to design distribution systems that take environmental impact into consideration, reduce energy consumption and carbon emissions, and manage waste. This is because the existing supply chain methods being applied are not properly sustainable (Sbihi & Eglese, 2007; Bouchery, 2012).

In an attempt to mitigate global warming problems, a variety of actions are being introduced by the Malaysian government. It has been shown in the Tenth Malaysia Plan that Malaysia has already reached a 33% decrease in carbon emissions. The road haulage industry, which plays a significant role as one of the largest industries in Malaysia in reducing its transport emissions (Daim, 2021). There are tonnes of strategies and improvements that can be implemented by the road haulage industry to meet the goals of reducing carbon emissions, which can lead to global warming. Besides that, by having an effective transport plan such as route and load planning, logistics performance could be increased, and these methods are the main key elements in transport operations (Alaharja & Helo, 2015).

In fact, route planning can achieve up to 10% cost efficiency and energy savings. This can be supported by the statement by Blanco and Sheffi (2017) that transport routing and arrangement are one of the most effective practices for the environment. Besides that, Kamakate and Schipper (2009) reported that effective load planning for trucks can reduce fuel consumption and carbon emissions.

The major issues that can be discovered in many transport companies are the empty movement of lorries and improper transport planning by the management. The issue of empty movement is not new in Malaysia, but it is a very serious issue concerning all countries around the world. The right approach for handling empty movements will result in cost savings. It also has the additional benefit of reducing global warming. One of the elements that is being studied in order to determine the efficiency of the strategies is cost savings. Rodrigue (2017) said that the purpose of business is to gain profit. The company will adapt a strategy that will enable them to cut costs, especially transportation costs. This study demonstrates the significant role of cost as a main standard in

transport planning. Other than that, carbon emissions are also an important component that plays an important role in transport planning. A study conducted by Ubeda, Arcelus, and Faulin (2011) stated that the reduction in distances and carbon emissions shows the importance of optimising transport operations. Proper planning can reduce fuel use and, consequently, average greenhouse emissions per vehicle.

Nevertheless, a further study is needed to provide a better understanding of green logistics implementation in Malaysia because there is a lack of information for road freight companies on how to implement green logistics practises in Malaysia. Poor planning in transport operations can lead to unnecessary fuel usage and a high level of carbon release. Thus, an effective approach to transport planning is required to reduce operational costs, which will indirectly reduce carbon emissions (Tarudin, 2013; Tarudin & Adlan, 2022). The government and industry must sit at the same table to discuss and come up with a variety of green strategies that can be implemented.

Therefore, the researchers intend to assess the best strategic transport planning practises in transport companies towards supporting green logistics and find a way to cut operational costs and reduce carbon emissions. If transport companies fail to make changes to their logistics activities, more complications will affect the whole supply chain of the business in the future, such as losing the business opportunity because of high operational costs and contributing to global warming because of high carbon emissions.

DEVELOPMENT OF CONCEPTUAL FRAMEWORK

There are many previous studies that support the idea that cost savings can be achieved by supporting green logistics. The main elements of sustainability are the economy, the environment, and society. In other words, sustainability can be achieved through strategies that address the environment, society, and economy all together. A study by Tarudin and Adlan (2020) shows that almost all road haulage firms in Malaysia believe that operating costs can be reduced by having the right plan. Based on the number of trips covering the activity of HGVs, the number of trips by firms adopting the right strategy is lower than the number of trips by firms that do not adopt any strategy. Based on this case, it demonstrates that the development of the road freight sector in Malaysia will indirectly minimise global warming effects because it will cut their operational costs and carbon emissions by adopting the right strategy.

Freight transport operation costs include both internal and external costs. Internal costs are fixed costs paid by the road freight company. It covers operating expenses and capital investments. The total operating cost consisted of electricity, wages, maintenance, costs, depreciation, and insurance. For the transportation industry, fuel prices comprise over 50% of total operating costs.

Fuel prices have taken a significant share of the operating costs of freight transport. The price of oil depends on a range of parameters, such as global Brent prices, the cost of oil purification or import charges, the margin for oil dealers, the expenses of delivery of refined products to end customers, and national taxes on oil (Gohari et al., 2018). According to Kenny (2017), the operating cost of trucks is based on fuel and tolls. Road tolls can contribute to making transport more efficient. The increase in cost has been expected to have an impact on the efficiency of loading trucks as pricing pressure increases the probability of empty movements or inefficient truck loads. Kenny also stated that tolls are necessary if a country wants to move to cleaner and smarter transport systems. Toll is a funding tool capable of encouraging low-emission vehicles and smart transport attitudes while raising money for the public budget.

Reducing carbon emission levels plays a vital role and has become a primary goal for every service provider. A study conducted by Ubeda, Arcelus, and Faulin (2011) points out that the reduction of distance travelled and greenhouse gas emissions correlated with the emergence of transport planning, demonstrating the significance of improving operations. It might seem that fuel efficiency can have an impact on reducing fuel consumption and indirectly reducing the average carbon emissions for every vehicle. In England, for example, vehicle carbon emissions are one of the main causes of air pollution. But with the implementation of green logistics, it will minimise environmental damage, as all operational costs will be reduced and revenues will increase (Rad, 2017).

A conceptual framework is used to demonstrate what the researchers want to find through the research. It includes how the variables might relate to one another. This conceptual framework proposes green practises for sustaining HGVs in terms of cost-effectiveness with regards to the operational strategy viewpoint. The conceptual framework has been proposed by utilising empirical pieces of evidence in the existing literature, whereas future research will be carried out to validate the proposed conceptual framework. For a deep understanding, this proposed framework adds value to the existing body of knowledge regarding the effort to support green logistics practices, especially in the road haulage industry. From a managerial point of view, managers could utilise the proposed framework to improve their insights on how to manage their HGVs using green planning tools.

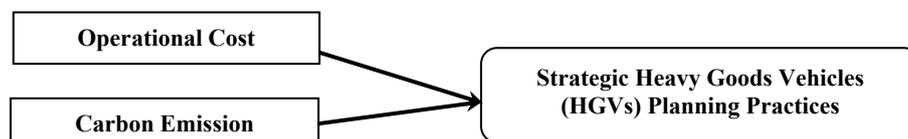


Figure 1. Conceptual Framework
Source: Author's Drawing

METHODOLOGY

This is a mixed-mode research paper, combining quantitative and qualitative research, because the researchers have conducted an estimated calculation of the operation's cost and also the carbon release. The researchers also conducted an interview to get a better understanding of the transport planning practises at transport companies. Hence, for this study, the purpose is to assess the best strategic transport planning practises in transport companies towards supporting green logistics. The researchers' role would be to analyse the data with the hope that the findings from this study can reduce the companies' operation costs and carbon emissions to help sustain the world's environment for future generations.

Method of Data Collection

The data collected for this study comes from several sources, such as primary and secondary data. Primary data refers to data and materials attained by the researcher on the variables of sources for the purposes of the study (Sekaran & Bougie, 2016). Generally, primary data is gained from interviews, observations, and questionnaires. Thus, the researcher used an estimated calculation and a personal interview as the methods of data collection.

A personal interview method was conducted, which involves face-to-face communication where the researchers verbally ask the respondent questions as the primary data. McNamara (2022) stated that interviews are the most suitable method to learn from respondents' experiences. The researchers also acquired accurate information about the operation by receiving follow-up from the respondent through interviews. In this study, the researchers conducted interviews with certain groups in order to obtain information based on the respondent's experiences and observations. The researchers used this technique in the early part of the study as they attempted to explore the issues that arose in the organization. The researchers also used the interview method to gain more data and get a clearer picture of the operation.

In addition, the researchers used an estimated calculation to determine the cost of the operation as well as the percentage of carbon emissions. Figure 2

shows the calculation of the formula that has been used in this study to calculate the operational cost.

$\text{Total Cost} = a1 + a2 + a3 + \dots$
a is the element of cost Total Cost per Day = Fuel Cost + Toll Fuel Cost = Fuel (L) x Price (RM/L)

Figure 2. Formula for Operational Cost

Source: Assessing Heavy Goods Vehicles (HGVs) from Operational Strategy Perspective in Reducing Global Warming (Adlan & Tarudin, 2018)

The researchers also used the simplest and most reliable method for transport firms to measure their carbon emissions, to record fuel consumption and then use regular carbon exchange ratios to turn fuel quantities into carbon emissions. Transport providers that have access to fuel consumption data are therefore encouraged to compile all their fuel consumption data. Each litre of fuel used would contribute to a certain level of CO₂ emissions.

$\text{CO emissions} = \text{fuel consumption} \times \text{fuel emission conversion factor}$ $[\text{Tonnes CO -emissions} = \text{litre} \times \text{kg CO per litre fuel} / 1.000]$

Figure 3. Energy-based Approach (Calculation Method Recommended for use by Transport Companies)

Source: NSAI Standards (2012). CEN/TC 320/ WG 10 Methodology for calculation and declaration of energy consumptions and GHG emissions in transport services (Freight and passengers).

Table 1: Well-to-Wheel Fuel Emission Conversion Factors

Fuel type	kg CO/liter	kg CO/kg
Motor Gasoline	2.8	
Diesel Oil	2.9	
Gas Oil	2.9	
Liquefied Petroleum Gas (LPG)	1.9	
Compressed Natural Gas (CNG)		3.3
Jet Kerosene		3.5
Residual Fuel Oil		3.5
Bio gasoline	1.8	
Biodiesel	1.9	

Source: NSAI Standards (2012). CEN/TC 320/ WG 10 Methodology for calculation and declaration of energy consumptions and GHG emissions in transport services (Freight and passengers).

In addition, the researchers also used the secondary data to complete the calculation analysis. The secondary data comes from the company's internal parts, ranging from records of truck movement until it completed its distribution

operation. Secondary data can be gathered more quickly than primary data because it has already been documented by somebody else prior to the researcher's needs.

Sample

For the purpose of the study, the sample size would be the twelve (12) transport companies in the Klang Valley area, and the targeted respondents would be the workers who had experience in logistics and transport management and operation. The respondents are divided into three groups: big companies, medium-sized companies, and small companies, according to several criteria set by the Companies Commission Malaysia. The size of the company can be determined by looking at its sales turnover per year or the number of employees. In this current study, the researchers chose to look at their sales turnover per year; medium-sized companies ranged from RM 3 million to RM 20 million, while small companies ranged from RM 300,000 to RM 3 million. A maximum of six road haulage companies were chosen for each category: three companies implementing strategic transport planning strategies and three companies that are still implementing the normal transport planning distribution process. The calculations for finding its average and moderate fuel consumption are being done, respectively.

RESULTS AND DISCUSSIONS

In order to effectively examine each component of the data collected from various sources, analytical and logical reasoning were used to evaluate the data in order to formulate the presented conclusions and findings. This form of analysis proved to be critical in completing the research.

Current/Normal Practices

The researchers began by identifying the current transport planning practises in the transport companies. Thus, the researchers interrogated the interview in order to capture and identify the firm's current transport planning.

Operational Cost (Current Practices)

This is an illustration of the current transport planning that is practised by most transport companies in their daily operations. The problem with current transport planning is the inefficient use of space or empty movements of containers, involving empty pickup or empty return. Figure 5 shows an example of current transport planning practises for goods delivery in a common area in Klang Valley; the trip from the transport company location (Point A) to Westport (Point B) is 42 kilometres, while the trip to Port Klang (Point C) is 34 kilometres.

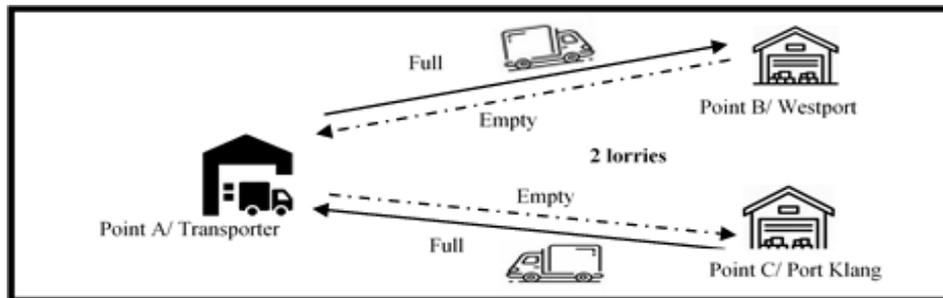


Figure 5. Combination of the Process Delivery for Current Practices (Operational Cost)
Source: Author's Drawing

1 Liter (Diesel): 6 kilometer (estimation)
Fuel price (Diesel): ***RM 2.15 / liter

Point A to Westport: 42kilometres / Two-ways: 84kilometres
Point A to Port Klang: 34kilometres / Two-ways: 68kilometres

Toll (Point A to Westport): RM 3.00 / Two-way: RM 6.00
Toll (Point A to Port Klang): RM 3.00 / Two-way: RM 6.00

Revenue (Point A to Westport): RM 669.95
Revenue (Point A to Port Klang): RM 669.95

$$\text{Profit} = (\text{RM } 669.95 \times 2) - [\text{RM } 2.15 \times (84\text{km}/6\text{km}) + \text{RM } 6] - [\text{RM } 2.15 \times (68\text{km}/6) + \text{RM } 6]$$

$$\text{Profit} = \text{RM } 1339.90 - \text{RM } 66.46$$

$$\text{Profit} = \text{RM } 1,273.44$$

***Malaysia Fuel price for 6th – 12th January 2022: Diesel RM 2.15 per liter
*Weekly petrol price adjustments in Malaysia announced by the Ministry of Finance Malaysia (MOF)

Figure 6. Estimation Calculation for Current Delivery Practices (Operational Cost)
Source: Author's Calculation

This is an example of a profit calculation. This calculation is based on the researcher's observation and also supports data from the companies. For example, the total cost of fuel and tolls for a trip to deliver goods from the transport company's premises to client B and client C locations, then have both trucks come back to the transport company's premises, is RM 66.46. If the revenue collected from the client (Client B + Client C) is RM 1399.90, then after deducting the total costs like fuel and toll, the transport company received RM 1,273.44 in profit for the two truck movements.

Carbon Emission (Current Practices)

This is an illustration of the normal transport planning practises being the same as in Figure 5. The company used 2 trucks instead of fully utilising 1 truck to pick

up stuff from their client. Thus, the carbon emission level will continue to increase if they continue to practise this kind of strategy.

Point A – Westport = 14 liters’ x 2.9 kg CO per liter = 40.60 tonnes CO -emission
Point A – Port Klang = 11.33 liters’ x 2.9 kg CO per liter = 32.86 tonnes CO -emission
Total CO emission = 73.46 tonnes CO -emissions

Figure 7. Estimation Calculation for Current Delivery Practices (Carbon Emission)
 Source: Author’s Calculation

This type of practise will not bring much benefit or profit to the company, but it will have more negative effects on the environment because the carbon released by the truck can actually be reduced with proper planning. So, in order to save on operation costs like fuel and tolls and increase profit, the company needs to plan a new strategy that can contribute to high profit and support green logistics to sustain the environment for our future generations.

Strategic Transport Planning Practices

Next, the researchers proceeded with Research Objective 2 to propose a better transport planning practise to improve the daily operation of transport companies and fulfil the second research question, which is, "Is there a better transport planning practise to improve the daily operation of transport companies? The researchers will compare the current practises with the new practises to show the changes that effective transport planning can bring.

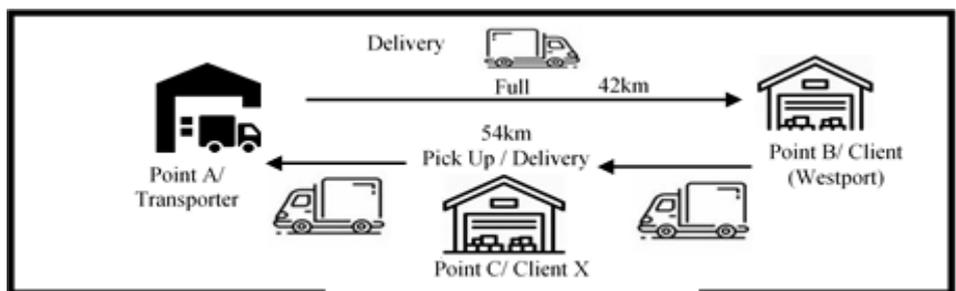


Figure 8. Strategic Transport Planning Practices – Operation Flow
 Source: Author’s Drawing

The researcher believed that this strategy could bring changes to the transport companies' operations. For example, the lorry will deliver stuff from point A to client B, and on the way back along the same route, the lorry can pick up stuff at client C's location. The keyword here is along the same route. Instead of using two trucks to do the work, transport companies can fully utilise the space of one truck and reduce the empty movement of the truck. By implementing this

strategy, transport companies can not only reduce their operation costs but also increase their profit. The environment will also benefit from this strategy, as the carbon emissions from two trucks will be reduced by fully utilising just one.

Operational Cost (Optimization)

Figure 8 shows the illustrations for optimization planning and operational cost if the transport companies implement strategic transport planning in their distribution process. This is an example of a profit calculation. This calculation is based on the assumptions of the researchers. For example, if the total cost of fuel and tolls for the trip to deliver goods from the transport companies' premises to the client location and to go back to the transport companies is RM 18.05. What if the transport planner can find a client along the route and schedule the truck to pick up their product on the way back to the transport company? This can help reduce the operation's cost. If the revenue collected from client B is RM 669.95, then on the way back along the route to the transport company, they can pick up the product at client C and get another RM 669.95. Then, after deducting the operation costs such as fuel and tolls, the transport company can receive up to RM 1,299,50 in profit.

$\begin{aligned} \text{Profit} &= \text{Revenue} - \text{Point B} - \text{Point C, Client X} \\ \text{Profit} &= (\text{RM } 669.95 \times 2) - (\text{RM } 2.15 \times 7\text{km} + \text{RM } 3) - (\text{RM } 2.15 \times 9\text{km} + \text{RM } 3) \\ \text{Profit} &= \text{RM } 1339.90 - \text{RM } 18.05 - \text{RM } 22.35 \\ \text{Profit} &= \text{RM } 1299.50 \end{aligned}$

Figure 9. Estimation Calculation for Optimization Distribution (Operational Cost)
Source: Author's Calculation

Carbon Emission (Optimization)

The researcher thought that transport companies may use this new practise to reduce empty movement as well as carbon emissions, which is the main agenda of all transport provider companies in the world. This illustration shows the most optimised transport planning practises that a transport company can implement. Instead of using two trucks, a transport company can fully utilise one truck to pick up items from their client by properly planning the load and route. The calculation showed that by having effective route and load planning, the firm can reduce its carbon emissions because the distance travelled by 2 lorries is reduced by fully utilising 1 lorry.

$\begin{aligned} \text{Point A} - \text{Westport} - \text{Client X} - \text{Point A} &= 16 \text{ liters} \times 2.9 \text{ kg CO per liter} \\ \text{Total CO emission} &= 46.4 \text{ tonnes CO -emissions} \end{aligned}$

Figure 10. Estimation Calculation for Carbon Emission (Optimization)
Source: Author's Calculation

Summary of Estimated Calculation

The researchers used an estimated calculation to calculate the profit gain and carbon emission percentage saved before and after implementing green strategies. By looking at the table, it shows that by planning the route effectively, the company can reach up to 2.05% of profit just by using 1 truck per trip, and if the company implements this strategic plan for all trucks, it will generate more profit for the company. Besides that, transport companies can also reduce their carbon emissions by up to 36.84% when they implement this strategy, and it is a good practise towards supporting our Malaysia agenda towards reducing carbon emissions. The researchers believe that a green logistics strategy is the best transport planning practise for their daily operation because there is a positive change between the normal practises and the new practises after the route optimization in terms of cost and carbon emissions.

Table 2: Comparison of the Profit and Carbon Emission Produce

Comparison	Current/Normal	Strategic Planning / Optimization	Percentage (Differentiation)
Profit	RM 1,273.44	RM 1,299.50	2.05 %
Carbon Emission	73.46 tonnes CO	46.4 tonnes CO	36.84 %

Source: Author's Calculation

CONCLUSION

In a nutshell, the researchers have identified the current transport planning practises of transport companies through interviews with the right employees that handle the transport distribution operations. It shows that the current transport planning practises can be improved to minimise carbon emissions and gain more profit in the future. Logistics are a vital part of today's economic activity and a key driver of globalisation to promote trade. Logistics operations are thus responsible for a massive proportion of carbon emissions and other toxins. Transport companies must select a good practise to support green logistics. The main purpose of doing business is to gain profit, but the best practises for transport planning for daily operations are those that will benefit the economy, society, and environment.

Improvement is always possible; it is the main key to success. All firms must improve in order to remain competitive. In this study, the researcher has proposed a new approach for the firm to achieve the goals of sustainable development in their daily operations based on economic, social, and environmental drives. It will not only benefit the firm, but it will also help settle the world's biggest threat, which is climate change. Route planning and load planning are some of the best practises that can be used in transport planning because, by applying the right strategy, the company can reduce costs and carbon

emissions. Therefore, it is necessary for transport companies to apply green logistics in their operations to attain a sustainable ecosystem and continue business in the long term.

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Received: 24th Jan 2023. Accepted: 20th July 2023



RANKING PARENTS CONCERNS ABOUT ROAD SAFETY AT SCHOOL USING AN ANALYTIC HIERARCHY PROCESS

Siti Salwa Salleh¹

¹*Malaysia Institute of Transport (MITRANS),
Kolej Pengajian Pengkomputeran, Informatik dan Media,
UiTM Cawangan Negeri Sembilan, Kampus Seremban,
UNIVERSITI TEKNOLOGI MARA, MALAYSIA*

Abstract

School road safety concerns include the drop-off location for children at the school entrance, traffic congestion around the school, and road safety amenities. Most research is done by analyzing data with descriptive statistics, but these don't give a clear order of the factors that lead to these incidents. So, the Analytic Hierarchy Process (AHP) has been used to help figure out which ways of intervening are the most effective at cutting down on accidents. The following objectives have been outlined: (i) to identify the most critical factors that contribute to road safety measures in the school area, such as high traffic volume, speeding, or a lack of pedestrian infrastructure, and (ii) to prioritize potential interventions for improving road safety. The study's methods include four main steps: making an instrument, collecting data, analyzing the data with AHP, and coming up with a list of actions to take based on priority. Results show that the most significant outcome was 33% peak hour management, and 33% of the needs of parent car management are equally critical. The other concerns are on the children's path. The outcome presented herein gives an insight into how to prioritize roads for safety mitigation, which is expected to be useful to various decision-makers.

Keywords: Road safety, traffic congestion, multi-criteria analysis, AHP, school children

¹ Senior Lecturer at UiTM. Email: ssalwa@uitm.edu.my

INTRODUCTION

The number of child pedestrians killed or seriously injured (KSI) on roads is a major global issue, and road traffic injuries are the leading cause of death for children and young adults aged 5 to 29 years old (Global Status Report, 2018). Along with being the second leading cause of death in Malaysian children aged 5–14 years (Norainy et al., 2020), MIROS responded to this issue by making a Guideline for Pedestrian Facilities in School Areas to help keep schoolchildren safer on the roads. This is a preventive strategy meant to find potential safety problems for everyone who uses the road and make sure that solutions to get rid of or lessen the problems are thoroughly looked at. The most vulnerable road users, particularly kids, will suffer the most if the emphasis of road environmental design remains on motorized traffic (Alvin et al., 2021). This is shown on the roads near schools, where the safety of pedestrians is sometimes put at risk so that other vehicles can pass. Besides that, the type of route also plays a big role in the occurrence of conflict (Akmalia et al., 2021). Aside from all of that, there are also no safety concerns for schoolchildren, such as the use of helmets and reflective clothing, how to ride bicycles and motorbikes safely, and how to use walkways correctly. Also, the way other drivers act when they are near a school can affect how safe it is for kids to be there (Nur Zarifah Harun, 2020).

Based on these scenario, three concerns arise among parents in safeguarding children at school are on the drop-off location for children at school entry, traffic congestion around school, and road safety amenities such as traffic signs and signals around a school (Rothman et al., 2017). Even though the concerns are well-known, there has been little research in Malaysia to ascertain parental concern about the measures. Furthermore, if research is undertaken and data is analyzed, descriptive statistics are used to provide information on the frequency and distribution of road accidents, but they do not provide prioritize insight into the underlying variables that contribute to these incidents. Thus, Analytic Hierarchy Process (AHP) needs to be employed to perform this kind of analysis. It can analyze road safety data in order to assist decision-makers in prioritizing intervention mechanisms that are most effective in reducing the number of accidents. To conduct the study, the following objective have been outlined: (i) to identify the most critical factors that contribute to road safety measures in the school area, such as high traffic volume, speeding, or a lack of pedestrian infrastructure, and (ii) to prioritize potential interventions or solutions for improving road safety based on their relative impact and feasibility using an analytical hierarchy process. The outcome of this study helps to identify the most important factors concerned with the school area.

LITERATURE REVIEW

Road Safety Among School Children

Students in school are safe if they are not injured, in pain, or in danger (Gregory, Cornell, & Fan, 2012). Accidents and injuries on school grounds are no longer a strange concept in any country, including Malaysia. Schools are considered low-risk places, but ironically, accidents, injuries, and deaths still happen to children at school. According to Sivasankar et al. (2016), traffic accidents are the leading cause of death and injury among young people. Commonly, parents' have the most concern for the safety of their children. In addition, road safety emerged as a major issue for all parents, as they may have had bad driving experiences from both passing traffic and school traffic. A study showed that parents claimed that they had witnessed numerous instances of cars failing to stop at pedestrian crossings on their way to school and cars driving down the wrong side of the road to avoid stationary traffic (Nikitas, 2019). To address this issue, the government is committed to improving child safety, particularly in traffic. Aside from providing decent road amenities to its residents, the Malaysian government has taken numerous initiatives to educate both adults and schoolchildren about road safety (MOE, 2023).

Analytic Hierarchy Process

The Analytic Hierarchy Process (AHP) can be used to prioritize actions to be taken in improving road safety at school. It is a structured method for breaking down actions into smaller, more manageable chunks and measuring the relative relevance of the criteria in the decision-making process. It builds a hierarchical model of the road safety concerns, with the top level representing the overall aim, which is the action to be taken, and lower levels representing criteria and sub-criteria. Then, using pairwise comparisons, AHP assigns weights to the criteria based on their relative importance and compares the alternatives based on the criteria. According to Panchal and Shrivastava (2021), AHP has been widely employed in a variety of industries, including business, engineering, and healthcare, to assist decision-makers in making more informed and reasonable choices (Nejad, Mansour, & Karamipour, 2021). Moreover, it has been frequently employed, particularly for complicated challenges with several criteria and highly subjective choice selection (Dewi & Putra, 2021). Figure 1 depicts how the AHP develops goals based on stated criteria in order to make the best judgments (Putra, 2019; cited in Dewi & Putra, 2021). Overall, AHP provides a more thorough and nuanced approach to analyzing data than descriptive statistics alone, allowing decision-makers to make more educated and effective decisions to minimize and improve road safety.

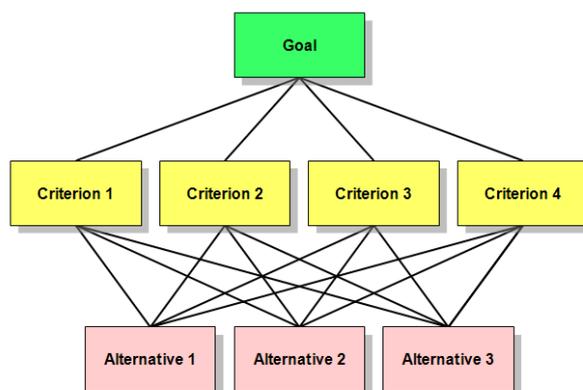


Figure 1: AHP hierarchy of goals, objectives and alternatives.

Exploration of Contributing Criteria for Road Safety at School

The contributing criteria for road safety at school focused in this study are as follows:

Drop-off space for children at the school entry

Pedestrian motor vehicle collisions (PMVC) commonly occur during school drop-off and pick-up times, with on-site parking being identified as a significant risk factor (Rothman et al., 2017; SMR, 2020). La Vigne et al. (2017) also noted that parents dropping off and picking up their children are the primary cause of traffic congestion around schools. The most frequent behaviors that contribute to PMVCs include uncontrolled mid-block crossings, blocked vision from parked cars, and double parking (Rothman et al., 2016). The added congestion during peak travel times in the morning increases safety risks for both students and drivers (Adams et al., 2017). To address these concerns, many schools have implemented drop-off and pick-up procedures that require vehicles to line up and drop off or pick up students at a marked location in front of the school, where an attendant is present. While some argue that such procedures create additional congestion and may not be effective, the potential risks of PMVCs around schools demand immediate attention and action (Rothman et al., 2017). Therefore, a comprehensive approach involving collaboration between schools, parents, and transportation agencies is essential for improving student safety.

Traffic congestion around the school

To ensure children's safety, congestion around schools has been identified as a significant risk factor (Hiep 2020). La Vigne et al. (2017) explained that the crowded streets due to cars during pick-up and drop-off times pose a grave threat to safety. Parents' convenience is often cited as the reason for their behavior,

despite the risks involved. This traffic congestion is a significant issue in Malaysia and other places around the world, affecting students, teachers, parents, residents, and drivers (Mohd Yusoff *et. al*, 2022). Finding solutions to this problem and promoting safer ways for children to get around is crucial for ensuring safety in and around schools.

Facilities relates to Road Safety

The safety of schoolchildren traveling to and from school also depends on the design of the area around the school and the availability of necessary facilities. Narrow streets or those with parking on both sides can lead to congestion and a lack of space for automobiles to manoeuvre (La Vigne *et al.*, 2017). Al-Metwali *et al.* (2019) emphasized the importance of an appropriate environment with adequate road design, geometry, signboards, pathways, and zebra crossing intersections. Poorly timed traffic lights, entry and exit routes, and a lack of temporary parking spots can also contribute to congestion. The planning of new school construction should include the design of pedestrian crossings, speed restrictions, parking, drop-off, and pick-up areas, as well as procedures to ensure children's safe transportation. Improving road infrastructure, promoting road safety education, and enforcing traffic laws could help reduce the number of child-related road traffic accidents (Hiep, 2020).

Related Research

Yannis *et al.* (2020) did a study and used AHP to look at the data to find out what factors affect the severity of pedestrian injuries in cities. The study analysed data from pedestrian accidents in Greece between 2009 and 2015. They found that several factors, including pedestrian age, gender, and behaviour, as well as the type of road and time of day, significantly influence the severity of pedestrian injuries. However, the research was carried out in a specific urban area in Greece and may not be applicable to other cities with different characteristics and road infrastructure. It also relied on police reports, which may not contain accurate information about the factors that contributed to pedestrian injuries. Only a few variables, such as age, gender, and accident location, can influence the severity of pedestrian injuries. Other variables, such as vehicle speed, weather conditions, and pedestrian behaviour, were not considered. The use of a cross-sectional design limits the ability to establish causality between the identified factors and the severity of pedestrian injuries. Li *et al.* (2021) present a comprehensive approach to reducing the subjective influence of expert experience judgment in traditional methods for highway traffic safety evaluation using the analytic hierarchy process, the entropy weight method, and fuzzy mathematics theory. Their work, however, lacks discussion of how these methods were used and their effectiveness in reducing subjectivity in evaluation. The study provides some useful insights into computation but lacks sufficient detail and analysis to fully

evaluate the approach's effectiveness and validity. Nanda and Singh (2018) picked seven accident causes and created a table indicating the number of accidents associated with each factor. They then used AHP to calculate a weight for each factor. They generated a ranking of the states with the highest accident rate using the weighting and the number of accidents. In the case of Keymanesh et al.'s (2017) research, they identified nine factors that contribute to accidents on a single road. They then divided the road into eight sections and identified potential black spots in each. Five experts used AHP to weight the most important factors and the most dangerous potential black spots in each section. The identification and prioritization of black spots were compared to data collected from police accidents. In addition, the Analytic Hierarchy Process (AHP) approach within Multi-criteria Decision Analysis was used for the study's analysis, which revealed accidents involving child falls that can be avoided by creating proper policies and regulations (Yusuf *et. al*, 2021).

MATERIALS AND METHODS

This study of four major activities, which are instrument development, data collection, data analysis using AHP, and finally the outcome, which recommends action be taken based on priority, the flow of activities is illustrated in Figure 2. Data was collected using a questionnaire, and random sampling was applied in selecting 30 respondents, who were parents who came to pick up their children, and they filled in the questions manually. The data collection has been done at a school on the outskirts of Klang that only has one class in the morning. Apart from normal children, there are also 19 visually impaired children in year 1–6 at the school. The questionnaire was divided into five sections. The first section focuses on the demographic information of the respondents.



Figure 2: Flow of activities

Followed by three sections that comprise questions that used Five Likert-scales were used in the questionnaire, ranging from "Strongly Agree" (SA), "Agree" (A), "Disagree" (D), and "Strongly Disagree" (DA). The three sections gathered respondents' concerns about drop-off and pickup points, traffic, and facilities, but the descriptive statistical analysis of the Likert scale construct will not be discussed in this paper. For Section 5, our enumerators guided

respondents to select their road safety concerns in a pairwise manner. The criteria that focused in the analysis are shown in Table 1.

Table 1: The description of criteria.

No.	Criteria	Description
1	<i>Drop off and pick up points (DOP)</i>	<i>School drop off and pick up points are designated areas near schools where parents can safely drop off and pick up their children. These areas are often marked with signs and may have special lanes or parking spaces to facilitate the smooth flow of traffic.</i>
2	<i>Traffic Congestion (TC)</i>	<i>School traffic congestion refers to the high volume of vehicular and pedestrian traffic that occurs around schools during drop off and pick up times. This congestion can be caused by a number of factors, including parents parking illegally or inappropriately, inadequate school infrastructure or facilities, and insufficient planning for the movement of people and vehicles.</i>
3	<i>Road safety facilities (RSF)</i>	<i>Road safety facilities such as crosswalks, speed humps, traffic signs and signals, sidewalks, school zone signs and crossing guards are designed to safeguard children and other vulnerable road users from accidents and injuries on the road by providing safe and regulated traffic flow.</i>

DATA ANALYSIS

Data from Section 5 selected for AHP calculation. An example of its input scale for pairwise matrix is shown in Figure 3 and the multi-level constructed for the AHP analysis is shown in Figure 4.

Criteria	Scale									1	Scale									Criteria
	9	8	7	6	5	4	3	2	1		2	3	4	5	6	7	8	9		
DOP																			TC	
DOP																			RSF	
TC																			RSF	

Figure 3: Input scale for pairwise comparison

The scale as shown in Table 2 is used to compare the importance of each criterion and sub-criterion to one another. For example, if a decision maker wants to compare the importance of two criteria, they would assign one of them a rating on the scale relative to the other. The rating would indicate how much more important one criterion is over the other, with a rating of 1 indicating equal importance, and a rating of 9 indicating extremely strong importance. By using the Scale for Relative Importance, a structured and systematic approach to evaluating and prioritizing criteria and sub-criteria in order to make more informed decisions.

Table 2: Scale for Relative Importance (Source: (Mohammed & Daham, 2021)).

Intensity	Definition of importance	Intensity	Definition of importance
1	Equal	2	Weak
3	Moderate	4	Moderate plus
5	Strong	6	Strong plus
7	Very strong	8	Very, very strong
9	Extreme		

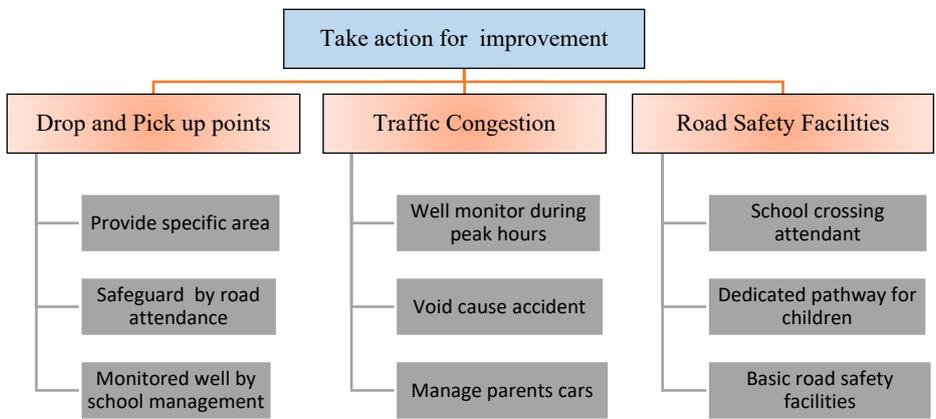


Figure 4: Multi-level analytical structure

To execute the AHP analysis, the following steps have been taken: Step 1: Define decision criteria based on the hierarchy of objectives. A standardized comparison scale for relative importance is shown in Table 2. Step 2: Development of judgment matrices A by pairwise comparisons Step 3: After a judgment matrix is calculated, a priority vector to weight the elements of the matrix is calculated. Step 4: After the generation of the priority vector, inconsistency in pair-wise comparison may occur due to subjective human judgment error. Therefore, it is important to check the consistency of the response through a consistency index (CI) by using the following equation:

$$CI = (\lambda_{max} - n)/(n - 1) \quad (1)$$

Step 5: Finally, the consistency ratio (CR) is calculated as the ratio of the CI and the random consistency index (RCI), which is shown in Table 3.

$$CR = CI/RCI \quad (2)$$

Table 3: Random Consistency Index

Matrix	1	2	3	4	5	6	7	8
RI	0.0	0.0	0.58	0.90	1.12	1.24	1.32	1.41

Repeat steps 3–5 for each criterion to re-evaluate the pairwise comparisons. If the CR value for all the criteria is less than 0.10, the process is absolutely consistent as long as the weight is acceptable. By using the same prioritization method, the local weights of sub criteria are calculated as in Figure 5.

Decision Hierarchy			
Level 0	Level 1	Level 2	Glb Prio.
Action for improvement	Drop and Pick up points 0.073	Specific area 0.692	5.1%
		Road attendant 0.077	0.6%
		Monitored well 0.231	1.7%
	Traffic Congestion 0.727	Peak hour management 0.455	33.0%
		Accident prevention 0.091	6.6%
		Manage parents car 0.455	33.0%
	Road Safety Facilities 0.200	Crossing attendant 0.405	8.1%
		pathway 0.481	9.6%
		Basic RS facilities 0.114	2.3%
			1.0

Figure 5. Results from Judgment Matrices of Sub-Criteria

RESULT AND DISCUSSION

The outcome is shown in Figure 6 as it depicts that there is a significant pattern in parents’ concerns where 33% indicated that peak hour management to oversees public vehicles passing by and around the school. The usage of cars by parents with small children exacerbates the problem of excessive traffic volume (Shamsul Harumain *et. al*, 2022). The other concerns which is 33% are concern on oversees and management of parents car which considered as equally critical. The other concerns are on the children's pathway. To mitigate school traffic congestion, many schools have implemented a variety of measures, such as designated drop-off and pick-up areas, staggered start and end times, and encouraging parents to use alternate forms of transportation, such as walking or biking. Local governments and transportation authorities may also work with schools to improve traffic flow and safety around schools by calming traffic and making infrastructure improvements. It can also cause delays and frustration for parents, students, and other commuters who may be passing through the area. Another concern is on the road safety facilities, where it's important to help safeguard

children and other vulnerable road users. It is important for both drivers and pedestrians to be aware of and follow these safety measures in order to promote safe and responsible use of the roadways at school.

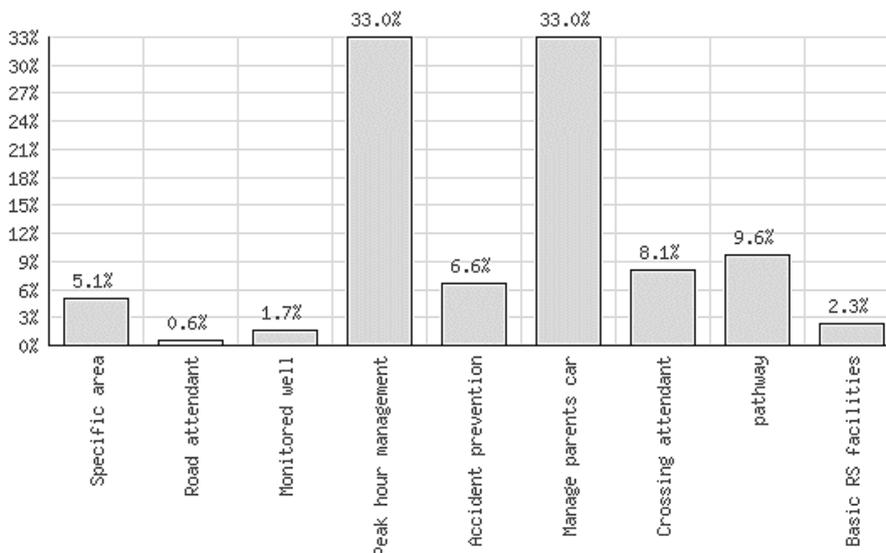


Figure 6: Results from the analysis

The areas of least concern are at the drop-off and pick-up points, where the space is normally set by the school. Even if the space is provided, but it still requires parents to be aware of and follow the rules and procedures at these points.

CONCLUSION

This study analyses road safety concerns among parents at a school on the outskirts of town where most of the parents are from low-income families (B40). The parents are also those who have visually impaired children in grades 1-6 at the school. The significant outcome has been obtained from the analysis, where peak hour management that involves public cars around the school areas and effective management of parent vehicles are equally to be considered the most critical. The other concerns are on the children's pathway, which is insignificant but helps the visually impaired children. Overall, AHP managed to help produce an outcome that could help schools and responsible bodies identify the most important action to be taken.

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Received: 24th Jan 2023. Accepted: 20th July 2023



PLANNING MALAYSIA:

Journal of the Malaysian Institute of Planners

VOLUME 21 ISSUE 4 (2023), Page 126 – 138

ELV POLICY IMPLEMENTATION AS A SOLUTION TO ABANDONED VEHICLES PROBLEMS FACED BY LOCAL AUTHORITY IN MALAYSIA

Siti Sarah Sulaiman¹, Noorazrein Noorazlan Ong², S. Sarifah Radiah Shariff³

¹*Faculty of Law,*

UNIVERSITI TEKNOLOGI MARA

²*Legal Unit,*

MAJLIS BANDARAYA PULAU PINANG (MBPP)

³*Malaysia Institute of Transport (MITRANS),*

UNIVERSITI TEKNOLOGI MARA

Abstract

End of Life Vehicle (ELV) is a vehicle that has reached the end of its service life due to the age or condition of the vehicle itself that is no longer roadworthy. Several countries namely EU countries, Japan, Taiwan and South Korea have their own law and policy being implemented to deal with the disposal of ELV through recycling system management which includes the process to de-register, dismantling, depollution and recycling. However, since Malaysia do not implement such policy, the old and unused vehicles are just being abandoned by the roadsides and also housing area. Eventually, it will become a nuisance and eye sore to the public as well as impacting the environment and quality of life. The objective of this study is to examine the legislations and procedures adopted by the local authorities in dealing with these abandoned vehicles, to identify the challenges and to find solution in solving this abandoned vehicles issues. This research employed a qualitative methodology by analysing available legislations, conducting interviews with the enforcement officers from the selected local authorities. References to other jurisdictions were also made to learn a lessons from their practices. At the end of the research, it was found out that the current procedures being enforced through the limited powers given under existing provisions are unable to solve the increasing number of abandoned vehicles. Therefore, this research proposed law and policy to regulate End-of-Life Vehicles and amending the Street and Drainage Building Act 1974 to give absolute power to Local Authority to deregister the abandoned vehicles.

Keywords: Abandoned vehicles, ELV, Local Authority, Policy

¹ Senior Lecturer. Email: siti_sarah@uitm.edu.my

INTRODUCTION

The roles and function of the local authorities as the third-tier government is to provide and maintain vital services in relation to housing and planning, waste collection, traffic, and community development (Maidin & Mobarak Ali, 2009). This role also covers the cleanliness and peaceful surrounding in the residential area and the roadsides. One of the major problems the public faces are abandoned cars left parked on the roadside or in the residential area for a very long time. This has caused nuisance and is an eye sore to the public for letting the abandoned car be left in derelict condition. Before 2000, the ownership of private vehicles such as cars was still low compared to nowadays, whereby each family owns at least two cars or more. It has become a basic necessity for everyone to move around, as the reliability of public transportation is still low. However, due to the high demand for cars, the production of new cars has been widely increasing, and this caused the increasing numbers of old and abandoned unused cars too. Society tends to keep the old car rather than sell it or dispose of it for various reasons such as sentimental value, not worth for the selling value, or for the sake of just keeping it.

In addition to that, Malaysia is one of the countries that does not implement the policy of End-of Life Vehicle (ELV) as part of the measure to dispose of and recycle old and unused cars or derelict cars due to damage and no longer roadworthiness. Vehicle owners are not obliged to voluntarily de-register their vehicle and send it either to be disposed of or recycled for a proper discard procedure. The absence of legislation on the ELV policy by the government had resulted in old, and end-of-life vehicles were not managed properly. These derelict cars could also give rise to dengue outbreaks when the windows on the vehicles are broken and left open, allowing water to get into the car during the rainy season (The Star,2013).

There is a limitation to the power of the local authorities in taking action against abandoned vehicles. Under the existing law adopted by the local authorities, Section 46 of the Street, Drainage and Building Act 1974 (SDBA 1974) provides that the local authority may remove derelict and abandoned cars that have caused obstruction in public places. On the other hand, Section 48 of the Road Transport Act 1987 provides the right of way to remove vehicles from the road, however, this empowerment given under these two Acts is limited. Currently, the Standard Operating Procedure (SOP) carried out by all the local authorities in Malaysia is just to tow or remove the car, which causes obstruction on the roadside and bring it to the depot. A notice will be sent to the owner of the registered vehicle giving them seven days to claim their car. However, if the vehicles are not claimed by the owners, a second notice will be sent to them, giving another 30 days to collect the vehicles, or the unclaimed cars will be disposed of. However, in reality, the disposal of abandoned cars does not happen,

as the provisions in the Acts do not give the power to de-register or revoke the ownership and vest it under the Mayor of the council before the vehicles can be scrapped or auctioned. Failure to deregister the ownership from the grant and subsequently auction or any other ways to deal with the vehicles is an infringement of fundamental liberty under Article 13 of the Federal Constitution as no person shall be deprived of his property save in accordance with the law.

The weaknesses of the available law relating to abandoned cars are due to the reason that there is no power given to the local authority to de-register the car. This research contributes to the body of knowledge in the area of public authority law in Malaysia. Most of the time, researcher only focus on the significant and the needs for Malaysia to implement the End-of-Life Vehicles. However, no article or research being conducted to discuss about the legal issues and challenges in eliminating abandoned car. Consequence of non-availability of such law results into more ELV and old unused vehicles being abandoned as there is no regulation to control and monitor this type of vehicles. Furthermore, there has not been much research done in the aspect of the local authorities' power in enforcing the regulations on the street, especially in respect of obstruction due to abandoned being left on the street. Even though the local authorities have been empowered to remove or tow away vehicles that cause obstruction on the street by the amendment of Section 48 Road Transport Act in 2011 and to remove derelict cars under the Street, drainage and building Act 1974, but there has been gap in the law where problems start to arise beginning in the late 2013 and still occurring till to date.

RESEARCH METHODOLOGY

The initial stage of preparing the research framework is done by library- research method to identify the legal issues and challenges in disposing abandoned cars. Primary data for this research were obtained by analysing relevant legislations namely Street, Drainage and Building Act 1974 (SDBA 1973) and Road Transport Act 1987 (RTA 1987). The provisions in these acts were analysed to understand further the local authority's role in disposing abandoned car in the local authority's jurisdiction. Secondary sources including textbooks, scholarly articles in the various journals, magazines, and newspaper reports were also utilized to give better understanding and provide perspective on the current position and situation in Malaysia. As a result, the procedures and legal framework from Japan were referred to. This has helped to recommend the amendment and improve the procedures in disposing abandoned cars. In validating the data and information obtained through literature review and analysis of legislations, interviews were conducted with enforcement officers from selected local authorities (Suaree et al., 2022). The interview was aimed at obtaining feedback on the issues and challenges faced by the local authority at

present. The interview was conducted after receiving the approval letter from the UiTM Law Research Ethics Committee dated 25th May 2022. Among the questions asked are the statistic number of abandoned vehicles removed by the local authority, the current procedures carried out in disposing abandoned vehicles, their opinions on the causes the vehicles being abandoned and their recommendation on how to solve this problem.

ANALYSIS AND DISCUSSION

Laws governing abandoned vehicles in Malaysia

It has been mentioned clearly that Malaysia do not implement ELV policy. The available laws in dealing with abandoned vehicles are the Street Drainage and Building Act 1974 [Act 133] (SDBA 1974) and the Road Transport Act 1987 [Act 333] (RTA 1987). Malaysia is one of the largest South East Asia countries producing its national car but does not have specific regulations on the disposal of derelict vehicles or vehicles that have reached a certain age period, which is called as End- of Life Vehicles (ELV). Malaysia also did not implement the End-of-Life policy like other developed countries, where certain ages of vehicles should be disposed of by the owner and sent for dismantling and recycling. For that reason, the local authorities in Malaysia must use the existing provisions of the law to resolve the issue of vehicles being abandoned on the roadsides or in the parking lots owned by the City Council or on private property such as in residential areas. It should be noted that, any matters or occurrences in a public place such as the street will be governed by SDBA 1974. The local authority being the third-tier government in the country, is often referred to by the public regarding any complaints involving nuisance or matters involving public safety and health.

In carrying out its duty, the local authority is given the power to remove obstruction under section 46(3) of the SDBA 1974. The section provides that: (a) The local authority may cause any such obstruction to be removed or may itself, through its servants remove the same to a suitable place, there to remain at the risk of the owner or person offending and may detain the same until the expenses of removal and detention are paid. (b) The local authority shall certify such expenses to the owner or the person offending, and the certificate of the local authority shall be conclusive proof of the sum due. (c) Such sum shall be recoverable in the manner hereinafter provided. Under this provision of law, subsection (1) (e) and (g) are the most appropriate provisions to solve the problem of abandoned cars in public places. As for Section 46 (1) (e), this provision is more specific because the word "derelict vehicles or any part thereof" indicates that this provision is to remove obsolete or old vehicles parked in public places. This means whichever vehicle is found to have been derelict and it is parked or left in a public place, it is an offence of obstacles under this Act.

In addition, Section 46(1) (g) of the SDBA 1974 provides that “a vehicle parked on a footway is also an obstacle.” Although this provision is more general and not specific to obsolete, old or abandoned vehicles, but this provision can also be used if the owner only leaves their vehicle that is no longer used on the footway, which indirectly obstructs public access on the footway. For both of these provisions, any vehicle found to be obstruction at public place is an offence that the local authority can enforce under this Act. If any person is found guilty under these provisions, he can be arrested or prosecuted in court and if found guilty, may be imposed a fine of not exceeding RM500 and in case of repeated offences, may be imposed a fine not exceeding one thousand ringgit. However, bringing the case to court and fine alone will not solve the problem of the vehicles being abandoned in the public place if there is no owner to claim responsibility for the act of abandoning the vehicle in public places. Therefore, this provision also empowers the local authority to remove the obstacles of abandoned, derelict vehicles parked or left on any public place to a more appropriate and suitable location. Despite that, this provision only ceases to that extent and there is no provision detailing of how the removed abandoned cars should be disposed of if the owner does not claim it after the stipulated time. Therefore, reference will be made to section 116 of the same Act concerning action that local authorities can take regarding vehicles that have been removed or towed away as consequences of causing an obstruction. Section 116 of the SDBA 1974 is a provision used by the local authority to carry out the process of disposing of abandoned vehicles that have been left in public places and have been removed or towed away by the local authority, but the main issue is the owner does not reclaim the vehicle after notice has been served.

In another aspect, any vehicle that needs to be disposed of must go through the process of deregistration first with the road transport department to remove the ownership of the previous owner and be vested under the new owner, that is, the local authority. Otherwise, it is considered as violation of a person's liberty under Article 13 of the Federal Constitution. Under article 13 of the Federal Constitution, no person shall be deprived of property saved in accordance with the law. The process of disposing of a vehicle without de-registering the name of the previous registered owner on the grant would leave the numbers in the Road Transport Department's record to continue to increase. Therefore, the implementation of de-registration should be carried out first before the abandoned vehicle can be disposed of.

In summary, the enforcement action will be carried out by removing or towing away the abandoned vehicle through the record of complaints received from the general public. An investigation will be made with the police as to determine whether that particular vehicle has any criminal records. The vehicle will be handed over to the police if there is any. The local authority also needs to

check with the Chemistry Department on the engine identification by an expert in the Chemistry Department. Then, the local authority has to serve an administrative notice to the owner of the abandoned vehicle to claim the vehicle within 14 days. If no claim is made, the local authority may obtain an order from the Asset Disposal Committee Meeting either to sell through public auction or dispose of within seven days. The local authority also needs to obtain consent to prosecute from the Deputy Public Prosecutor's office and order from the Court to remove the ownership of the registered owner. After obtaining the order, the local authority must apply from the Road Transport Department to transfer ownership and vehicle registration rights.

One of the issues faced by local authorities regarding abandoned vehicles that are not claimed and wanted to be disposed of is the de-register procedures. For countries with specific legislation on the disposal of these ELV vehicles, owners voluntarily transfer their ownership before the vehicles are disposed of. This will remove the previous owner's name from the record of together with the skeleton of the car will be discarded altogether. However, since there is no such regulation in Malaysia to require vehicle owners to dispose of their vehicles voluntarily, such as the ELV policy and there is no action towards owners who refuse to reclaim their vehicles which the local authority has removed, this makes it difficult for the local authority to dispose of the vehicles without de-register the ownership of the vehicles. In spite of the fact that it is stated in the guidelines that deregistration can be made through a court order, but in reality, the process of removing the name of the owner is not easy and local authorities are not carrying out the procedure in Malaysia for various factors. Based on respondent feedback among local council enforcers, the factors include the complexity of preparing a complete investigation paper, the missing of the engine or chassis number and the time consuming of obtaining the court order. The complex process to de-register the ownership also received attention from the Minister of Transportation, where all local authorities throughout Malaysia faced the same problem of removing the name of the vehicle owner and to the vested under the local authority before it can be disposed of. Acknowledging the major problems faced by all local authorities in Malaysia (Nawi et al., 2020), an amendment was made by the Ministry of Transportation in 2018 under Section 66(nn) of the RTA 1987 [Act 333] to facilitate local authorities to remove the name of the vehicle owner. Prior to the amendment, Section 66(nn) states that "the Minister may make rules to regulate the deregistration of motor vehicles that are not roadworthy of repair due to serious accidents, old age or other causes". However, after the amendment in the year 2018, Section 66 (nn) states that, "The Minister may make rules to regulate the de-registration of motor vehicles". This amendment is made to empower the transport minister to set a specific and detailed procedure in regards to the cancellation of the registration of abandoned

vehicles for a reasonable purpose. The Transport Minister, Anthony Loke Siew Fook reportedly said that the amendment to the Act would enable local councils to remove abandoned vehicles within their jurisdiction. However, regrettably, no such rules are made by the Transport Ministry or the Road Transport Department until the present day. This bureaucratic process of deregistering the ownership of the abandoned vehicles will cause difficulties to the local authority to dispose of the abandoned vehicles promptly. In this regard, the RTA 1987, is another legislation which give power to authorities to take action against the abandoned vehicles. Amendment was made in 2008 whereby the provisions under Section 48 were amended to include subsection (2) to subsection (8) to the existing provision. This amendment includes enforcement actions that can be taken against motor vehicles that remain at rest on any road that causes danger, obstruction or undue inconvenience to other road users and traffic. Actions that can be taken include clamping or removing the vehicle to an appropriate location. This empowerment is also extended to other authorities, including to local authorities as provided under subsection (8).

There are two enforcement actions that can be taken against motor vehicle which is left abandoned on any road and caused cause danger, obstruction or undue inconvenience to other road users or to traffic by the appropriate authorities. The appropriate authorities here is defined under Section 67 of the RTA 1987, and it includes police officer, road transport officer or any appropriate authority, including local authorities. These appropriate authorities may clamp the wheel of the motor vehicle or remove or cause to be removed the motor vehicle to any other road or some other location. The implementation of these actions will depend on whether the obstacle caused by the vehicle is a temporary obstacle or a permanent obstacle. If the vehicle is left at the roadsides only temporarily and it does not cause traffic jams, then the enforcer may use the option to clamp the vehicle. However, if the vehicle left on the roadsides causes obstruction and severe traffic congestion, or danger to other road users, then the enforcer may tow or remove away the vehicle to s suitable location. The same rules apply to vehicles that have been clamped for more than four hours from the time of notice that the car has been clamped, if the owner fails to appear and request the release of the vehicle, and if no claim is received within that period, then the motor vehicle may be moved to the appropriate location by the authorities. As mentioned earlier, section 48 of the RTA 1987 only authorises the forfeiture of the ownership to be vested under the name of Director General of Road Transport Department. This provision does not authorise the conversion or forfeiture of the ownership of the vehicle to be vested into the name of the Mayor of the respective local authority. The missing gap here is that the Road Transport Department does not have a mechanism to accept vehicles towed by the local authority and the ownership can only be forfeited to the Director General of the

Ministry of Transport Malaysia. This provision also does not have a complete process on how the removed vehicles are to be discarded. This section is silent on the process of discarding the motor vehicle after the ownership of the vehicle has been vested under the Director General’s name. Although the motor vehicle can be auctioned to the public, but if the vehicle is under the category of obsolete and can no longer be used due to the condition of the vehicle or the high age of the vehicle, the vehicle still needs to go through the automotive waste disposal process in accordance with the standards set by the Ministry of Environment. However, the reality now is that all vehicles removed under section 48 of the RTA 1987 have never been referred to the Road Transport Department due to the lack of SOP and as a result, the numbers of abandoned cars dumped at the depot keep increasing as they are no solutions on the disposal of these vehicles removed under this provision. Table 1 and Table 2 highlight the numbers of unclaimed vehicles which contributed to the massive number of abandoned vehicles in Pulau Pinang and Kuala Lumpur respectively. If these vehicles are not de-register, dismantle or recycle, it will give adverse impact to the environment. Therefore, ELV policy should be implemented in Malaysia following the practices in another jurisdictions.

Table 1: Enforcement on abandoned vehicles: Pulau Pinang City Council

Month (2021)	Number of cars (Towed)	Number of cars (Claimed by owner)	Number of cars (Claimed by RMP)	Number of cars (Unclaimed)
Jan	47	25	-	22
Feb	39	20	-	19
Mac	37	16	-	21
April	21	6	-	15
May	16	9	-	7
June	18	5	-	13
July	12	7	-	5
August	19	9	1	9
September	29	17	-	12
October	30	10	-	20
November	14	8	-	6
December	12	6	-	6
Total	294	138	1	155

Source: Enforcement Department, Pulau Pinang City Council

Table 2: Enforcement on abandoned vehicles: Kuala Lumpur City Council

Month (2021)	Numbers of cars towed	Numbers of claimed vehicles (owner)	Numbers of claimed vehicles (police case)	Numbers of unclaimed vehicles
Jan	118	19	1	98
Feb	62	13	1	48
Mac	107	23	1	83
April	154	28	3	123
May	102	16	1	85
June	97	3	0	94
July	68	10	0	58
August	100	23	2	75
September	73	23	4	46
October	60	25	4	31
November	29	15	6	8
December	50	16	0	34
Total	1020	214	23	783

Source: Enforcement Department, Kuala Lumpur City Council

Laws in another jurisdiction

In order to reduce waste originating from the automotive industries mainly from the ELVs, as well as to solve other problems such as abandoned cars by owners, illegal dumping of scrap metal cars and lack of final disposal site, there are countries which have taken a bold action to introduce laws, policies, directives and guidelines to regulate the management activities of vehicles that have reached the age of ELV or are no longer used by vehicle owners. As these countries also have their laws to manage these ELV vehicles, abandoned car is no longer a problem and does not arise in these countries as when a vehicle has reached a certain age and limit or can no longer be used, owners or manufacturers are obliged to be disposed of under the introduced law. Therefore, laws and directives used by other countries to manage ELV vehicles and how these laws can solve the problem of obsolete and abandoned vehicles and also to manage automotive waste disposal according to procedures that are in accordance with environmental sustainability and also economically feasible should be referred to. In this regard, a reference is made to law in Japan.

In Japan, the law that governs the ELV is the Law on Recycling of End-of-Life Vehicles or ELV Recycling Law. It was first promoted to the Japanese on 12 July 2002 and gradually enforced beginning of January 2003. The law fully came into force on 2005 with an estimated value of 5 million number of ELVs to be collected and recycled under this law (Ahmad et. al., 2014). The provisions of the law and the obligations is presented in Table 3.

Table 3: The Law on Recycling of End-of-Life Vehicles

Article	Responsible party	Obligations
Article 3	Obligations of Vehicle Manufacturers	<p>(1) Vehicles Manufacturers, etc., shall promote long-term use of Vehicles, facilitate the Recycling, etc. of End-of-Life Vehicles and endeavour to reduce the expenses required for the Recycling, etc. of End-of-Life Vehicles by devising the design of Vehicles and parts thereof or types of raw materials.</p> <p>(2) Vehicle Manufacturers, etc. shall take into account the importance of the role they play in the implementation of the Recycling, etc. of End-of-Life Vehicles to provide the implementation appropriately and smoothly, and adequately provide information regarding the structure of Vehicles they Manufacture, etc. as well as parts and raw materials used to Related Business Operators, and endeavour to cooperate as necessary to implement Recycling, etc. of End-of Life Vehicles</p>
Article 4	Obligations of Related Business Operators)	<p>(1) The Related Business Operators shall endeavour to improve their knowledge and competence relating to the Recycling of End-of-Life Vehicles to properly dispose of the waste pertaining to the End-of-Life Vehicles and to ensure that the resources are used effectively by implementing Recycling of End-of-Life Vehicles properly and smoothly.</p> <p>(2) Collection Operators shall work in concert with the Vehicle Manufacturers, etc. to ensure that the Vehicle owners are thoroughly familiar with the fees for Recycling, etc. of Vehicles and other matters and shall endeavour such that the delivery of the End-of-Life Vehicles by the owners of the Vehicles is carried out smoothly.</p>
Article 5	Obligations of Vehicle Owners	Vehicle owners shall endeavour so as to prevent vehicles from becoming End-of-Live Vehicles by using the vehicle for as long a period as possible, and endeavour to promote Recycling, etc. of End-of-Life Vehicles by selecting a Vehicle manufactured taking into account the implementation of Recycling, etc. when they purchase a vehicle and using goods obtained from Recycling of End-of-Life Vehicles or goods using them
Article 6	Obligations of the State	<p>(1) The State shall endeavour to promote research and development relating to Recycling, etc., of End-of-Life Vehicles, disseminate the results, and take other necessary measures.</p> <p>(2) The State shall endeavour to appropriately provide expenses required for Recycling, etc. of End-of-Life Vehicles, to provide resources in an amount which can be effectively utilised in Recycling, and other information required for Recycling, etc. End-of-Life Vehicles to promote the delivery of End-of-Life Vehicles by the</p>

Article	Responsible party	Obligations
		Vehicle owners as well as implement Recycling by Related Business Operators in a proper and smooth manner. (3) The State shall, through educational and publicity activities, endeavour to increase the public understanding of the Recycling, etc. of End-of-Life Vehicles and to ask for public cooperation to implement such activities.
Article 7	Obligations of Local Governments	Local governments shall endeavour to take the measures required to promote Recycling, etc. of End-of-Life Vehicles according to local circumstances
Article 8	Obligation to Deliver End-of-Life Vehicles	When a vehicle has become an End-of-Life Vehicle, the vehicle owner shall deliver the End-of-Life Vehicle to a Collection Operator.

Source: Act on Recycling, etc. of End-of-Life Vehicles (Act No. 87 of July 12, 2002)

Accordingly, Article 5 provides the obligations towards the vehicle owner to ensure that they prevent their vehicle from being ELV and not abandoned but instead send the end-of-life vehicles for recycling. Apart from stating the obligation of the economic operators and vehicle owners, this law also imposed the responsibilities of the States and Local Government to promote recycling and to provide the necessities in order to implement the recycling of end-of-life vehicles.

CONCLUSION

The main problem causing obsolete and old unused vehicles left abandoned because there is no regulation or law governing the vehicles that have reached the age limit or that can no longer be used due to damage or are no longer desired by the owner and also known as end-of-life vehicles. The lack of a law that compels certain parties such as the vehicle owner himself, to be responsible for disposing of their end-of-life vehicles resulted in them being taken for granted or less accountable for their own vehicles. Besides that, without any legislation governing these end-of-life vehicles, the government also has no control over how these vehicles are discarded and disposed of. Although the local authority is currently taking action in removing the abandoned vehicles with their existing standard operating procedure (SOP), their process is limited until they dispose of the vehicles as scrap metals to scrap dealers and operators. There is no regulation on how these operators dismantle, discard and dispose of the scrap metals. Without intervention or regulation governing how these vehicles are being disposed of, it may cause automotive waste not to be discarded in an environmentally friendly manner. Scrap dealers and operators are only interested in taking parts and components with economic value, and other parts hazardous to the environment may not be disposed of properly. Apparently, this will contribute to environmental pollution in the long term if there is a measure to

control and regulate these activities. Therefore, it is suggested that the ELV policy be implemented. The government can impose obligations and responsibilities to parties that need to dispose of the vehicle. The model provision in Japan can be as sample of reference by the government in introducing the law suitable to Malaysia. In doing so, few amendments can be made to the relevant provisions.

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ELV Policy Implementation as a Solution to Abandoned Vehicles Problems Faced by Local Planning Authority in Malaysia

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Received: 24th Jan 2023. Accepted: 20th July 2023



PLANNING MALAYSIA:

Journal of the Malaysian Institute of Planners

VOLUME 21 ISSUE 4 (2023), Page 139 – 151

FEMALE USERS AND LEVEL OF SAFETY AT LIGHT RAIL TRANSIT STATION, PETALING JAYA, SELANGOR

**Zaharah Mohd Yusoff^{1,2*}, Farah H M Yusak², Nor Aizam Adnan²
S. Sarifah Radiah Shariff^{1,3}, Nur Farizan Tarudin^{1,4}, Gde Ngurah Purnama Jaya⁵**

¹*Malaysia Institute of Transportation (MITRANS), UiTM, Malaysia*

²*College of Built Environment (CBE), UiTM, Malaysia*

³*College of Computing, Informatics and Media, UiTM, Malaysia*

⁴*Faculty of Business and Management, UiTM, Malaysia*

⁵*Faculty of Engineering Pakuan University Bogor, Indonesia*

Abstract

Public transportation is an important way of moving people or goods from one point to another point of destination. Light Rail Transit (LRT), Monorail, taxis and buses are currently a good choice for people, especially those who work at the city centre. Lately, the light rail transit was seen to be preferable by all, especially in the area with heavy traffic congestions. The increased number of vehicles heading to the city centre day by day causes the delay in traffic movement on the road. This can easily be seen especially in the morning when people are mobile to work and at the evening time after the working hour. Choosing the public transportation as LRT has helped much in reducing the congestions in many roads to the city centre. Apart from the intention to ensure the minimum road congestion, the other concern is the safety parameter. The safety level among the passengers must also become a priority matter especially for female users. Nowadays, the female users were seen to become more aggressive using the LRT to work, shopping, travelling short distances or for weekend sight-seeing. This is a good sign in the transportation sector as people had noticed that using the LRT would help to reduce mileage, cost, reduce stress, and promote a healthy lifestyle. This research will investigate the safety level among female users in using the LRT in selected destinations and to identify the unsafe location along the walking trails from or to LRT station.

Keywords: Female users; Light Rail Transit (LRT); Level of Safety; Location

¹ Associate Professor at Universiti Teknologi MARA: zmy1208@uitm.edu.my

INTRODUCTION

The light rail transit (LRT) is a common city rail transit track in develop countries, and it can be constructed in a variety of configurations. Based on some international practices, the train sub-surface tracks are normally located below the road level, and usually aligned with the road pattern. Practices at overseas shows that some independent alignment tracks were seen to have a design that followed under the building constructions, parks, water bodies, or other railways. Many aerial pathways aligned with the pattern of the road. LRT stations in some countries have easy ground level platforms where travellers can securely board and underground stations can be securely served as electric railcars emit dangerous fumes into the environment The design seems applied differently in Malaysia, where the train tracks were built at the independent land surface and were built in far distance from the major road. Some latest designs are to be found above the road level and aligned with the road pattern.

The main concern by the LRT passengers in all places, are the level of safety. Safety is a vital element that has always been highlighted in the research involving spaces. Previous research showed that female users are more worrying compared to male (Shamsul, 2019). Living in the urban areas have urged the public to choose the LRT and the percentage of female users using this public transport is growing. However, the number of female users potentially becoming the victims of crime are also increased. The hot spot crime near the area of transit rail is somewhat unpredictable. Based on a previous study by Siti and Aldrin (2011), the correlation between fear of crime (FOC) and gender was seen as significant even though the crime itself does not directly reflect the transport-related crime. Traditionally a high crime occurrence subscribes to the belief that the higher the crime rate in an area, the higher the chances of becoming a victim of crime in that area.

The transit system uses various methods to improve the safety of transit vehicles, including the use of surveillance cameras. The impression of poor infrastructure around the LRTs station, especially footpaths, poor designs and bus stop maintenance, inadequate security measures throughout the journey may risk female movement into the risk of criminal violence (Howie, 2000). Safety parameters specifically for female users in the Light Rail Transit should be discussed seriously, as cases involving them were often reported while using the public transportation. Special coach for female users may become part of safety indicators in the overall journey using the LRT, but this should extend to the time that they are walking from or to the LRT station. Bullied, robbed and sexual harassment are the most unwanted scene to happen while in a journey using the public transportation. Sexual harassment and other forms of sexual violence in public space could happen everywhere or even in LRT coach.

FEMALE USERS AND SAFETY CONCERNS AT LIGHT RAIL TRANSIT

Safety is a big deal for a traveller where it begins from the starting point of their home, travels out to certain destinations until they are safely back home. The moment they are away, the risk of being victims seems to exist. Normally the violence towards female users is quite higher than the male users. Sexual harassment and other forms of sexual violence in public space are daily occurrences and become threatened to females. It can be happening anywhere on the street, in and around public transport, schools and workplaces, in public sanitation facilities, parks and many more. Specific awareness and information campaigns on trains, on platforms or at stations aiming to inform passengers that in the event of sexual harassment they may call certain phone numbers or use certain applications to seek help. This is also applied in Malaysia public transport too. The goal is to raise public awareness on the topic and increase civic courage.

In some countries the train company proposes separate female trainees on long-haul trains. Malaysia is seen to apply the same rules too and it is extended to the light rail transit. The safety of the females was not only to stop that privilege on the couch, but it has to be extended to ensure that they are safe to walk out from the LRT no matter day or night time.

AIM AND OBJECTIVES

The aim of this research is to explore the level of safety among female users at the Light Rail Transit (LRTs) in selected stop-stations of Petaling District, Selangor. Two objectives were laid out to support the aim, that are:

- i) To study the perceptions of female users towards safety feelings.
- ii) To analyse the level of safety among the female users at night-time.

THE STUDY AREA

The study area covers the light rail transit of Kelana Jaya stations in the Latitude 3 ° 6'45.24 "N and Longitude 101 ° 36'13.09" E by Google Earth. Figure 1 shows the routes of the Light Rail Transit transport flow at Kelana Jaya area.

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 Female Users and Level of Safety at Light Rail Transit Station, Petaling Jaya, Selangor



Figure 1: Light Rail Transit
 (LRT Corp, 2017, Source: Google)

RESEARCH METHODOLOGY

This study comprises 4 phases that start with the initial study, followed with the data collection, the data processing and analysis, and finally the research findings. The core of this research is to check on the security and the safety level of the LRT users. The selected area is within the Kelana Jaya Light Rail Transit (LRT) station. The base map from the open street map is used to indicate the LRT transport route. This research uses the physical interview session around the LRT station. The questionnaire via google form was also used to get the number of feedback from the online respondents. Figure 2 shows the research methodology flowchart.

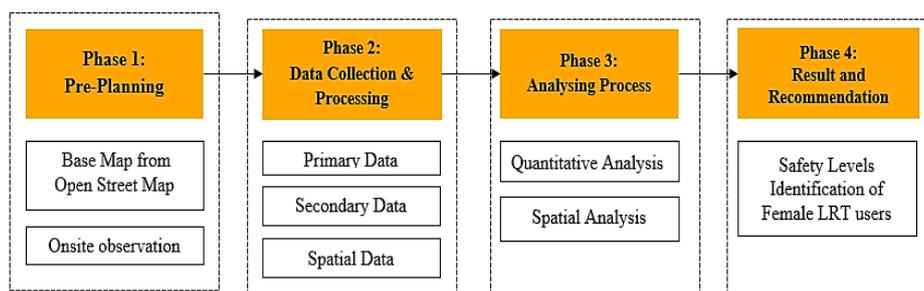


Figure 2: Research Methodology Flowchart

RESEARCH FINDINGS

The benefits of light rail transit as optional public transport can be based on the user's perception towards their satisfaction when using the rail transit. Roughly 8 out of 10 rail passengers are satisfied with the ease of buying tickets at the train terminal, especially with the provision of information about the schedules and platform. A similar result was found for the rail passengers' satisfaction with 77% were confident with the security at the rail station. While 4 from 10 rail passengers are very satisfied with the facilities of public parking space. Besides from the respondents' satisfaction in using the rail transit and its facilities have shown some issues that there are people complain about their dissatisfaction with the quality of facilities and services like toilets, shop, café in train stations and somewhat larger proportion of passengers (36%) were dissatisfied with the cleanliness and maintenance of station facilities.

Light Rail Transit in Daily Life Activity by Female Users

This analysis is to study the range of female users that use the Light Rail Transit (LRT) in daily life activity. Based on Figure 3, the major percentage of female users using the LRT is led by the Malays (43.3%), Indian (30%) and followed by Chinese (26.7%). From the interviews, female students become dominant in using the LRT to school, leading to 47%, while working females with 43% and the rest percentage is coming from the females who are not working. The study also found that the percentage by location is higher from Petaling Jaya, Shah Alam, Kuala Lumpur and Subang Jaya. These areas are in the buffer location of public and private higher institutions and so as the focus location of many offices that are also known as the place with higher traffic jams. Therefore, the choice of using the LRT is very much appreciated by these female users. In this research, the focused group would be the female worker as the idea is to look at their attitude in using the LRT at day and night-time with consistency of travelling time. The safety criteria for female workers who back home late from the office were the target group in this research.

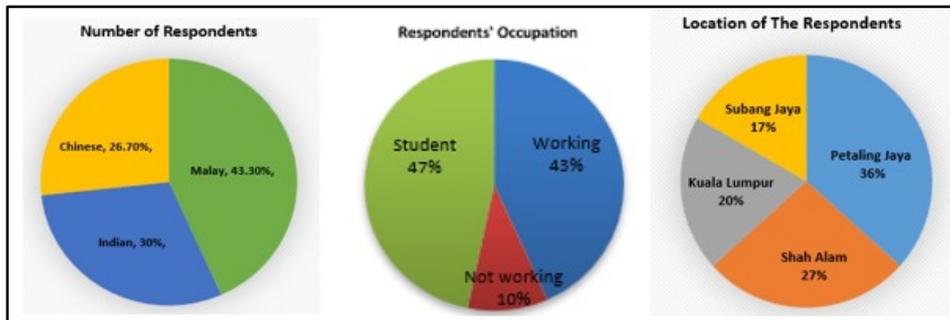


Figure 3: The respondents' background

Female User Experience in using the LRT at Daytime.

This analysis is to study the experience of a female user who is found to come from a far distance area and had to use both bus and LRT services. Figure.4 shows the sample of respondents walking to the bus stop from section 19 Shah Alam. The distance of the respondent's house is far away from the main connection to public transportation. Based on the image, it is shown that the respondent walks from her house to the bus stop to get a bus to arrive at the nearest LRT station. The time taken for the respondent to walk to the bus stop was around 10 minutes with the distance of 400m from her house. The respondent spent time walking to the bus stop and had to spend almost 20 minutes waiting for a bus, then continue using the LRT to reach her office. Figure 5 shows the overall journey from respondent's house to workplace that she had to go through every day. In response to this travelling pattern and respondent's behaviour, the awareness in selecting a suitable place to live should have become the most priority concerned to all working people who choose to use public transport to the workplace.

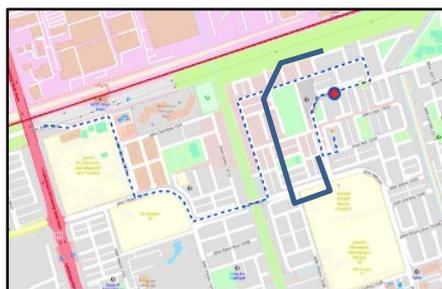


Figure 4: Walking distance to the bus stop.



Figure 5: Travel to LRT using bus.

Female Users Experience in using the LRT at Night-time

Next analysis is to identify the feelings of safety by the female users from the LRT to their house. The study focuses on night-time which is when the users are mostly heading home from the office. The questions are set up mostly to look at

respondents' feelings while walking out from the LRT to straight away to their home or to have another type of transportation before reaching home. The range of the feeling's safety is divided into three categories: safe, moderately safe or not safe. Final outcome to this analysis was to present a safe and unsafe location or hotspots-based location of each user who is using the LRT.

Table 1 shows that there are four modes of transport that the respondents have to continue with, after stepping down from the LRT, they have to continue with their own vehicle, taking a bus, taxi or walking to finally reach home. Based on the analysis, the results show different feelings according to each destination. The respondents who are using taxis and buses choose not to feel safe to travel in the night-time even though the distance is only less than 10 kilometres from the LRT. The feelings are about the same for the respondents who are using the bus. The night-time seemed to be not favourable by the female users. Those who are using their own vehicle reported feeling safe when the distance is less than 10 kilometres but not for those who have to drive more than that distance. This is shown by a respondent who had to travel to Sri Kembangan after using the Kelana Jaya LRT station. She claimed to be not feeling safe as she had to travel with her own car for another more than 19 km every night of weekdays. In summary, from the overall result of the analysis, it is shown that not feeling safe is dependent on the time attitudes and the distance taken. The night-time is also claimed to be not safe for the female users to use the taxi or even walking. Most of the female users are travelling alone when the questions were asked.

Table 1: Level of safety by female users at night-time

User's Location	Type of Transportation use after using the LRT	Travelling time after using the LRT	Time attitudes	Level of safety	Distance from the LRT to house (m)
Seri Kembangan	Own vehicle (car/motor)	More than 30 minutes	Night	Not Feeling Safe	19658.6
USJ 11, Subang Jaya	Own vehicle (car/motor)	30 minutes and less	Night	Feeling Safe	1212.1
Subang Jaya	Taxi	More than 30 minutes	Night	Not Feeling Safe	9369.7
Subang USJ 6	Bus	More than 30 minutes	Night	Feeling Safe	5706.9
Shah Alam Section 19	Walking	More than 30 minutes	Night	Not Feeling Safe	6369.4
Shah Alam Section 24	Own vehicle (car/motor)	30 minutes and less	Night	Feeling Safe	8785.9

Analysis of Safety and Unsafety Location Experience by Female Users

Next analysis is to locate the safety and unsafe zones according to the response rate by the female users. The LRT routes involved from the Shah Alam area which starts from Padang Jawa, straight to the Subang Jaya railway, then continues to Petaling Jaya and stops at Petaling station. This analysis involved thirty female users to analyze the safety and unsafety zone area by their location. The Inverse Distance Weighted from spatial interpolation analysis was used. Table 2 shows Feelings Attitude by Female User when travelling using LRT Feelings Attitude by Female User when travelling using Light Rail Transit.

Table 2: Feelings Attitude by Female User when travelling using LRT

Maximum of Distance (m)	Buffering Distance (m)	Distance of Location(m)	Passenger's Location	Feeling of Attitude	Class
4432	1330	12749.5	Taman Maya Jaya, Petaling	Not Feeling Safe	1
4432	1330	15287.9	SS 4, Petaling	Not Feeling Safe	1
4432	1330	9369.7	SS 4, Petaling	Not Feeling Safe	1
4432	1330	8898.02	Taman Sea, Petaling	Moderately Feeling Safe	2
4432	1330	7776.3	SS 2, Petaling	Not Feeling Safe	1
4432	1330	7776.3	USJ 11 Subang Jaya	Moderately Feeling Safe	2
4432	1330	10219.9	USJ19, Subang Jaya	Feeling Safe	3
4432	1330	6593.8	Kota Kemuning, Shah Alam	Moderately Feeling Safe	2
4432	1330	11169.1	Sek 7, Shah Alam	Not Feeling Safe	1
4432	1330	11169.1	Sek 19, Shah Alam	Not Feeling Safe	1
4432	1330	13717.3	Subang Bestari, Shah Alam	Not Feeling Safe	1
4432	1330	13109.6	Sek 13, Shah Alam	Moderately Feeling Safe	2
4432	1330	7903.6	Glenmarie, Shah Alam	Moderately Feeling Safe	2
4432	1330	9658.6	Bukit Jalil	Not Feeling Safe	1
4432	1330	3939.7	Kuala Lumpur	Not Feeling Safe	1
4432	1330	1263.1	Sri Petaling	Not Feeling Safe	1
4432	1330	1653.2	Seri Kembangan	Not Feeling Safe	1

Maximum of Distance (m)	Buffering Distance (m)	Distance of Location(m)	Passenger's Location	Feeling of Attitude	Class
4432	1330	3286.6	Taman Universiti, Petaling	Not Feeling Safe	1
4432	1330	555.2	SS 5, Petaling	Not Feeling Safe	1
4432	1330	386.9	Sek 51A, Petaling	Moderately Feeling Safe	2
4432	1330	5393.5	Dataran Prima, Petaling	Moderately Feeling Safe	2
4432	1330	438.35	Taman Jaya, Petaling	Moderately Feeling Safe	2
4432	1330	1212.1	Damansara, Petaling Jaya	Not Feeling Safe	1
4432	1330	6369.4	Subang Jaya, USJ 6	Feeling Safe	3
4432	1330	1293.6	Subang, SS 17	Not Feeling Safe	1
4432	1330	1299.2	Subang Jaya	Not Feeling Safe	1
4432	1330	8143.3	Pantai Dalam, KL	Not Feeling Safe	1
4432	1330	5706.9	Shah Alam	Feeling Safe	3
4432	1330	8785.9	Shah Alam	Moderately Feeling Safe	2
4432	1330	12749.5	Taman Maya Jaya, Petaling	Not Feeling Safe	1
4432	1330	15287.9	SS 4, Petaling	Not Feeling Safe	1
4432	1330	9369.7	SS 4, Petaling	Not Feeling Safe	1
4432	1330	8898.02	Taman Sea, Petaling	Moderately Feeling Safe	2
4432	1330	7776.3	SS 2, Petaling	Not Feeling Safe	1
4432	1330	7776.3	USJ 11 Subang Jaya	Moderately Feeling Safe	2
4432	1330	10219.9	USJ19, Subang Jaya	Feeling Safe	3
4432	1330	6593.8	Kota Kemuning, Shah Alam	Moderately Feeling Safe	2
4432	1330	11169.1	Sek 7, Shah Alam	Not Feeling Safe	1
4432	1330	11169.1	Sek 19, Shah Alam	Not Feeling Safe	1
4432	1330	13717.3	Subang Bestari, Shah Alam	Not Feeling Safe	1
4432	1330	13109.6	Sek 13, Shah Alam	Moderately Feeling Safe	2

Maximum of Distance (m)	Buffering Distance (m)	Distance of Location(m)	Passenger's Location	Feeling of Attitude	Class
4432	1330	7903.6	Glenmarie, Shah Alam	Moderately Feeling Safe	2
4432	1330	9658.6	Bukit Jalil	Not Feeling Safe	1
4432	1330	3939.7	Kuala Lumpur	Not Feeling Safe	1
4432	1330	1263.1	Sri Petaling	Not Feeling Safe	1
4432	1330	1653.2	Seri Kembangan	Not Feeling Safe	1
4432	1330	3286.6	Taman Universiti, Petaling	Not Feeling Safe	1
4432	1330	555.2	SS 5, Petaling	Not Feeling Safe	1
4432	1330	386.9	Sek 51A, Petaling	Moderately Feeling Safe	2
4432	1330	5393.5	Dataran Prima, Petaling	Moderately Feeling Safe	2
4432	1330	438.35	Taman Jaya, Petaling	Moderately Feeling Safe	2
4432	1330	1212.1	Damansara, Petaling Jaya	Not Feeling Safe	1
4432	1330	6369.4	Subang Jaya, USJ 6	Feeling Safe	3
4432	1330	1293.6	Subang, SS 17	Not Feeling Safe	1
4432	1330	1299.2	Subang Jaya	Not Feeling Safe	1
4432	1330	8143.3	Pantai Dalam, KL	Not Feeling Safe	1
4432	1330	5706.9	Shah Alam	Feeling Safe	3
4432	1330	8785.9	Shah Alam	Moderately Feeling Safe	2

The feeling attitudes were divided into three categories which is class one for not feeling safe, class two for moderately feeling safe and class three is for the passenger that is feeling safe while in the journey to LRT facility. Fifteen of the female passengers chose class one for their route to the LRT, while nine moderately feeling safe and only five feeling safe. This shows that the feeling attitude by the consumers was affected by their travel distance journey.

As shown in Figure 6, there are three classes used to classify the safety area, average safety area and not safety area and these were differentiated by colours which are from the blue to orange and the red zone area. The location for each user was represented by the colour and the percentage of hot spot area on a

map. The location for each user was represented by the colour and the percentage of hot spot area on a map. First class is the blue range of 1-2.25 meant for the safety zone area. Second class was indicated with yellow colour and ranged from 2.25 – 2.58, which is the average level of zone area. Finally, the hot spot area indicated by red colour and ranging from 2.58 – 3 class range. It means the area are in a red zone which is not safe. From the observation, there are two areas in the third class which are in the red zone. The hot spot of crime is its counterpart, in both Section 19 and Sri Kembangan areas with an analysis of 90 percent shown as unsafe areas. Spotted areas around Section 19, Section 18 and Section 15 are in the range of unsafe zone areas.

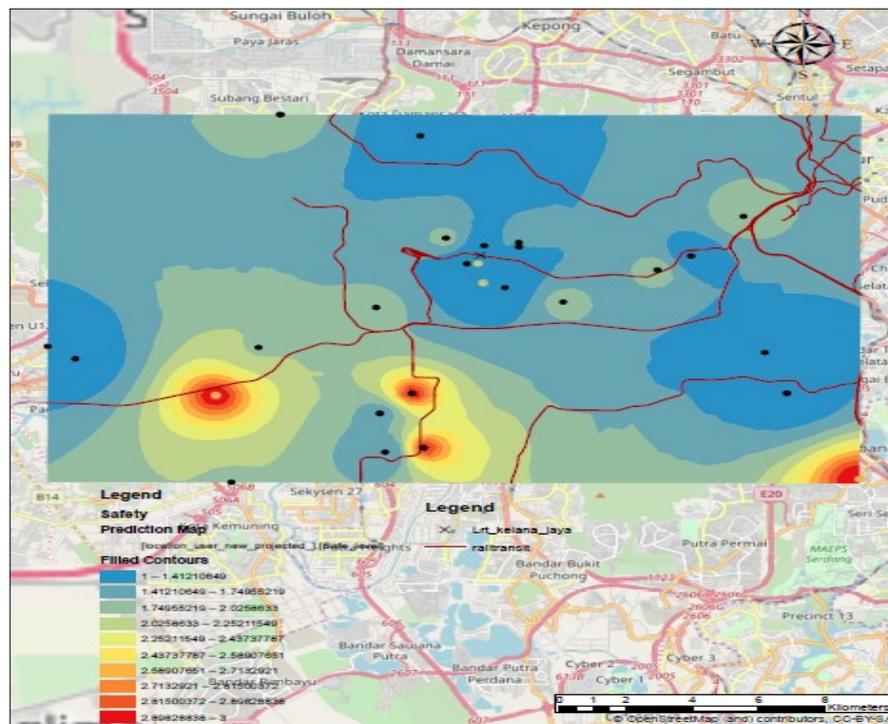


Figure 6: The not feeling safe zone by female users.

The indication of unsafe here is referring to the area that is too far from the service station. The respondents around this area needed to get to the LRT exchange station and the area was found to have been relatively closed to the manufacturing industry and away from the public's attention. In fact, it is found at the front of the entrance to the station that there is construction work and far away from the public settlements. The respondents feel unsafe as they have to

walk alone for a longer distance with lack of safety measures to the main LRT station. The design and the maintenance of the bus stop locations with lack of lighting, shows the inadequate security measures and this seems to contribute to the safety risk for females to walk near the LRT. As is the case with users from the Seri Kembangan area, their routes are much longer. Figure 1.6 shows the Safety analysis according to the respondents' locations. The red colour indicates most of the respondents complain about the feeling of not being safe after using the LRT service and while heading to their home by walking or using another public transport such as bus or taxi.

CONCLUSION

The Light Rail Transit could become the first chosen transport services by the public if the important issues such as safety and facilities are well tackled. This research has exposed the percentage of safety and satisfaction towards facilities that have always become the priority concerned by the female users while using the train, walking near the station and surrounding area. The cases involving female passengers have seemed to increase lately where the safety measures should be seriously managed. The lack of facilities for passengers such as proper bus stop, lamp post, less safety guard and improper pedestrian pavement will reduce the interest of the public to use the LRT.

ACKNOWLEDGEMENTS

The authors wish to thank the Malaysia Institute of Transport (MITRANS) for funding this publication through the Vanguard 3.0 research grant. The authors would also like to thank PLANMalaysia, JUPEM, the Ministry of Transportation for assistance in providing space and data to the research. Special thanks also go to all of the female LRT users who are willing to become part of this research.

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Received: 24th Jan 2023. Accepted: 20th July 2023



PLANNING MALAYSIA:

Journal of the Malaysian Institute of Planners

VOLUME 21 ISSUE 4 (2023), Page 152 – 163

ACCESSIBILITY AND CONNECTIVITY ANALYSIS IN THE GROWING RURAL AREA: A CASE STUDY OF REMBAU DISTRICT, NEGERI SEMBILAN

Zaharah Mohd Yusoff^{1,2}, Norazrina Md Ramlan², Pauziyah Mohd Salim², Aminah Mohsin³, Mazlan Mohd⁴, Lilis Sri Mulyawati⁵

¹*Malaysia Institute of Transportation (MITRANS), UiTM Shah Alam, Selangor*

²*College of Built Environment (CBE), UiTM, Shah Alam, Selangor*

³*Department of Real Estate, Faculty of Built Environment and Surveying, UTM, Johor*

⁴*PLANMalaysia (Jabatan Perancangan Bandar dan Desa) KPKT, Putrajaya*

⁵*Faculty of Engineering Pakuan University Bogor-Indonesia*

Abstract

Rural areas are the ideal place to handle urban sprawl, whether for future administrative, college, manufacturing, residential, commercial, or for business growth. In the land development context, the shifting from rural into several areas such as agricultural into houses or subdividing real estate into commercial lots etc. were seen to be worth trying. However, this will succeed with the help of better road connectivity to the demanded area. This research is aimed to explore the road accessibility and connectivity and its function in supporting the growth of land development in Rembau, Negeri Sembilan. The research methodology produces maps of new potential growth development areas using GIS techniques. For data acquisition, there was a two-approach which is using the primary and secondary data. The primary data consist of the observation on the site, interview method with the experts and local people. Meanwhile, the secondary data is using the Landsat data from USGS to produce a land-use map for four consecutive years, base map and route connectivity data for GIS method, and statistical data from related agencies. The result of this research is to produce a new potential development map in Rembau, Negeri Sembilan. Remote sensing (RS) and Geographical Information System (GIS) allows the town planners to identify the potential rural spaces to cater the urban population.

Keywords: Rural area; Urbanization; Accessibility; Connectivity

¹ Assoc Prof at Universiti Teknologi MARA: zmy1208@uitm.edu.my

INTRODUCTION

The government of Malaysia is seen to be very committed towards the development of rural areas and it is continuously becoming the first agenda in rural growth (*Kementerian Pembangunan Luar Bandar, 2019*). The adaptation of a new tagline as 'Prosperous, Inclusive, Holistic, and Sustainable' will become the major goal of Malaysia's external growth process cities in 2030. Prosperous countryside perspectives reflect the Government's intention to ensure that rural residents have access to services and social facilities equivalent to the city area. Moreover, to increase the economic potential in rural areas and the number of productive populations, the government aims to encourage many urban residents and investors to move to the countryside. The rural area may become an interesting domestic and overseas destination for holidays and tourism to enjoy the natural beauty, heritage culture, and fun of the countryside living (*Kementerian Pembangunan Luar Bandar, 2019*). In short, development is a process of evolution from a low progressive to a more advanced level in either the physical or environmental aspects. The concept of development covers four key components that complement each other and need to be achieved efficiently in order to ensure rapid economic growth, equitable distribution of wealth, sustainable and people's empowerment, especially vulnerable groups such as the poor. In other words, development is nothing but a reduction effort or eradicating poverty, inequality, and unemployment in an economic context is growing.

Realising the necessity for a more comprehensive infrastructure planning management mechanism at the state level, Negeri Sembilan State built its planning support system to track the execution overtime of its development plans (Masser, 2016). Negeri Sembilan is made up of 7 Districts with 8 Local Authorities including Rembau District Council. This study uses the tools in GIS software and land-use changes using Erdas Imagine software to explore the potential factors of Rembau District in terms of its connectivity to tourist attraction places and amenities.

Growing Rural Area Impacted from Urbanization Process

Land growth processes are very important in developing land. The unplanned and uncontrolled population expansion has already had important adverse effects on the suburban residents and their surroundings or environment (Mohammed et al., 2016) and this is another factor for land development to achieve unbalanced sustainability (Tahir & Abdul Malek, 2017). According to Yeh, (2004) land is under transition when it continues performing major economic roles. Implementing a modern land policy has had a significant effect on land usage patterns and land-use conversion. Overall process can tell the background or chronology of an area and it plans a better development in the future. The emergence of a new city, industrial areas, housing, skyscrapers, and large bridges could be worth millions of dollars and the existence of all is interpreted as a

modern development (Abdul Rahman, 2018). In early 1949, the concept of the growth pole was introduced by Francois Perroux. In this theory, Francois enlightened that it is very important to identify the economic space with attractive elements and potential for growth.

The industrial sector stimulates the economic growth of a region to develop backward areas as this might help for a better growth (Gavrila-paven, 2018). Thus, this could also give a great opportunity for the rural land to cater the urban and suburban activities. According to Saleh et al., (2011), the theory of Central Settlement that presented by Walter Christaller in 1933 is a generalisation made as deductive intent in describing the relationship between population size and several settlements on the earth. It is also claimed that there was a close relationship between the size of the settlement and its function. The growing population size in the city will open many new settlement areas in the fringe and rural areas. Mohd Balwi (2005) reported that in between 1970 until 1997, Malaysia underwent dramatic urban spatial changes. Not only have urban units grown in size, but the larger urban centres also grew outward and broke out the gazette borders, expanding through the countryside into the open spaces.

Factors Influencing the Rural Growth

As reported in the *Rancangan Tempatan Daerah Rembau, (2014)*, Rembau District has the potential to become a Dormitory Town to residents working in the area adjacent to it, such as Tampin, Port Dickson, Kuala Pilah, Seremban district, and Alor Gajah (Malacca) including the Klang Valley (Selangor). Negeri Sembilan previously aims to become a developed state in 2020. To date, the development of activities at the core of the economy centre was given the key focus as a state growth generator. The Negeri Sembilan Structure Plan 2001-2020 and the latest District Local Plan (RTD) are among the key references to the government's planning and implementation to develop Negeri Sembilan which has affected land use in the state. Meanwhile, the focus on regional development has led to its existence rural development approach through settlement system strategies to achieve balanced economic growth, distribute, and reduce poverty. This is achieved through the provision of infrastructure facilities, including institutional infrastructure. Also, the upgrading of the urban-rural relations system attracted activities such as housing, trade, and industry along the main or secondary routes.

Potential Attraction Places

Nasir Ahmad & Mustafa (2019) said that the tourism areas with good facilities and infrastructure are among the tourist's attractions to visit. Rural tourism plays an important role in the development of socio-economic development in many countries. Each district has its own attractions, e.g., the Port Dickson district offers the coastal tourism concept, while the Rembau District is more about

traditional tourism, community culture, and history. Rembau is also famous for the use of the unique customary land act and became an attraction to the academia or researcher to study further. Highland's areas such as mountains, hills and green areas are another attraction for tourists. Mountain tourism has been significant in contributing to the development of rural tourism through various programs such as adventure in sports, arts, and local culture. According to the *Rancangan Tempatan Daerah (2014)*, the tourism development resources of Rembau District comprise Gunung Datuk Forest Reserve, traditional Homestay, Rembau Museum and the Wet World Hot Water Spring, Pedas.

Accessibilities

The setting of rural settlement is quite challenging in terms of physical and geographical in most of the rural areas in the world. Accessibility plays a big role as a fundamental of sustainable living (Elisabetta, 2020). Abdullah (2016) said that the proximity distance does increase accessibility, but longer distances will make the rural area seem difficult to be reached. However, Rembau District was in good geographic location, and it was categorised under a moderate development at the National context, which it falls under category 3; developing slowly. The Port Dickson District and the Seremban District which border the Rembau District are part of the Conurbation of Kuala Lumpur. In this context, land near the core business area usually will develop faster than the area which is far away. It was reported in the *Rancangan Tempatan Daerah Rembau, (2014)*, that Rembau District was placed next to the administrative land of Seremban, Tampin, and Alor Gajah. This could be a great opportunity for the Rembau District to grow well in social, physical and economic sectors.

Connectivity

The rural development programs will focus on transforming rural areas to better investment and attractive living by enjoying all the basic amenities of quality infrastructure and social services. According to Nasir Ahmad & Mustafa, (2019), the increases in the availability of major roads in 2014 made it more efficient to connect the districts in Negeri Sembilan and it became more efficient than in 1961. Good transport access can increase the rate of accessibilities residents to goods, facilities, information, and necessities. Adding to that, good transportation facilities will also attract many new built-up land uses (Abdul Gapar *et.al*, 2021) and the growth pattern extended to the neighbouring districts.

RESEARCH AIM AND OBJECTIVES

This research aim is to explore the factors that influence the growth and potential of tourism development in Rembau, Negeri Sembilan. This is supported by three objectives, that are:

- i. To identify the land use changes in 10 consecutive years (1990 to 2010).
- ii. To analyse the potential factors for Rembau Districts to grow.

The Study Area

Rembau is a district in Negeri Sembilan that was located at south border of the Malacca State with coordinates $2^{\circ}35'30''\text{N}$ $102^{\circ}05'45''\text{E}$. Rembau is 402.76 square kilometres or 41,512 hectares. The district grew well with a total population of 43,011 in 2010 and it was predicted to grow at 51,800 by 2025. The village people mostly live in 17 *mukim* comprising 204 villages. The residents of this area are mostly farmers, government officers, manufacturing workers from the industrial district, such as Senawang and Seremban. It took about 20 km distance from Rembau to Senawang and 7km from Senawang to Seremban. The location of Rembau District is also near to Malacca A’Famosa Freeport Outlet which took about 25 minutes to reach. Figure 1 shows the location of the study area.

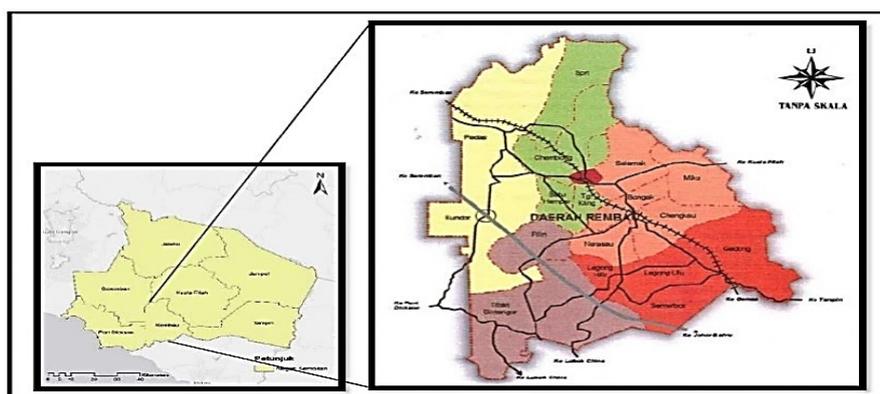


Figure 1: Location of Rembau District

RESEARCH METHODOLOGY

The research methodology processes start with the identification of potential factors that contributed to the growth of Rembau district, Negeri Sembilan as shown in figure 2. The project planning includes the search on suitable study areas and the data collection from primary and secondary approach. The primary data consist of observation on site, interview session with experts and online questionnaire via google form to get the public response. The secondary data was gathered using Landsat from USGS to produce land use maps for four consecutive years (1990,2000,2010 and 2020), while the base map and route connectivity data is done using the GIS techniques. The result of this analysis is used to produce a new potential development map.

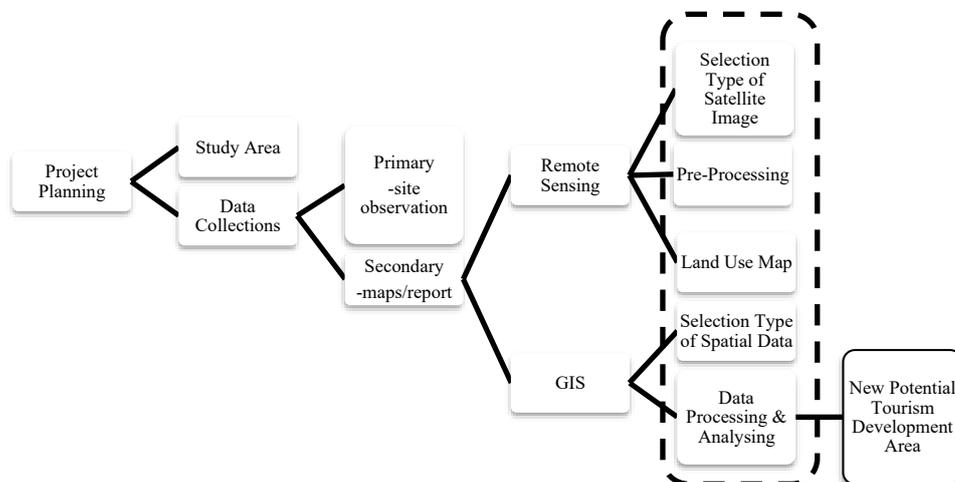


Figure 2: Research Methodology Flowchart

RESEARCH FINDINGS

Land use changes in 10 consecutive years

Several factors influence land-use change in Rembau, Negeri Sembilan from 1990 to 2020. The result obtained from Satellite Image which is Landsat data. Based on figure 3, the land use distribution for Rembau district is dominant with agricultural areas, which is almost 50% for the period 1990 to 2010 and slightly decreased in 2020 to 43%. However, in 2010, agricultural land use in Rembau district was dominated by oil palm plantations. Forest land use in 2010 was found to be declining, a decrease of 5% from 1990, and flattening again in 2020, which remained at 34%. From 1990 to 2020, there was a decrease in Rembau district forest land use because most of the forest area was cleared for agricultural and urban development. The bare soil land use in 1990 was 6888.91 acres.

Changes have occurred in 2020 which is an increase to 14770.7 acres. This is because most forests and agricultural land might be developed by 2020. Urban land use has undergone the slightest change of an increase of only 6%. The progress that has taken place has brought changes to the use of Rembau town. Moreover, in 1990, the housing area only covered the village area. However, in 2010, housing areas included villages, low-cost housing, terrace houses, and bungalows. This shows that urban land use which includes residential areas, industrial areas, institutions, utilities, and facilities is increasing towards 2020. Figure 3 shows the land use changes from 1990 to 2020.

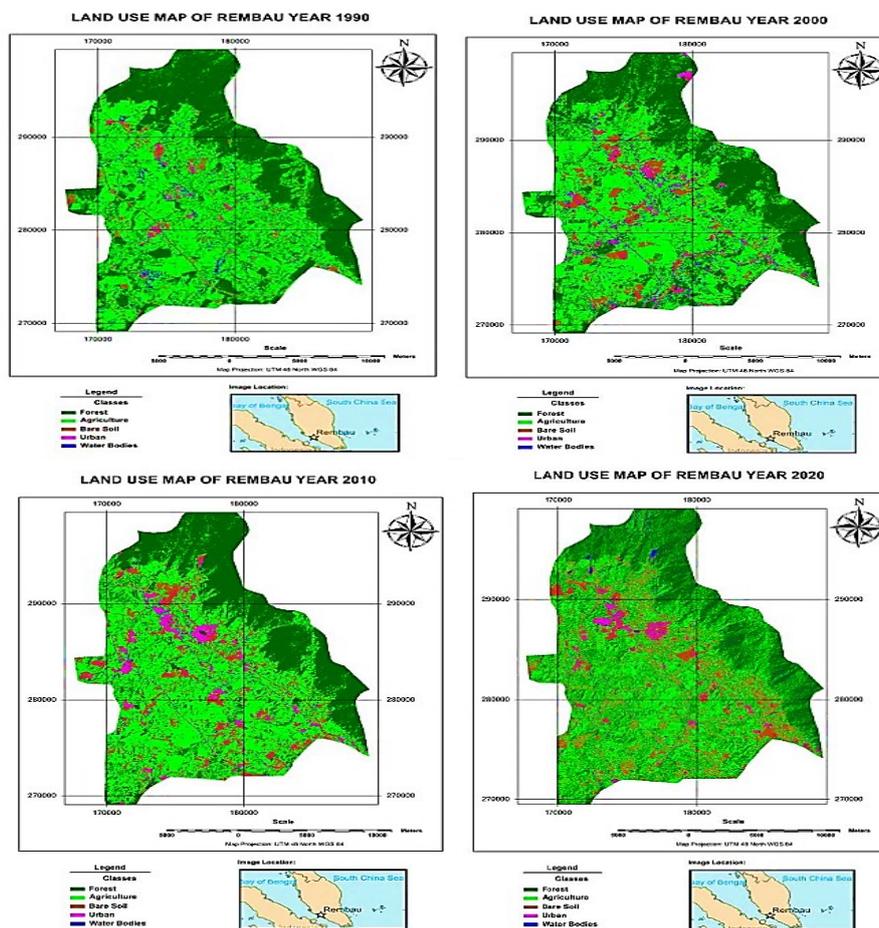


Figure 3: Land Use Map of 1990,2000,2010 and 2020

The Accessibility and Connectivity Analysis

The purpose of this analysis is to look at the accessibility and connectivity between residential places and the Rembau small town area. Most of the residential locations are located within the distance of 1 to 2 km from the town area. The total development area in Rembau is only 7.15 percent from the total area of 40430.165 hectares. Among the areas developed are residential, commercial, industrial, transportation, community facilities institutions as well as infrastructure and utilities. Rembau area is an agricultural area consisting of 67.856 percent of land area. The undeveloped area covers 91.92 percent of the entire Rembau district. Figure 4 shows the development area in each of *mukims*.

Location	Area	Map	Distance (KM)
Bandar Rembau	<ul style="list-style-type: none"> ● Taman Sri Rembau ● Taman Rembau Utama ● Taman Bunga Raya ● Taman Rembau Perdana ● Primary and Secondary School ● Commercial Lot 		0.78
Chembong	<ul style="list-style-type: none"> ● Taman Chembong Utama ● Taman Sedia Raja ● Primary and Secondary School ● IKTBN Chembong ● Industrial (Factory) 		1.18
Pedas	<ul style="list-style-type: none"> ● Desa Permai Pedas ● Taman Pedas Perdana ● Taman Pinggiran Pedas ● Taman Pedas Indah ● Primary and Secondary School ● ILP Pedas ● Pedas Halal Park 		0.38 0.53 0.55
Selemak	<ul style="list-style-type: none"> ● Rumah Rakyat Sungai Layang 		0.16
Chengkau	<ul style="list-style-type: none"> ● Taman Fajar Harapan ● Rumah Rakyat Chengkau 		0.63

Location	Area	Map	Distance (KM)
Kota	<ul style="list-style-type: none"> ● Rumah Rakyat Kota ● Taman Kota Indah ● Rumah Rakyat Astana Raja 		0.17

Figure 4: The development area in Rembau District

Based on the study, it was found that the accessibility and road connectivity throughout the districts were in a good plan and there are many lands that could be pushed for future development. The Rembau district has great potential to continue developing as most of the areas are well connected and have good accessibility to neighbouring areas. Rembau was situated in the location between Seremban district and Melaka state, and this could give good chances for Rembau to potentially grow in identified sectors such as the light or medium factories and the tourism industry. Table 1 shows the key element for establishing the tourism places in Rembau and Figure 5 shows the identified tourism places in Rembau District.

Table 1: The Key Land Development in Rembau District

Parameter/ Key Development	1	2	3
Accessibility & Connectivity	Improve Road Network	Improving the Quality of Transportation Services	Improving More Efficient Traffic Management
Attraction Places	Upgrade the Tourist Areas	Enhancing Marketing and Product Promotion Efforts Tourism	Reasonable and affordable prices

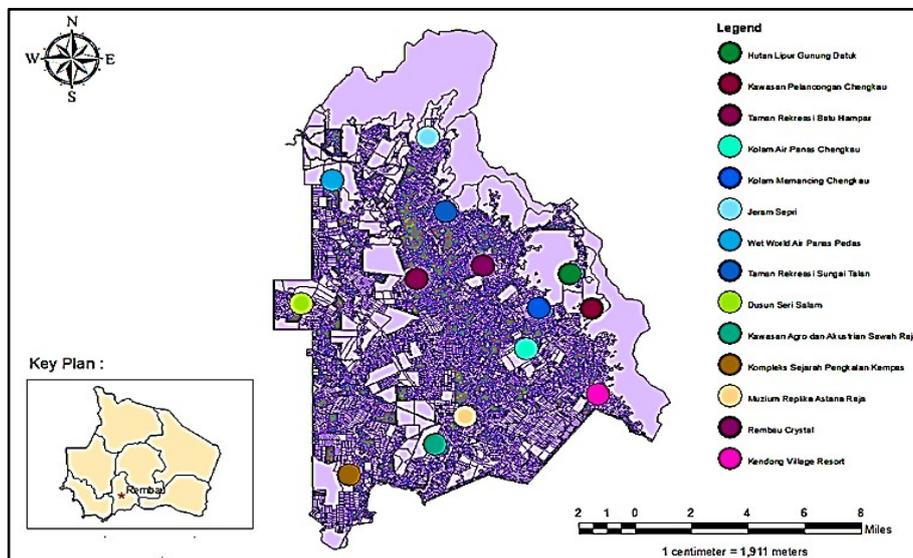


Figure 5: Identified Attraction Places in Rembau

The New Potential Development Area

Current land use maps are very important to be evaluated before planning future development for an area because to find out about the current situation on the land. The development situation in Rembau is currently deep in an unbalanced situation where development is concentrated only in the town and along the main roads. This Rembau district seems to be developing but the process is too slow. Based on the result that appears in figure 6, the new proposed area for future potential development purposes has been established as shown in orange colour. The growing development areas as identified in the map involve Bandar Rembau, Pekan Pedas, Pekan Chengkau, and Pekan Kota. While the identified attraction places are located at Gunung Datuk, Sg. Talan and Pengkalan nelayan and for agro tourism are at Pedas and Gadong. There are two historical relics of cultural heritage such as Replika Istana, Makam Raja Melewar at Kg Astana Raja. Other than that, Rembau has a water park located at Pedas and Sukabumi at Kendong.

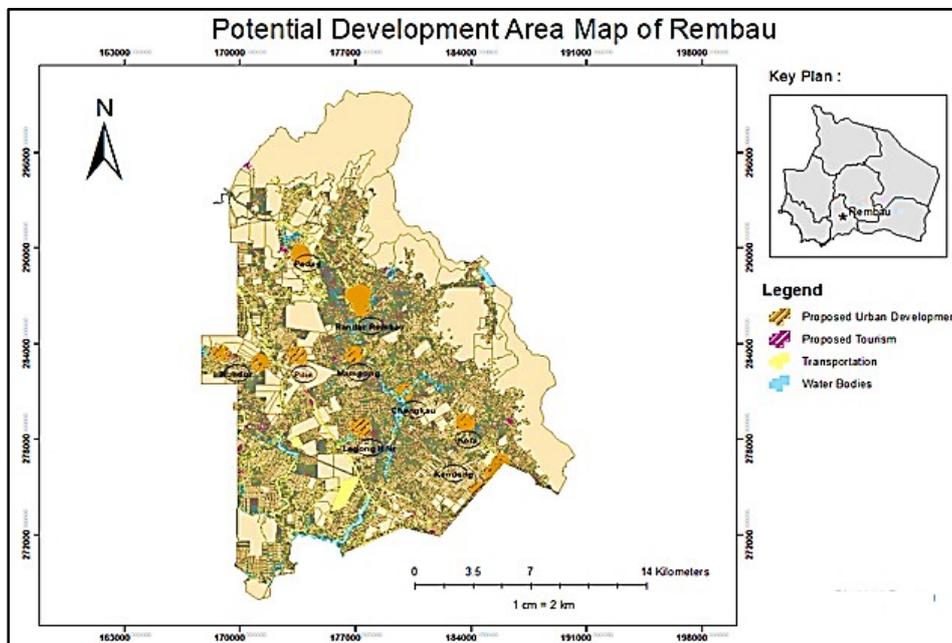


Figure 6: New Potential Development Map

CONCLUSION

Generally, Rembau can be identified as having a slow progress of development in terms of size, speed, and patterns of growth. It is important to identify the factors that could speed up the process of the development to prepare for the needs of a place that can cater the fast-growing development of Seremban and Senawang. Although the distance from Rembau to Senawang, Seremban and Melaka could benefit the growth of Rembau economic activities, it seems the process took longer time. The state of Negeri Sembilan authority should be preparing a good future development for Rembau district to become a tourism place in the near future. This would be useful to introduce the attractive places in Rembau rural areas as well as to express some uniqueness that Rembau could offer.

ACKNOWLEDGEMENTS

The authors would like to thank the Malaysia Institute of Transport (MITRANS), Universiti Teknologi MARA for funding this publication under the Vanguard Grant 3.0. The wishes also go to Negeri Sembilan Land and Mines office, PLANMalaysia and JUPEM for the assistance in providing the data to this research.

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Received: 24th Jan 2023. Accepted: 20th July 2023



PLANNING MALAYSIA:

Journal of the Malaysian Institute of Planners

VOLUME 21 ISSUE 4 (2023), Page 164 – 175

EVALUATION OF THE OPERATIONAL METHODS FOR THE ANALYSIS OF SIGNALISED INTERSECTIONS

Zarina bt Rahmat¹, Jezan Md Diah², Siti Zaharah Ishak³, Raha Abd Rahman⁴

^{1,2,3} *School of Civil Engineering, College of Engineering,
UNIVERSITI TEKNOLOGI MARA (UITM), SELANGOR, MALAYSIA*

³ *Malaysia Institute of Transport (MITRANS),
UNIVERSITI TEKNOLOGI MARA (UITM), SELANGOR, MALAYSIA*

⁴ *Department of Civil Engineering, Faculty of Civil Engineering and Built Environment,
UNIVERSITI TUN HUSSEIN ONN MALAYSIA, JOHOR, MALAYSIA*

Abstract

The problem of traffic congestion in urban areas is worse at road intersections. Junction design, traffic light capacity, and driver behaviour are prevalent influences on traffic congestion. Since the traffic signal is one of the traffic controls to alleviate road congestion, adequate traffic capacity with a good design and an optimum delay is the key to improving the signalised junction. Hence, this research aims to determine the performance of signalized junctions with different traffic methods compared to on-site data. Two methods were selected for the analysis: Signalised Intersection Design and Research Aid (SIDRA) and the Malaysia Highway Capacity Manual (MHCM). Prominent signalised intersections along Jalan Kempas in the Kempas neighbourhood of Johor Bahru were selected for this study to measure the length of the vehicle line-up during rush hour. Based on these two (2) methods used, the significant different are related to traffic parameters, namely capacity analysis and level of service and by different conditions of traffic, geometric and type of traffic signal. It was determined that the parameter used for both SIDRA and MHCM is suitable; however, the output of SIDRA resulted in a more similar performance to the site observation. Based on the findings, this research is able to measure the efficiency of traffic assessment tools compared to the actual situation on site and assist the traffic engineer in efficiently investigating and evaluating the performance at signalised junctions.

Keywords: Signalised Junction, Traffic Method, Malaysia Highway Capacity Manual, SIDRA

² Assoc. Prof at UiTM. Email: jezan@uitm.edu.my

INTRODUCTION

Each day, billions of people and trillions of dollars rely on the transportation network. It's a complex and far-reaching system with many layers and players (Almasri, 2014). Many factors affect how well transportation systems work these days, including safety, efficiency, and reliability. These factors are essential to everyone, from consumers to the business community (The World Bank, 2015). With traffic congestion increasing in much of the world and continuously worsening, it represents an absolute menace to the quality of urban life (Findley et al., 2015). Therefore, this paper presents the assessment of the operational methods for analysing signalised junctions, namely Signalised Intersection Design and Research Aid (SIDRA) and the Malaysia Highway Capacity Manual (MHCM) conducted at Johor Bahru's neighbourhood as a case study.

PROBLEM STATEMENT

The primary cause of traffic congestion is the high number of vehicles, and most Malaysian car owners use them daily or regularly. As a result, it is estimated that 1 million wasted hours are spent each day stuck in traffic (The World Bank, 2015). Also, the main cause of traffic jams is an imbalance between how much traffic there is and how much people want to drive. This problem gets worse at road intersections in cities (Findley et al., 2015). Installing traffic lights is one of the traffic control measures to alleviate traffic congestion. An efficient traffic light system will make the traffic flow smoothly and save time. However, junction design, traffic light capacity, and driver behaviour are prevalent influences for traffic congestion (Bull, 2004; Kumala et al., 2016). For example, some drivers like to cut a few seconds off their journey times by forcing their way into intersections and blocking the passage of other motorists, which causes congestion.

A traffic signal is one of the traffic controls to alleviate road congestion and adequate traffic capacity with a good design, and optimum delay is the key to improving the signalised intersection (Almasri, 2014). Therefore, this study has been undertaken to assess the different aspects of junction performance at the signalised junction, using two different capacity methods, SIDRA and MHCM methods.

LITERATURE REVIEW

Signalised Intersection Operation Elements

Signalized intersection operations are a function of three elements: traffic volume characteristics; roadway geometry; and signal phasing.

Traffic Volume, Geometry Design and Signal Phasing

Volume plays a critical role in traffic engineering (Akçelik, 2017). These volumes can be used to quantify events such as traffic accidents, congestion, and speed variations and to determine the effectiveness of control measures to mitigate these events (e.g. road widening or the introduction of new traffic signals). Volume studies are used at various stages in the planning, design, and operation of transportation infrastructure. They can be conducted by either human observers or by sensors installed along the roadway surface.

Geometry design describes the possible impact on intersection performance and safety, an intersection's geometry is crucial (Yusuf & Jordan, 2018). Sight distance, vehicle separation, operations, and capacity are all directly impacted by geometry. Because of this, intersection geometrics must constantly be considered when working with existing conditions, newly constructed, or signalised intersections.

Signal phasing refers to the way in which different traffic signals are timed and synchronized (Adeke et al., 2020). Improper phasing can result in overcrowded roads, delayed bus schedules and wasted fuel. The effects of signal phasing on transportation service can be seen during rush hour when multiple vehicles attempt to travel simultaneously on the same road. Proper signal phasing can help manage traffic flow and reduce congestion during peak hours. Conversely, poor signal phasing can worsen congestion by causing delays for buses and other vehicles crossing the road while congested. Improper signal phasing can also increase fuel consumption and emissions due to increased idling time and unnecessary speed changes while driving.

Parameters for Evaluating Intersection Operations

In order to analyse the performance of signalised junction, several factors need to be considered such as capacity, delay, vehicle queue, and Level of Service (LOS).

Capacity Analysis, Vehicle Queue, Delay and Level of Service

Roads have certain capacities, which are determined by the width of the lanes and their surface (Reilly & Levinson, 2011). The capacity of a road can be measured in various ways, and it varies depending on the intended use of the road in question. Some of these methods include load rating method (Sameni & Moradi, 2022), speed rating method (Hansen, 2017), and occupancy rate method (Ghiasi et al., 2017).

All evaluations of signalised intersections may consider vehicle queuing as a critical indicator of effectiveness (Ghiasi et al., 2017). To determine the amount of storage needed for turn lanes and to assess whether overflow occurs at upstream facilities, estimates of vehicle waits are necessary (driveways, unsignalized intersections, signalised intersections, etc.).

Delay involved three methods of calculating the LOS performance indicators that can be differentiated depending on the performance measure: analytically, by measurement or by simulation (Axer et al., 2012). Queue delays and level of service for signalized intersections are principal performance measures that contribute to driver discomfort, frustration, fuel consumption, and increased travel time (Zalfi et al., 2013). Therefore, the evaluation of signalized junction capacity is critical since it is directly related to delay, level of service, accident, operation cost, and environmental issues.

Level of Service (LOS) is directly related to the controlled delay value (Albrka Ali et al., 2018). The average controlled delay per vehicle is estimated for each lane group and aggregated for each approach and for the intersection as a whole. Delay and the level of service when waiting at an intersection indicate the potential capacity and performance of that intersection. A major factor causing moderate traffic congestion at the traffic light is the length of cycle time and the number of phase numbers at the intersection (Kumala et al., 2016). The signalized intersection LOS is the average delay of all vehicles entering or exiting an intersection.

Traffic Operational Analysis

Traffic operational analysis is an invaluable tool for understanding traffic behaviour and creating strategies for improving the existing transportation infrastructure. For this study, two traffic operational analyses were involved: Malaysian Highway Capacity Manual (MHCM) and Signalised Intersection Design and Research Aid (SIDRA).

Malaysian Highway Capacity Manual (MHCM)

In Malaysia, in order to measure the performance of existing roads, the Highway Planning Unit (HPU) of the Ministry of Works Malaysia has come up with the Malaysian Highway Capacity Manual (MHCM). The MHCM has developed its own formulation, and adjustment factors based on extensive research carried out in several states throughout Malaysia to carry out its job (Figure 1).

MHCM, specific to Malaysian road conditions, offers transportation practitioners and researchers a standardised and up-to-date system of techniques for evaluating the quality of service on a two-lane highway, multilane highways, basic segment, and ramps motorways.

The guidelines and instructions in this manual offer a methodical and uniform way to evaluate the transportation facilities' capacity and level of service. Determining the capacity and level of services for each lane group and the entire intersection is the goal of traffic analysis under MHCM. In addition, detailed information on the intersection's geometry, traffic flow, and signalization is required based on the existing or proposed new intersection.

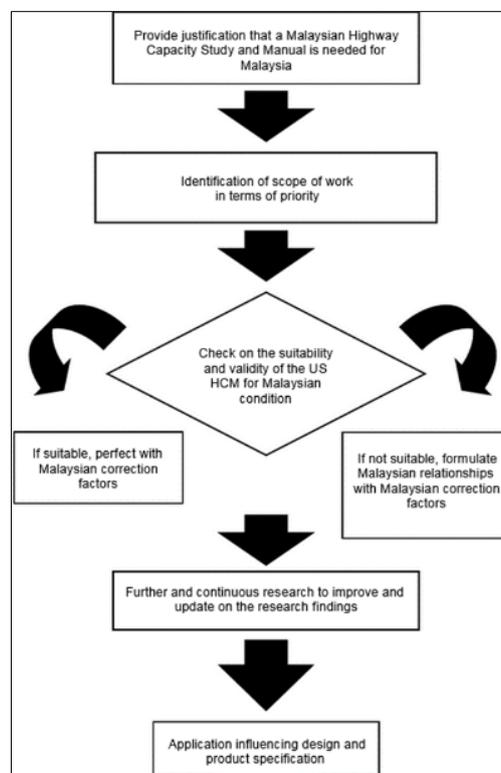


Figure 1: Approaches for the Malaysian Highway Capacity Study
 Source: Malaysia Highway Capacity Manual, Highway Planning Unit

Signalised Intersection Design and Research Aid (SIDRA)

Signalised (and unsignalised) Intersection Design and Research Aid, also known as SIDRA, was developed in 1984 which is a simulation software mainly used for road intersection analysis and design (Nicoli et al., 2015). SIDRA emphasises a micro-analytical traffic evaluation tool that employs lane-by-lane and vehicle drive cycle models by comparing the alternatives of the intersections and network intersections (Yumlu et al., 2014). For determining an appropriate junction and network design, SIDRA offers a wide number of intersection and network performance measurements, various alternate Level of Service (LOS) techniques and LOS target settings (Akmaz & Çelik, 2016). In addition, there are standard performance indicators like delays, queue lengths, and stop counts, as well as indicators to help with economic and environmental effect analyses.

METHODOLOGY

The flowchart of the research process to assess the operational methods for analysing signalised junctions namely Signalised Intersection Design and Research Aid (SIDRA) and the Malaysia Highway Capacity Manual (MHCM). Prominent signalised intersections along Jalan Kempas in the Kempas neighbourhood of Johor Bahru were selected for this study to measure the length of the vehicle line-up during rush hour. The selected junction was known to be one of the busiest roads and traffic in Taman Kempas Utama and Taman Kempas Indah.

Field Data Collection

The selected signalised junction conditions in the study area were ascertained through visual reconnaissance surveys and comprehensive traffic counts. Traffic counts is collected using two methods, manual count and automatic count.

Traffic Data Collection

The survey was recorded via mounted camera for a 6-hr count consisting of the morning peak (7.00am to 10.00am), and evening peak (4.30pm to 7.30pm). It will be classified into four vehicle categories: car/van, motorcycle, light truck and heavy truck/bus at a 15-minute interval. Subsequently, these classified counts were converted to equivalent passenger car units (pcu) which corresponding to various directions identified during the traffic survey as recommended by Malaysian Highway Capacity Manual (MHCM).

Geometry Characteristics

Reconnaissance surveys obtained the geometric information of the study area and Figure 2 tabulates the geometric data at the Jalan Kempas intersection.

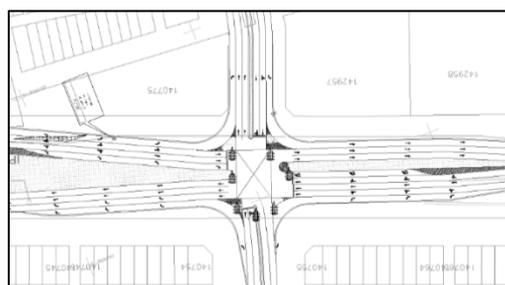


Figure 2: Condition scenario for geometric condition

Signalised Conditions

Signal phasing is the basic control mechanism for a signalized intersection and determines the efficiency and safety of the procedure. Figure 3 shows the Jalan Kempas intersection phasing plan according to the current cycle time.

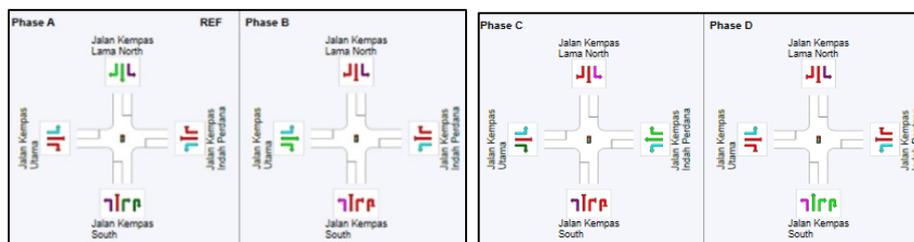


Figure 3: Jalan Kempas intersection phasing plan according to current cycle time

Data Analysis

Two traffic signal analysis methods were used to estimate queue length: SIDRA Intersection 9.1 and Malaysian Highway Capacity Manual (MHCM). SIDRA Intersection 9.1 is a micro-analytical software used to aid the design and evaluation of single intersections and networks of intersections. Meanwhile, MHCM is a logical method to measure the performance of highways for each study facility, assure that practitioners have access to the latest research result, and present sample problems.

RESULT AND DISCUSSION

Input Parameters for SIDRA and MHCM Models

Table 1 highlights the parameters used for two traffic signal analysis methods, SIDRA Intersection 9.1 and Malaysian Highway Capacity Manual (MHCM). The parameters involved in these methods are based on the type of condition, namely geometric conditions (7 parameters), traffic conditions (8 parameters), and signalised conditions (9 parameters).

Table 1: Parameters used for SIDRA and MHCM

Type of Condition	Parameter	SIDRA	MHCM
Geometric Conditions	Area Type	1	1
	Number of Lanes	Input User	Input User
	Average Lane Width	3.5m/lane	3.5m/lane
	Grades	0%	0%
	Existence of Exclusive RT or LT Lane	Yes	Yes
	Length of Storage Bay, LT or RT Lane	Yes	Yes
	Parking Conditions	No	No
Traffic Conditions	Volumes by Movement	pcu/hr	pcu/hr
	Ideal Saturation Flow Rate	1950 tcu/hr	1930 pcu/hr
	Peak Hour Factor	Default	Input User
	Percent Heavy Vehicles	Default	Default
	Conflicting Pedestrian Flow Rate; peds/hr	N	N
	Local Buses Stopping in Intersection NB	N	N

Type of Condition	Parameter	SIDRA	MHCM
	Parking Activity, pkg manoeuvres /hr	N	N
	Approach Speed, km/hr	N	N
Signalised Conditions	Cycle Length, sec	132 secs	132 secs
	Green Time, sec	25 secs & 33 secs	25 secs & 33 secs
	Amber-Plus -All-Red Change and Clearance	5 secs	5 secs
	Interval (intergreen), sec	2 secs	2 secs
	Actuated or Pretimes operation	A	A
	Pedestrian push-button	N	N
	Minimum Pedestrian green, sec	N	N
	Phase Plan	Yes	Yes
	Analysis Period, hr	AM Peak	AM Peak

Parameter Used for Geometric Condition

Table 2 highlighted the parameters used for geometric condition (based on the current condition scenario): Area Type, Number of Lanes, Average Lane Width, Grades, Existence of Exclusive RT or LT Lane, Length of Storage Bay, LT or RT Lane, and Parking Conditions.

Table 2: Geometric data and flow direction for all approaches of the intersection

Intersection Leg, Road Name	Lane No	Direction of Flow	Lane Width (m)	Approached width	Grade %
S Jalan Kempas Lama South	1	L	3.5	14	-0.5
	2	T	3.5		
	3	T	3.5		
	4	T	3.5		
	5	R/UT	3.5		
W Jalan Kempas Utama	1	LT	3.5	7	-0.5
	2	TR	3.5		
N Jalan Kempas Lama North	1	R/UT	3.5	14	-0.5
	2	T	3.5		
	3	T	3.5		
	4	R	3.5		
E Jalan Kempas Indah Perdana	1	LT	3.5	7	-0.5
	2	TR	3.5		

Parameter used for Traffic Volume

Figure 4 highlights the parameters used for traffic volume (based on the current condition scenario) comprised of peak hour traffic volumes by the directions.

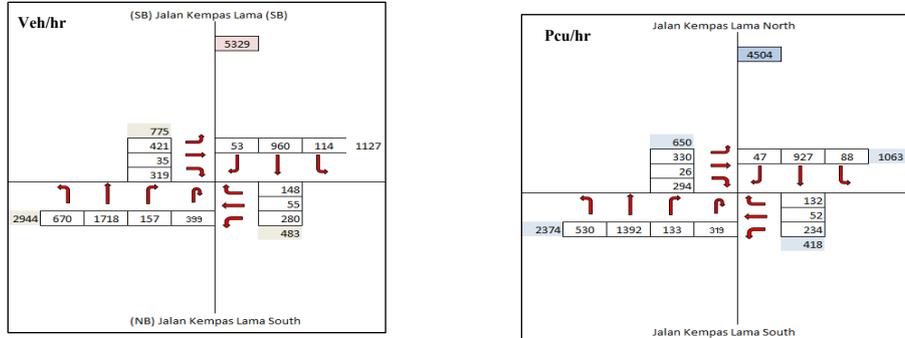


Figure 4: Condition scenario for traffic volume

Parameter Used for Signal Phasing

Figure 5 highlights the parameters used for signal phasing (based on the current condition scenario) comprised of Cycle Length (sec), Green Time (sec), Amber-Plus -All-Red Change and Clearance, Interval (intergreen) (sec), Actuated or Pretimes operation, Pedestrian push-button, Minimum Pedestrian green (sec), Phase Plan, and Analysis Period (hr).



Figure 5: Condition scenario for signal phasing

Indicator Used that Relates to Queue Length and Delay

Table 3 tabulates the relationship between the traffic volume and the average delay as per the present condition scenario at the signalised intersections.

Table 3: Current condition scenario of delay

Approach	Traffic Volumes (pcu/hr)	Longest Queues (m)	Average Delay (sec)
Northbound	2374	316.00m	178
Eastbound	650	27.00m	141
Westbound	418	8.00m	90
Southbound	1063	306m	155

Comparison Result of Junction Performance Analysis Between SIDRA and MHCM Methods

The analysis is to determine whether junction performance analysis was different between SIDRA Intersections and MHCM methods. Table 4 showed the result of

junction performance analysis between SIDRA and MHCM methods. Based on the same parameter used for both SIDRA Intersections and MHCM, output in SIDRA resulted more similar performance with the site observation.

Table 4: Comparison Result of Junction Performance Analysis between SIDRA and MHCM Methods

Approach	Traffic Volumes		Site Observation	SIDRA Default		
				Default	Change Basic Saturation	Change Lw _(fv)
Basic Saturation (S)			N/A	1950	1930	1930
Lane width (f_w)			3.5	3.3m	3.3m	3.5
Northbound	2734	178	178	174.1	183.4	174.1
Eastbound	650	141	141	148.3	142.3	148.3
Westbound	418	90	90	156.9	81.1	81.8
Southbound	1063	155	155	149.3	157.9	149.3
Intersection Delay				103.1	109.6	104.6
Approach	Traffic Volumes		Site Observation	MHCM		
				Default	Change Basic Saturation	Change Lw _(fv)
Basic Saturation (S)			N/A	1930	1930	1950
Lane width (f_w)			3.5	3.5m	3.3m	3.5
Northbound	2734	178	178	160.1	185.3	154.9
Eastbound	650	141	141	47.83	49.23	47.56
Westbound	418	90	90	42.53	43.21	42.4
Southbound	1063	155	155	79	94.51	76.29
Intersection Delay				109.7	126.5	106.5

CONCLUSION

In conclusion, the result findings summarised that parameters involved for SIDRA and MHCM methods are based on type of condition namely geometric conditions (7 parameters), traffic conditions (8 parameters), and signalised conditions (9 parameters) is suitable and the differences results between these two methods is not quite different between each other. However, the output in SIDRA resulted more similar performance with the site observation.

Hence, both SIDRA Intersection and MHCM are tools suitable for planning, analysing and designing purposes for the intersections in Malaysia context. Both have different advantages and disadvantages, which can differentiate them from other tools and make them suitable in Malaysia. However, for SIDRA Intersection to be used in Malaysia, some of the parameters need to be adjusted first to get a desirable result that can reflect on the intersection's real-life situation. As for MHCM, it is a manual which has been developed based on the current situation and condition of the Malaysia road. Therefore, the manual gives a significant advantage compared to other tools, which contain general guidelines and parameters that can be used in whole countries, unlike MHCM, which can only be used in Malaysia. Therefore, combining these tools can help produce a suitable and desirable result for planning, analysing and designing the intersections in Malaysia to make Malaysia

one of the best countries in the world in terms of designing a good transportation network.

ACKNOWLEDGEMENT

The authors would like to thank the Malaysia Institute of Transport (MITRANS) for financial support for this paper submission and contributing to Vanguard MITRANS grant. This paper is part of MSc by dissertation study under School of Civil Engineering, College of Engineering, UiTM Shah Alam, Malaysia.

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Received: 24th Jan 2023. Accepted: 20th July 2023



PLANNING MALAYSIA:

Journal of the Malaysian Institute of Planners

VOLUME 21 ISSUE 4 (2023), Page 176 – 189

ENABLING INTELLIGENT TRANSPORTATION SYSTEM (ITS) APPLICATION FOR SMART PARKING MONITORING SYSTEM (SPMS) AT URBAN ENVIRONMENT

**Siti Nurzafira Binti Mohamad Taufik¹, Siti Zaharah Ishak²,
Zaharah Mohd Yusoff³, Mohd Nizar Mohd Jaafar⁴**

^{1,2,3}*Malaysia Institute of Transport (MITRANS),
UNIVERSITI TEKNOLOGI MARA (UiTM), SELANGOR MALAYSIA*
²*School of Civil Engineering, College of Engineering,
UNIVERSITI TEKNOLOGI MARA (UiTM), SELANGOR MALAYSIA*
⁴*MNJ Teras Sdn.Bhd,
PETALING JAYA, SELANGOR, MALAYSIA*

Abstract

Smart City conceptual development is as an approach to solve urbanization issues and improve the quality of life. Among others, the needs of Smart City are focused to enhanced the users of smart mobility. Taking action to reduce and control pollution levels is a major priority because Urban mobility accounts for 40% of all CO2 emissions of road transport and up to 70% of other pollutants from transportation record. The study was performed by reviewing and highlighting existing published studies on Intelligent Transportation System (ITS) application for smart parking monitoring system and performing gap analysis. This paper reviewed recent research towards smart parking monitoring system highlighting its implementation stage, factors and impacts.

Keywords: Intelligent Transportation System (ITS), Smart City, Smart Mobility, Smart Parking Monitoring System

¹ Senior Lecturer at UiTM. Email: sitiza406@uitm.edu.my

INTRODUCTION

Given the rising pace of global urbanization, improving the quality of life in cities is becoming a more pressing concern for urban planners for having an efficient and sustainable urban planning system. In Malaysia context, smart city is a new idea and new mode of initiatives to promoting smart city planning, construction, management and services. The document includes the smart city definition in the context of Malaysia, seven key components of smart city, policy directions and outlines the proposed strategies and initiatives for each component that can be a reference to those interested in implementing smart city initiatives in Malaysia. In the global context, smart cities are used as one of the approached to resolve urbanization issues and improve the quality of life in the city.

Smart city is seen as a new to make Malaysia's cities more sustainable and liveable. A new strategy to urban management and development is needed. At the same time, technological advancements are taking place and the application of information technology (IT) make smart cities more feasible and convenient for people living in cities. Throughout Malaysia's development plans such as the Eleventh Malaysia Plan (11MP), the National Physical Plan 3 (NPP3) and the National Urbanization Policy (NUP2) is emphasized towards making Malaysian cities into smart cities and strengthening digital infrastructure has been embedded in Malaysia. The development of smart cities is to support Malaysia's commitment towards global agenda such as Sustainable Development Goals (SDGs) and New Urban Agenda (NUA). Cities that use ICT and technological advancement to address urban issues including to improve quality of life, promote economic growth, develop sustainable and safe environment for encourage efficient urban management practices. The components of smart city are categorized in seven components which are Smart Economy, Smart Living, Smart Environment, Smart Government, Smart Mobility, Smart Digital Infrastructure.

In short, smart mobility is a network of intelligent transportation and mobility. Smart mobility is the reimagining of the transportation infrastructure utilized in daily life and business by connecting various elements of technology and mobility. Traditional gas and electric vehicles, bike and scooter share programmers, autonomous vehicles, rail lines, and even augmented traffic realities, where road space is designated for specific modes of transportation at different times throughout the day, are all included in the definition of the smart mobility ecosystem. Smart mobility promises to bring a number of benefits for the majority of businesses across nearly every industry, efficiency being the most measurable. Increasing efficiency with smart mobility services would not only have a positive impact on the economy. The environmental impact of a massive decrease in CO₂ emissions and resulting pollution would positively improve the quality of life for the urban population. The issues pertaining to CO₂ emissions is very much related to transportation. Parking spaces are found to be more than

plenty in some places and very hard to find in others. This difficulty in finding parking spaces may lead to more time consuming besides cost and CO2 emissions. The main aims of this paper is to review the existing Intelligent Transportation System (ITS) used to support Smart Parking Monitoring Systems (SPMS) and identifying the gap of its implementation. The motivation of this paper is to propose the mandatory installation of ITS application at every parking space under the local authority applying for 'Planning permits' from Local authority.

SMART CITIES

Smart Cities were defined by the British Standards Institute as the effective integration of physical, digital and human systems in the built environment to deliver a sustainable, prosperous and inclusive future for its citizens (Filipe, 2019). In addition, a smart city also can be defined as an urban area which encompassing possibly different areas and scales of the city that includes street, plaza, neighbourhood and the entire city. The smart cities use electronic data collection sensors which located on infrastructures, buildings, vehicles, institutions and devices which known as Internet of Things (IoT) to supply real time information of the main cities operating system. Since most smart city related to the projects have risen from the bottom-up experiences related to the specific problem it will become difficult to have a generalizable definition.

According to Byod (2014), the smartest cities in the world has emerged as a key mechanism for cities to find innovative solutions to the challenges they face Increased demand for infrastructure, housing, transportation, jobs, energy, food, and water are all straining city governments and infrastructure as people from all over the world flock to cities in search of a better life and more opportunities. However, in recent years, cities have begun to think more holistically about what it means to be a smart city, and have innovated new ways to modernize how a city serves its citizens. Smart cities are a complex phenomenon and any effort to measure them needs to contain breadth and depth of indicators. Other than that, the smart city is a concept, and there is no clear and consistent definition of it between academics and practitioners. In addition, a smart city is a location where traditional networks and services are made more flexible, efficient, and sustainable through the use of information and digital technologies with telecommunications technologies. In other words, in a smart city, digital technologies translate into improved public services for residents and businesses. In other hand, the smart city is a city connecting the physical infrastructure which includes the information technology infrastructure, the social infrastructure and the business infrastructure to leverage the collective intelligence of the city. A smart sustainable city is an innovative city that uses information and communication technologies (ICTs) and other means to improve

quality of life, efficiency of urban operations and services, and competitiveness, while also meeting the economic, social, and environmental needs of current and future generations. Smart city includes the components to be labelled as smart component. These elements are what enable cities to be smart and efficient. ICT (information and communication technology) are key enablers in the transformation of traditional cities to smart cities. The Internet of Things (IoT) and Big Data (BD), two closely related emerging technology frameworks, make smart cities efficient and responsive. The technology has sufficiently matured to allow smart cities to emerge. However, there is a great need for physical infrastructure, renewable energy, ICT, IoT, and BD to make the majority of cities around the world smart. A smart city is an urban area using information and communication technologies, business models and solutions for increasing operational efficiency, sharing information with the public, and improving both service quality and citizen satisfaction welfare. One of the key pillars of the Smart City concept is Smart Mobility. Using various technological solutions in all areas of transportation and traffic science, the possibilities for incorporating technology into the transportation sector are expanding increasing. The advancement of information and communication technologies is taking place key elements in the creation of a Smart City Mobility in cities has become one of the most important issues the most serious issues confronting local governments. Related to this component, there are many different definitions that are the growing number of private cars, road accidents, congested roads in the traffic network, less public space for people, and economic stagnation force local governments to develop sustainable and environmentally acceptable urban mobility solutions. Smart Mobility is a concept in which travel time is optimized using various past and real-time data and the assistance of information and communication technologies, resulting in reduced space usage, road congestion, road accidents, and harmful gas emissions. According to Nagy (2020), smart mobility is being separated into two segments which are (1) innovative solutions and (2) development of current services. In order to consider that the mobility system of a city is smart, it is necessary that the smart mobility system is operating and self-correcting by requiring little or no human intervention. In terms of smart mobility, the main aspect of smart mobility is connectivity which including the big and open data. Road users can transmit all the information in real time, and public administrators can simultaneously conduct dynamic management which the preparation of data will including the data on available of parking spaces, traffic conditions, accidents, trains and bus delays. In these two terms, the open data and big data is not the same. The big data is a dataset usually difficult to process with traditional database and software techniques; for example, the data generated by millions of trips and logged on a daily basis by electronic transit cards and “open data” is data.

The SMART principle which known as smart, measurable, achievable, relevant and timebound helps to determine the optimal set of indicators for assessing the level of quality in transport systems. To sustain the urban mobility process, smart mobility indicators must be set. The concept of smart mobility widely used is focused on citizen needs, quality of life and health in the city, during the planning and implementation phases. The chosen measures, serving as guidelines for achieving the sustainable goals, should be measurable by indicators. The indicators are based on measuring the rate of implementing information and communication. The concept of smart cities practically focuses on urban transformation, based on sustainability.

However, because every society has economic, social, environmental, and institutional dimensions, smart cities and sustainability must incorporate these elements as well. In addition to the aforementioned trends, ICT applications and information or knowledge-based societies emerge. Globalization, re-urbanization, and changes in social mobility behavior pose significant challenges to transportation technologies. There are two segments for smart mobility concept which known as (1) innovative solutions and (2) development of current services. Innovative solutions are not present in every urban transportation system, however according to Simon (2020), innovative solutions are not present in every urban transportation system. The innovative solutions play a main role in smart mobility-oriented development. In smart mobility, the autonomous vehicles (AV) and electric vehicles are tools on the vehicle side. Mobility as a Service (MaaS) is a new concept. Shared mobility solutions are effective tools to increase the efficiency of cars. ICT applications that include hardware and software demand driven solutions are spreading. Parking services are also moving to automated solutions.

Hence in Malaysia, to realize the objective of smart mobility, there is a crucial need to improve on accessibility to public transportation, integrated mobility, management of traffic and technologies for parking. These will then become a turning point in the government's initiative towards becoming a Smart City. But then most Malaysians prefer to drive their own cars, adding to traffic congestion problems. Therefore, the government needs to discourage the usage of cars while upgrading our public transportation system to encourage people to make the right choice. Based on the literature study, indicators of smart mobility are as follow:

Table 1: Indicators of smart mobility based on literature

Variables	Indicators	Concept
Location Efficiency	Support for Sustainable Growth	Transportation plan that supports for Sustainable Growth
	Transit Mode Share	Level of intermodal transportation usage
	Accessibility and Connectivity	Accessibility and connectivity of transportation mode
Reliable Mobility	Multi Modal Travel Mobility	Efficiency of time and cost on transportation
	Multi Modal Travel Reliability	Time predictability
	Multi Modal Service Quality	User's satisfaction by convenience transportation
Health and Safety	Multi Modal Safety	Safety on Transportation
	Design and Speed Suitability	Suitable Facilities
	Pedestrian and Bicycle Mode Share	Level of Pedestrian and Bicycle Users
Environmental Stewardship	Climate and Energy Conservations	Level of Vehicle Usage
	Emission Reduction	Emission level generated from vehicles
Social Equity	Equitable Distribution of Impacts	Adequate facilities for all social groups
	Equitable Distribution of Access and Mobility	Adequate cost and time on transportation for all

Source: Indrawati (2017)

Smart mobility aims to improve everyone's daily life. The advantages for implement smart mobility in the city will improve the motorist's experience which the road users, whether in their own vehicles or on public transit, have real-time information that gives them the opportunity to make mobility choices based on events. They can also make the most of the time they spend in transportation by planning their itinerary before leaving. Other than that, the Intelligent mobility makes public transportation more accessible, more reliable, and more attractive. The various tools enable users, for example, to pay contactless, simply and quickly, or to locate their bus/tram and find out how far away they are from the stop. They also make it possible to improve traffic flow, optimize network and fleet management and reduce disruptions due to service interruptions.

Smart mobility helps reduce congestion and pollution, for example by offering alternative routes in the event of an accident, thus avoiding traffic jams that cause pollution peaks.

FACTORS ON INFLUENCING PARKING ISSUES

Intelligent Transportation System (ITS) for Smart Parking Systems

Luis (2019), noticing that the global smart parking system market size is expected to reach USD 368.7 million by 2024. Smart parking systems are considered ITS solutions that enable effective traffic congestion and parking-related issues to be addressed. Such systems aid in reducing fuel consumption and, as a result, vehicular emissions. The increase in the number of automotive and the lack of an efficient. The increasing number of automotive and the lack of an efficient parking management system is affecting the availability of parking spaces and is subsequently driving the demand for these technologies across the globe. Smart parking development implies an IoT based system that sends data about free and occupied parking places via web/mobile application. The IoT-device, including sensors and microcontrollers, is located in each parking place. The user receives a live update about the availability of all parking places and chooses the best one. The creation of smart parking using the Internet of Things and ultrasonic sensors where available parking places could be displayed in a dashboard or any web application in Malaysia. Smart parking also is a strategy that combine technology and human innovation in an effort to use as few resources as possible such as fuel, time and space to achieve faster, easier and denser parking of vehicles for the majority of time they remain idle. Parking is divided into two categories which known as:

On -Street Parking

On-street parking means parking the vehicle on the street, anywhere on or along the curb of streets, in contrast to parking it in a parking garage. In some streets, this type of parking can always park your vehicle on the street, but sometimes there are restrictions. Mostly these restrictions are presented on traffic signs.

Off -Street Parking

Off-street parking means parking your vehicle anywhere but on the streets. These are usually parking facilities like garages and lots. Off-street parking can be both indoors and outdoors. Off-street parking also includes private lots, garages and driveways.

Smart parking development implies an IoT based system that sends data about free and occupied parking places via web/mobile application. The IoT-device, including sensors and microcontrollers, is located in each parking place. The user receives a live update about the availability of all parking places and

chooses the best one. The creation of smart parking using the Internet of Things and ultrasonic sensors where available parking places could be displayed in a dashboard or any web application in Malaysia. Smart parking also is a strategy that combine technology and human innovation in an effort to use as few resources as possible such as fuel, time and space to achieve faster, easier and denser parking of vehicles for the majority of time they remain idle.

Smart parking refers to the use of sensing devices to determine occupancy at the space level or at the lot/structure level. Car parking problems are a major contributor. Searching for a parking space is a routine activity for many people in cities around the world. This search burns about one million barrels of the world's oil every day. Based on previous study, more than half of drivers among 8000 commuters in twenty cities worldwide said during the past year they gave up at least once when looking for a parking space. When the driver rapidly finds a parking area by minimizes the on-street parking, it helps to regulate public transportation and generates revenue for developing smart cities. The connectivity in a major challenge in developing cities. IoT based free parking space shows accessibility with the android-based application.

The current model of parking management requires a manual mechanism, to guide the free parking area as well as record the number plate and the time of every vehicle. The manual methodology takes a lot of time to record the vehicle information like the number and entry-exit time. With the existence of internet of things (IoT) devices, regular advertising the free slot and occupied slot to a centralized location where the driver or concerned person can easily access the information about their vehicle. An automated method to record the vehicle information and guide for the free slot save time. Vehicle information likes entry-exit time and real-time situation including the threats and stored into the cloud timely which this will access by the authorized person. Vemula (2014), creates a model that shows how smart parking management system connected to this study.

For above model, the presented automated parking management model does not require any manual intervention. Integration of cameras and sensors simplifies the complexity. A free area of land meant for parking purpose have 100 number of parking slot available, out of which 75 for 4-wheeler and 25 for 2 wheelers. Each slot has allocated a unique number. There are two lanes, one is for entry and the other one is for an exit. A camera and infrared (IR) sensor are connected to each gate which controls the activity of the turnstile gate. When a vehicle comes near the turnstile gate to enter, the IR sensor at the entry of the gate detects the vehicle. Whenever a vehicle has detected the camera (CCTV/webcam) captures the image of the number plate and saves it on the local disk of the mainframe system. Smart parking suggests an IoT-based system that sends data to free and busy parking places via net and mobile applications. The IoT-network

includes sensors and microcontrollers, which are found in each parking place. We implemented an enclosed smart parking project (SPMS), that using the Internet of Things and IR sensors, where available parking places can be displayed in a web application, then the user receives a live update about the availability of all parking places and chooses the best one. Smart parking IoT implementation is usually divided into the following parts.

Table 2. Smart Parking System

Collection	The collection depends on parking sensors to collect real-time parking. The parking systems may use sensors like Infrared, and Ultrasonic Sensors detect whether a parking spot is empty or not
Processing	The processing unit acts as interference between the sensors and the cloud. It includes an Arduino which is a processor on-chip. All the sensors are wirelessly connected to the processing unit, and data collected from various sensors are sent to it through the esp8266 chip.
Deployment	It deals with communication methods. Message Queue Telemetry Transport Protocol (MQTT) is a publish-subscribe based messaging protocol that is used on top of the TCP/IP protocol
Services	It can be made available to users once they finish storing data and monitoring information
Connection	Interested in the Internet of Things layer that deals with the database of parked cars through a shared server. The cloud stores data for available parking lots, user sites, profiles.
Mobile Application	It is the interface application between humans and the system

Source: Amira A (2020)

Intelligent Transportation System for Smart Parking Monitoring System: Review in Malaysia

In Malaysia, some of the areas you still can park free without need to pay anything. Due to not fully implement the parking meters from the government or the parking meters always malfunction, and lack of the officer manpower to raise the compound tickets to the car parking users. But this is going to end very soon. Malaysia's city council have launched the Smart Parking Systems or Apps in order to increase the car parking collection and reduce the operating cost. The

using of LPR Smart Parking is the one of technology that moving rapidly which using the LPR Technology that can be ticketless when enter the parking area. With the IOT revolution in the smart parking system in Malaysia, not only makes the lives easier to the car park user like you and me but reduce the operating cost of the car park operator, business owners, and building owners tremendously. This might not really realize now, but very soon in coming near few years, 70%–80% of the car park in Malaysia is covered using IOT smart parking and wherever you go, no more seeing the ticket/card machine. The implementation of smart parking monitoring system is a system that indicate the available parking spaces for the car owners. The management of the parking system has been improved for searching the available car parking spaces. The smart parking monitoring systems will indicate the available car park spaces using a monitor at the entry point of the car park. In Malaysia, the uses image processing and CCTVs to detect the car movement in the parking system. This research uses image processing and CCTVs to detect the car movement in the parking system via the car registration number. The implementation of ITS regarding to smart parking monitoring system includes:

Image Detection System

In Malaysia, many of image detection systems have been implemented and its restriction has offered. these restrictions are sometimes overcome through expensive and complex systems. The need on this research is a versatile (licenses plate recognition) LPR system that yields good results running on a low-cost platform in a controlled environment. Based on some principles of neural networks, that is fast enough to be applicable in camera in motion, the system embed the use of plate recognition in, with the specific parking ticket the system will be optimum.

Siti Nurzafira Binti Mohamad Taufik, Siti Zaharah Ishak, Rusdi Rusli, Zaharah Mohd Yusoff, Mohd Nizar Mohd Jaafar
Enabling Intelligent Transportation System (ITS) Application for Smart Parking Monitoring System (SPMS) at Urban Environment



Figure 6: Image Detection System
Source: Thinxtra (2021)

CCTV (Closed Circuit Television) is a visual surveillance technology designed for monitoring a variety of environments and activities. CCTV systems typically involve a fixed (or "dedicated") communications link between cameras and monitors, in our work CCTV involve as shown in the flow chart somehow it will make the system complement by adding level of management on the parking system. The CCTV'S in this system will be distributed as two CCTV in each area.



Figure 7: CCTVs System
Source: Thinxtra (2021)

CONCLUSION

Smart Parking is currently the most popular Smart City initiative. Several Smart Parking projects have been launched in many cities around the world to alleviate traffic and parking issues. Smart Parking is regarded as a low-barrier solution due to its ease of installation, scalability, efficiency, and flexibility. It is ideal for modern cities looking to provide potential benefits to their citizens while leveraging the power of IoT. Advanced and intelligent parking solutions not only reduce traffic on the roads, but also keep drivers from becoming stranded in areas where parking is unavailable. Drivers can easily find available parking spaces by using real-time data displayed on digital displays or mobile applications. These innovative solutions are perfect for resolving the parking problems in urban areas. The smart parking solution provides a stress-free parking experience to the drivers and enables them to find vacant parking spaces immediately around their destination.

ACKNOWLEDGEMENT

The authors would like to thank the Malaysia Institute of Transport (MITRANS) for financial support for this paper submission. This paper is part of MSc study under MITRANS, UiTM and contributing to Vanguard MITRANS grant.

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Received: 24th Jan 2023. Accepted: 20th July 2023



PLANNING MALAYSIA:

Journal of the Malaysian Institute of Planners

VOLUME 21 ISSUE 4 (2023), Page 190 – 203

THE EFFECTIVENESS OF TOURISM DEVELOPMENT IN SOCIAL CULTURAL APPROACH IN SABAH

Mohamad Pirdaus Yusoh¹, Ang Kean Hua^{2*}, Normah Abdul Latip³, Zulayti Zakaria⁴, Dg Junaidah Awang Jambol⁵, Mohammad Al Amir As Khairullah⁶, Ridzuan Abd Gafor⁷

^{1,3}Borneo Institute for Indigenous Studies,

²Geography Program, Faculty of Social Sciences and Humanities,

⁴Sociology and Anthropology Social, Faculty of Social Sciences and Humanities,

⁵History Program, Faculty of Social Sciences and Humanities,

^{6,7}Geography Program, Faculty of Social Sciences and Humanities,

UNIVERSITI MALAYSIA SABAH

Abstract

The generation of the national economy also lists the tourism industry as one of the sectors that need to be taken into consideration, primarily through social-cultural that has its characteristics to attract foreign tourists to visit the state of Sabah. This research study was conducted to investigate and evaluate the effectiveness of tourism development on social-cultural in Sabah. This research uses a quantitative approach, where questionnaires are the main instrument in collecting data in Sabah. The questionnaire format's structure is divided into two, namely, part A (focused on the demographic profile) and part B (concentrate on the cultural-social approach in tourism development in Sabah). The study sample was a total of 74 respondents, and the questionnaire was distributed randomly in the tourist focus area of Kota Kinabalu. The analysis used is descriptive and correlational. The findings of the study indicate that the majority of cultural variables and social variables are centred on a positive curve (or towards the right), where most respondents think that local government programs and activities help a lot in understanding the cultural-social importance of the tourism sector. In addition, the uniqueness and privilege of cultural-social tourism, such as through clothing, food, wedding events, dance, etc., can play a significant role in the development of tourism. In conclusion, cultural-social tourism should be the main theme not only for the generation of the national economy but also crucial in the preservation and conservation of the continuity of Sabah's local cultural-social tourism characteristics, which should be preserved in their originality forever rather than being outdated by the era of modernisation.

Keywords: Social-culture, Tourism sector, Economic generation, Authenticity, Era of modernisation

² Corresponding author Email: angkeanhua@ums.edu.my

INTRODUCTION

Sabah has various tourist attractions, such as cultural, environmental or man-made structures. According to Danting et al. (2018), the rural tourism sector in Sabah may be further enhanced with a comprehensive development plan by the government. The importance of tourism has been widely recognized globally as an important factor in the development of rural areas (Aytuq and Mikaeli, 2017). In general, tourism is one of the most important industries in most developed countries as well as in developing countries, because it is able to develop physical, economic, social, cultural, political, and technological dimensions (Hausman, 2001). Due to tourism activities, various types of opportunities are created such as job opportunities, infrastructure development and so on. Sabah is one of the states in Malaysia that contributes to national tourism development because of its excellent natural ecosystem including flora and fauna. Moreover, Latip et al. (2013) suggested the need for a sustainability approach in forest management as well as any other hot spot tourism. The islands in Sabah are the main attraction for tourists worldwide who like to enjoy the untouched ecosystem and mesmerise with beautiful scenery. The Sabah Tourism Board is an agency responsible for promoting the tourism industry in Sabah. The government allocated RM228 million from the state budget as stated in the State Government's Direction Policy, and RM15 million was allocated in the 2018 budget to empower rural tourism, as well as diversify the attractive destinations in the state (Sabah Tourism Board, 2019).

The government sees tourism as a tool for infrastructure development, employment opportunities, earning foreign exchange, balance of payments, regional development and generating benefits for local communities (Glasson et al., 1995). Tourism development can increase income and individual results for the host country (Ahn et al., 2002). Tourism plays an important role for economic development in this regard (Yusoh et al, 2022). This industry has a different contribution to the economy based on the perspective of each country. Tourism is a major source of foreign exchange earnings for most third world countries. In this regard, less developed countries (LDCs) consider tourism as an important tool for their economic development (Taleghani, 2010). The government of each country has provided support in the tourism sector to increase and recognize economic benefits. Tourism can contribute to the economic development of a country's macro and micro level. At the macro level, tourism is a catalyst for foreign exchange earnings, revenue generation, balance of payments and contributes to gross domestic production (GDP). Community involvement, people's well-being, job creation, income distribution, sustainable regional development are micro-level contributions of tourism.

Tourism is an important income generating industry in Malaysia. This sector was chosen as the second engine for the country's growth to develop global

competitiveness. This industry has a positive impact on the Malaysian economy to increase foreign exchange earnings, and employment opportunities (Bhuiyan et al., 2011). Malaysia has been ranked third in tourist arrivals among Commonwealth countries after Britain and Canada. According to 2005 statistics, tourism accounts for over 40% of Malaysia's balance of payments and is the main contributor to the country's foreign exchange (Malaysia, 2006). In 2006, tourism accounted for the second largest foreign exchange earning sector after manufacturing. Tourism earned US\$18.1 billion in export revenue which represented 10% of Malaysia's total exports in 2006 (WTTC, 2006). The Malaysian government has placed emphasis on the development of the tourism industry in the mid-1980s following the global economic recession and the decline in petroleum assets. The Government has established the Ministry of Culture, Arts and Tourism in this connection. In 2004, this ministry was named the 'Ministry of Tourism' (Fateh et al., 2009). The government has allocated sufficient funds to provide basic infrastructure in the tourism industry. Malaysia captured 2% of the global market share of inbound tourism in 2008. The industry employs 1.7 million workers or about 16% of total employment in 2008 (Malaysia, 2011). The Malaysian government has played an important role in creating a legal and institutional framework to ensure sustainable tourism. Therefore, this article presents a research study conducted focusing on the effectiveness of tourism development in a cultural-social approach in Sabah, Malaysia.

INSTRUMENTS AND METHODS

This research study focused on a quantitative approach, where questionnaires were used to collect raw data in the area of Kota Kinabalu, Sabah. In other words, this questionnaire will only be disseminated to local residents who will be respondents to this research study by living in tourist focus areas and able to carry out tourism activities. The sample size of this research study will involve local residents who live near coastal areas, mountainous areas, and forest edge areas, where the information provided is more accurate, true and accurate. This situation will also reduce the error gap between the information obtained from the respondents. The total sample size is recommended to be 100 respondents only, but not limited to that number and the rate of adding respondents will help improve the accuracy of the information obtained through the analysis in this study. The sampling method used in this study is random, where the collection of this data is not conditional on gender, age, or other factors that can limit the data collected. As for the questionnaire format, it is divided into part A and part B, where part A focuses on profile demographics only and part B will focus on the variables of the effectiveness of tourism development in a cultural-social approach. The scale used is the Guttman Scale in Part A and the Likert Scale in

Part B. 5-points are used in the Likert Scale, namely 1-Strongly Disagree, 2-Disagree, 3-Neutral, 4-Agree, and 5-Strongly Agree. This research study uses the method of descriptive analysis and correlation analysis with a total of 74 respondents who were successfully collected.

Research Study Area

Sabah is a state that has the potential to be developed as a world tourism center with the theme of island tourism (such as Mabul Island), highland tourism (such as Mount Kinabalu), cultural tourism (such as ethnic Kadazan-Dusun), nature tourism (such as hot springs poring) and flora and fauna tourism (such as Hutan Lipur Sepilok). The speciality of the state of Sabah with an area of 73904 km² has led to economic growth in the state and has become an attraction for the migration factor to occur, as the latest population (with data obtained in 2020) is 3418785 people (City Population, 2022). Suppose you look at the coordinates of longitude 5°15'N and latitude 117°0'E (Figure 1), Sabah. In that case, it cannot be denied that the state has an equatorial or tropical climate with an estimated temperature of 32°C (90°F) for the land area and an average temperature of 21°C (70°F) for the highlands. In other words, Sabah is a 'hot and sunny' state all year round. In addition, rainfall occurs frequently from October to February with the Northeast Monsoon season throughout the year, as well as hot or dry months in May and September.



Figure 1: The study area in Kota Kinabalu, Sabah.

RESULTS AND DISCUSSION

In this study, descriptive analysis based on frequency and percentage is used in part A (ie demographic profile) and part B (ie variable cultural impact and social impact). In other words, the exact number that was successfully collected was as many as 74 respondents and can be shown in the form of Table 1. The findings of the study show the gender variable where the number of women (N=55) exceeds the number of men (N=19) by 48.6%. The significant difference that occurs is due to the majority of male going out to work to find income to support their families. And not to forget, most of the female whose number is high due to the respondents do not work or become housewives completely and are only at home all the time. Not only the gender variable, the length of stay in Sabah is also one of the necessary and important variables in the determination of authentic, accurate and precise information in this research study. In other words, Table 1 proves that 81.1% of respondents have stayed for more than 9 years with a total frequency (N) of 60 people, followed by 12.2% of respondents who have stayed for less than 1 year with only 9 people, and lastly 1 to 3 years and 4 to 6 years for 4% (N=3) and 2.7% (N=2). If you look at the trend, the results of this study can document information related to the development of tourism that can have a positive or negative impact on culture and society in Sabah. In summary, the longer the respondent lives in Sabah, the more accurate and precise the information obtained for variables related to social impact and cultural impact. This will be discussed in the next section.

Table 1: Part A: Social and Demographic Profile.

Category	Frequency (N)	Percentage (%)
Gender		
Male	19	25.7
Female	55	74.3
Length stays in Sabah (years)		
<1	9	12.2
1 to 3	3	4
4 to 6	2	2.7
7 to 9	-	-
>9	60	81.1

Furthermore, in part B, the social impact variable shows the variable of tourism development on the social and cultural impact by the perception of local residents in Kota Kinabalu, Sabah (Table 2) showing that the majority of the variables are curved to the right or positive. In other words, most respondents have views and opinions that are 'neutral' to 'strongly agree'. Referring to the

findings of the study in Table 2, in summary the majority of variables that are holistic towards strongly agree are (Figure 2):

- 1) I have relatives who live together in this area;
- 2) Local residents actively interact while carrying out the duties of the tourism event;
- 3) I agree that tourism improves leisure and entertainment facilities that improve my life; and
- 4) Other organisations support my community through tourism knowledge programs.

While the other variables are more 'disagree-neutral-agree'. In other words, most respondents think that only tourism activities have the ability to generate daily economic income. Because of this, the local population, especially those who live close to the coast, mountains, flora-fauna; will tend to be active in the tasks of events related to tourism. Not only that, the local residents also hope that the state government can help in improving leisure and entertainment facilities so that the respondents not only help from the perspective of the national economy, but also have the opportunity to maintain social relations between local residents together in maintaining and protecting the natural uniqueness of tourism in morning Coupled with relatives who live nearby in groups, respondents are very positive that the tourism knowledge program by related organisations can be carried out comprehensively and this situation is very helpful to the local population for the purpose of reducing the negative impact in the social impact of tourism development, can even increase the positive impact social together with efforts to develop tourism through appropriate activities.

Meanwhile, the cultural variables (Figure 3) involved can be proven through positive tendencies through Table 2 as follows:

- 1) Income through traditional activities (eg fishing and farming) maintained by local residents;
- 2) Tourism events help promote the culture and image of my community.
- 3) I am confident that my skills and experience can help in finding a good job;
- 4) I gradually increase my understanding of culture;
- 5) I have the opportunity to improve my job skills;
- 6) I have experienced local government training programs to improve my skills and knowledge.
- 7) I understand the advantages and benefits of tourism; and
- 8) I am aware of the cost of tourism.

Referring to the knowledge of local people, most respondents are inclined to practise traditional culture in search of daily income, for example fishing and farming. However, there are a number of respondents who think that if they are exposed to local government training programs, this situation will surely improve the respondents' skills and knowledge of tourism and also have the opportunity to help them find better jobs, as for example through the development of tourism activities. One of the examples that can be directly seen is through tourism events that promote the culture and image of the local community. This situation has encouraged Sabah's cultural tourism to take place, and the factor contributing to this is through the local government's training program. Although local people are aware of the cost of tourism, but for the longer term, the respondents are very positive that the advantages and benefits of tourism obtained are multiples of the cost of production in the first time. Because of this, respondents believe that socio-cultural tourism does not bring negative stimulation in the minority, but brings the majority of benefits and advantages to the local population and the country through efficient tourism development in long-term planning.

Table 2: Descriptive analysis based on tourism development on cultural and social impact in Sabah.

Category	SD (%)	D (%)	N (%)	A (%)	SA (%)
Social Impact					
I have relatives who live together in this area.	1 (1.4)	5 (6.8)	36 (48.6)	18 (24.3)	14 (18.9)
Local residents interact actively while carrying out the tasks of the tourism event.	2 (2.7)	5 (6.8)	32 (43.2)	26 (35.1)	9 (12.2)
I participate and exchange ideas in community meetings and events.	1 (1.4)	13 (17.6)	35 (47.3)	16 (21.6)	9 (12.2)
I agree that tourism enhances the leisure and entertainment facilities that enhance my life.	2 (2.7)	6 (8.1)	28 (37.8)	25 (33.8)	13 (17.6)
My community has ample meeting space for community gatherings.	1 (1.4)	11 (14.9)	36 (48.6)	19 (25.7)	7 (9.5)
I recognize those tourist faces in my daily life.	1 (1.4)	8 (10.8)	42 (56.8)	16 (21.6)	7 (9.5)
My community usually runs tourism activities and events.	2 (2.7)	12 (16.2)	28 (37.8)	24 (32.4)	8 (10.8)
The State Government financially supports my community organisation.	2 (2.7)	9 (12.2)	37 (50.0)	19 (25.7)	7 (9.5)

Category	SD (%)	D (%)	N (%)	A (%)	SA (%)
Other organisations support my community through tourism knowledge programs.	3 (4.1)	7 (9.5)	38 (51.4)	18 (24.3)	8 (10.8)
Cultural Impact					
I still practise extreme traditional life.	1 (1.4)	10 (13.5)	39 (52.7)	15 (20.3)	9 (12.2)
Ceremonial activities are enhanced in my community.	1 (1.4)	8 (10.8)	38 (51.4)	21 (28.4)	6 (8.1)
Income through traditional activities (eg fishing and farming) is maintained by local residents.	2 (2.7)	6 (8.1)	37 (50.0)	18 (24.3)	11 (14.9)
Tourism events help promote the culture and image of my community.	2 (2.7)	4 (5.4)	27 (36.5)	24 (32.4)	17 (23.0)
I am confident that my skills and experience can help in finding a good job.	2 (2.7)	7 (9.5)	32 (43.2)	22 (29.7)	11 (14.9)
I gradually improved my understanding of the culture.	3 (4.1)	3 (4.1)	26 (35.1)	30 (40.5)	12 (16.2)
I have the opportunity to improve my job skills.	2 (2.7)	4 (5.4)	27 (36.5)	32 (43.2)	9 (12.2)
I have experienced local government training programs to improve my skills and knowledge.	3 (4.1)	6 (8.1)	31 (41.9)	27 (36.5)	7 (9.5)
I understand the advantages and benefits of tourism.	2 (2.7)	5 (6.8)	23 (31.1)	30 (40.5)	14 (18.9)
I am aware of the cost of tourism.	3 (4.1)	4 (5.4)	23 (31.1)	28 (37.8)	16 (21.6)
I have participated in the coastal environmental impact program.	3 (4.1)	8 (10.8)	32 (43.2)	23 (31.1)	8 (10.8)
I have attended a local government program on tourism knowledge.	4 (5.4)	9 (12.2)	35 (47.3)	19 (25.7)	7 (9.5)

Notes: SD=Strongly Disagree; D=Disagree; N=Normal; A=Agree; SA=Strongly Agree.

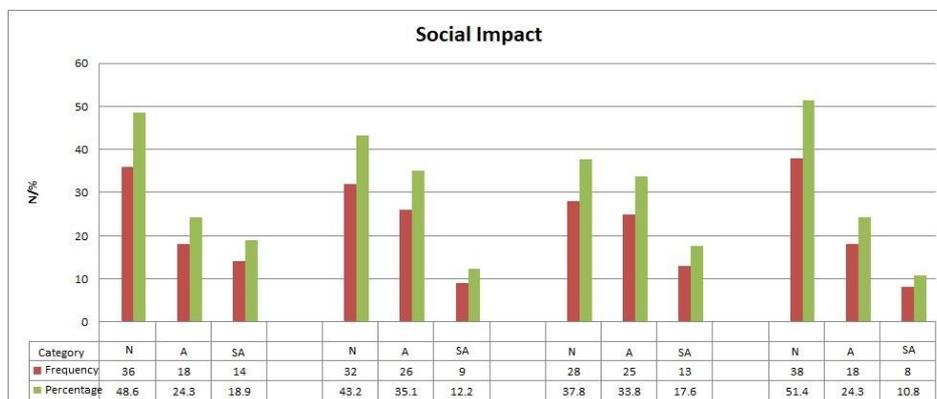


Figure 2: Descriptive analysis based on tourism development on social impact in Sabah.

(Notes: N=Normal; A=Agree; SA=Strongly Agree)

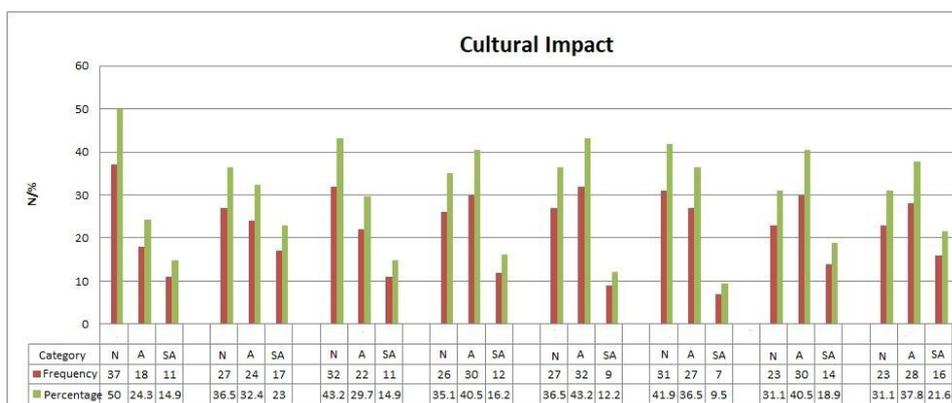


Figure 3: A descriptive analysis based on tourism development on the cultural impact in Sabah.

(Notes: N=Normal; A=Agree; SA=Strongly Agree)

The next analysis is important for the determination of tourism activities that can have a direct and indirect impact on these social cultures. Previous analysis techniques show that tourism development that has an impact on culture and impact on society is individual and cannot show the relationship between the two variables. In order to obtain continuity between these cultural-social variables, it can only be done through correlation analysis (Table 3). Overall, the research findings prove that cultural variables have an impact-and-reflection on social variables by tourism development in Sabah. On a positive note, it can be said that respondents think that practising an extreme traditional life can be linked to most relatives living together in the area. It is very important for relatives to be able to live together because if there is a problem, they can help each other. When this happens, the respondent will feel

very comfortable and the probability of accepting the change is lower. Because of this, the respondents continue to practise extreme traditional attitudes and lives, where it is related to fishing and farming in the hinterland, the city, or on the coast.

The local people who live a traditional life are not only a source of daily food for the family, but the catch and agricultural products will be sold to the local residents. Small-scale business activities will occur in economic generations in a family. Indirectly, relationships between relatives or with residents can also be maintained, as well as getting the attention of the state and federal governments in an effort to improve the national economy through the tourism sector. For this reason, the state government takes this initiative and opportunity by providing financial support to local community organisations. In other words, the local government will provide and run a training program on tourism knowledge to the residents, and this situation is also agreed by most respondents who actively participate in the activity where they admit that the tourism training program greatly increases the knowledge of the local population regarding tourism development. This situation greatly increases the local population's economy many times over, apart from being completely dependent on small business activities.

It is not just the state government in efforts to improve the tourism sector through various programs, other organisations including non-governmental organisations (NGOs) are also involved in efforts to improve tourism development. For example, the Government encourages the involvement of NGOs (Utusan Borneo Online, 2016), NGOs are encouraged to organise more sports activities (Utusan Borneo Online, 2019), and NGOs play an important role in helping develop rural communities (Nabalu News, 2022); in an effort to increase and develop the tourism sector in Sabah. Because of this, the local residents interact actively when carrying out the tasks of the tourism event. This is because with the promotion of tourism programs that are held every time, respondents will definitely get information and knowledge regarding the probability of the existence of opportunities to generate daily income through this tourism sector. Respondents also strongly agree that tourism events help promote the culture and image of the local community, in addition to positively thinking that tourism improves leisure and entertainment facilities in the local area. For example, customary activities such as wedding ceremonies, ceremonies to celebrate the birth of a baby, ceremonies to celebrate the new year, and death ceremonies that attract foreign tourists from abroad to witness the uniqueness and traditional authenticity of Sabah's social culture. And also, traditional equipment can be a privilege in developing the tourism sector. Therefore, regardless of directly or indirectly, the socio-cultural characteristics are very unique and dynamic, as well as special because this matter not only contributes to the generation of the national economy, but the development of tourism helps a lot in terms of conservation and preservation of the local social-culture in Sabah.

Table 3: Correlation analysis between cultural impact variables and social impact variables by tourism development in Sabah.

Social Impact versus Cultural Impact		I have relatives who live together in this area.	Local residents interact actively while carrying out the tasks of the tourism event.	I participate and exchange ideas in community meetings and events.	I agree that tourism enhances the leisure and entertainment facilities that enhance my life.	My community has ample meeting space for community gatherings.	I recognize those tourist faces in my daily life.	My community usually runs tourism activities and events.	The State Government financially supports my community organization.	Other organizations support my community through tourism knowledge programs.
I still practice extreme traditional life.	P.C. S. N.	.279* .016 74	.461* .000 74	.579** .000 74	.384** .001 74	.386** .001 74	.408** .000 74	.350** .002 74	.533** .000 74	.574** .000 74
Ceremonial activities are enhanced in my community.	P.C. S. N.	.482** .000 74	.410** .000 74	.426** .000 74	.399** .000 74	.335** .004 74	.414** .000 74	.455** .000 74	.496** .000 74	.544** .000 74
Income through traditional activities (eg fishing and farming) is maintained by the local population.	P.C. S. N.	.320** .005 74	.357** .002 74	.317** .006 74	.369** .001 74	.298** .010 74	.438** .000 74	.337** .003 74	.374** .001 74	.465** .000 74
Tourism events help promote the culture and image of my community.	P.C. S. N.	.372** .001 74	.411** .000 74	.256** .028 74	.438** .000 74	.309** .007 74	.394** .001 74	.329** .004 74	.382** .001 74	.463** .000 74
I am confident that my skills and experience can help in finding a good job.	P.C. S. N.	.336** .003 74	.279** .016 74	.376** .001 74	.353** .002 74	.246* .034 74	.381** .001 74	.198 .091 74	.370** .001 74	.505** .000 74
I gradually improved my understanding of the culture.	P.C. S. N.	.317** .006 74	.334** .004 74	.284* .014 74	.434** .000 74	.276* .017 74	.188 .109 74	.156 .186 74	.368** .001 74	.346** .003 74

Social Impact versus Cultural Impact		I have relatives who live together in this area.	Local residents interact actively while carrying out the tasks of the tourism event.	I participate and exchange ideas in community meetings and events.	I agree that tourism enhances the leisure and entertainment facilities that enhance my life.	My community has ample meeting space for community gatherings.	I recognize those tourist faces in my daily life.	My community usually runs tourism activities and events.	The State Government financially supports my community organization.	Other organizations support my community through tourism knowledge programs.
I have the opportunity to improve my job skills.	P.C. S. N.	.369** .001 74	.369** .001 74	.220 .059 74	.432** .000 74	.437** .000 74	.406** .000 74	.232* .046 74	.343** .003 74	.405** .000 74
I have experienced local government training programs to improve my skills and knowledge.	P.C. S. N.	.302** .009 74	.305** .008 74	.454** .000 74	.307** .008 74	.358** .002 74	.486** .000 74	.333** .004 74	.369** .001 74	.446** .000 74
I understand the advantages and benefits of tourism.	P.C. S. N.	.375** .001 74	.366** .001 74	.129 .274 74	.398** .000 74	.387** .001 74	.340** .003 74	.195 .097 74	.284* .014 74	.341** .003 74
I am aware of the cost of tourism.	P.C. S. N.	.347** .002 74	.370** .001 74	.205 .079 74	.496** .000 74	.393* .001 74	.449** .000 74	.250* .032 74	.386** .001 74	.480** .000 74
I have participated in the coastal environmental impact program.	P.C. S. N.	.370** .001 74	.307** .008 74	.346** .003 74	.358** .002 74	.444** .000 74	.332** .004 74	.221 .058 74	.372** .001 74	.477** .000 74
I have attended a local government program on tourism knowledge.	P.C. S. N.	.253* .029 74	.307** .008 74	.391** .001 74	.353** .002 74	.493** .000 74	.266* .022 74	.231* .047 74	.358** .002 74	.387** .001 74

Notes: P.C. = Pearson Correlation; S=Significant (2-tailed); N=Frequency.

CONCLUSION

In conclusion, tourism development has a lot of positive impact on the local social culture in the state of Sabah. The locals who live in this tourist destination area are very open-minded and believe that tourism activities should not only be themed to the environment or based on coastal scenery, but also important in promoting the special cultural and social characteristics through clothing, food, wedding events, dance, etc. Therefore, cultural-and-social tourism should be listed as one of the main themes not only for the generation of the national economy, but also important in preserving and conserving Sabah's local cultural-and-social uniqueness so that it can be maintained forever rather than being swallowed up by time.

ACKNOWLEDGEMENT

The author would like to thank to the Research Management Center (PPP), Universiti Malaysia Sabah (UMS) for providing and financial support to complete this research study as well as publishing the academic paper.

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Received: 18th May 2023. Accepted: 20th July 2023



ASSESSING THE EVOLUTION OF PADDY CULTIVATION IN KOTA BELUD, SABAH USING GIS AND REMOTE SENSING TECHNIQUES

**Lindah Roziani Jamru¹, Mohamad Nazril Bin Sharil², Mohamad Pirdaus
Yusoh³**

*^{1,2}Faculty of Social Sciences and Humanities,
UNIVERSITI MALAYSIA SABAH*
*³Borneo Institute for Indigenous Studies,
UNIVERSITI MALAYSIA SABAH*

Abstract

This study aims to analyse the development of paddy cultivation in Kota Belud, Sabah using remote sensing and Geographic Information Systems (GIS) from 1990 to 2020. The cultivation of agriculture-based crops began in the early 1990s, and in 2017-2018, the Malaysian and state government identified Kota Belud as a paddy granary, making the cultivation of paddy a priority. This was in line with the National Agro-Food Policy 2021-2030, which aims to improve food security policies and reduce dependence on imports by enhancing rice production through technology reform and various initiatives. This study employed GIS and remote sensing techniques to analyse the changes in land use for paddy cultivation. Landsat TM 5 and Landsat TM 8 images were used to extract data of land use from 1990 to 2020. The results indicate that the area of paddy cultivation increased from 4,329 ha in 1990 to 12,564 ha in 2020, with fluctuations in between. The specific GIS and remote sensing techniques used in the analysis included unsupervised and supervised classification technique with accuracy classification of 94%, 86%, 98.30% and 91.60 % for year 1990, 2000, 2010 and 2010, respectively. Overall, the findings of this study can be used as a guideline by local authorities to improve rice production and food security in Malaysia.

Keywords: GIS, Remote Sensing, Paddy cultivation, National Agro-Food Policy, Food security

³ Senior Lecturer at Universiti Malaysi Sabah. Email: pirdaus@ums.edu.my

INTRODUCTION

The National Agro-Food Policy 2021-2030 prioritizes rice as a primary commodity for food security in Malaysia, given its importance as a staple food. The production of rice contributes significantly to Malaysia's GDP, with an expected increase in revenue from RM 2.47 billion in 2021 to RM 2.91 billion in 2030. This priority in the production of rice is explained in the results of rice production in Malaysia, which is estimated to experience an increase from 2.98 million MT in 2021 and an increase of 2.62 million MT by 2030 at a rate of 2.16% which causes an increase in rice production from 1.92 million MT to 2.33 million MT at the same time (Ministry of Agriculture and Food Industry, 2021).

Kota Belud in Sabah has the largest paddy field area in the state, making it a focus area for the Malaysian government to increase rice production. The potential for developing paddy cultivation in this district has encouraged the Malaysian government to cooperate with the state government to formulate a strategic step to strengthen the Agrofood policy. The government has allocated funds for the development of Kota Belud as a new rice granary area to strengthen national food security through the 11th Malaysia Plan in presenting the state budget from 2017 to 2019 (Siti Hadawiah Tahir & Talip, 2020). According to Rahim et al., (2019), the paddy granary area in Kota Belud is in the East Malaysian part of IADA Kota Belud, which has 9,083 ha to 9,672 ha.

Despite many efforts to increase production of paddy, however, the paddy and rice sub-sector still falls short of meeting the country's needs, as the gap between production and consumption remains significant. To address this issue, it is necessary to focus on holistic and sustainable solutions that consider factors such as efficient resource utilisation and diversification of products.

Therefore, this study aims to use GIS and Remote Sensing techniques to investigate the development of rice cultivation in Kota Belud between 1990 and 2020. The study will analyse potential land use changes that may have resulted from government policies and funding between 2017 and 2019. Latip et al. (2022) indicates that the GIS study approach to the land use changing pattern will result in government policy towards the current situation. By utilising GIS and Remote Sensing, the study will provide valuable insights for policymakers to make informed decisions and improve rice production in the district, thereby enhancing the country's food security.

LITERATURE REVIEW

Application of GIS and remote sensing in agriculture

Digital agriculture is a modern approach that involves the use of large data sources and environmental analysis tools to assist farmers in adopting proper crop management practices that are both economically viable and environmentally sustainable. Remote Sensing is a digital agricultural technology that allows

farmers to gather, visualize, and assess crop and soil health at various production stages using low-cost methods. The technology helps to detect possible problems and make early recommendations for timely action (Khanal et al., 2020).

Remote Sensing technology has been used in agriculture since the launch of the Landsat Multispectral Scanner System (MSS) satellite in 1972. It provides high spatial resolution data that can help distinguish crop characteristics at the stand level and assess crop health patterns that are not visible to the naked eye. Different spectral resolutions are required for different agricultural applications depending on management objectives, crop growth stages, and farm size (Khanal et al., 2020).

GIS, in combination with Remote Sensing, is a useful technology for monitoring crops and preventing yield losses due to weather, diseases, and pests. It can analyze yield estimates, crop soil conditions, and agricultural accuracy. The technology can also provide decision support for crop and agricultural strategies by producing land use/land cover (LU/LC) information important for agricultural land planning and development (Vibhute & Gawali, 2013).

Crop identification is critical for determining the crop area and expected yields. Remote sensing techniques use multispectral and multitemporal data for crop identification and classification, with supervised and unsupervised classification approaches available. Supervised classification requires providing an exercise in pixels, while unsupervised classification evaluates many unknown pixels and separates them into different classes based on the image value's groupings (Vibhute & Gawali, 2013).

Study Area

Kota Belud is a coastal district located in the West Coast Division of Sabah, Malaysia, approximately 77 kilometres away from Kota Kinabalu. The district features a lowland or coastal area facing the sea, while the inland area consists of hilly and mountainous terrain, with Mount Kinabalu, the highest peak in the country at 4,095 meters, located at the centre of the valley. Figure 1 showed the geographic features of Kota Belud that dominated by lowland area. The region's unique topography plays a crucial role in shaping its land use and agricultural development, making it an ideal area for paddy cultivation.

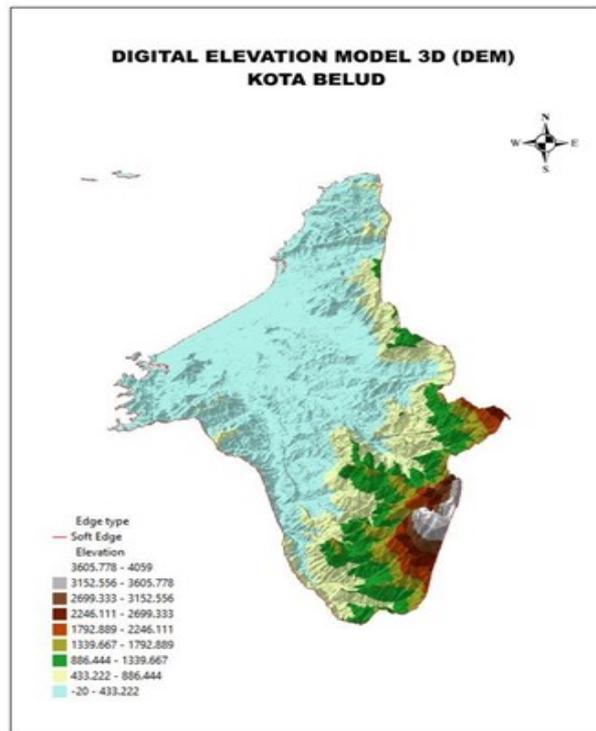


Figure 1: Digital Elevation Model of Kota Belud, Sabah

RESEARCH METHOD

Remote Sensing Data

In this study, land use data obtained from Landsat TM 5 and Landsat TM 8 data products were downloaded from the United States Geological Survey (USGS) website. The data was acquired for the years 1990, 2000, 2010, and 2020, and was used to analyse land cover changes and the rate of change of paddy cultivation in the study area. The data was obtained in GeoTiff format and was processed in raster form using ArcGIS 10.8 software. Table 1 shows the details of remote sensing data used in this study.

Table 1: Details of Remote Sensing data

Data availability	Date	Source	Format (band)
Landsat 5 Satellite Image	1990 2000 2010	USGS	7 band
Landsat 8 Satellite Image	2020	USGS	11 band

Figure 2 illustrates the process flow for deriving land use data from satellite images. The process involves several steps, starting with the download of product data from the USGS website, followed by radiometric correction to ensure that image values accurately reflect the surface reflectance of the earth. To cover the entire study area, two scenes are required, and Figure 3 demonstrates the mosaic technique used to combine both images to create a single image. Cloud masking was then performed to remove clouds from the satellite imagery, as clouds can obscure features on the ground and affect the accuracy of land cover classification. Figure 4 shows the satellite image after cloud masking.

To classify the images, both supervised and unsupervised classification techniques were used. Unsupervised classification grouped pixels based on spectral properties into clusters, while supervised classification required manual labeling of training samples representing known land cover types, which were then used to train the classification algorithm. Supervised classification is more accurate but time-consuming, while unsupervised classification is faster but less accurate. Both techniques were applied in this study to ensure high accuracy of data (Figure 5). Finally, the raster data was converted to vector format to perform geospatial analysis and determine changes in paddy fields from 1990 to 2020.

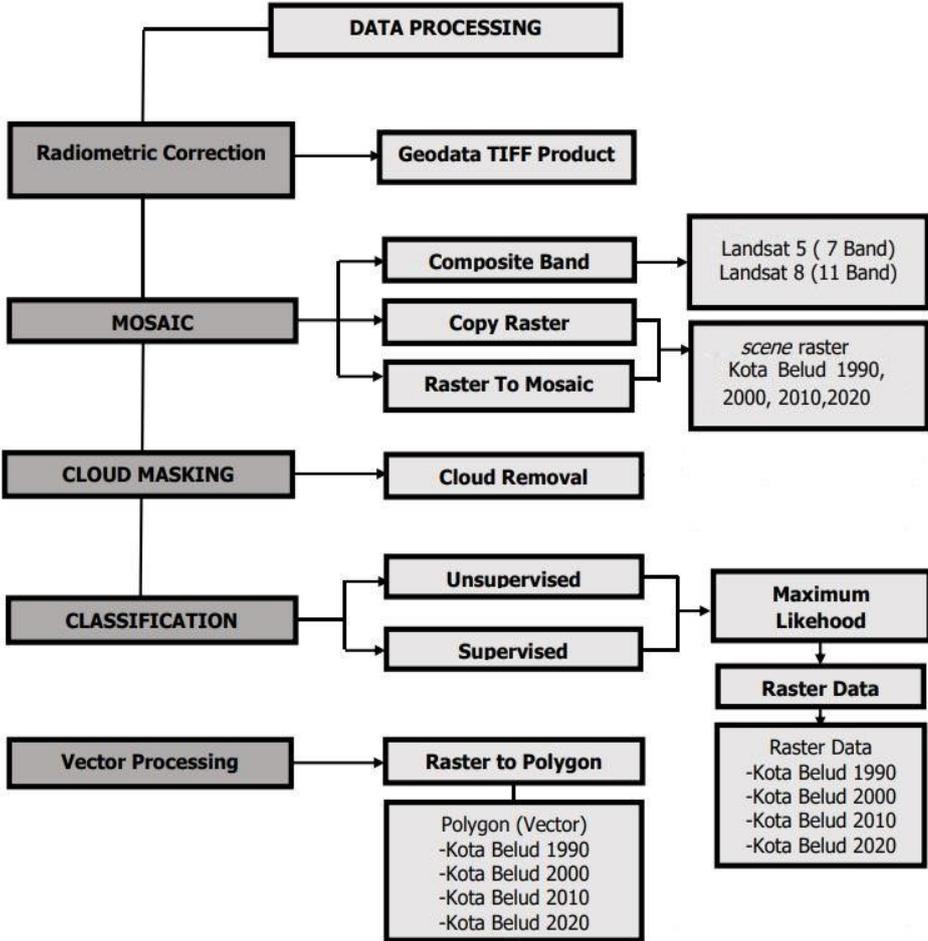


Figure 2: Flowchart of the research

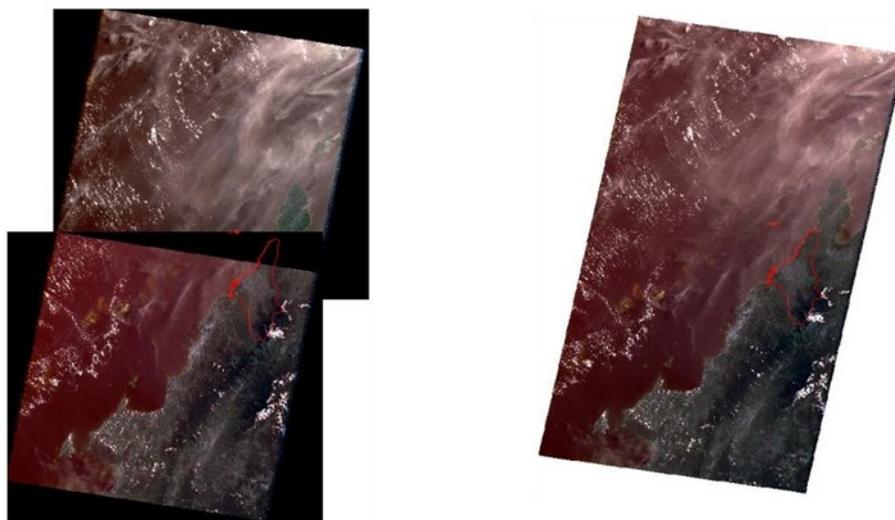


Figure 3: Process of mosaic images

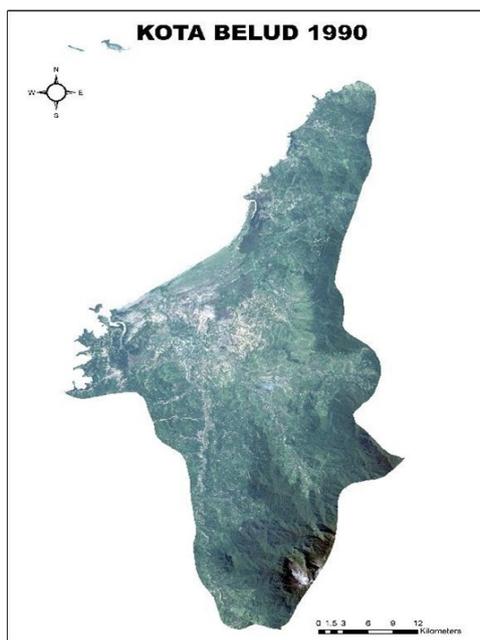
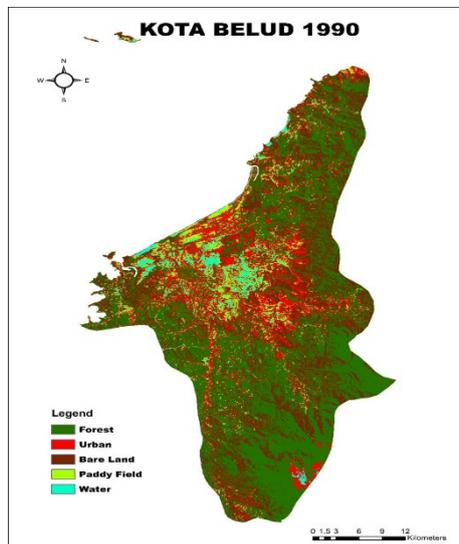
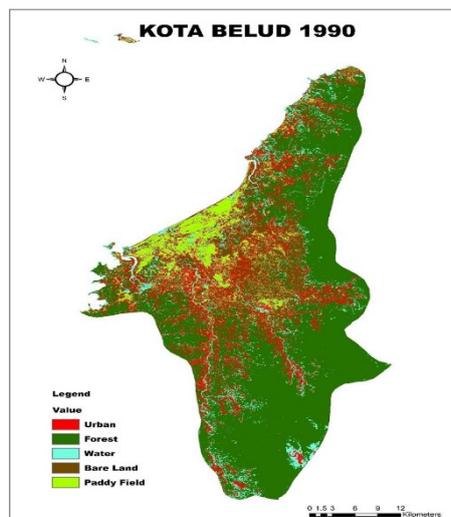


Figure 4: Process of Cloud Masking



(a)



(b)

Figure 5: (a) Unsupervised and (b) Supervised classification.

Accuracy assessment

Accuracy Assessment is an analysis that determines the accuracy of the classification land use in study area. This is to ensure that the results of the classification are accurate and reliable. This study using equation by Congalton,

(1986) to evaluate the accuracy of the classification land use. Table 2 show the results of accuracy assessment for land use classification.

$$\text{Overall Accuracy} = \frac{\text{Total Number Of Correctly Classified Pixels (Diagonal)}}{\text{Number Of Reference Pixels}} \times 100 \text{ Total}$$

Table 2: Accuracy Assessment of land use classification

Satellite image	Percentage of accuracy
1990	94%
2000	86%
2010	98.30%
2020	91.60%

RESULTS AND DISCUSSIONS

Spatial pattern of change in paddy cultivation area from 1990 to 2020

Table 3 presents the area of land use types in Kota Belud from 1990 to 2020. In 1990, Kota Belud had paddy area of 4,329 ha, bare land (17,887 ha), forests (91,393 ha), urban areas (7,008 ha) and oil palm (1,092 ha). By 2000, the paddy area had increased to 10,917 ha, bare land (13,619 ha), forests (85,426 ha), urban areas (8,208 ha) and oil palm (1660 ha). The area changed further in 2010, with paddy area decreased to 7,935 ha, bare land (15,800 ha), forests (80,788 ha), urban areas (8,636 ha) and oil palm (2,088 ha). In 2020, Kota Belud had paddy area had increased to 12,564 ha, bare land (10,151 ha), forests (77,848 ha), urban areas (9,535 ha) and oil palm (5,589 ha).

Table 3: Land use change in Kota Belud from 1990 to 2020

Land Use	Area ha			
	1990	2000	2010	2020
Paddy	4,329	10,917	7,935	12,564
Bare Land	17,887	13,619	15,800	10,151
Forest	91,393	85,426	80,788	77,848
Urban	7,008	8,208	8,636	9,535
Oil palm	1,092	1,660	2,088	5,589

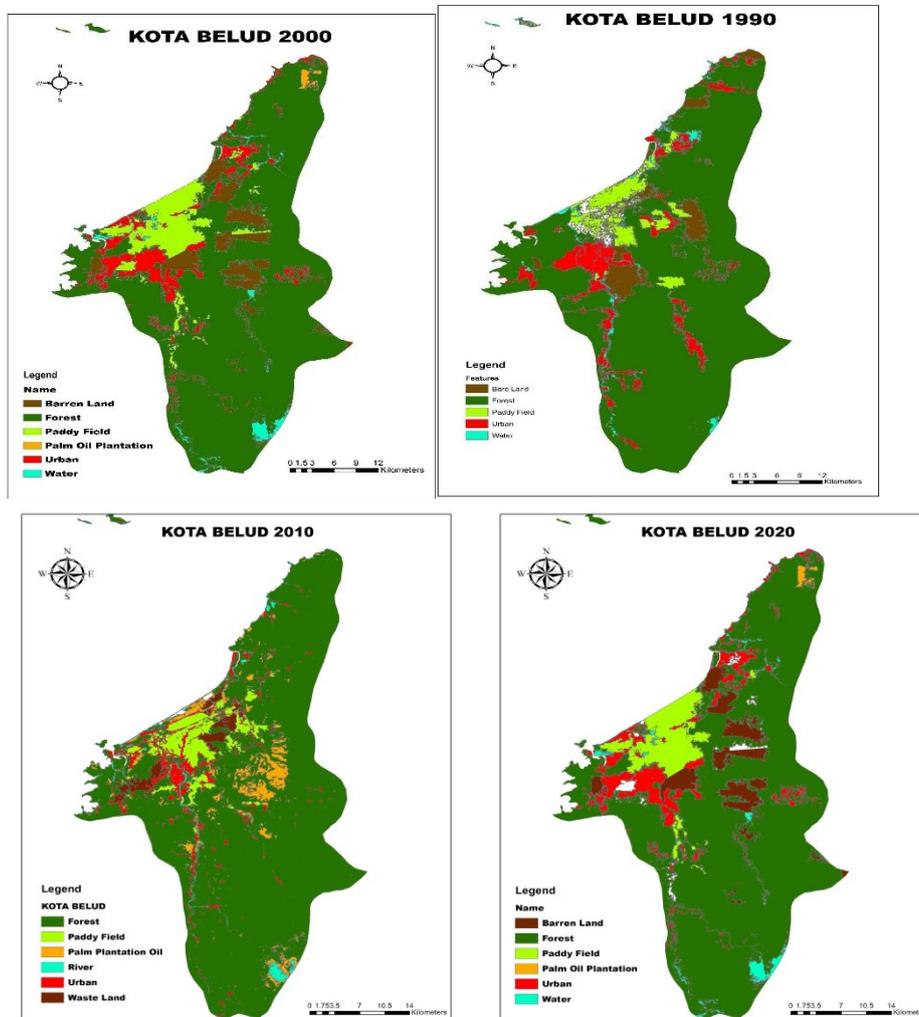


Figure 8: Map of evolution of land use from 1990 to 2020

The Kota Belud district has a significant contribution to the agricultural land area of Sabah, with 22% of the total agricultural land out of 52% in Sabah (Gindanau Sakat, 2005). The earliest villages in development, such as Kampung Piasau, were used as initial areas in the study of agricultural practices and technology development. Kota Belud's agricultural development is closely linked to various government policies and initiatives aimed at achieving food security and production, such as the National Agro-Food Policy.

The map in Figure 8 shows the changes in land use in Kota Belud from 1990 to 2020, which were calculated through pixel-by-pixel digitization and

supervised classification of paddy areas. The trend in paddy area evolution shows an increasing trend with fluctuations between 1990 to 2020. However, the decline in paddy production in 2016 due to natural disasters had a direct impact on the overall performance of the paddy, while the subsidy reduction in 2016 only affected the interest rate reduction that year.

After the earthquake occurred in 2015 in Ranau, the frequency of floods in the Kota Belud area increased due to rock erosion deposition into the river, which reduced the river's capacity to hold a large amount of rainwater. As a result, the lowland topography of Kota Belud became susceptible to floods. Furthermore, the floodwater carried sand from the river, resulting in rice fields being flooded and no longer cultivable. This situation particularly occurred in Kg Lingkodon, which contributed to rice cultivation areas turning into bare land because they were no longer viable for cultivation. This issue caused a decline in rice production and productivity between 2015 and 2017, as the set target could not be reached due to the negative impact of the earthquake and subsequent flooding.

Among other factors, weaknesses in the management of rice crop development from a financial aspect, the method of granting Plowing Incentives to Farmers (IPKP) and plowing machinery, as well as weaknesses in irrigation and drainage systems, also affect the level of efficiency of rice crop development management. To increase the productivity of rice production, it is recommended that the State Department of Agriculture, Sabah Farmers Organization Board, and the State Department of Irrigation and Drainage study commercial rice cultivation alternatives and invest in suitable rice cultivation technology. The Department and the agency are also recommended to review the method of channeling subsidies or assistance from various Federal agencies to be managed or coordinated by the state government and consider the use of technology such as 'drone' or the Global Positioning System (GPS) to facilitate the monitoring of subsidy claim verification methods more effectively.

The Sabah State Department of Agriculture (2017) reported that Sabah has maintained an agricultural or rice planting area of 33,530 ha, producing 4.20 metric tons per hectare with an allocation of RM 17,200,000. Based on the policy and development initiatives taken by the state and federal governments, Kota Belud is one of the new rice granary areas aimed at improving national security policy. The lowland area in Kota Belud is 13,8560 ha and is one of the Malaysian rice granaries that have been declared in the Malaysian Plan the 9th. The potential for the development of a new agricultural chain in Kota Belud is greatly influenced by the Malaysian Government and Sabah State policy in achieving the National Agro-Food Policy, which focuses on food security and production. The increase in rice cultivation in Kota Belud began in 2017 after the corporation carried out various measures to help farmers cultivate their paddy.

CONCLUSION

The analysis showed significant changes in land use from 1990 to 2020, largely driven by economic factors and government policies to develop the area as a new rice granary. The development of infrastructure, such as roads and irrigation systems, also played a significant role in shaping and giving potential to Kota Belud as a strategic agricultural area. The study recommends further strengthening of agricultural practices and technological support, such as the use of agricultural drones, to ensure the quality and production of crops. Overall, the study shows that there has been significant progress and development in agriculture in Kota Belud, supported by clear factors and the economic history of the area.

ACKNOWLEDGEMENTS

This paper was a part of the research grant SLB2268 “Application of GIS and remote sensing in the agricultural sector in developing abandoned land for paddy cultivation in Kota Belud, Sabah”. The author would like to take this opportunity to express a thousand thanks to the Research Management Centre (RMC), Universiti Malaysia Sabah (UMS) for covering the research and publication costs of this academic article.

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Received: 18th May 2023. Accepted: 20th July 2023



PLANNING MALAYSIA:

Journal of the Malaysian Institute of Planners

VOLUME 21 ISSUE 4 (2023), Page 217 – 232

THE RELEVANCE OF SCUBA DIVING ACTIVITIES AS A TOURIST ATTRACTION ON PANGKOR ISLAND

Mohamad Pirdaus Yusoh¹, Nurhazliyana Hanafi², Normah Abdul Latip³, Jeannet Steaphen⁴, Muhammad Fuad Abdullah⁵, Ang Kean Hua⁶

*^{1,3,4}Borneo Institute for Indigenous Studies,
UNIVERSITI MALAYSIA SABAH*

*²Developmental Science Program, Centre for Research in Development & Environmental Studies (SEED), Faculty of Social Science and Humanities,
UNIVERSITI KEBANGSAAN MALAYSIA*

*⁵Institute For Biodiversity & Sustainable Development (IBSD),
UNIVERSITI TEKNOLOGI MARA (UITM)*

*⁶Geography Program, Faculty of Social Sciences and Humanities,
UNIVERSITI MALAYSIA SABAH*

Abstract

Scuba diving tourism is one of the tourism products that contributes to Malaysia's economic returns. There are three main issues underlying this research problem, namely the validity of Pangkor Island as a scuba diving tourism destination in Malaysia, the confusion about Pangkor Island's actual status as a scuba diving tourism destination in Malaysia based on tourism agency promotions and souvenir sales, and past studies conducted by local scholars. To obtain validity, several stakeholders were made respondents of the study, namely foreign tourists, local residents, and resort entrepreneurs. This study aims to identify the characteristics of tourist attractions on Pangkor Island based on the perceptions of foreign tourists and local communities, examine the involvement of local communities in tourism development, and the level of their knowledge about scuba diving tourism. Furthermore, it examines whether this activity is a characteristic attraction that drives international tourists to visit Pangkor Island based on the stated attraction characteristics and the scuba diving activity service offerings by hotel and resort entrepreneurs there. This study uses a quantitative approach and is supported by a qualitative approach. The research methods used are face-to-face interviews using questionnaires, observations, and in-depth interviews. The study's findings on 125 foreign tourists, 179 local communities, and 42 hotels and resorts show that Pangkor Island is not relevant as a scuba diving destination. All three stakeholders gave negative responses to this research problem. For foreign tourists, the main attraction stated is the beach and the sea, as well as the attractive natural environment, which is 71.4%. Local community interviews showed that Pangkor Island is not popular as a scuba diving destination, which is 52.0%, and resort analysis found that scuba diving package offerings are only offered by four out of 42 resorts and hotels on the island, and only if there is demand. The study's findings indicate that scuba diving is not popular as a tourist attraction there. Therefore, this study's findings reject the Professional Association of Diving Instructors (PADI) statement that places Pangkor Island as a scuba diving tourism destination. In conclusion, this research contributes to the academic discipline, particularly in service geography and tourism, and policy makers such as the Malaysian Ministry of Tourism.

Keywords: Scuba diving tourism, Stakeholders, Tourist attractions, Validation

² Corresponding author: nurhazliyana@gmail.com

INTRODUCTION

Tourism plays a crucial role in the development of a country. The tourism industry is an effective medium in advancing a country's economy and the development of a region (Dahles & Bras, 1999). Economic activities related to travel and tourism are expected to continue to grow with revenue reaching up to US\$7.0 trillion in 2011 (Goeldner & Ritchie, 2003). According to analysis by the United Nations World Tourism Organization (2003), tourism is one of the world's largest export industries (Burns & Holden, 1995). In fact, international tourism is an important industry for most developing countries as it is capable of generating high foreign exchange earnings, contributing to the overall economy and providing major employment opportunities (Harrison, 2004; UNWTO, 2009). The number of tourists worldwide is expected to continue to increase by 4.3% each year. By 2020, it is estimated that there will be 1.6 billion tourists (Giulianotti, 2002).

In Malaysia, tourism is the fifth largest industry and one of the main sectors contributing to the Malaysian economy. According to the 2011 Budget Report, this sector contributed RM53 billion to the country's economy in 2009 and increased to RM58.3 billion in 2011. Malaysia received international tourist arrivals of 16 million people in 2004, which increased to 24.7 million people in 2011 (www.motour.gov.my, accessed on 15 April 2012) and ranked ninth in terms of tourist arrivals (United Nations World Tourism Organization, 2012). The Gross Domestic Product (GDP) in 2012 recorded a growth of 12% with revenue from this sector reaching RM62 billion.

In the mid-1990s, scuba diving tourism was among the alternative tourism activities that were rapidly developing and popular at the international level. This makes scuba diving one of the alternative tourism activities that contribute to a country's revenue through the foreign exchange system between the countries concerned (Uyarraa & Côté, 2007; Garrod & Gossling, 2007). According to Cheryl (2010), scuba diving tourism is one of the alternative tourism attractions whose development is the fastest. This is evident through the number of licensed divers which reaches one million people annually with a growth of 14% per year (PADI, 2012). It is classified as a high-performance tourism that has a bright future prospect and provides significant returns to a country's economy.

The attraction of scuba diving activities has become a profitable tourism product for several countries in the world. It is able to expand the sub-sector market in the world tourism agenda (Bennet, 2003; Dignan, 1990). The revenue of some countries such as Greece is highly dependent on the scuba diving industry, while other countries such as Malta, Egypt, Maldives and Turkey also benefit from this type of tourism due to the inflow of currency to their countries (Garrod & Gossling, 2008). Countries rich in water resources and marine life such as natural landscapes, various species of aquatic animals and plants, underwater

caves and volcanoes, and others benefit greatly from this tourism (Hall, 2005; Alban et al., 2008; Peters & Hawkins, 2009). Therefore, Malaysia is also noted as one of the popular scuba diving destinations in the world. This is because it is rich in marine environment located in the Indo-Pacific Basin (Jabil, 2010). Scuba diving tourism is one of the tourism products that provides high-impact income to Malaysia.

PROBLEM STATEMENT

The issue being studied is the relevance of Pangkor Island as a scuba diving tourism destination. In the field of tourism, promoting through various media is important to attract tourists to a destination. The strength, uniqueness, and distinctiveness of a location can attract both international and domestic tourists to visit the destination. Pangkor Island is known as one of the popular island tourism destinations in Malaysia, along with several other resort islands such as Langkawi Island, Redang Island, Tioman Island, Perhentian Island, and Sipadan Island.

Recently, there have been several sources stating that Pangkor Island is a scuba diving tourism destination. This claim is based on a literature review of the research findings of several researchers who associate scuba diving tourism activities with some issues in Pangkor Island (Saliza et al., 2011, Norsyaidah et al., 2011, and Rosniza Aznie, 2011). Norsyaidah et al. (2011) examined the implications of marine tourism, namely scuba diving and snorkelling activities, on entrepreneurship and sustainability aspects in Pangkor Island. Saliza et al.'s (2011) study, on the other hand, is related to the impact of scuba diving and snorkelling activities on socio-economic and environmental aspects. Such research results presented in conference papers, book chapters (Saliza et al., 2011, Norsyaidah et al., 2011), and journals (Rosniza Aznie, 2011) seem to indicate that Pulau Pangkor is a popular scuba diving tourism destination. However, based on an email inquiry with a scuba diving researcher and expert, Ghazali Musa, he explained that scuba diving tourism is no longer relevant in Pangkor Island. This conflicting opinion and research findings between researchers related to the actual situation could be one of the sources that can form the basis of the research problem.

Secondly, information about a tourism destination issued by a recognized institution usually becomes a tourist reference before visiting the destination, especially if it can be accessed online. The Professional Association of Diving Instructors (PADI) is the world's largest recreational scuba diving training and certification organization founded in 1966. Through the information provided by PADI, Pangkor Island is one of the scuba diving destinations mapped in Malaysia. With PADI's reputation as a global organization that is involved in research, statistics, location mapping, offering courses and training, and

supplying scuba diving equipment, its website will undoubtedly be the main reference for scuba diving enthusiasts from all over the world.

The question is whether the information about the mapping of Pangkor Island as a scuba diving destination by PADI is based on outdated sources and not updated, or if it is still displayed on their website until now. Therefore, this scenario encourages this study to find out the extent to which Pangkor Island is relevant as a scuba diving tourism destination to avoid confusion among international tourists and to prevent a negative image from being portrayed to the tourism sector in Pangkor Island.

LITERATURE REVIEW

Dive tourism

Scuba diving tourism is a trip to a destination for the purpose of diving, whether it's on a remote island, an archipelago off the coast, or a coastal area of a country. It involves at least one diving expedition (Jabil, 2010). Scuba diving tourism involves individuals traveling from their home to spend at least one night actively participating in one or more diving activities, and it combines sports, vacation, marine tourism, cultural tourism, nature tourism, and eco-tourism. In addition to the opportunity to see marine flora and fauna at the sea bottom, they can also encounter cultural effects, ruins, and remnants such as historic shipwrecks (Garrod and Gossling, 2008). According to Tabata (1992), scuba diving is a special form of tourism that offers scuba diving as the main activity during a traveller's vacation. Diving activities involve a combination of cruising and exploration of the sea bottom. It is also related to studies of caves, archaeology, photography, fishing activities at the sea bottom, and gastronomy (Gržinić & Zanketić, 2009).

Before the concept of scuba diving tourism became popular, most activities associated with it included snorkelling, free diving, and fishing activities that fall into the categories of island tourism, marine tourism, eco-tourism, and sports tourism (Jabil, 1999). According to Tourism Queensland (2003), an attractive diving destination is one that has a healthy marine environment, complete and accurate information throughout the entire trip, a variety of diving locations such as shipwrecks, deep trenches, and coral reefs, good visibility, and rich with various marine species.

Operationally, scuba diving tourism involves a person's participation in scuba diving activities throughout their trip to a destination, even if they only dive once. It must be the main purpose of their visit to the destination and they must stay there for more than 24 hours. In the context of this study, the researcher wants to identify whether the purpose of travellers coming to Pangkor Island is solely for scuba diving, including travellers who make scuba diving an incidental activity during their stay on the island.

Stakeholders In Tourism

Stakeholders in tourism refer to those who are directly or indirectly involved in the sector, whether in the service or business sectors related to tourism itself. Freeman (1984) defines stakeholders as any party or individual who impacts or receives impacts from the formation of an organization's objectives. In the tourism sector, there are many stakeholders involved who both receive and give impacts to the tourism industry itself. Among the stakeholders in tourism are tourists, residents, and local authorities (Saftic et al., 2011).

STUDY AREA

Pangkor Island is located on the coast of the Malacca Strait at latitude 4° 12'50" North and longitude 100° 34'30" East. Its area is 22 km², including Pangkor Laut Island, which covers 1.3 km². According to the Pangkor Penghulu, Tuan Haji Marzuki, the population of Pangkor Island is 12,999 people (Table 1). Pangkor Island is a group of ten islands, including Pangkor Island and nine other small islands, namely Pangkor Laut Island, Mentagor Island, Giam Island, Dua Island, Tukun Pelan Island, Fukun Terindak Island, Batu Orang Tua, Simpan Island, and Jarak Island.

Table 1 : Total local residents

Location	Total Local		Total
	Man	Women	
Teluk Raja Bayang	3860	2120	5980
Teluk Dalam Village	168	141	309
Teluk Gedung Village	385	367	752
Sg. Pinang Besar Village	3372	2094	5466
Teluk Kecil Village	254	238	492
Total	8039	4960	12,999

Source: Office of the Village Chief of Pulau Pangkor (2012)

Pangkor Island is located about 85 km west of Ipoh, the capital of Perak, and 3.8 nautical miles from Lumut. The island is separated from the mainland of the Peninsula by the Dinding Strait (figure 1). Together with Lumut and Setiawan, Pangkor Island has formed a sandy beach, muddy beach, and mangrove swamp area in Perak State, covering about 200 km. Accessibility to Pangkor Island is high. Visitors can reach the island by ferry from Lumut. Before May 3, 2010, tourists could also fly to Pangkor from Subang Airport through Berjaya Air, but now the airport is no longer operational for domestic flights. Only private planes land at the airport (Manjung Municipal Council, 2012).

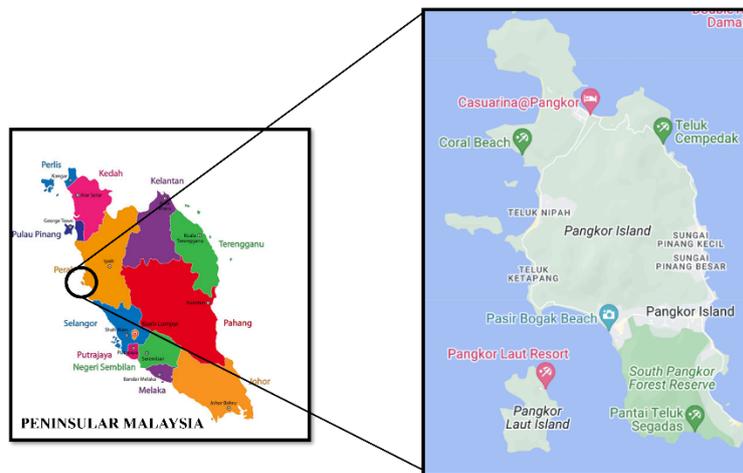


Figure 1: Map of Pangkor Island

METHODOLOGY

The research was conducted using both quantitative and qualitative approaches. The quantitative approach was conducted on 125 foreign tourists and 179 local community members. Checklist analysis was also used for the 42 hotels and resorts on Pangkor Island, while the qualitative method (in-depth interviews) was conducted with tourism officials at the Manjung Municipal Council.

FINDINGS OF THE STUDY

Respondents' Demographic Profile

The study sample involved a total of 125 foreign tourists, 179 local community members, and 42 hotels and resorts on Pangkor Island. Table 2 shows the demographic profile of foreign tourists. The demographic characteristics of tourists considered and discussed were related to country of origin, gender, age, occupation, and education level. Out of 125 respondents, 63.2% were tourists from Europe, followed by 12.8% from the Middle East, 12.0% from East Asia, and the least were from South America, with only 0.8% recorded.

Table 2: International tourist demographics profile

Category	Frequency	Percentage
Nation of origin		
Europe	79	63.2%
West Asia	16	12.8%
East Asia	15	12.0%
Southeast Asia	5	4.0%
South Asia	4	3.2%
south America	1	0.8%
And others	5	4%
Gender		
Men	62	49.6
Female	63	50.4
Age category		
Under 20 years old	11	8.8
21 to 30 years	60	48.0
31 to 40 years	26	20.8
41 to 50	12	9.6
50 years and above	16	12.8
Jobs		
Student	44	35.2
Private sector workers	24	19.2
Entrepreneur / Trader	14	11.2
Self-employed	12	9.6
Public sector workers	9	7.2
Retired	5	4.0
Housewife	4	3.2
And others	13	10.4
Educational status		
Higher Education	93	74.4
Secondary Education	27	21.6
Elementary Education	4	3.2
No Formal Education	1	0.8
Total	125	100.0

A total of 179 local community members were selected as respondents in this study. The local community is the group of people who are closest to the development and progress that occurs in a tourist location. Therefore, research on the local community is important in this study. Of the 179 interviewees, 58.7% were male and 41.3% were female (Table 3). Most of the respondents from this stakeholder group are residents involved in the tourism sector, such as beach boys, traders, boat operators, taxi drivers, and cleaning staff at tourist locations.

The respondents involved in this study were from various age categories. The highest age group of respondents was 51 years and above

(24.0%), followed closely by the age category of 20 to 30 years (23.5%). The comparison between other respondent categories did not show significant differences. The lowest age category was 41-50 years (12.3%). More than half of the respondents in this study were married (55.9%), followed by single individuals (42.5%) and others (1.7%).

Table 3: Categories of Local Resident Respondents

Category		Frequency	Percent (%)
Gender	Men	105	58.7
	Female	74	41.3
Age	Under 20 years old	38	21.2
	21 to 30 years	42	23.5
	31 to 40 years	34	19.0
	41 to 50 years	22	12.3
	50 years and above	43	24.0
Marital Status	Single	76	42.5
	Get married	100	55.9
	Others	3	1.7
Total		179	100

The results of the study from 125 respondents through open-ended questions found that many respondents gave more than one answer. Therefore, the researcher took into account all the answers given by the respondents for analysis. Out of the 125 questionnaires distributed, a total of 179 responses were received regarding the main attractions to Pangkor Island.

The study found that the main attraction features chosen by international tourists to Pangkor Island (Table 4) are the physical environment attractions such as the sea and beaches, with 54.8% of the 125 respondents studied. In addition, other attraction features that received attention from foreign tourists are physical aspects such as a peaceful environment (7.8%), beautiful island (6.7%), interesting natural environment (6.1%), weather (5.6%), and wildlife (3.9%).

Main attraction Tourist to Pangkor Island

Table 4: Characteristics of Main Attractions of Foreign Tourists to Pangkor Island

Main Attraction		Frequency	Percent
The attraction of the physical environment	Sea and Beach	98	54.8
	Quiet environment	14	7.8
	Island	12	6.7
	Beautiful surroundings	11	6.1
	The weather	10	5.6
	Wildlife	7	3.9
Human environmental attraction	Water recreational activities	12	6.7
	a) Snorkelling	8	4.5
	b) Banana boat	3	1.8
	c) Scuba diving	1	0.6
	Local food	8	4.5
Infrastructure	Cheap Cost	2	1.1
	Accommodation	2	1.1
	Others	3	1.7
Total		179	100.00

Among the characteristics of human attraction to the environment, water recreation activities recorded the highest value (6.7%). In this water recreation activity, researchers also classified the water activities offered on Pangkor Island such as snorkelling (4.5%), banana boat (2.2%), and scuba diving (0.6%). Based on respondents' answers, water recreation activities are also a major attraction to Pangkor Island, but the main water recreation activity is snorkelling. Only one respondent stated that scuba diving is the main attraction to Pangkor Island. Therefore, scuba diving tourism in Pangkor Island is less popular in attracting international tourists to visit here. Local food (4.5%) is also a draw for foreign tourists to Pangkor Island. In Pangkor Island, seafood products are famous because of many seafood processing factories. Local community products may attract foreign tourists to travel here.

Affordable cost (1.1%) for foreign tourists is not a problem for them as they prioritize satisfaction in tourism. European tourists, in particular, have a high currency exchange rate in Malaysia because their currency is higher than Malaysia. Therefore, cost is not the main issue for them. This finding supports the study conducted by Tan and Goh (2010) in Perhentian Island on the perception of foreign tourists who are found to prioritize satisfaction over cost in their vacation location.

The factor of accommodation facilities (1.1%) is less of a choice for foreign tourists, as are other attraction features (1.7%). Usually, foreign tourists

will survey websites about the accommodation facilities they will choose when vacationing at a destination. Therefore, accommodation is not a choice of attraction for foreign tourists as they prioritize the uniqueness of a tourism location over accommodation facilities.

The findings of this study are consistent with the results of a study conducted by Ghazali (2010). According to him, the three destination features listed in order of importance are (i) natural beauty; (ii) a suitable atmosphere for relaxation and rest; and (iii) easy accessibility to the location. The priority of foreign tourists visiting Pangkor Island is to enjoy the natural beauty of the beach environment there. Tourists prioritize satisfaction and beauty in their vacations, and other aspects are not the main attractions for them to visit Pangkor Island.

In addition to the local community's cultural attractions, local community support is important in attracting tourists. Tourists are not interested in visiting a destination if they do not receive good service. The local community's involvement in tourism is essential in supporting efforts to advance the tourism industry (Goh & Tan, 2012). Therefore, the views and voices of the local community are crucial in determining the development of tourism in a vacation destination.

In this study, the perceptions of the local community were also examined to determine the development of tourism development in Pangkor Island. Each answer given by the local community was analyzed and presented as in Table 4.18. Out of 179 respondents, many provided more than one answer. So, in the open-ended question method, all answers were taken for analysis, and 263 answers were obtained from 179 questionnaires distributed.

Table 5 shows that the attraction of the sea and beach is the main attraction for tourists to Pangkor Island according to the perception of the local community, accounting for almost half of the collected answers, i.e., 49.8%. Water recreation activities recorded the second-highest value with a value of 16%. This is a significant difference from the sea and beach attraction. In water recreation activities, the researcher once again classified them according to the activities listed by the local community. Out of 42 responses related to water recreation activities, 69.0% stated that snorkelling was the most popular activity on Pangkor Island, followed by banana boat at 26.2%. Scuba diving was the least popular water recreation activity, accounting for only 4.8%. This study's findings clearly show that this activity is not a choice for tourists to visit Pangkor Island.

Table 5: Main Tourist Attractions to Pangkor Island according to the Perception of the Local Community

Attraction Features		Frequency	Percent
The attraction of the physical environment	Sea and Beach	131	49.8
	Island	18	6.8
	Beautiful surroundings	4	1.5
	Wildlife	13	4.9
	Historic sites	27	10.3
Human environmental attraction	Water recreational activities	42	16.0
	a) Snorkelling	29	69.0
	b) Banana boat	11	26.2
	c) Scuba diving	2	4.8
	Local food	6	2.3
	Cheap Cost	3	1.15
	Local Community	6	2.3
Infrastructure	Accommodation	10	3.8
	Others	3	1.15
Total		263	100

In addition, the distribution of features that attract tourists and the lowest feature is affordable prices and others with only 1.15%. The local community believes that the prices offered on Pangkor Island are very reasonable. This finding contradicts the study conducted by Rosniza Aznie (2011), which found that nearly 80% of tourists were dissatisfied with the high prices on Pangkor Island, especially transportation costs such as taxis.

To answer the next objective in this study, a checklist analysis was conducted. The study was conducted by observing each hotel and resort, obtaining brochures and pamphlets, and indirectly interviewing hotel and resort owners and employees. From there, a checklist table was prepared to identify the services offered by hotels and resorts on Pangkor Island. Each resort and hotel offer the best packages and services to attract more tourists to their resort. There are various outdoor and indoor activities offered by each resort on Pangkor Island. There are several outdoor activities offered by resorts on Pangkor Island such as snorkelling, water recreation, jungle trekking, scuba diving, fishing, and so on. Table 6 shows outdoor activities related to beaches and seas offered by resorts on Pangkor Island.

Table 6: Beach and Sea Outdoor Activities offered by the Resort

Bil	Service package	Number of resorts	Percent	Total Resorts
1.	Snorkelling	27	64.3	
2.	Round island	16	38.1	
3.	Kayaking	15	35.7	
4.	Boat trip	15	35.7	
5.	Banana ride	13	30.1	42
6.	Fishing	11	26.2	
7.	Jet skis	11	26.2	
8.	Scuba diving	4	9.5	
9.	Beach tele match	3	7.1	

The most commonly offered activity by resorts on Pangkor Island is snorkelling, with 27 out of 42 resorts offering snorkelling packages. Snorkelling is the most popular activity on the island and is heavily promoted by various media outlets. Only four out of 42 resorts offer scuba diving, which is available upon request and requires advanced notice. These resorts must contact a dive instructor from outside the island to provide equipment and gear for the activity. The four resorts that offer scuba diving packages are Nipah Guesthouse Pangkor, Ombak in Resort, Puteri Bayu Beach Resort, and Sea View Hotel & Holiday Resort.

Activities related to the beach are highly sought after on Pangkor Island, and resorts generally offer a variety of packages related to beach and water recreation. In addition to scuba diving and snorkelling, other outdoor activities offered by resorts include round island tours (16 resorts), kayaking (15), boat trips (15), banana rides (13), and fishing and jet skiing, each offered by 11 resorts. The beauty and uniqueness of the island's beaches drive the offering of these services. Beach tele match (7.1%) is the least offered activity by resorts on Pangkor Island. Beach tele match is a beach game that uses specific equipment such as giant balls and loops. This activity is suitable for children as it is not dangerous, but most resorts do not offer it due to the high cost of maintaining the equipment and lack of interest.

Table 7 summarizes the findings of the study on the relevance of scuba diving activity as a tourist attraction in Pangkor Island from three stakeholders. The ratio of 1 tourist out of 125 respondents who were surveyed about the relevance of scuba diving activity as a tourist attraction in Pangkor Island is too high. Similarly, the ratio of 2 residents out of 179 respondents interviewed and 4 resorts offering scuba diving services on demand compared to the 42 hotels and resorts surveyed also indicates that Pangkor Island is not a scuba diving tourism destination as advertised by some websites, tourism agencies, and entrepreneurs in Pangkor Island.

Table 7: Stakeholder Responses to the Attractions and Offers of Scuba Diving Activities on Pangkor Island

Stakeholders		
Attraction Features		Offer
Tourist	Local Community	Hotel and Resort Operator
1	2	4
125	179	42

To obtain accurate information and clear evidence about scuba diving tourism in Pangkor Island, the researcher conducted an in-depth interview with a local authority. The researcher interviewed a tourism officer in the Manjung Municipal Council (MMC), who is responsible for all tourism activities in the Manjung District. The 31-year-old individual, who has served with the MMC for over 10 years, explained that the development of tourism in Pangkor Island is indeed rapid. The influx of foreign and domestic tourists is very encouraging, with more than one million visitors every year. In 2012 alone, the number of tourists reached 1.7 million people. He expected that in 2013, the number of tourists to Pangkor Island would reach 2 million people. Based on statistics released by the Northern Region Marine Department, the average monthly number of tourists to Pangkor Island is around 80,000 people.

Furthermore, the researcher asked about the development of scuba diving tourism in Pangkor Island. The tourism officer explained that scuba diving activities in Pangkor Island did exist, but only in 2005-2007. During those years, there were indeed operators of this activity such as 'One Divers.' However, with less encouraging response, the operator closed its operations and moved to other locations. He also emphasized that in Pangkor Island, the main activities are snorkelling and other marine recreational activities, while scuba diving activities no longer exist. The operator of this activity is no longer operating in Pangkor Island.

Regarding future plans for scuba diving in Pangkor Island, Mr. Shahril explained that the MMC has no plans to develop scuba diving activities. The prospects for this activity are very small, and its success is also very low. Pangkor Island is a tourist destination for middle-class people who want a quiet and peaceful atmosphere while filling their leisure time. Scuba diving activities require high costs, which do not match the concept of budget tourism in Pangkor Island.

In addition, he emphasized that the MMC is not involved in promoting this activity to tourists. They highlight Pangkor Island as a destination for other water sports and recreational activities such as snorkelling, banana boat, kayaking, round island, and so on. Scuba diving activities around Pangkor Island are more for training purposes for the Navy, Maritime Enforcement Agency, and the Malaysian Fire and Rescue Department.

CONCLUSION

The study found that tourism development on Pangkor Island is rapidly growing. From all stakeholders' analyses, it can be seen that tourism development here is indeed rapid. With a high arrival of tourists every year, the enthusiastic involvement of the local population in tourism, and the increasing development of accommodation facilities, the positive development of the tourism sector on Pangkor Island is evident.

However, the study found that the scuba diving tourism sector on Pangkor Island is not relevant and not popular. Therefore, the researcher rejects the data released by PADI about Pangkor Island as one of the scuba diving locations in Malaysia. In addition, promotional activities related to scuba diving tourism on Pangkor Island, whether on websites, print media, or electronic media, should be stopped. The sale of craft items and clothing related to scuba diving activities on Pangkor Island should be re-examined. This is to avoid confusing many parties, especially foreign tourists who come to Pangkor Island for scuba diving activities. This can create a negative perception among tourists about the tourism sector in Pangkor Island and Malaysia in general.

After analysing all the research objectives, the researcher concludes that scuba diving tourism on Pangkor Island is not relevant. This statement is based on the analysis of three stakeholders who are the pillars of tourism. The research findings are further reinforced by in-depth interviews with the assistant tourism officer at the Manjung Municipal Council. According to Mr. Shahril Salihan, scuba diving tourism on Pangkor Island is no longer one of the tourist attractions here. Pangkor Island is more famous for activities that are affordable and do not involve high costs. In addition, he also stressed that there is no plan from the MMC to promote scuba diving tourism on Pangkor Island so far.

Tourism development in a location depends on all stakeholders. This is in line with the model proposed by Miller et al. (1999), the Broker-Local-Tourist (BLT) Model. These three parties have their respective roles in the tourism sector. Entrepreneurs (brokers) are those who make a living by participating in the tourism industry. For example, hotel entrepreneurs, workers, and guides who provide goods and services like private sector brokers (Miller and Auyong, 1998). The local community is a group that resides in a tourist location, and tourists are those who come to visit based on the attractive features of that location (Miller & Auyong, 1998). Although this model has been in use for a long time, it is still relevant in helping to identify tourism development in a particular tourist destination. These three components are the most basic in tourism. This model allows researchers to argue the irrelevance of Pangkor Island as a scuba diving destination in the country.

ACKNOWLEDGEMENT

The author would like to thank to the Research Management Center (PPP), Universiti Malaysia Sabah (UMS) for providing and financial support to complete this research study as well as publishing the academic paper.

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Received: 18th May 2023. Accepted: 20th July 2023



PLANNING MALAYSIA:

Journal of the Malaysian Institute of Planners

VOLUME 21 ISSUE 4 (2023), Page 233 – 249

SOCIAL CARRYING CAPACITY AS A PLANNING TOOL FOR SUSTAINABLE TOURISM: A CASE OF PANGKOR ISLAND, PERAK, MALAYSIA

Mohamad Pirdaus Yusoh¹, Normah Abdul Latip², Nurhazliyana Hanafi³, Ang Kean Hua⁴, Zulayti Zakaria⁵, Mohamad Ikhran Mohamad Ridzuan⁶

^{1,2}*Borneo Institute for Indigenous Studies,
UNIVERSITI MALAYSIA SABAH*

³*Centre for Research in Development & Environmental Studies (SEED),
Faculty of Social Science and Humanities,
UNIVERSITI KEBANGSAAN MALAYSIA*

^{4,5,6}*Faculty of Social Sciences and Humanities,
UNIVERSITI MALAYSIA SABAH*

Abstract

Tourism can drive economic growth and development in destinations, but unchecked growth can have negative impacts on local communities and the environment. To ensure that tourism is sustainable and does not cause harm, social carrying capacity (SCC) has become a useful planning tool. SCC refers to the maximum number of tourists that a destination can accommodate without exceeding the capacity of local resources, infrastructure, and services. This study aims to identify the level of crowding on public holidays at Pangkor Island and the acceptance levels of tourists and the local community regarding tourism. A quantitative methodology was used, involving 96 international tourists, 332 domestic tourists, and 387 members of the local community. The results indicate that the level of crowding on public holidays at Pangkor Island is still within acceptable limits. The barometer showed that international tourist respondents rated the level of crowding as excellent (green colour), while domestic tourist respondents rated it as acceptable (yellow colour). Local community respondents also rated the level of crowding as high but still acceptable (green colour). This study concludes that the Social Carrying Capacity at Pangkor Island is still good, and it is important to maintain it to achieve sustainable tourism. By managing tourism growth and ensuring that the number of tourists does not exceed the SCC, destinations can reap the economic benefits of tourism while preserving the natural and cultural heritage of the area and protecting the well-being of the local community.

Keywords: Tourism, Carrying Capacity, Social Carrying Capacity, Sustainable tourism

³ Corresponding author: nurhazliyana@gmail.com

INTRODUCTION

Tourism plays a significant role in the development of a country. The tourism industry is an effective medium for advancing a country's economy and the development of a region (Dahles and Bras, 1999; Yusoh et al., 2022). In the context of Malaysia, the government allocated RM1.6 billion for the tourism sector in the 2022 budget. The number of tourist arrivals in Malaysia increased from 25.83 million in 2018 to 26.1 million in 2019, with revenues reaching RM86.1 billion (Tourism Malaysia, 2021). As tourism development in the country accelerates, environmental issues need to be taken seriously to ensure its sustainability. One important concept of sustainability is carrying capacity (Yusoh et al., 2021). A densely developed destination will affect the landscape and quality of the surrounding environment and also affect the comfort and satisfaction of visitors. Visitor satisfaction is a key factor in the intensity and repetition of visits to a tourism destination. In some cases, tourism operators take advantage of excessive visitor arrivals to a single location without considering the site's capacity to accommodate frequent and large numbers of visitors. Therefore, the importance of carrying capacity needs to be understood and embraced by practitioners in the tourism industry. For further theoretical analysis of carrying capacity in tourism, this paper will examine the concept, measurement, and influencing factors.

Sustainable tourism can be defined as "tourism that takes full account of its current and future economic, social and environmental impacts, addressing the needs of visitors, the industry, the environment and host communities" (World Tourism Organization, 2004). This definition emphasizes the importance of tourism that is economically viable, socially responsible, and environmentally sustainable. Sustainable tourism aims to promote economic growth while minimizing negative social and environmental impacts. Sustainable tourism also involves promoting responsible tourism practices such as reducing waste, conserving resources, supporting local businesses and communities, and protecting natural and cultural heritage sites. It requires collaboration between stakeholders, including tourism operators, local governments, community groups, and visitors.

Tourism can be a significant driver of economic growth and development for many destinations around the world (Pirdaus Yusoh et al., 2022). However, unchecked tourism growth can also have negative impacts on the local community and the environment, such as overcrowding, strain on local resources and infrastructure, and degradation of natural and cultural heritage sites. To ensure that tourism development is sustainable and does not cause negative impacts, social carrying capacity (SCC) has emerged as a useful planning tool in sustainable tourism. SCC refers to the maximum number of tourists that can be

accommodated in a destination without exceeding the capacity of local resources, infrastructure, and services (Yusoh et al., 2021).

Social Carrying Capacity (SCC) is a crucial aspect of sustainable tourism that focuses on the social and cultural impacts of tourism on the local population. Compared to physical, ecological, and economic carrying capacities, measuring SCC is challenging as it heavily depends on perceptions and values (Saveriades, 2000; Symmonds and Hammitt, 2000). Furthermore, SCC is difficult to measure as it is influenced by individual preferences, attitudes, opinions, and experiences (Mauerhofer, 2013; Jurado et al., 2013). SCC considers the concepts of crowding and their impact on locals and tourist satisfaction (Qian Jin, 2009).

SCC assessment involves analysing the carrying capacity of natural and cultural attractions, availability of accommodation and transport, and the attitudes and behaviour of visitors and local communities. Once the SCC is established, it can guide tourism development plans and policies that promote responsible tourism practices, protect the local environment and culture, and ensure that the tourist experience remains positive. Effective management of SCC in sustainable tourism requires collaboration between stakeholders such as tourism operators, local governments, community groups, and visitors. This management can involve zoning and land-use planning, implementing carrying capacity limits and monitoring systems, and capacity-building for local communities and tourism operators.

Overall, SCC is an important planning tool for sustainable tourism as it ensures that tourism growth is balanced with the needs and capacities of local communities and the environment. By managing SCC effectively, sustainable tourism can generate economic benefits while preserving the natural and cultural assets that make a destination attractive to visitors.

PROBLEM STATEMENT

Pangkor Island is a highly popular tourist destination in Malaysia, with a population of 15,499 recorded in 2015. However, the rapid development of the island is expected to attract more tourists, which may cause pressure on stakeholders such as tourists and the local community. To ensure sustainable tourism development, it is crucial to consider both physical and social aspects of sustainability.

Unfortunately, the local authority has only conducted physical development planning, and no party has studied the social carrying capacity aspect of sustainability in tourism. Previous studies have focused on only one stakeholder, such as foreign tourists, and did not provide a comprehensive definition of social carrying capacity.

Therefore, this research aims to address this gap by determining the level of social carrying capacity in tourism on Pangkor Island, especially during holidays. The monthly statistics released by Manjung Municipal Council (2019) indicate that public holidays attract a high number of tourists, resulting in overcrowding and indicating a high influx of visitors.

This situation highlights the importance of assessing social carrying capacity. In 2015, Pangkor Island received 1.9 million tourists, which increased to 2.1 million in 2016. As the number of tourists continues to rise annually, it creates pressure not only on tourism resources but also on the local community.

Assessing social carrying capacity involves not only evaluating the quality of the tourist experience that a destination can handle before visitors seek alternative destinations but also assessing the level of tolerance of the local community towards the presence of tourists (Saveriades, 2000). Therefore, it is essential to consider the perspectives of both tourists and the local community when assessing social carrying capacity.

Overall, the research aims to provide valuable insights into the level of social carrying capacity in tourism on Pangkor Island, which can inform sustainable tourism development planning and ensure the well-being of both tourists and the local community.

LITERATURE REVIEW

Sustainable tourism

Sustainable tourism is defined as "tourism that takes full account of its current and future economic, social, and environmental impacts, addressing the needs of visitors, the industry, the environment, and host communities" (UNWTO, 2018). Sustainable tourism seeks to minimize negative impacts while maximizing positive ones, ensuring that tourism can continue to benefit communities and the environment for generations to come.

There are several ways in which sustainable tourism can be implemented. For example, sustainable tourism can involve the use of environmentally friendly practices in the tourism industry, such as the use of renewable energy sources, minimizing waste, and reducing the carbon footprint of tourism activities (Lindberg et al., 1996). It can also involve the promotion of local cultures and traditions, supporting community-based tourism initiatives, and investing in the development of local infrastructure to support sustainable tourism activities (UNWTO, 2018).

Several studies have highlighted the importance of sustainable tourism for the long-term success of the tourism industry. For example, a study by Gössling et al. (2012) found that sustainable tourism practices can lead to improved economic, social, and environmental outcomes for tourism destinations. Similarly, a study by Higham et al. (2013) found that sustainable

tourism practices can help to reduce the negative impacts of tourism, such as environmental degradation and cultural erosion, while also enhancing the positive impacts of tourism, such as economic growth and employment creation.

In conclusion, sustainable tourism is an important concept that seeks to ensure the long-term viability of the tourism industry by minimizing negative impacts and maximizing positive ones. There is a growing body of research that highlights the benefits of sustainable tourism practices for both tourism destinations and the tourism industry.

Tourism Carrying Capacity

Starting in the early 1960s, research on outdoor recreation activities has used the concept of Tourism Carrying Capacity (TCC) to address the sources and social impacts of visitor use (Manning et al., 1999; Lawson et al., 2003). This concept has been used by researchers and managers in the context of tourism and environmental science to address financial resources and avoid negative effects on society (Manning et al., 1996). It prioritizes ecological and social parameters, such as the quality of the environment and the visitor experience. In this way, policymakers will promote sustainable tourism through the "distribution ratio for tourism activities" without exceeding the threshold for each area based on its nature and characteristics (Decleris, 2003). Saveriades (2000) and other researchers (Pásková, 2003; Salerno et al., 2013) emphasize the dynamic nature of carrying capacity. For example, Saveriades (2000) explains that "carrying capacity is not a scientific concept or formula that outputs numbers or formulas used to obtain some numbers or ranges that cause development to stop. It is a limit that may need to be given attention. This limit must be determined and monitored carefully, equipped with standards, and so on. This carrying capacity is not fixed, it evolves over time and with tourism growth and can be influenced by management techniques and controls."

The basic element of this concept is the need to establish limits on tourism activities that reflect the concerns and priorities of local managers and planners (Coccosis and Mexa, 2004). In the early 1990s, most TCC concepts were replaced with the idea of sustainable tourism, but many challenges were outlined for this new concept, such as past issues regarding TCC in terms of objective definition, practice, utility, and diversity (Navarro Jurado et al., 2012). Sustainable tourism is defined as "tourism that is economically viable but does not destroy resources - where the future of tourism will depend primarily on the physical environment and the social fabric of the host community" (Swarbrooke, 1999). The discourse on sustainable tourism development revolves around the main issue of how to manage the resources of the host community to meet basic criteria in promoting their socio-economic well-being while meeting the needs of tourists (Ko, 2001). The concept of TCC occupies an important position in

sustainable tourism (Tribe et al., 2000), and it is interpreted as the implementation of sustainable tourism and characterizes that both can exist and can be a useful framework for analysing the effects and limits of development (Butler, 1996).

Social Carrying Capacity

This study focuses on social carrying capacity in tourism. Although tourism carrying capacity has many other branches such as physical, economic and environmental carrying capacity, the researchers chose to conduct a study on social carrying capacity (SCC). Social carrying capacity involves the perceptions and views of stakeholders in tourism, namely tourists and local community, on the conditions in a tourism destination.

There has been much debate among researchers regarding the determination of the carrying capacity of a destination (Pirdaus et al., 2020; Yusoh et al., 2021), with some arguing that it should be based solely on the satisfaction of tourists, as stated by Getz (1983), Coccossis et al. (2001), and Choi and Sirakaya (2006). Tourist satisfaction is considered one of the key indicators in measuring sustainable tourism and carrying capacity. This indicator is usually based on the number of satisfied or dissatisfied tourists. However, the concepts of tourist satisfaction and service quality are broad, and therefore, a more accurate indicator that considers different perceptions of tourists about the destination during different seasons of the year should be used to test whether significant variations in tourist satisfaction exist. Alldredge (1972) asserted that visitor satisfaction decreases as usage levels increase.

SCC refers to the social and cultural impacts of tourism on local communities. SCC is one of the most difficult thresholds to measure compared to physical, ecological, and economic carrying capacity as they depend heavily on perceptions and values (Saveriadis, 2000; Symmonds and Hammitt, 2000). Additionally, it is also difficult to measure as it depends on individual choices, attitudes, opinions, and experiences (Linberg et al., 1996; Mauerhofer, 2013; Jurado et al., 2013). The idea of social and psychological carrying capacity is often used to consider the concept of crowding and its effects on local community and tourist satisfaction (Qian Jin, 2009).

Saveriadis (2000) defines SCC as the maximum level of use that can be absorbed by an area without an unacceptable decrease in the quality of visitor experience and without unacceptable side effects to the local community. Both components of SCC are (i) the acceptable quality of visitor experience before seeking alternative destinations (i.e. the ability to sustain tourist psychology) and (ii) the tolerance level of the host community towards the presence of tourists (i.e. the psychological carrying capacity of the residents). Many researchers have stated that SCC is the most difficult threshold to assess (compared to environmental, economic, and cultural aspects) because it depends entirely on

value judgments. Furthermore, the impact of tourism on the local population and their attitudes or tolerance towards tourism development and tourists themselves have been more systematically studied. Social carrying capacity in tourism can be seen in Table 1.

Table 1. Social Carrying Capacity in Tourism

Social Carrying Capacity (SCC)		
Tourist	Interaction between tourists and tourist	Satisfaction
Local Resident	Interaction of locals – tourists	Quality of life

Source: (Pirdaus et al., 2020)

In determining this social carrying capacity, it is calculated based on the level of satisfaction of domestic tourists. As most researchers emphasize (Choi & Sirakaya, 2006) tourist satisfaction as one of the indicators in measuring sustainable tourism and social mobility. These indicators are usually based on the amount of satisfaction or dissatisfaction of tourists and suggest a ratio between two types of travelers.

According to Kakazu (2008), SCC is defined as the maximum socially acceptable number of tourists that can be accommodated by the local population. She also agrees with the views of Marzetti and Masetti (2005) and Saveriades (2000) that in determining SCC, both tourists and local community need to be investigated. In her study, she emphasized the concept of Cost-Benefit-Analysis in obtaining the value ratio of SCC in Okinawa Island, Japan. Therefore, to assess SCC in a location, both stakeholders, namely tourists and local community, must be involved.

STUDY AREA

Pangkor Island is situated on the coast of the Malacca Strait, with coordinates of latitude 4° 12'50" North and longitude 100° 34'30" East. It covers an area of 22 km², which includes Pangkor Laut Island spanning 1.3 km². The population of Pangkor Island, according to the Office of the Village Head of Pangkor Island in 2017, is 16,748 individuals (refer to Table 2). Additionally, Pangkor Island is a cluster of ten islands, with Pangkor Island as the main island, along with nine other small islands such as Pangkor Laut Island, Mentagor Island, Giam Island, Dua Island, Tukun Pelan Island, Fukun Terindak Island, Batu Orang Tua, Simpan Island, and Jarak Island. Pangkor Island is approximately 85 km west of Ipoh, the capital of Perak, and situated 3.8 nautical miles away from Lumut.

The number of tourists visiting Pangkor Island has consistently increased every year, with an average rise of over one million tourists. According

to the latest statistics released by MPM in 2020, the number of tourists who visited Pangkor Island in 2019 was recorded at 1,389,923 individuals. This upsurge in tourism indicates a rapid growth of the tourism industry on Pangkor Island.

Table 2: Total local community

Race	Total resident	Percentage (%)
Malay	7,610	46.1
Chinese	7,874	47.8
Indian	970	5.9
Others	28	0.2
Total	16,482	100

Source: Office of the Village Chief of Pangkor Island (2017)

METHODOLOGY

The researcher began the study by listing the major public holidays in Malaysia. The study aimed to be conducted during these public holidays. The data collection period for this study was one year and every major public holiday in the country was targeted. The selected public holidays were the Chinese New Year holiday (January 28 and 29, 2017), Hari Raya Aidilfitri holiday (June 27 and 28, 2017), Merdeka and Hari Raya Haji holiday (August 31 to September 2, 2017), and the school holiday and Christmas holiday (December 24 and 25, 2017). Most of these public holidays involved a relatively long break of more than 3 days. Therefore, the researcher believed that it would attract tourists to visit Pangkor Island. As written in the study of Lopez-Bonilla et al. (2008), the selection of tourism season concept is appropriate because during tourist season such as public holidays and school holidays, the number of tourist arrivals is noticeably high. The quantitative approach was conducted using questionnaire on 96 foreign tourists, 332 local domestic tourist and 387 local community members. The analysis of this study used PAOT, the assessment of crowding and the respondents' acceptance of crowding. The minimum values will be plotted on a barometer to determine the respondents' acceptance towards the social carrying capacity in Pangkor Island. Three categories of minimum scores were set, where values between 1.00 to 2.33 were considered low or weak, values between 2.34 to 3.67 were considered moderate, and values between 3.68 to 5.00 were considered high (Pallant, 2007). These readings were then plotted on a barometer representing red (low/bad), yellow (moderate), and green (high/excellent). This barometer will determine the state of social carrying capacity in tourism on Pangkor Island.

FINDINGS OF THE STUDY

Respondents' Demographic Profile

This study involves four phases of data collection except for local community. Data collection for local community does not require any phase or time period because they are always on Pangkor Island and experience with every situation there. Based on Table 3, the largest number of tourist respondents is in Phase 1, with a total of 128 people followed by Phase 4 with 105 people. Phases 1 and 4 are the main public holidays in Malaysia.

Table 3: Total of respondent according to phase

Category	Phase 1 January	Phase 2 June	Phase 3 August	Phase 4 Disember	Total
International tourist	32	18	22	24	96
Domestic tourist	96	77	78	81	332
Local Community	387				387
Total	128	95	100	105	815

The four phases found that out of 96 international tourist respondents, 62.5% were male while only 37.5% were female. This finding shows a difference compared to the findings of Rosniza Aznie Che Ros (2011) who stated that female respondents were more numerous at that time. Table 4 also shows that out of 332 domestic tourist respondents, 55.4% were male, compared to 44.6% female respondents. From these findings, it can be observed that the gap between male and female respondents is not too significant, which is an advantage as it will provide better results since the responses from both genders are uniform. Of the 387 respondents in the local community category, 61.2% were women and 38.8% were men. The local community is the group of people who are closest to the development and progress happening in a tourist destination. Therefore, researching the local community is important in this study. The local community involved as respondents in this study include those who are involved in tourism and those who are not involved in the tourism development in Pangkor Island.

Table 4: Respondent profile demographic

International tourist	Domestic tourist	Local community
Item	Percentage (100%)	
Gender		
Man	62.5	38.8
Woman	37.5	61.2
Age		
Below 20 years old	-	17.6
21-30 years	45.8	34.4
31-40 years	32.3	24.3
41-50 years	14.6	20.4
51 years old and above	7.3	3.4
Level of Education		
Higher	79.9	9.8
Secondary	9	81.1
Primary	8	7.8
No formal education	-	1.3

Crowding at Pangkor Island during the public holiday

This section describes the situation on Pangkor Island during public holidays based on the perspective of the respondents, to investigate the crowding situation on Pangkor Island during public holidays. To investigate the crowding situation, the People At One Time (PAOT) method was used to determine the situation on Pangkor Island during the study. The PAOT method uses a series of images created using computer software (Image Capture Technology). It is a popular method for determining conditions related to recreation and tourism use. It is particularly useful in situations of high usage or extraordinary environmental conditions where it is not realistic to assess the situation through written means alone (Manning, 2007)

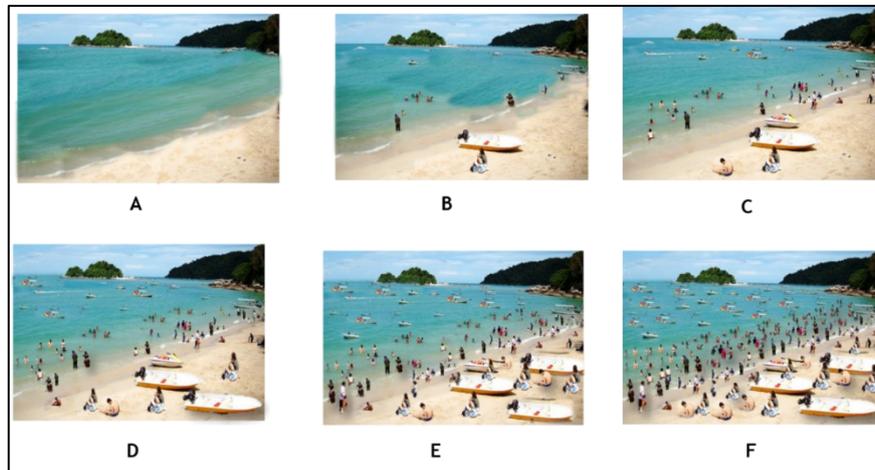


Figure 1: A selection of images depicting the situation on Pangkor Island

The findings of the study show that 45.8% of foreign tourist respondents chose Photo B. Most of the foreign tourist respondents chose an area for recreation that is relatively far from other tourists because they want privacy. In addition, the activity time of foreign tourist respondents is not the same as the activity time of domestic tourists. For example, foreign tourist respondents prefer to spend time in the beach area from early morning until midday to sunbathe and their trips to and from Pangkor Island are not regular like domestic tourist respondents.

For domestic tourist respondents, the average findings from all four phases show that Photo C recorded the highest amount with an average amount of 37.5 percent. It shows that domestic tourists feel that the situation on Pangkor Island during public holidays is 'moderately crowded'. Local community respondents stated that the situation on Pangkor Island during public holidays was 'very crowded' with 74.4% choosing Photo F (Refer to Figure 1). The selection of Photo F shows the local community stating that in the area of 271m x 44m, the number of tourists is as many as 800 people. This situation clearly shows that it is very crowded. This difference gap is very noticeable between the other photos. Photo A had the lowest number of choices with only 1.3% recorded. This significant difference clearly shows that the local community respondents stated that the situation on Pangkor Island is 'very crowded' during public holidays.

Table 5: Respondents' Perception of Crowding in Pangkor Island

Image	International tourist	Domestic Tourist	Local Community
	Percent	Percent	Percent
A	6.3	3.7	1.3
B	45.8	11.8	1.8
C	26.0	37.5	5.7
D	10.4	31.2	9.6
E	8.3	8.1	7.2
F	3.1	7.7	74.4
Total	100	100	100

Tourist respondent acceptance level of Crowding on Pangkor Island

In this section, the researcher will discuss about the acceptance of international and domestic tourist respondents towards the crowded conditions on Pangkor Island during public holidays. This finding is important to find out whether the respondents are comfortable with the crowding that happened on Pangkor Island at that time. If the situation of crowding is still acceptable to the respondents, the social capacity in Pangkor Island is still good. The acceptances criteria have been made to know the respond from respondents.

Based on table 6, the average on mean value for international respondent is 1.38 compared to domestic tourist is 2.87. From these mean values, researcher evaluated the mean value and plotted them on a barometer to analyzed the acceptance for the crowding aspect made by the respondents. From the barometer readings, it was found that the level of acceptance of foreign tourists towards the tourism condition on Pangkor Island was at the 'excellent' level (green) [orange arrow], while domestic tourists were at the 'moderate' level (yellow) [Black arrow] (figure 2).

Table 6: Respondents' Acceptance of Crowding on Pangkor Island

No	Statement	International tourist	Domestic Tourist
		Mean	Mean
1.	The large number of sunbathing tourists causes problems for me	1.29	3.04
2.	The large number of swimming tourists causes problems for me	1.24	3.06
3.	The large number of beach-goers causes problems for me	1.27	2.94
4.	The large number of water activity tourists causes problems for me	1.29	2.64
5.	The large number of snorkeling tourists causes problems for me	1.11	3.07

6.	The large number of fishing tourists causes problems for me	1.16	2.77
No	Statement	International tourist	Domestic Tourist
		Mean	Mean
7.	The large number of boat drivers causes problems for me	2.00	3.01
8.	The large number of tourists at historical sites causes problems for me	1.74	2.81
9.	The large number of jungle tracking/hiking tourists causes problems for me	1.07	2.60
10.	The large number of tourists at seafood factories causes problems for me	1.10	2.64
11.	The large number of driving/riding tourists causes problems for me	1.90	3.03
Average. Min		1.38	2.87

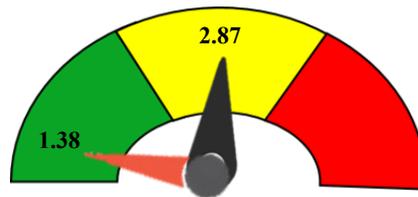


Figure 2: Barometer of respondents' acceptance of crowding on Pangkor Island

Local community Acceptance level

In this section, the researcher examines the local community acceptance of tourist arrivals to Pangkor Island. It is one of the essential aspects in determining the social carrying capacity of tourism in a location. This is consistent with Saveriades' (2000) definition, which emphasizes that in determining the social carrying capacity of an area, the crowding and satisfaction of tourists as well as the local community acceptance of tourist arrivals to their area need to be studied. Based on Table 7, most of the aspects of acceptance studied are at a high level, with a minimum value of more than 3.67, but the respondents' acceptance of sharing facilities with tourists (mean=3.04) is at a moderate level of acceptance (mean 2.34 - 3.66). The highest minimum value is recorded for the aspect of quality of life, with a mean value of 3.91. The respondents feel that their quality of life has improved due to the arrival of many tourists. This is because it will encourage the addition of better facilities and infrastructure in their area. In addition, the shift from the fishing sector to the tourism sector is more beneficial to them. The respondents' acceptance of their living comfort as local community is also at a high level with a mean value is 3.85.

The safety aspect had the lowest mean value within the high range, with a mean of 3.69. Respondents were somewhat concerned about their safety with the arrival of many tourists to Pangkor Island. This finding differs from Mastura et al (2016) study in Mabul Island, where local community felt safer with a large number of tourist arrivals as there would be more frequent monitoring by authorities.

Table 7: Local Community Acceptance of Tourist Arrival to Pangkor Island

The presence of a large number of tourists will certainly have an impact on you as a local community. Therefore, what is the level of acceptance regarding the following aspects as a result of tourism in Pangkor Island?			
No	Statement	Mean	SD
1.	Changes in the attitudes or sociocultural of local community	3.71	0.937
2.	Quality of life of local community	3.91	0.981
3.	Your comfort as a local community	3.85	0.917
4.	Facilities that need to be shared with tourists	3.04	0.882
5.	Safety level	3.69	0.865
6.	Increase in the number of tourists in the future	3.75	1.262
7.	Overall, what is your level of acceptance as a local community towards tourist arrivals to Pangkor Island?	3.84	1.334
Average		3.68	

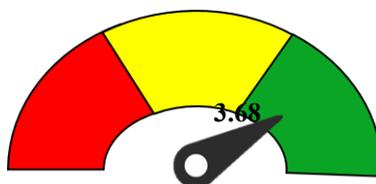


Figure 3: Barometer of Local Community Acceptance of Tourist Arrival to Pangkor Island

Overall, respondents' acceptance of tourist arrivals to Pangkor Island is at a high level with a mean value of 3.84. By taking the average value of all these indicators, the researcher concludes that the level of acceptance of local community towards tourist arrivals is high (Figure 3). According to the Irredex Doxey Model (1976), this high level of acceptance indicates that it is in the Euphoria stage, meaning that tourist arrivals are well-received by local community.

CONCLUSION

The findings of the study show that the tourism sector in Pangkor Island is experiencing positive development, with increasing tourist arrivals and the development of accommodation facilities. However, rapid development can have negative impacts on the environment and the local community. Therefore, sustainable tourism practices should be implemented to ensure the long-term viability of the tourism industry on the island.

One of the key aspects of sustainable tourism is maintaining the social carrying capacity of a destination. The study highlights the importance of assessing the social carrying capacity of both tourists and locals towards tourism activities. This means considering the impacts of tourism on the local community and ensuring that they are involved in the decision-making process.

Overall, the study demonstrates the importance of balancing economic development with environmental and social sustainability in the tourism industry. By implementing sustainable tourism practices, Pangkor Island can continue to attract tourists while ensuring the long-term viability of the tourism industry and preserving the island's natural and cultural resources.

By considering social carrying capacity in tourism planning and management, sustainable tourism can help to ensure that the benefits of tourism are distributed more equitably among local communities and that tourism development does not negatively impact their quality of life. In this way, sustainable tourism can promote social and economic development, while preserving the natural and cultural resources that make a destination attractive to tourists.

ACKNOWLEDGEMENTS

The author would like to take this opportunity to express a thousand thanks to the Research Management Centre (RMC), Universiti Malaysia Sabah (UMS) for covering the research and publication costs of this academic article.

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Received: 18th May 2023. Accepted: 20th July 2023



PLANNING MALAYSIA:

Journal of the Malaysian Institute of Planners

VOLUME 21 ISSUE 4 (2023), Page 250 – 264

GIS AND OIL SPILL TRACKING MODEL IN FORECASTING POTENTIAL OIL SPILL-AFFECTED AREAS ALONG TERENGGANU AND PAHANG COASTAL AREA

Yaniza Shaira Zakaria¹, Azizul Ahmad², Mohd Zulhafiz Said³, Ailis Elizabeth Epa⁴, Nur Afiqah Ariffin⁵, Aidy M Muslim⁶, Mohd Fadzil Akhir⁷, Rosazman Hussin⁸

*^{1,6,7}Institute of Oceanography and Environment,
UNIVERSITI MALAYSIA TERENGGANU*

*²Centre for Spatially Integrated Digital Humanities (CSIDH),
UNIVERSITI MALAYSIA SARAWAK*

³School of Social Sciences,

^{4,5}School of Humanities,

UNIVERSITI SAINS MALAYSIA

*⁸Borneo Institute for Indigenous Studies (BorIIS),
UNIVERSITI MALAYSIA SABAH*

Abstract

Oil contamination can occur accidentally or incidentally in the environment as long as petroleum or shipping activities exist. There is a need to take appropriate preventive measures to reduce the negative impact by carefully monitoring the sprinkles and dispersion particles due to the oil spill movement. An expected oil spill originating from the Resak platform is positioned at 49.1 nautical miles from the Kuala Terengganu shoreline. The Dulang platform, positioned at 69.8 nautical miles from the Kuala Terengganu, can pollute the coastline of the Terengganu and Pahang ecosystems. This study aims; (i) make predictions from the direction of oil particle dispersion and; (ii) engage the ecosystem to determine the effect of an oil spill on a platform around the coastal area. The combination of the Geographic Information System (GIS) and the Oil Spill Trajectory Model (OSTM) has been used to establish the appropriate response to locate the dense area of the slick. The result from the model running show in Northeast (NE) monsoon season, Terengganu and Pahang, have a high potential to affect. It is highly likely to reach the Terengganu coast area, especially in Dungun. It was predicted that 466 barrels of oil would arrive within four days of the December incident. Moreover, Kemaman and Pekan districts in Pahang also have the highest risk of being exposed to oil pollution during the Northeast Monsoon. This is due to the wind factors, which blow from South to North along the East coast of Malaysia Peninsular with a speed maximum of 13 ms⁻¹ and indirectly carry the oil particles to coastal areas in Terengganu and Pahang.

Keywords: GIS, Oil Spill Tracking Model (OSTM), Monsoon Season

³ Lecturer at Universiti Sains Malaysia Email: mzulhafiz@usm.my

INTRODUCTION

Oil spills are one of the significant sources of pollution in the environment. These unfortunate events could cause severe damage to the environment, especially to the sea ecosystem and tourism. Oil spills in the sea would take several months to get vanished. It can be lethal if it remains for an extended period on the sea surface, as it can spread over a vast area within a few hours in an open ocean due to the wind and waves (Jha, 2008). There are a minimum of 135011 platforms in the South China Sea (SCS), and 74% offshore installations in the SCS for Indonesia, Malaysia and Thailand (Twomey, 2010).

The South China Sea (SCS) covers a maritime area of 3.5 million square kilometres, with more than 70.78 billion barrels of oil reserves. It also is a part of the shipping route connecting the Pacific and Indian Oceans (Metelitsa, 2014). Malaysia has an estimated 615,100 km² of acreage available for oil and gas exploration, which that area is almost the size of Myanmar (Khan et al., 2013). An enormous amount of oil was released from a barge found around the SCS on March 14, 2014 (Bernama, 2014). Oil drilling and mining activities are harmful. To the extent that they not only affect the ocean ecosystem due to the oil spill but also increase the risk of chemical material pollution, such as ferum, sulphur, and mercury, that has adverse effects on human health and ecosystems (Ohimain, 2002).

Moreover, Terengganu and Pahang states are exposed to the seasonal monsoon, influenced by Northeasterly (Nov, Dec, Jan, Feb and Mar) and Southwesterly wind (Jun, July, Aug). The Northeast (NE) monsoon winds that cross the SCS and Siamese Bay bring heavy rain to both areas (Suhaila et al., 2010). When the NE monsoon wind groups cross the equator and enter the southern hemisphere, the direction is refracted to the left by the Coriolis force and later becomes the northwest monsoon wind (Loo et al., 2015). The difference in the direction and the strength of the winds in these states will affect the movement and the direction of the pollution on the sea surface and the ability to tackle an issue, especially in case the pollution occurs in an open sea area.

Therefore, proper monitoring of oil spill movement directions can be carried out through a remote sensing image by obtaining the reports of a location which have been affected due to an oil spill. The cause of the problems and the solutions have been analysed and identified based on the possible incidents. Geographic information systems (GIS) and OSTM from National Oceanic and Atmospheric Administration (NOAA) are valuable tools for oil spill disaster management. Integration between these techniques produced a simulation model for monitoring areas likely to be contaminated. The results provided by OSTM the analysis can be stored in ArcGIS for making the oil spill model that can show the virtual simulation of the spreading pattern and the pollution effect on any potential area that is experiencing the pollution (Jordi et al., 2006).

STUDY AREA

Terengganu and Pahang are situated at the East Malaysia Peninsular, surrounded by beautiful beaches that have always been a source of tourist attraction. However, the focus area of this research is the mainland Terengganu and Pahang because the sources of oil pollution are caused by the platforms located close to Terengganu and Pahang shoreline. Terengganu has various kinds of islands, such as Redang Island, Lang Tengah Island, Wan Island, Bidong Island, Tenggol Island, Kapas Island and Perhentian Island, that are visited by many local as well as international tourists (Figure 1).

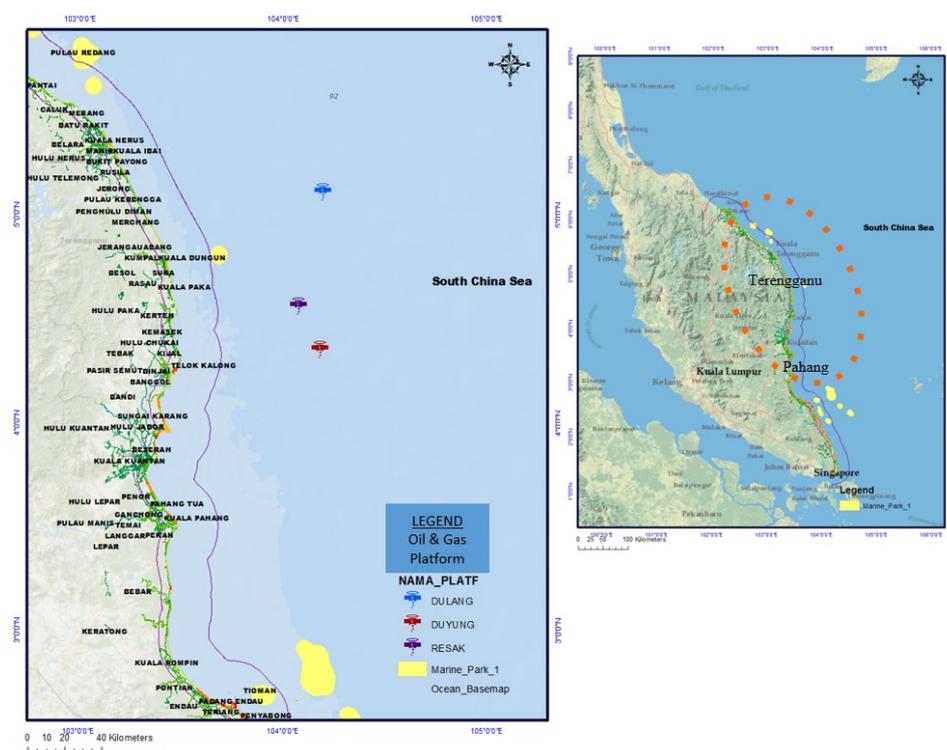


Figure 1: Research Area- Terengganu and Pahang Coast.

While in Pahang state, Kuantan is the capital of Pahang state and is one of the East Coast Economic Region (ECER). Most of the beach area at Pahang is a tourist attraction area. Specifically, Cherating has several international-class hotels, including Club Med Cherating, which high-end travellers visit. Apart from the tourist attractions in Cherating, the coastal area along Sg. Ular is also a famous

tourist attraction and a location for grouper farming, where it is becoming one of the significant economic resources to the locals in the region. Meanwhile, based on the wind system, Terengganu and Pahang are exposed to the NE monsoon, where the wind regularly blows from the northeast in November and ends in the middle of March (Akhir, 2014).

The majority of the mining platform for oil and gas are found in relative structures along the country's coast, such as the Resak platform is positioned 91 km from the Kuala Terengganu shoreline, and the Dulang platform, located 130 km from Kuala Terengganu, excluded the other platform around. Consequently, the risk of an oil spill in the Terengganu and Pahang shoreline is high, especially when the NE monsoons, where the northeasterly wind indirectly will force the oil particle from SCS to move to the coastal area.

METHODOLOGY

Material & Method

Two platforms offshore are chosen as a source of oil pollution point latitude 5.1836°N, longitude 104.3253°E, which is the location for the Dulang platform and 5.7975°N, 103.9281°E for the Resak platform. The research areas are facing the SCS and are bounded by the coordinates 102.601°E, 6.403°N, 104.787°E and 2.367°N. The wind blowing strongly through the areas situated in this winding path will experience the cold effect. This leads to temperature fluctuations in Southeast Asia due to the monsoon climate and equator being over-exposed to the monsoon wind with rough sea conditions, which indirectly influence the oil spill on a coast.

The OSTM integrates Oil Spill Trajectory from NOAA and GIS techniques. The OSTM can conduct sensitivity analyses to understand how a spill's environmental parameters can affect a spill's spread and fate (Al-Azab et al., 2005). ArcGIS is the primary tool for producing a map of the environmentally sensitive area for oil spill management. ArcGIS mapping with several layers of land use and classifying the land cover map for research area according to the sensitivity to oil pollution based on the socio-economy and habitat types. ArcGIS will import an image from OSTM to observe the oil spill trajectory. Satellite image from the LANDSAT 8 ETM+ images on April 15, 2013, was used to produce the land use map and the shoreline map using the Image classification (supervised) technique. The views on the satellite images that show various types of landscape and colour tones can help to identify land use in the study area. Determining the kind of land use helps determine the areas with high value and a contributor to the economy.

The combination band technique was used to determine the land use type more clearly. This includes the combination of band middle-infrared (7), thermal infrared (6) and near-infrared (4) to classify the utilised land in the study

area. Combination Band 432 provides more precise water boundaries and distinguishes apparent different types of vegetation. This band was also used for forecasting vegetation (Apan, 1996). Usually, band 432 is used to view the vegetation more accurately and make differences with the other vegetation area. Image composite 432 executes to interpret images matches with functional, vegetation mapping, identification, reflection chlorophyll, and differences in the species of vegetation (Dat & Yoshino, 2011).

Moreover, the image classification technique (Supervised) was used to classify the vegetative beaches, sandy beaches and much more (Clinton et al., 2010). While digitising, the baseline was done using the shoreline buffer with the pre-existing baseline. The buffer technique with a distance range of 50m was used to divide the distance between water surfaces with land to produce images of the coastline area. The buffer technique was used after the classification technique. It specifies the length of all other shorelines' landward and seaward positions.

Observing the incident scenario depends on the type and status condition of the pollution or fate of oil spilt floating, beached, or evaporated. In this observation, wind speed data will be used. The data taken from the ECNWF (European Centre for Medium-Range Weather Forecast) web is open, and the process by MATLAB software for plotting to produce a map for wind direction and wind speed in ms^{-1} . The wind data and wind direction were taken from November 1 to March 31, 2013, every 6 hours and started from 00.00, 06.00, 12.00, 18.00 and 23.00 at 6 hours intervals so that oil spill modelling and oil spill movement can observe for NE monsoon season.

Model Run

The model is operated for about 168 hours for the first week, representing the oil spill at 168, 360, 672 hours and 720 hours for one month in finding the dispersion direction-classified based on the yearly wind blows. Therefore, the monitoring was done from 0:00 a.m. to 24:00 p.m. throughout the year commencing from January until December 2013, where the oil spill model operated with an estimated total spill of 1000 barrels with a medium crude oil with API (heavy oil type) gravity values 0.91 and the rates of an oil spill of 1000 barrels from Resak and Dulang platforms.

The year 2013 divided into four scenarios according to the monsoon seasons presented in this research was, from November 2012 to the end of March 2013, to forecast the fate of an oil spill in the NE Monsoon season. The period from April to the end of June and September to the end of October were identified as the monsoon transition seasons to see the risk of oil spills during the monsoon. Moreover, to forecast the Southwest monsoon season, the period from the whole month of June till the end of August was selected to see the risk and fate

trajectories of oil spills. To estimate the fate of the oil spill, specifically the movers, the model has been constructed by an equation as below;

$$\Delta x = \frac{u}{111,120.00024} * \Delta t, \Delta y = \frac{v}{111,120.00024} * \Delta t, \text{ and } \Delta z = 0$$

Where,

Δx , Δy = 2-D longitude and latitude displacement Δz = Held at zero

$\Delta t = t - t_i$ (Time elapsed between the time steps)

y = Latitude in a radian.

111,120.00024 = A number of meters per degree of latitude,

δx , δy = 2-d is long and flat displacement, respectively, at a given depth of a layer z

(GNOME, 2012).

The leading causes of pollutants' movement are the winds, currents and diffusion. To gain all the oil particle moves, a v (north-south) with u (east-west) components from diffusion, wind and currents and all types of other movers are added to each time step by the Euler Scheme in the equation above (1). It is divided into two types, the attached map movers and the universal movers.

A simple random walk makes diffusion with a square unit probability. The diffusion value is basic to a random walk; during the incidents, its value is calculated based on overflight data. The random walk, based on the diffusion value- D , represents the horizontal eddy diffusivity in the water. A low value would be $1,000 \text{ cm}^2 \text{ s}^{-1}$, and a high value would be between $100,000$ to $1,000,000 \text{ cm}^2 \text{ s}^{-1}$. The model default is $100,000 \text{ cm}^2 \text{ s}^{-1}$. The diffusion result is given by following the formulas;

$\frac{\partial C}{\partial t} = D \nabla^2 C$, and below are the coordinates of a Cartesian. C is the concentration of a material.

$\frac{\partial C}{\partial t} = D_x * \frac{\partial^2 C}{\partial x^2} + D_y * \frac{\partial^2 C}{\partial y^2}$; Where D is a scalar diffusion coefficient in the x and y direction

Where Diffusion coefficient is; $D_x = \frac{1}{2} * \frac{\sigma_x^2}{\Delta t}$; (3)

While a variant of a distribution is
$$\sigma \frac{2}{x} = \int_{-\Delta x}^{\Delta x} \frac{x^2}{2 * \Delta x} dx = \frac{\Delta x^2}{3} \quad (4)$$

Moreover, for the
$$\Delta x = \frac{dx * \sqrt{\frac{6 * \frac{D}{10,000} * \Delta t}{111,120,00024}}}{\cos(y)}, \Delta y = dy * \sqrt{\frac{6 * \frac{D}{10,000} * \Delta t}{111,120,00024}} \quad (5)$$

Where,

t, t_i = Time elapse (age in hours) at time steps.

y = Latitude in radians.

While the evaporation result was calculated using the equation

$$x_{prob} = \frac{P_1 * \left(\frac{-t_i}{2H_1} - 2 \frac{t_i - 1 - 2 * t_i}{H_1} \right) + P_2 * \left(\frac{-t_i}{2H_2} - 2 \frac{t_i - 1 - 2 * t_i}{H_2} \right) + P_3 * \left(\frac{-t_i}{2H_3} - 2 \frac{t_i - 1 - 2 * t_i}{H_3} \right)}{P_1 * \frac{-t_i}{2H_1} + P_2 * \frac{-t_i}{2H_2} + P_3 * \frac{-t_i}{2H_3}} \quad ; (6)$$

Where,

H = Half-lives of each constituent (in an hour) for a pollution while.

P = Percentage of each constituent (as decimals).

RESULT AND DISCUSSION

During the Northeast Monsoon

About 473 barrels in January came from Resak, reached the Kemaman district shoreline, and contaminated the Marang area to Kuala Paka. These are based on the forecast analysis of OSTM, according to which 20 barrels of oil spill particles were in the second week have taken place in November (Figure 2). However, the December results from the Resak platform reveal that the spreading radius is much smaller. The spreading radius is only from the Marang district shoreline to the Dungun district shoreline. However, in Dungun, it was predicted that 466 barrels of oil would arrive within four days after the incident in December. In contrast, the spread of oil particles from the Dulang platform is wider, where the particles have been spread to almost 223 km from Kemasik to the Bebar area at Pekan, Pahang.

In January, 473 barrels of oil spilt came from Resak. They reach the shoreline at Kemaman district, contaminating the Marang area to Kuala Paka, thus affecting the shores, mangroves, epifauna and infauna, wildlife and the socio-economic area along the coast of the Kemaman district up to the Kuantan district in Pahang. The Resak platform is closer to the Kuala Terengganu shorelines. Therefore, the wind cannot spread the oil particles to a broader area.

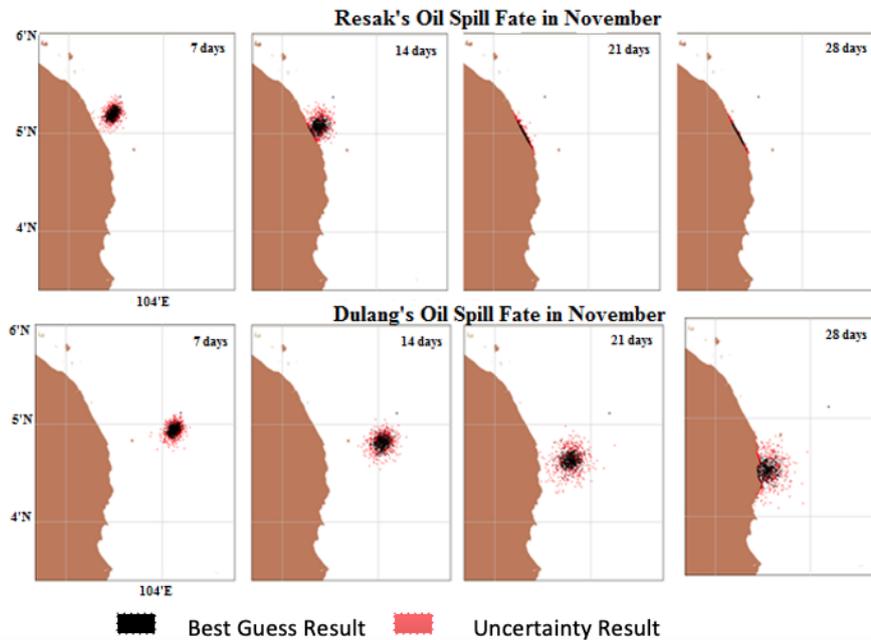


Figure 2: Oil particle movement during the Northeast monsoon in November.

Moreover, in February, there were 43 barrels of particles found in February, risking the pollution in the shoreline at Merchang. Likewise, in March, almost 217 barrels of particles were found to be threatening the pollution at the Pulau Kerengga beaches by the first week. In March, the forecasting analysis also shows that contaminated particles have a significant prospect of reaching the shoreline on December 14. Compared to December, February and March, the forecasting results show that oil particles from the Resak platform are at high risk of reaching the shore of Pulau Kerengga to Merchang by the fourth day. Moreover, the model also indicates that the wind speed in December is stronger as compared to November and that it takes just a short period to carry all the contaminated materials to the land along the coast of Marang, Kuala Paka, Dungun beaches up to the area of Pekan and Pahang from Dulang platform with a wider radius.

During Southeast Monsoon

The scenario is different during the southwest monsoons in which, even after a month, 50.9% of the raw materials still floating on the sea and did not disperse to the beach by June from both platforms (Figure 3).

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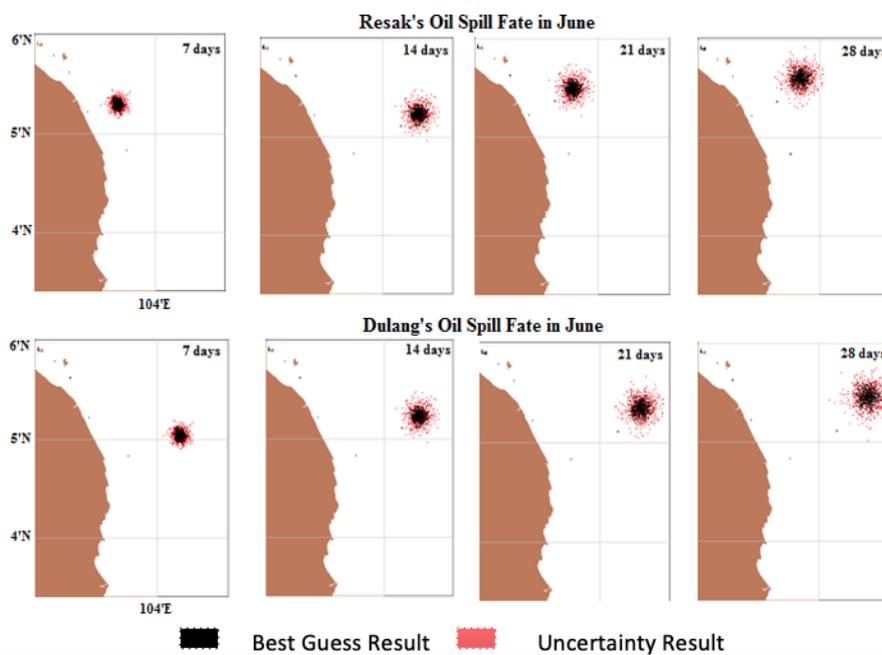


Figure 3: Oil particles movement during Southwest Monsoon in June

Moreover, modelling showed that the spilt material in this season was moving away from the Dulang and Resak platforms, and the onshore spill was heading towards the sea in the direction of the southwest monsoon winds.

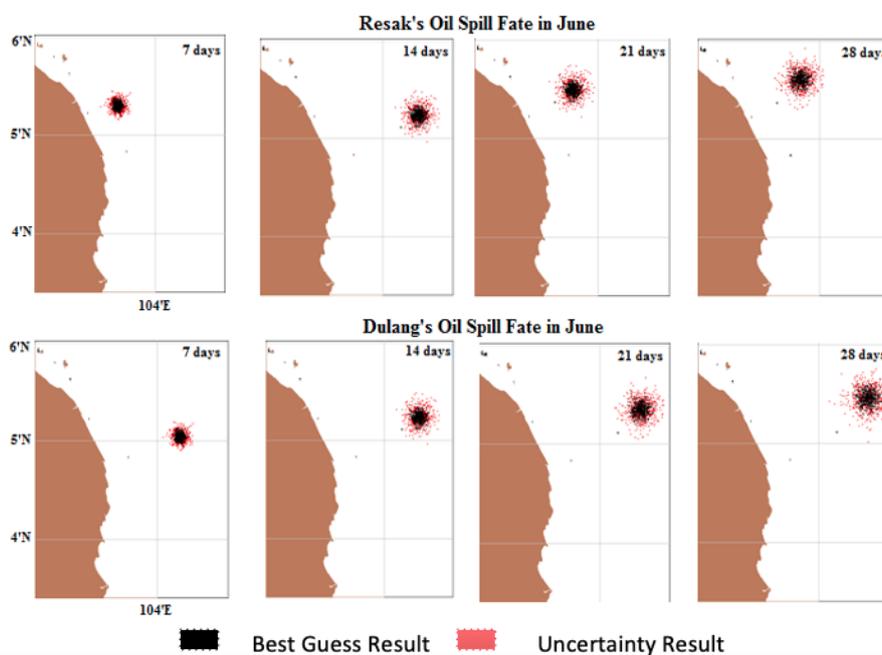


Figure 4: Oil particles movement during Southwest Monsoon in August

However, it was different in July and August during the monsoon season for the Resak platform because, based on the analysis, about 18 barrels of contamination could reach the shoreline or the islands in the North (figure 4).

During Transmission Monsoon

The winds are weaker during the monsoon transition in April, May, September and October. This season spills from the Dulang platform do not spread as far and remain near the spillage. The spreading processes model has discovered that 50.9 % of the total is floating contaminants after a month, whereas the remaining 49.1 % is dispersed and evaporated. However, the Resak platform is closer to the Kuala Terengganu coast. The wind in April carries about 11 barrels of oil on the 13th day and then pollutes the shoreline along the district of Batu Rakit to the Pulau Kerangga (Figure 5). Therefore, based on the results from modelling, it is revealed that the processes that occur in the oil spill depend on the state of the ocean's current and the influence of monsoon winds or weather conditions. In contrast, based on the forecasting for Resak Platform, results show that only a few oil particles contaminated the Terengganu offshore areas by the 23rd day of September and October, and they were headed to the North of Malaysia

Peninsular and created a significant likelihood of polluting the island at the North of Malaysia Peninsular.

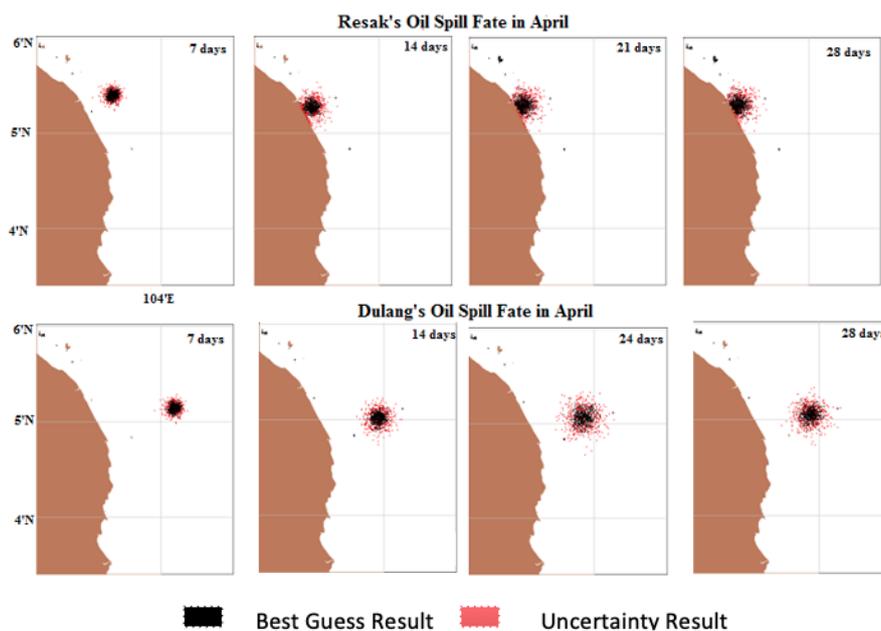


Figure 5: Oil particles movement during Inter-monsoon in April

The analysis and forecasting model demonstrate that the wind direction and capacity can indirectly impact and will influence the oil particles and wave strength of their size and movement. If the spill happens during the northeast monsoon season, the possibility of the risk of particles reaching the shoreline is almost 100%. In contrast, the Northeast Monsoon data shows wind from the Northeast in November until March is blowing from the North to the south throughout the year, most of the time during the monsoon. The result shows that an oil spill modelling is moving in the wind direction to the land. However, the NE wind direction indicates that the oil spill movement was slower in the early monsoon in November than in December. This is because, in the second week of December, the oil spill reached the land and polluted a few areas compared to the early monsoon, and the contaminants were still in the sea during the second week.

Also, according to the modelling forecast, the oil movement in November and March is more concentrated and in groups compared to December, January and February, in which the activities are more spread and scattered. Furthermore, the wind is strong during this season, and the sea condition is

usually wavy. Thus, the waves break up the oil slick and form the oil droplets that later become suspended in the water. Only a small proportion of these droplets and neutral buoyancy remain dispersed in the water, and most of it floats back to the surface. The oil slick breaks up into smaller droplet sizes before it disperses down through the water column, and all these activities are the effect of the current, also known as 'the intrusion depth' (Delvigne & Sweeney, 1989).

Based on the results of oil spill observation and modelling, the oil spill process is heavily dependent on the density of oil, sea surface temperature and wind direction as well as the wind speed, which can cause the surface waves to transform the oil particles into a much smaller and thicker in size and is regarded as the physical and dynamic process. As a result, it impacts the movement and spreading of oil spills, while the chemical and biological process reduces the thickness of the oil. Thus, the oil spill modelling showed that the process of dispersion, dissolution, spreading and evaporation can be seen within seven days. It begins when the oil forms a slick being moved by the surface current and the winds.

Later, the majority of the oil components evaporate from the surface. Still, the lighter hydrocarbons get separated into the water column, and by breaking waves generated by the wind, the oil eventually emulsifies. Moreover, this process still depends on the amount and the type of oil involved as well as on the location of the incident. Apart from that, the wind movement in this month during the Northeast monsoon season produces a different rate of oil fate according to the other months. The figure below (Figure 6) demonstrates that the wind blows more strongly in December.

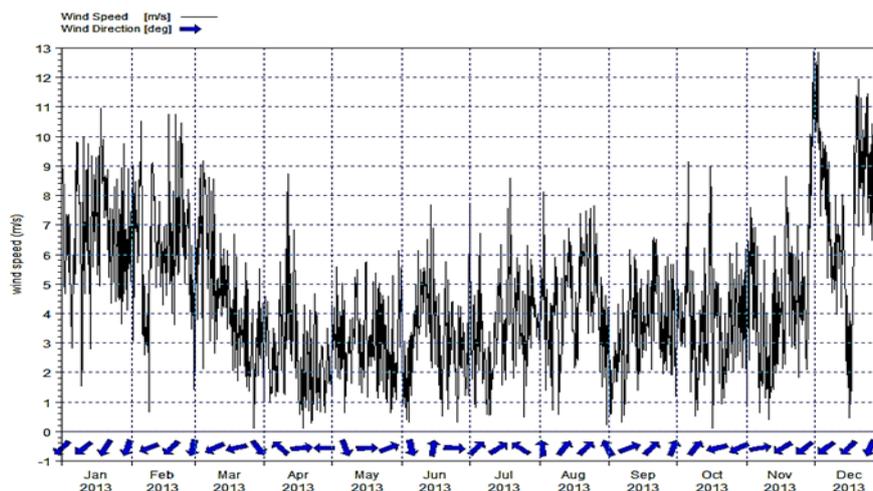


Figure 6: Show Wind direction and a capacity graph of the 2013 ECNWF source.

Consequently, it indirectly carried the oil particles on the sea surface to the coastal area. It polluted the whole area on the 14th day after the incident as opposed to the other months. Based on the result from the analysis of the northeast monsoon, it was also found that in January, the wind movements are lighter as compared to February, in which the wind sometimes becomes relatively strong and can carry the oil particles to the land in a massive quantity as compared to December on the 20th day after the incident. This reveals that the wind blows and direction can significantly influence the radius of oil particles spreading patterns with the quantity of the particles that reach the land before contaminating the affected area.

However, the schedule for March shows that wind movement changes and sometimes becomes windy, causing the wind to carry the oil molecules to the coast earlier than in January and February. However, the total of spills brought and affected the east coast shoreline is still lesser as compared to the aforementioned in December. These clearly showed that wind direction and speed got slower by the end of March. The wind direction and strength also influence the radius or habitat ecosystem's destruction rate due to the oil spill. Through oil spill fate trajectory observation, the results of the research and wind-blowing graph demonstrate that in the northeast monsoon season, which begins in November, it was evident that the wind movement was from West-Southwest to East Northeast. By the middle of November, the wind direction had changed from East-Northeast to West-Southwest up until February. According to the forecast results for the Resak platform, the destructive area radius in the upcoming months is almost the same and concentrated more on the area from Marang to Dungun, where the radius of the oil particles spreading is 22 km to 38 km.

However, in January, the oil particles are found to be in excess in the south of Terengganu, but different in March, where oil particles concentrate more towards the North of Terengganu. For the Dulang platform, the oil spreading radius is much wider because of the distance factor of the Dulang, which is more remote than the Resak platform. This caused the oil particles to remain to exist much longer on the sea surface, and after undergoing a few processes and wave actions lead to the particles were separated and scattered on a broader scale, whereas, in February, the oil particles spread and contaminated the area from the Kemaman district to the Penor, Pahang. Since the oil particles' radius this month caused by the Dulang platform was extending over 101km, which means that the larger the radius, the longer the oil particles will stay in the water and wave action will indirectly carry them into multi directions, hence possibly exposes the area to the pollution in a larger scale of radius.

CONCLUSION

The OSTM can be used as a faster tool to define a trajectory for emergency response, and GIS is used to observe each attribute in the risky area more clear. Through this research, the OSTM provides a clearer picture of the dispersion of pollutants based on the current state of the oceans. Integration between these tools enables a more efficient analysis which is done in the case of any accident that may impact marine life and the surrounding areas. Moreover, the simulated OSTM shows that oil spread is directed to the northwest, heading towards land and reaching the coastal area, where the oil spreading model can assist in the contingency plan to tackle a potential incident that may pollute an area in Pahang and Terengganu.

Furthermore, OSTM is a very efficient and widely used model as it can easily be applied and does not require a substantial cost. Besides, modelling also makes it easier to observe and understand. In light of this research, a few precautionary steps might also be taken in the event of any accident in the National Sea. However, a plan should be executed for contingency and conservation according to the needs and interests of the area since the conservation plan cannot be taken lightly. Lastly, any research without knowing the background of the incident could result in a massive disaster.

Furthermore, GIS databases store the spatial data or affected area location and can also maximise the spatial data in one particular area that can be made as a research possibility of arriving at a decision or taking more certain actions, as well as connecting the spatial data with the attribute data. Spatial data are needed to understand the effects of the negative impact caused by the oil spill that indirectly influences the sea organisms and offshore areas. While modelling provides a better view regarding the movement or what is happening on the surface, along with making the prediction and the Disaster Recovery Management more easily planned and executed. A comprehensive strategy is one activity set under disaster management to reduce the risk by decreasing the elements of risk, ensuring precisely that planning is done before the incident happens, and effectively and efficiently taking counteraction to overcome the disaster when it occurs.

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Received: 18th May 2023. Accepted: 20th July 2023



PLANNING MALAYSIA:

Journal of the Malaysian Institute of Planners

VOLUME 21 ISSUE 4 (2023), Page 265 – 281

CHALLENGES IN IMPLEMENTATION OF COMMUNITY-BASED-TOURISM AND HOMESTAY POST-COVID-19 MOVEMENT CONTROL ORDER (MCO) AT KUNDASANG, SABAH

Dayang Siti Noorafidah Datu Nordin¹, Normah Abdul Latip², Kasim Mansur³, Rosazman Hussin⁴, Jalihah Md Shah⁵

*^{1,5}Faculty of Social Science and Humanities,
UNIVERSITI MALAYSIA SABAH*

*^{2,4}Borneo Institute for Indigenous Studies,
UNIVERSITI MALAYSIA SABAH*

*³Faculty of Business, Economic and Accountancy,
UNIVERSITY MALAYSIA SABAH*

Abstract

This article discusses the challenges in implementing the community-based tourism and homestay post Covid-19 movement control order (MCO) at Kundasang, Sabah. The spread of the Covid-19 virus has had a significant impact on the community and, at the same time, on tourism activities. The implementation of the MCO, announced by the Prime Minister of Malaysia on March 18, 2020, has led all sectors, including the tourism sector, to stop operating temporarily to curb the virus from continuing to be prevalent among the community. On June 10, 2020, the government implemented the Recovery Movement Control Order (RMCO), allowing all sectors to operate again. However, there is a question of what challenges the tourists face in implementing the post-covid-19 recovery strategy and plan in Kundasang. The primary approach to this study is qualitative, based on primary and secondary data sources. The preliminary data is used through in-depth interviews while in the field. Secondary data is from journal articles, academic reference books and newspaper news widely used in this writing. The results of this study found that there were challenges facing the community, especially homestay operators, where the challenges they faced were different in implementing the post-covid-19 tourism recovery strategy in Kundasang, Sabah.

Keywords: Challenges, Strategies, Tourism Recovery, Community, Homestay, Movement Control Order (MCO), Covid-19

² Corresponding author: normah.abdullatip@ums.edu.my

INTRODUCTION

The Covid-19 virus is an issue that has a place on social media every day. It is a disease that is caused by the SARS-COV-2 virus or better known as the Severe Acute Respiratory Syndrome Coronavirus 2. Every day, the number of cases shown by the Ministry of Health (MOH) is public attention. The Covid-19 outbreak was reported in Wuhan, China, at the end of December 2019. The spread was categorised as an epidemic as it occurred suddenly in Wuhan, China, and several other countries such as South Korea, Japan and Italy (Academy of Sciences, 2020). Deaths abroad continued to rise until early January 2020; it was detected in Malaysia due to Chinese tourists entering Malaysia through Singapore. However, the Malaysian government still allows the economic sector to operate as usual. World Health Organization (WHO) has defined this outbreak as a pandemic as the spread of new diseases worldwide. This is because the outbreak's spread seems difficult to contain by any country worldwide as the outbreak has spread across the border so quickly.

In Malaysia, the spread of the Covid-19 pandemic has forced the government to impose a 14-day Movement Control Order (MCO) from March 18, 2020 to March 31, 2020. The implementation aims to keep the people home to decide on covid-19 chain. This implementation has led to all sectors of the economy, including tourism, being ordered to stop operating temporarily until a date to be informed by the government. Therefore, the government called on all Malaysians to work from home so that the spread of Covid-19 could be prevented from spreading among the people. However, the implementation of the MCO has not only stopped within the period set by the government due to increasing cases that have undermined the safety of the people and the country. The 8th Prime Minister of Malaysia, Tan Sri Dato '(Dr) Haji Muiyiddin bin Haji Muhammad Yassin has taken a proactive step by announcing an extension of the CPP period from April 1, 2020, to April 14, 2020.

From April 15, 2020, to June 9, 2020, the government implemented the Conditional Movement Control Order (CMCO). Relaxation has been given to the people to continue their daily activities with new norms. Several sectors of the economy have resumed under the SOP set by the government after several months of closing due to the Covid-19 case. On June 9, 2020, the government reported no Covid-19 spread cases among locals. As such, the government has again announced the relaxation of the people's daily activities and allowed more economic sectors to operate, including tourism. This shows the government's success in ensuring people's and the country's safety is always preserved. Therefore, the government needs to focus on the country's economic recovery. Furthermore, Latip et al. (2021) emphasise that tourism is the faster contribution towards economic growth from human mobility and movement base activity, as well as hoteliers, mainly homestays.

From June 10, 2020, to August 31, 2020, the government announced the Recovery Movement Control Order (RMCO) that focused on the country's full recovery due to the Covid-19 pandemic. The Malaysian Homestay Experience Program has issued instructions that entrepreneurs must provide protocols on homestay premises that include disease surveillance and prevention of infection according to the standards set by the Ministry of Health Malaysia. Several activities are not allowed by the government. Among them are activities involving mass-gathering and physical contact, indoor accommodation room owners of homestay operators, sports and recreational activities in the pool, restaurants, and cafe buffets (Sektor Kesenian dan Kebudayaan, 2020).

Homestays have been identified as a program that enhances the country's income while benefiting the community directly. To develop the tourism sector in a country, the local community should be involved because, without the involvement of the local community, tourism development in the area is considered unsuccessful (Hussin & Tunjuraman, 2015). Homestay in Kundasang is increasingly popular and has the potential to attract more tourists to visit Sabah. With the arrival of many tourists, its local community, especially homestay operators, benefits the economy and has a positive view of the homestay program (Tunjuraman, 2019).

However, various challenges in implementing community-based and homestay travel and tourism strategies need to be resolved immediately. Hussin et al. (2022) indicate that a homestay recovery plan and strategy must be explored, especially in the Kundasang area. The community, especially homestay entrepreneurs, must address the challenges to ensure a safe and comfortable tourism environment to attract tourists.

LITERATURE REVIEW

Most countries in the world have taken the tourism sector seriously as it has the potential to compete with other sectors. After manufacturing, the tourism industry is Malaysia's second largest major contributor (Bujang, 2017). Through the Ministry of Tourism, Arts and Culture Malaysia in the Malaysian Homestay Experience Statistics Report February 2023 recorded 2022 showed RM 8,113,591.87 with a 31% increase in five years compared to 7% with RM 1,940,289.68 in 2020 during Covid-19 outbreaks occurred. However, it can be seen that homestay revenue performance in Sabah before the Covid-19 spread in 2019 showed a 6% increase with a total income of RM 7,950,954.46 compared to the previous year.

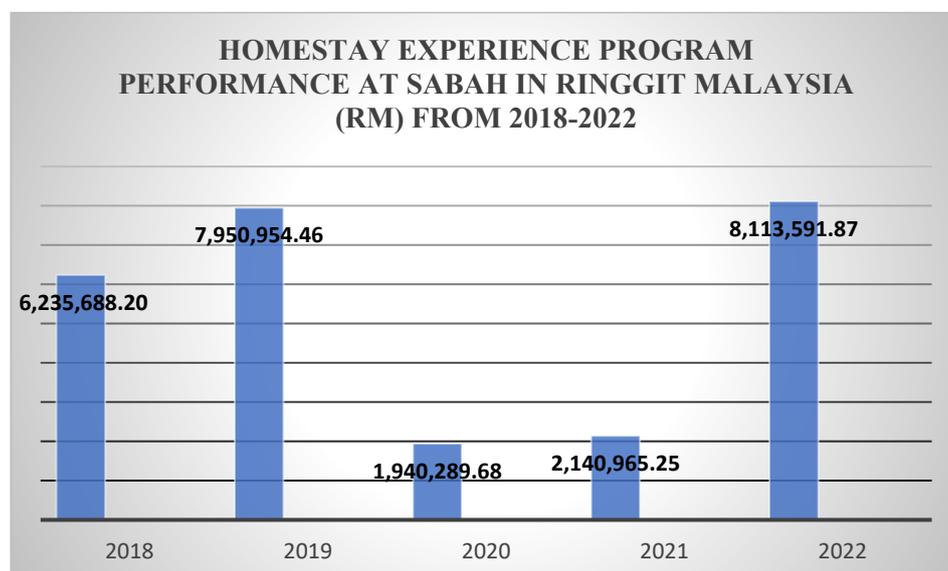


Figure 1: Homestay Experience Program Performance at Sabah in Ringgit Malaysia (RM) from 2018 to 2022 (MOTAC, 2023)

By 2021, it showed an increase of 1% from 2020. This is due to the cross-country permission of Malaysia. However, it is still by the government's Standard Operation Procedure (SOP). Among the SOP to be followed is the homeroom owner of the homestay owner, the individual or family must complete 2 doses, homestay operators need to provide a QR code to customers, ensure a 1-meter physical imprisonment during counter or office and homestay operators must provide hand sanitizer facilities and ensure its use by guests at the entrance of the premises. (Pelan Pemulihan Negara-FASA 2, 2021)

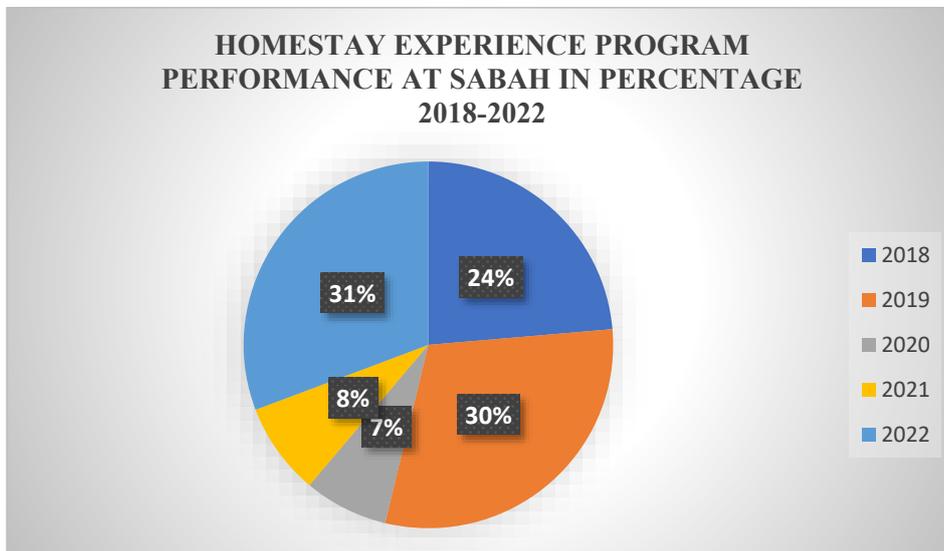


Figure 2: Homestay Experience Program Performance at Sabah in Percentage from 2018 to 2022 (MOTAC, 2023)

The study by Siti et al. (20220) entitled Setup Tourism Agency in offering services during the Covid-19 Pandemic Period aimed at researching strategies used by agencies Tourism in Malaysia during the post-Pandemic Covid-19 period. The approach used in this study was a qualitative approach using the interview method for four travel agencies that have been operating for ten years in Malaysia. In addition, secondary data from various sources published is used as the basis of research data. The study found that travel agencies made five preparations to offer services during the post-Pandemic Covid-19 period. Among them is the preparedness to offer the government's current directive service with the reopening of the tourist destination of Langkawi after the announcement was made by the Ministry of Tourism, Art and Culture (MOTAC) in September 2021. Meanwhile, the provision of new packages and services according to current needs by promoting domestic tourism, especially to islands such as Langkawi Island, as there is no permission to cross the state while promoting e-voucher service packages in the country as its focus is on domestic tourism only. Other initiatives to ensure the survival of travel agencies in the industry where travel companies have permission to run other businesses on the premises effective March 18, 2020, to 30 June 2021 (Motac, 2021). Many agencies have taken the opportunity, and the government has begun introducing reskilling and upskilling programs to reduce unemployment in the country. According to the Department of Statistics Malaysia (2021), 100,000 individuals

in the tourism sector lost their jobs by 2020 due to a 2.9 % tourism depreciation of 3.6 million people in 2019 compared to 3.5 million employers by 2020. Not just there, relationships Continued among agencies involved in other industries but still used the agency's name to attract more customers. The industry's transition began to change towards digitalisation during the COVID-19 pandemic using Facebook, Instagram, Twitter, Website and TikTok. However, once the tourism industry has fully reopened, the use of digital platforms to 50-50 combines traditional and digital platforms in promoting their services. Therefore, travel agencies should have preparations and strategies for dealing with all possible disasters or changes.

A study of the Emergency Planning Disaster Recovery in Malaysia's Hospitality Industry studied by Al-Battat and Ahmad Puan Mat Som in 2014 to identify some disasters and emergency planning that could reduce the impact of disasters and research how to restore the industry after a disaster. It focuses on the crisis and disasters in Malaysia's hospitality and tourism industry. In the meantime, through the economy in Malaysia, this study evaluates the contribution of the Gross Domestic Product (GDP), which discusses its impact on tourist arrivals from overseas to Malaysia. It also analyses the rates of occupancy during disasters. This shows that this study is more touching on strategies to take before the disaster. Furthermore, some of the natural disasters in Malaysia whether natural disasters have affected the hospitality enjoyed by the community and the tourism sector. Existing preparations are just reactive, according to the reports of most industrial businesses. This has caused the industry's business to rely on government planning to restore the sector as a result of natural disasters. Existing plans should be organised in the form of a proactive. Therefore, there are several strategies designed to withdraw tourist arrivals, such as cheap tourism packages, tax reductions, improvement in service quality, hotel renovations, and promotions through mass media that play an essential role in post-disaster recovery purposes.

Subsequently, in the study of Covid-19 and the Recovery of the Tourism Industry by Albert Assaf and Raffaele Scuderi in 2020, the need for recovery strategies for the domestic and international tourism industry. The tourism industry is experiencing a new scenario. To ensure that the writing of this article is successful, the author has contacted several people and collected their feedback on the two issues raised in this writing. First, examine how the tourism industry can move as usual. Second, what is the role of the government in helping entrepreneurs in a business that can last longer? Several strategies experts provide, namely cleaning and sanitation, should be emphasized using adequate hygiene equipment and PPE facilities for tourist safety. In the meantime, reducing the rate of hotels and restaurants can improve customer safety perceptions. The facility can limit access by stipulating that social activities must be limited depending on the inventory rather than relying on third parties. In addition,

several other hotels and travel firms can agree with government institutions to provide individual facilities infected with the Covid-19 virus. The best hotel selection at a higher price also allows tourists to feel their safety.

The government also plays an essential role in restoring tourism. Among the government strategies are:

- Offering interest-free loans, loan guarantees, flexible mortgage agreements, creative financing options and non-refundable subsidies.
- Provide funds to promote tourist destinations.
- The relaxation of visa regulations for foreign countries when the pandemic is recovered to enhance international tourism flow.
- Enables local governments to implement lighter rules than the central government.
- Introduction of Pigouvia taxes to deal with some outbreaks, such as Covid Recovery Taxes
- Controlling the possibility of a predator investor to protect the weak business is critical.

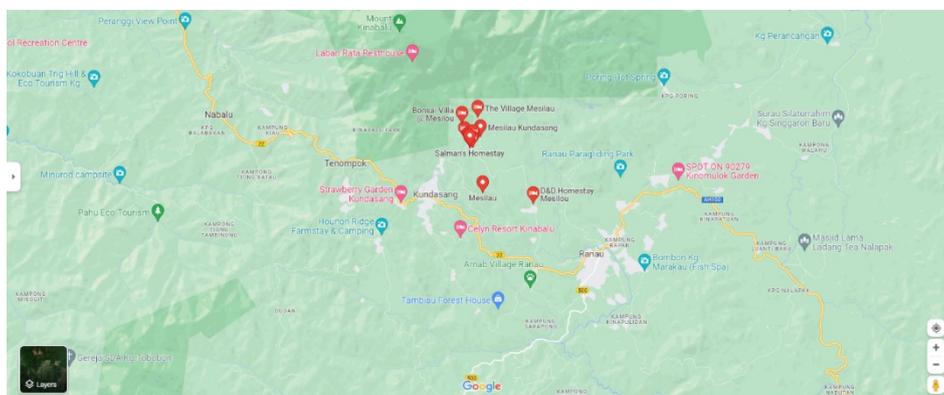
RESEARCH METHODOLOGY

Study Area

Mesilou Village is one of the villages located in the Ranau district. The Ranau District is located in the central part of Sabah (Ramzah & Buang, 2008). The area has experienced the strongest earthquake and has significantly impacted the tremor. However, the Kundasang area is still the focus of both local and overseas tourists on the beauty of nature, and Kundasang is one of the districts in Ranau district. It is located on the outskirts of Mount Kinabalu, which is used as a study site. Kundasang small town, known as a "vegetable town", is 15 kilometres from the Ranau area. In Sabah, the Kundasang region has several unique features on a sizeable geographical scale (Ramzah, 2010).

One of the unique features of the Kundasang geographical scale is to show Mount Kinabalu is the highest mountain in Southeast Asia. The highest peak of the range is 4095m, with a height of 13,435 feet from the sea level, the most prominent area in Sabah (Sabah State Government website). Therefore, it is known as "The Highest and Coldest Village in Malaysia". In addition, the Kundasang area located on the hillside has made the area a highland vegetable producer in the country (Fujimoto & Miyaura, 2002).

Dayang Siti Noorafidah Datu Nordin, Normah Abdul Latip, Kasim Mansur, Rosazman Hussin, Jaliyah Md Shah
 Challenges In Implementation of Community-Based-Tourism and Homestay Post-COVID-19 Movement
 Control Order (MCO) At Kundasang, Sabah



Source: <https://www.google.com/maps/search/kampung+mesilou+kundasang/@5.9959019,116.6039971,12.02z> (01 April 2023)

Materials and Methodology

This study uses a qualitative approach based on primary and secondary data. Primary data requires interviews with informants. In-depth interviews are broad, open, unstructured, and not necessarily permanent (Jasmi, 2012). This interview enables informants to answer questions in more detail related to the challenge of implementing strategies and recovery plans. In addition, secondary data is used from scientific books, journal articles and newspapers obtained from related websites. Researchers commonly use it as a reference, comparison and expression to strengthen their views and interpretations of what is being studied (Ibrahim, 1997). Data results are analysed but compact to facilitate the study's formulation and conclusions. The implementation of the MCO has undermined essential sectors, including the tourism sector, which has to stop operating temporarily. Various strategies are made to attract domestic and international tourists to ensure the tourism sector benefits the country. However, some challenges in implementing strategies and recovery plans need to be considered so that the strategies will run smoothly.

Table 1: Main Informants Profile

Informants	Role	Gender
1	Head of Village	Male
1	Homestay Owner	Female
1	MEVOC Secretary	Male
1	Member of Neighborhood Committee	Male

ANALYSIS AND DISCUSSION

Demographic profile

All variables are analysed using frequency and percentage, as shown in the table. Table 1 shows 167 people responding, of which 84 are men and 83 are women. Most of those who answered the questionnaire were men, 50.3 per cent. The percentage of women, on the other hand, is 49.7 per cent.

Table 2: Respondents by gender

Demographic	Respondents profile	Frequency	Percentage
Gender	Male	84	50.3
	Female	83	49.7

Respondents' age in this study showed a high percentage of young people aged 18-29 years, 44.3 per cent, followed by 30-39 years old, made up 28.1 per cent.

Table 3: Respondents by age

Demographic	Respondents profile	Frequency	Percentage
Age	18-29 years	74	44.3
	30-39 years	47	28.1
	40- 49 years	25	15.0
	50-59 years	17	10.2
	60 years and above	4	2.4

Most of the Dusun tribes participating in this study were 122 individuals, representing 73.1 per cent. Among the Kadazan people, there were 9 or 5.4%. The Bajau tribe with 6.0%, first person and others, there were 25 or 15.0%.

Table 4: Respondents by race

Demographic	Respondents profile	Frequency	Percentage
Race	Dusun	122	73.1
	Kadazan	9	5.4
	Bajau	10	6.0
	Rungus	1	0.5
	Others	25	15.0

In addition, the level of eligibility or education showed that SPM had the highest percentage of 47.3, with 79, followed by SPM, with 47 people, 28.1 %. The bachelor's degree, 13 people, 7.8 %, UPSR by 12 people, 7.2 %, PMR by ten people, 6.0 %. No formal education of 5 by 3.0 % and the other, and only one person attended this study, namely 0.6 %.

Table 5: Respondents by education

Demographic	Respondents profile	Frequency	Percentage
Education	Non-formal education	5	3.0
	UPSR	12	7.2
	SRP/LCE/PMR	10	6.0
	SPM/MCE/SPAM	79	47.3
	STPM/Diploma/STAM	47	28.1
	Bachelor Degree	13	7.8
	Others	1	0.6

The highest number of people participating in this study was working in the private sector, with 90 people matching 53.9 per cent, followed by self-employed, matching 30.5 per cent. A total of 10 people working in the public sector participated in this study, 6.0 per cent, another 7 with 4.2 per cent, five students with 3.0 and one housewife with 2.4 per cent.

Table 6: Respondents by Working Status

Demographic	Respondents profile	Frequency	Percentage
Working status	Working in the public sector	10	6.0
	Working in the private sector	90	53.9
	Self-Employed	51	30.5
	Housewife	4	2.4
	Students	5	3.0
	Others	7	4.2

The study found that the RM 1000 and below respondents' income category was 22.2 per cent, 37 people. Meanwhile, the highest monthly income of the respondents was RM1001-RM2000 showing the highest number of 95, 56.9 per cent. This was followed by 15 people with an income of RM 2001-RM3000, 9.0 per cent, RM3001-RM4000 income of 4.2 per cent, RM4001-RM5000 with 3.0 per cent and those with RM5001 and above, eight people, 4.8, 4.8. per cent.

Table 7: Respondents by Income

Demographic	Respondents profile	Frequency	Percentage
Income	RM 1000 and below	37	22.2
	RM 1001- RM 2000	95	56.9
	RM 2001- RM 3000	15	9.0
	RM 3001- RM 4000	7	4.2
	RM 4001- RM 5000	5	3.0
	RM 5001 and above	8	4.8

Strategies Post-MCO in Kampung Mesilou

This study analyses community-based tourism recovery strategies and post-MCO post-homestays. As shown in Table 7, the strategy involving the government has the highest average of 4.49. This was followed in second place with a homestay entrepreneur strategy with an average of 4.46 and a community strategy in Kampung Mesilou with a mean of 4.43. With the advanced technology, it is necessary to cooperate with all parties, especially the government to help promote new tourism products.

This study divides the strategy into three groups: the community itself, honest men, and the authorities. The analysis of the overall strategies showed that the community strategy itself, by adding the parking lot, has a high mean score of 4.44, compared to the strategy of improving the 4.42 signboard. Therefore, the need for parking areas to curb the shortage of parking. Excessive offerings in this tourist area have led to high parking demand for tourists.

In addition, in this study, a strategy conducted by homestay entrepreneurs to attract domestic and international tourists came to Mesilou Village, including the addition of new tourism products, sources of income and increasing working with MOTAC for the promotion of new tourism products, promotion through media mass and cooperate with the private sector. Studies have found that the source of revenue has the highest mean score of 4.75, compared to the addition of a consistent new tourism product 4.43, partnering with MOTAC 4.44, promotion via Mass Media 4.48 and working with the private sector 4.22. Therefore, the cooperation and promotions made by homestay operators in various applications allow tourists to know about new tourism products either at a set price, promotional price or price according to the package taken by the tourist.

In addition, the strategies emphasised that the government together implement strategies to meet the needs of homestay and community operators in Kampung Mesilou post-MCO for two years. Post-MCO tourism recovery strategies that need the role of the government involve repairing roads, improving the tap water system and providing cleaning and clean water storage plants. The results show that the highest mean value of the road, which is 4.90, shows a narrow and hollow road condition. The next item is to improve the tap water system and provide a clean filter and water storage plant with a 4.29. This shows that water requirements are equally important in implementing recovery strategies.

Table 8: Strategies Post MCO in Kampung Mesilou

Strategies	Variable	Mean	Overall mean
Communities	Adding parking lot	4.44	4.43
	Improve signboard	4.42	
Owner Homestay	The addition of tourism products	4.43	4.46
	Source of income increases	4.75	
	Collaborate with Motac for the promotion of tourism products	4.44	
	Promotion through the mass media	4.48	
	Collaborate with the private sector	4.22	
Government	Repair the road	4.90	4.49
	Improve tap water system	4.29	
	Provide cleaning and clean water storage plant	4.29	

Roads play an essential role in the development of a place. Road construction must be well-planned from the beginning. The introduction of domestic and international tourists is happening in the village every holiday, causing the town to suffer congestion. Therefore, to ensure the safety of all parties, the village community is working to repair the damage to the hollow road by pasting the village road for community and tourist facilities. With the initiative of the village community, the repaired roads can be used as usual. Although the village road conditions are still crowded during peak hours or school holidays. The congestion can cause pressure and anxiety to tourists who come to visit as tourists have to take a long time and waste their energy to reach their destination. When the MCO implemented was replaced by the RMCO, adding new tourism products could attract domestic tourists to Mesilou Village. Among the new tourism products open is 360 Peak, where tourists can enjoy a 360-degree view. Second, the Mesilou Swing, the highest cradle in Sabah, reaches up to 32 feet in height. Mesilou Swing is also built by an experienced engineer so that the swing building is safe for all tourists to use. This new product indirectly opens up employment opportunities for the village community who are looking for jobs or losing their jobs due to the implementation of the MCO. It also increases the country's income through the flow of foreign money to our country and can introduce tourism products either in Kampung Mesilou itself or Malaysia to international tourists.

The condition of the irregular signage and overlapping of each other has made it difficult for tourists to identify the destination. Thus, one of the village organisations, the Entertainment Bureau Committee, aims to create guidance and convenience for the village community and tourists.

Last night I brought him to this story about this signboard. I asked what he was planning because it was not appropriate for such a trick. However, he said he had made a skeleton in a large signboard and then just put the name of the homestay to go anywhere with the houses being hit, according to him having a Bureau Committee planning.

(Informant 1, Head of Village, 5 November 2021)

Water is an essential element of daily life. Inefficient pipe maintenance has made this issue more serious. Although the Mesilou Village is a tourist attraction due to its unique natural scenery, it still depends on the gravity water pipe system or hill water. Increasing water filtering and water storage plants are one of the strategies for the recovery plans for homestay tourism activities. In the meantime, the government has allocated a total of RM7000-RM8000 to improve leaked pipes. The committee is responsible for ensuring that the supply of clean water is always as smooth as possible at the village level in case of leaking pipe damage. In addition, the strategy created by the committee operating the filtration and water storage plant is to provide clean water to a homestay registered with the Water Department. Meanwhile, homestays that are not registered with the Water Department or MOTAC need to find their initiative to obtain a clean water supply while waiting to construct a pure water plant in Ranau.

The use of information technology, such as the Internet, is one of the tourist recovery strategies in Kampung Mesilou. Various initiatives to promote tourism through Facebook, WhatsApp, website, travel agents and oral ads. All tourists will find accurate information and precise details related to tourism conducted in Kampung Mesilou. A prominent promotion can ensure the effective dissemination of all tour information and attract tourists to Kundasang.

Challenges in Implementing Strategies Community-Based-Tourism and Homestay

This study also examines the challenges of tourism recovery among communities, tourism operators and support. In addition, the results show that communities, tourism operators and support have challenges. The highest mean score was 4.32; compared to the community, there was no cooperation to restore homestay (3.03), and the community had no cooperation to restore ecotourism (3.05). Therefore, it can be classified by traffic congestion is the most crucial challenge in the study area.

In the context of the challenge, this study explores the challenge of tourism operators implementing the post-MCO post strategy. After conducting the analysis, studies have found that the lack of homestay rooms, with an average of 4.22, has the most significant challenge due to the arrival of tourists after MCO

has been implemented for a long time. Followed by the challenge of travellers' difficulty in obtaining homestay recovery capital with a mean of 3.84, it is challenging to obtain ecotourism rehabilitation capital with 3.66, slow financial assistance received by homestay operators 3.30, slow financial assistance received by ecotourism operators 3.32, insufficient net water supply 3.63, lack of good equipment 3.46 and 3.33 are the mean of the lack of ecotourism repair equipment.

In addition to the community and tourism operators, this study also evaluates the challenge of tourism recovery based on the support of particular parties, either through the government or the private sector. The highest mean score was 3.35 for associations and participants who did not receive the support of the private sector. The associations and participants did not receive the support of the government, with a mean of 3.15, the association and participants did not receive the support of the village chief 2.89, and the association and participants did not receive the support of the JPKK 2.89. This indirectly indicates that support has influenced the challenge of recovery of post-MCO tourism.

Table 9: Challenges in Implementing Strategies Community-Based-Tourism and Homestay

	Item	Mean	Overall mean
Community	No cooperation to restore homestay.	3.03	3.46
	No cooperation to restore ecotourism	3.05	
	Traffic jam	4.32	
Operator	Hard to get homestay recovery capital.	3.84	3.60
	Difficult to obtain ecotourism recovery capital	3.66	
	Slow financial assistance received by homestay operators.	3.30	
	Slow financial assistance received by ecotourism entrepreneurs	3.32	
	Insufficient clean water supply	3.63	
	Lack of Homestay repair equipment	3.46	
	Lack of ecotourism repair equipment	3.33	
Lack of homestay room	4.22		
Supporter	Associations and participants do not receive government support and cooperation.	3.15	3.09
	Associations and participants do not receive private support and cooperation	3.35	
	Associations and participants do not receive the support and cooperation of the village head	2.89	
	Associations and participants do not receive the support and cooperation of JPKK	2.96	

The study showed that all items show challenges in implementing a tourism recovery plan. However, the highest mean score reported was a mean value of 4.32. The narrow and one-way road conditions have made it difficult for

tourists to reach their destination in a planned period. This is also the same as the hilly road conditions causing the drivers to press the brake pedal so hard to wear the safety of passengers. The influx of post-MCO tourists has proven that the road conditions are too crowded. In addition, the state of the hollow road structure makes the vehicle difficult to move. If left untreated, this problem will lead to prolonged traffic congestion in the future.

Besides that, parking in every homestay or tourist area in Kampung Mesilou is challenging. The absence of this parking lot causes tourists to park in a small place due to full parking or a narrow area. Some tourists carry more than one vehicle for one family, not more than five people, according to the sedan's size. This makes it difficult for homestay operators because of the lack of specific vehicles that lack comfort to the tourists themselves. Therefore, homestay operators or those managing the tourist area should warn tourists to carry only one vehicle according to the number of tourists present and the capacity of the vehicle to save space in the Mesilou Village.

In addition to the challenges of village regulations and traffic congestion, lack of financial aid is also a challenge in implementing tourism recovery strategies. The authorities do not provide sufficient provisions to the village community for tourism recovery. In this regard, the community has to find its initiative for tourism recovery, especially the community that wants to establish a homestay for their income.

Therefore, an adequate clean water supply allows the community to carry out daily activities quickly. However, collecting clean water sources is a problem for the community, especially homestay operators, as the demand for clean water is increasing in line with increasing tourist arrivals. In addition, the construction of homestays every day, like mushrooms, has caused the problem of clean water supply to be a severe issue during peak hours. Therefore, the construction of a clean water plant was implemented to curb this problem from continuing to continue. External homestay operators must take early initiatives by registering a homestay with the water department so that tourists can enjoy a clean water supply.

CONCLUSION

The implementation of the MCO has caused all sectors to stop operating temporarily. However, the community in Kampung Mesilou has provided strategies and recovery plans for post-MCO implementation. The emergence of new tourism products is one of the strategies for recovery and is classified as an experience from the passage of the earthquake. New tourism products must be promoted to attract domestic and international tourists. Assistance and support from the authorities should also be given more intensely to help communities who want to build tourism while opening up employment opportunities to the

community itself and increasing the country's income. Therefore, all parties must contribute to developing the tourism sector despite various challenges in implementing the post-MCO strategy and recovery plan.

ACKNOWLEDGMENT

The authors would like to acknowledge Universiti Malaysia Sabah (UMS) and Borneo Institute for Indigenous Studies (BorIIS) for providing financial support to conduct this research.

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Received: 18th May 2023. Accepted: 20th July 2023



PLANNING MALAYSIA:

Journal of the Malaysian Institute of Planners

VOLUME 21 ISSUE 4 (2023), Page 282 – 292

SPECTACULAR ISLAND TOURISM IN PULAU AMAN, PENANG MALAYSIA: THE VISITORS' PERSPECTIVE

Normah Abdul Latip¹, Mohd Umzarulazijo Umar², Rehmat Karim³, Mohamad Pirdaus Yusoh⁴, Ang Kean Hua⁵, Johan Johnes⁶, Rahmah Rashid⁷

*^{1,4,7}Borneo Institute for Indigenous Studies,
UNIVERSITI MALAYSIA SABAH*

*²School of Housing Building and Planning,
UNIVERSITI SAINS MALAYSIA*

*³Department of Tourism and Hospitality Management,
KARAKORAM INTERNATIONAL UNIVERSITY*

*⁵Geography Program, Faculty of Social Sciences and Humanities,
UNIVERSITI MALAYSIA SABAH*

*⁶Faculty of Social Sciences and Humanities,
UNIVERSITI MALAYSIA SABAH*

Abstract

Island tourism initiative plays a significant role in uplifting economic activity for the island and local people. The equilibrium point of view between service providers and visitors is essential. Therefore, visitors' perspective is crucial in understanding the need and requirement for establishment in tourist spots, including islands. This study examines visitors' perception of the study area through 3 main elements: activity, social and physical, comfortable, and natural beauty. The research design uses a descriptive analysis approach that uses a 5-point Likert scale, namely strongly agree (SA), agree (A), not sure (NS), disagree (D) and strongly disagree (SD). As for research analysis, the study used the SPSS program and specifically focused on frequency, mean, mode, median and level of agreement as to expected output. Preliminary findings indicate that visitors strongly agree that the area has the potential to be developed as a top tourism spot with minor improvement facilities and eco-tourism products.

Keywords: Island tourism, Pulau Aman, Visitor Perspective

¹ Associates Professor at Universiti Malaysia Sabah Email: normah.abdullatip@ums.edu.my

INTRODUCTION

Island tourism (Saad & Rahman, 2021) has substantial potential economic activity in offering many exclusive products and services from inland areas, beaches and marine areas. Latip et al. (2018) indicate that conservation efforts will ensure the viability and relevancy of the target tourism zoning. UNWTO (2023) suggests that island tourism is exclusive to their unique geographical situation, and their natural and cultural heritage richness makes them unique for visitors. However, simultaneously, it confronts them with several challenges and vulnerabilities. Islands are the most vulnerable and fragile of tourism destinations and will experience even more pressure as the combined impacts of economic, social and environmental change accelerate in the future (Carlsen & Butler, 2011). Many efforts have been made by government and non-government organisations, from locally to globally, to mitigate the issue arising from the island tourism area. Strengthening island tourism products made by the authority and relevant stakeholders ensures the agenda is implemented up to the desired standard. Moreover, the standard need to be verified by end users or traveller to the area.

LITERATURE REVIEW

The tourism (Talebi, 2017) sector began showing increased activity and visitor visits to famous destinations before the pandemic until the endemic. Domestic tourism (Nyaupane et al. 2020), inbound tourism (Wong, 2013) and outbound tourism (Jin & Wang, 2016) initially indicate the tourist movement at an increasing pattern. However, some constraints cause the operation of providing tourism facilities cannot be carried out to the maximum levels. The government has announced granting special assistance to more than 20 thousand tourism operators registered under the Malaysian Ministry of Tourism, Arts and Culture (MOTAC) for three months with an allocation of RM 85 million (MOTAC, 2022). This provision was made to fill the gap to maximise and develop Malaysia's tourism sector affected and suffered a severe downturn due to the pandemic that the WHO declared on 11 March 2020, and Malaysia was no exception. With the help of MOTAC, the Malaysian government has formulated a strategy to deal with and reduce the effects of this decline by focusing on domestic tourism. However, there is a high gap in the annual projections for 2019 (RM103.2 billion), 2020 (RM40.4) and 2021 (RM18.4), with the injection of funds from the government and the opening of the country's borders to foreign tourists. Therefore, the government expects the projection in 2022 to increase to the maximum level. As a result, domestic tourism spending nosedive 54.5 per cent to a record RM18.4 billion (2020: RM40.4 billion), the lowest since this survey started in 2008 (The Department of Statistics Malaysia, 2022). Various initiatives are mobilised to advance the tourism sector, including the search for islands in Malaysia with high tourism value.

Malaysia is famous for islands tourism (Yusof & Ismail, 2016), products with a very high value in authenticity and uniqueness. Either, either stand or in the water around the island. According to the guidelines of the Malaysian Town and Country Planning Department, there are four categories of islands. Table 1 indicates the island category under the Federal Department of Town and Country Planning Peninsular Malaysia.

Table 1: Island Category in Malaysia.

Category	Statement
Development Island	Development islands include islands with one or both of the following criteria: • have an area of more than 90 km. Square the number of inhabitants exceeds 20,000 people, or • are the most important islands that drive the national economy and have various development plans to improve the local and national economy. For example, Langkawi Island and Labuan Island.
Resort Island/Tourist Destination Island	A resort island or tourist destination island is an island that has the potential to be developed as an international and local centre. Tourism is characteristic of this resort or tourist destination island islands where a large part of the local economy depends on the tourism sector; • famous in the country and abroad and become the focus of tourism; and • has natural resources and attractions. For example, Pangkor Island and Jerejak Island.
Marine Park Island	A marine park is an area of marine waters zoned two nautical miles (3.7 km) from the lowest low tide mark, except for Kapas Island in Terengganu, Kuraman Island, Rusukan Besar Island and Rusukan Kecil Island in Labu, an which are zoned one nautical mile from the low tide mark the lowest. The gazette was made under the Fisheries Act 1985 (Act 317) through the Malaysian Marine Park Establishment Order 1994.
Uninhabited Island	An uninhabited island is an island that has no permanent inhabitants and can be shaped like rocks, shoals, ridges, and coral reefs. Immediate action should be taken to name and gazette the islands in question.

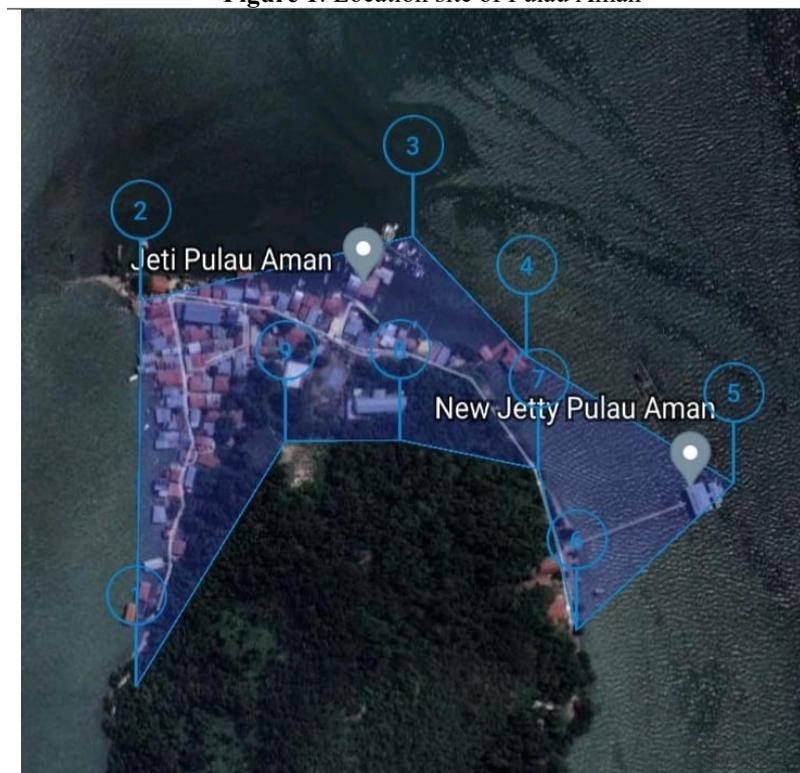
Source: JPBD, (2015)

As the chosen study area, based on Guidelines for Islands and Marine Parks by the Federal Department of Town and Country Planning Peninsular Malaysia 2015 (JPBD, 2015), Pulau Aman is initially under the category of development island. Possesses both island tourism products and rural development criteria, the island has the characteristics and potential to be developed based on marine life, and beaches, including a natural area and beautiful scenery. Not to mention the island tourism product to be explored.

Study Area

Known as the ‘Island of Peace, Pulau Aman is home to a traditional Malay village with a population of less than 300 and is considered one of the hidden gems in Seberang Perai, Penang (Akmal, 2020). The primary activities on the island include fishing and island tourism activities, namely, a boat ride to the fish farms nearby, kayaking, team building activities, jungle trekking, and camping (Akmal, 2020). Ecotourism (Mohamed & Hussin, 2006) activity dictated most of the island’s arrival. Some worked in the Small and Medium Scale Industries (IKS), such as processing marine products, the c; they make chips, breadfruit, and homestay.

Figure 1: Location site of Pulau Aman



Source: Authors, (2023)

Pulau Aman and inhabited atoll Pulau Gedung – Pulau Aman was occupied by the Bugis ethnic group of Kedah in 1817 and has been a rural fishing community ever since. (Ferrarese, 2022) Pulau Aman covers about 288 acres, and 95% of the island, equal to 284 acres, is still surrounded by forest. The place is the gateway to tranquillity and serenity. Pulau Aman is an idyllic Malay fishing village with Malaysia's oldest Sukun (breadfruit) tree. Pulau Aman is reachable

by ferry boat from the pier at Bukit Tambun. The main activities of its inhabitants include fishing and ecotourism. There is a Malay village on Pulau Aman. The houses are clustered together near the coast. A network of paths wraps itself around the town. There are many attractions in Pulau Aman, as shown in Table 2.

Table 2: Current Attraction in Pulau Aman.

Item	Statement
History of Telaga Emas	At the Jalan Telaga Emas, it will lead you to an old well dating back to 1789. This well is unique because it never runs dry, even during the worst drought, and its water remains fresh even when mixed with seawater. Many visitors draw water from the well to bathe in as it is believed to bring them good luck.
The oldest Sukun Tree in Malaysia	Mardi declares this tree as the oldest Sukun Tree or <i>Artocarpus altilis</i> (Rojas & Acevedo, 2022) in Malaysia, planted around 1890 by a Tok Guru Al-Quran, Tok Awang Bin Akid. The Buah Sukun tree is almost 120 years old but bears many fruits.
Fishing heaven	Pulau Aman is the best place for fishing using fishing rods or fishing nets. Many fishing enthusiasts will rent a homestay with a verandah facing the sea and start fishing.
Restaurant Terapung Pulau Aman	Pulau Aman is well known as a heaven for prawn noodle enthusiasm. The fresh prawn and the delicious dishes make Pulau Aman an attraction Islands.

Source: CTFA, (2015), Ferrarese, (2022 and Akmal, (2020)

METHODOLOGY

The research design approach is non-experimental, with descriptive research focusing on quantitative data. A random sampling technique (Evans, 2022) initiates the target population. Visitors depart at the main jetty area Pulau Aman use as respondents, and questionnaires form data collection with 19 variables as a core instrument to the research. The questionnaire discovered the impact of systematic management (Latip et al., 2020) towards visitors, tourists, and residents. It was divided into three sections demographic profile, an indicator of development and satisfaction level of respondents toward conservation at Pulau Aman based on a 5-point Likert scale analysis for the agreeable index, namely strongly agree (SA), agree(A), not sure (NS), disagree (DS) and strongly disagree (SD), initiate the visitor's perspective toward their visiting experience. An average of 15-20 minutes is used to finish the questionnaire. A total of 78 respondents cooperates during the interview session. The descriptive analysis uses to interpret the roar data from the questions. Descriptive analysis (Kemp et

al. 2017), namely means, median, frequency and Likert scale analysis used to analyse the pattern of visitors' perspectives toward the place they visit.

ANALYSIS AND FINDING

Table 3 indicates eight variables to lighten up the condition of the current situation on the visitor demographics profile, namely gender, age, education, income, employment, visitors' origin, the purpose of visit and type of companion. Statistically, the mean reading is 1.35; more than 50 per cent of males visit the island and 79.4 per cent of males aged 31-41. As for ages, the mean reading is 2.7821 and the highest percentage of the ages between 31-41 years with 6 at cent, followed by generations between 21-30 years at 32.1 and the rest at 24.4 per cent. For the education levels, the mean reading was 1.8974, and most of the arrival possesses a cert or diploma at 51.3 per cent. Followed by the secondary level at 29.5 per cent and the rest is 19.2 per cent. As for income, the mean reading at 3.3718, and the highest ranges from RM3000-RM4000 with 42.3 per cent. Out of that, 55 cents are certificate and diploma holders. Visitor origin indicates that most are local, with mean readings at 1.2179 and frequency at 79.5 per cent. As for visit purposes, the highest percentage is for gastronomy activity at 37.2 per cent, followed by recreational activity at 28.2 per cent. The rest is below 25 per cent, with a mean reading of 2.7949.

Most of them visit the island with a group of below five people at 65.4 per cent, with 44.8 per cent eager to enjoy the gastronomy variety, especially authentic and tasty prawn noodles or "Mee Udang" floating restaurant in Pulau Aman. As for the recreational activities in Pulau Aman, fifty per cent of respondents agree, followed by 23.7 per cent who strongly agree about the statement, "There are many recreational activities in Pulau Aman". During the week, many people come to this island to do activities such as fishing or bicycling. On the other hand, 7.2 per cent of the respondents disagree. There is a lack of activities that people can do around this island since there is no maintenance on the facilities that are prepared on the island 15.8 per cent of the respondents are not sure about the statement because it was their first time visiting Pulau Aman.

As for the choices of restaurants in Pulau Aman, most visitors are not sure about the reading 28.9 per cent, followed by agreeing 26.3 per cent, but some visitors strongly disagree 21.1 per cent. The pattern initiates further action due to distinguishing perceptions among visitors.

Table 3: Demographic profile

	Item	Mean	Mode	Median	Freq	%
Gender	1. Male	1.35	1	1	51	65.4
	2. Female				27	34.6
Ages	1. Below 20 years	2.7821	3	3	1	1.3
	2. 21-30				25	32.1
	3. 31-40				34	43.6
	4. 41-50				12	15.4
	5. 51 and above				6	7.7
Education	1. Secondary level	1.8974	2	2	23	29.5
	2. Cert. & Diploma				40	51.3
	3. Bachelor's Degree				15	19.2
	4. Msc & PhD.				0	0
Income	1. Below RM3000	3.3718	3	3	1	1.3
	2. RM 3001-4001				9	11.5
	3. RM 4001-5000				33	42.3
	4. RM 5001- 10000				30	38.5
	5. RM 10000 and above				5	6.4
Employment	1. Government	1.5769	2	2	33	42.3
	2. Private				45	57.7
Visitors origin	1. Local	1.2179	1	1	62	79.5
	2. Outsider				15	19.2
	3. International				1	1.3
Purpose visit	1. Family matters	2.7949	4	4	18	23.1
	2. Working				9	11.5
	3. Recreational activity				22	28.2
	4. Gastronomy activity				29	37.2
	5. Others				0	0
Type of Companion	1. Alone	2.7564	3	3	5	6.4
	2. Couple				16	20.5
	3. Below five persons				51	65.4
	4. 6-10 person				5	6.4
	5. More than ten persons				1	1.3

Source: Authors, 2021

Technically, there are only a few restaurants on the island, and there is no space for opening a new restaurant. The famous restaurant in Pulau Aman is “Restoran Terapung”, which serves delicious dishes and fresh seafood for the facilities on the Pulau Aman. Most of our respondents agree (39.5%) and strongly agree (34.2%) that the island has complete facilities. We can see “Dewan Serbaguna”, a clinic, shop, mosque, primary school, toilet, and so on that can be used by the occupant and people visiting Pulau Aman.

Table 4: Visitors' perspective at Pulau Aman

Item	SA	A	NS	D	SD	N(78)
Users and activity						
There are many recreational activities in Pulau Aman	23.7	50.0	15.8	7.9	2.6	100
The choices of restaurant	15.8	26.3	28.9	7.9	21.1	100
Complete facilities	34.2	39.5	18.4	7.9	0.0	100
Interesting activity	44.7	47.4	7.9	0.0	0.0	100
The signage on the island is helpful	42.1	39.5	15.8	2.6	0.0	100
The transportation within Pulau Aman is excellent and functional.	34.2	47.4	13.2	2.6	2.6	100
Social and physical						
The attitude of residents around the island is friendly	34.2	55.3	10.5	0.0	0.0	100
The existing design of the building is attractive	0.0	26.3	39.5	21.1	13.2	100
The building on the island is old and needs to be renovated.	34.2	52.6	13.2	0.0	0.0	100
Comfort and images						
The natural environment is clean and unpolluted	0.0	26.3	39.5	7.9	26.3	100
The scenery in Pulau Aman is great	34.2	44.7	13.2	7.9	0.0	100
The toilets that be provided are clean and comfortable	15.8	34.2	50.0	0.0	0.0	100
The Pulau Aman has excellent potential to be developed into a tourism area.	52.6	39.5	7.9	0.0	0.0	100

Note SA; Strongly Agree on A; Agree NS; Not Sure DA; Disagree SDA; Strongly Disagree

Source: Authors, 2021

The activities on the Pulau Aman are enjoyable. Most of our respondents strongly agreed (44.7%) and agreed (47.4%) with the statement because they loved fishing around this island due to the lot of fish that can be caught. Pulau Aman also served as a spot of feeling at the Pulau Aman to ensure the visitor that came to Pulau Aman could do some fishing activities. The signage on the Pulau Aman helps find the location. Most of our respondents agreed (39.5%) and strongly agreed (42.1%) that the signage on the island is helpful because most of the junction at Pulau Aman has signage for a visitor to find the location they want to go. Since the island is not huge, the signages are more helpful for visitors to see the attraction place. The transportation within Pulau Aman is excellent and functional. Our respondents agreed (47.4%) and strongly

agreed (34.2%) with the statement because, in Pulau Aman, they only use motorcycles and bicycles to move around, and there is no car being used since the island is small. 13.2% were unsure since it was their first time visiting Pulau Aman.

The attitude of residents around the island is friendly. Most respondents at, 55.3%, agreed, and 34.2% strongly agreed that the residents are friendly. Verbally the visitors are always welcome by the island residents and always smile at each other if they bump into each other on the walkways. It was an excellent attitude to pull more visitors to visit Pulau Aman. The existing design of the building is attractive. However, 39.5 per cent of the visitors need clarification about the statement because most of Pulau Aman's building is old-fashioned and needs to be renovated and some maintenance. As we can see, some of the building, like the chalet at Pulau Aman, needs to be renovated and maintained because it is a place for a tourist to rest. Three of them agreed due to the design of the building because they like old design buildings on the island. After all, they said it was Pulau Aman's identity. The island building is old and needs to be renovated. Most visitors agreed (55.3%) and strongly agreed (34.2%) with the statement and admitted the old building was the Pulau Aman's identity and only required maintenance and renovation. The rest are still determined.

The natural environment is clean and unpolluted. The visitors are unsure about the statement 39.5 per cent, followed by strongly disagree visitors 26.3 and agree on visitors 26.3 per cent. The result indicates further study on the matters that arise. The scenery in Pulau Aman is excellent. Most of our respondents agreed and strongly agreed with the total percentage of 78.9 about the statement because the views on the island are lovely and peaceful if we visit here to relax or release stress from our work or study. The toilets provided are clean and comfortable to use. 50% of the respondent not sure, and the rest vow to agree and strongly agree. The output needs to be further studied for future purposes. The bathrooms should be maintained because they are essential facilities the visitor uses. The Pulau Aman has excellent potential to develop into a tourism area. Most of our respondents total up to strongly agree and agree at 92.1 per cent with that statement because many visitors come to Pulau Aman weekly to do some fishing activities, sightseeing, cycle and eat "Mee Udang". So, Pulau Aman has excellent potential to be developed into a tourism area.

CONCLUDING REMARK

Pulau Aman is an island with tourist attractions from the Malaysian community and tourists from abroad. Due to this, the villagers must take serious about the facilities, cleanliness, safety and so on so that more tourists will come. The presence of exciting attractions there can indirectly provide benefits to the villagers. However, based on the issues regarding the island's safety, the villagers must take measures and urgent action to prevent the problem from persisting.

Good facilities are one reason tourists and visitors come to a place. Overall, agreeable index analysis indicates that visitors to Pulau Aman were satisfied with the situation there. This is because visitors who go to Pulau Aman are only for fishing and eating 'Mee Udang', yet there is more potential tourism product to be explored as a main attraction of Pulau Aman.

ACKNOWLEDGEMENTS

The authors would like to acknowledge Borneo Institute for Indigenous Studies (BorIIS), University Malaysia Sabah (UMS), for providing financial support to succeeding this article.

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Received: 18th May 2023. Accepted: 20th July 2023



PLANNING MALAYSIA:

Journal of the Malaysian Institute of Planners

VOLUME 21 ISSUE 4 (2023), Page 293 – 301

SUSTAINABLE URBAN PARK: A CASE STUDIES OF TAMAN AWAM TELUK LIKAS, KOTA KINABALU, SABAH. MALAYSIA

Normah Abdul Latip¹, Mohd Umzarulazijo Umar², Mohamad Pirdaus Yusoh³, Kasim Mansur⁴, Ang Kean Hua⁵, Rosazman Hussin⁶, Dayang Siti Noorafidah Datu Nordin⁷

*^{1,3,6,7}Borneo Institute for Indigenous Studies,
UNIVERSITI MALAYSIA SABAH*

*²School of Housing Building and Planning,
UNIVERSITI SAINS MALAYSIA*

*⁴Faculty of Business, Economic and Accountancy,
UNIVERSITI MALAYSIA SABAH*

*⁵Geography Program, Faculty of Social Sciences and Humanities,
UNIVERSITI MALAYSIA SABAH*

*⁶Faculty of Social Sciences and Humanities,
UNIVERSITI MALAYSIA SABAH*

Abstract

Urban Park is a manifest of healthy images surrounding the city and indicating policy the local authority implements. The studies purposely to measures the level of satisfaction in visitors toward the current condition of the study area as an urban recreational park. A descriptive research approach was used on 187 respondents in the study area. A Satisfaction Index Analysis (SIA) was imposed to see the level of visitor satisfaction with the environment, facilities and amenities provided. Preliminaries' finding indicates that most respondents were satisfied with the facilities and amenities provided in the study area. Whereby for the SIA analysis from 29 variables, info signage with 0.9401 (excellence) is the highest, and oppositely the lowest is debris collection centre at 0.6086 (fair). The finding demonstrates that the local authority's facilities and amenities are sustained towards visitors to the area.

Keywords: Satisfaction Index Analysis (SIA), Urban Park, Visitors Awareness

¹ Associates Professor at Universiti Malaysia Sabah Email: normah.abdullatip@ums.edu.my

INTRODUCTION

Urban Park's (Hayward, 1989) establishment is vital for decreasing urban heat based on transportation movement, economic activity, and social activity. They have proven worldwide that green or park areas in the city contribute to a healthy environment by reducing noise, improving air quality and as green belts for the city. Significantly enhance the environmental quality of the town, including Malaysia. The government makes various initiatives to ensure a balanced relationship between the population and the environment, from providing recreational areas with multiple facilities to planting trees with high carbon absorption levels, such as monkey pod trees or 'Trimbesi' and *Terminalia catappa* or 'Ketapang'. Safety is also emphasised to ensure that there are no criminal cases in the area with CCTV and emergency signs to contact the relevant authorities.

RESEARCH BACKGROUND

Urban parks were once thought to be representations of nature that would promote a better society (Young, 1995). A considerable pillar for sustainable cities (Mohamed et al., 2012) and its establishment is required to mitigate the planning, design, and management of public space in urban development and a socially constructed process in shaping cities primarily through capital investment designed to generate economic growth and promote healthy activity (Latip et al., 2016). An Urban Park defines as a park in an urban area that offers respite, rest, recreation, education, exercise, inspiration, or enjoyment to residents of and visitors to that urban area (Law Insider, 2023).

The urban park is also associated with cities' sustainability due to their wide range of ecosystem services, such as carbon capture, reduction of air pollution, biodiversity maintenance, aquifer recharge, and climate regulation (Ayala et al., 2019). However, all the arrangements and planning must consider the needs of visitors who will use and enjoy the facilities provided according to the standards set by the local authorities and any relevant stakeholders. Rosli et al. (2020) indicate that park quality is significantly correlated to the level of physical activity among visitors. Statistical evidence shows that park quality affects visitors' physical activity level (active lifestyle).

Urban Park generally has diverse functions and creates a pleasant municipal environment. Konijnendijk et al. (2013) and Latip & Umar (2022) indicates that urban park has many functions, as shown in Table 1.

Table 1: Urban Park functions

Functions	Statement
Human health and Well-being	Physical and mentally healthy through direct or indirect effects towards leisure and recreation activities.
Social Cohesion and Identity	Urban parks as a connection to strengthen social ties, cohesion and relation.
Tourism	The main attraction for domestic tourism, inbound tourism and outbound tourism. Potentially boosting the economic activity in surrounding areas.
Biodiversity	Contribute to flora and fauna biodiversity through natural experience, vital for ecosystem functioning and services.
Air quality and carbon footprint	Generate positive impact in reducing air pollutant levels and carbon sequestration.
Water management Cooling	Structure control on stormwater/runoff regulation Buffer zone to the urban heat area with trees canopy provided and absorber for the greenhouse effect.

Generally, urban park function offers many positive vibes to the city, ensuring the town is liveable, conducive, pleasant, and attractive for its citizens. However, urban parks must be equipped with sustainable utility and amenities for visitors' usage during their activities in the area. The equilibrium point of understanding and satisfaction towards the facilities and services provider must be accessed accordingly.

Table 2 indicates the list of standard urban park facilities and amenities in the town according to the rules of laws and policies implemented by local and federal authorities via relevant stakeholders.

Table 2: Urban Park Facilities and Amenities

<u>Item</u>		
<u>Facilities</u>	Fast food Restaurant	<u>Safety and Security</u>
Podium area	Bas stops	Warning signage
Children's play area/equipment	<u>Linkage and Circulation</u>	Emergency Signage
Exercise Stations		Local authority officer
Gazebo	Pedestrian route.	Patrol car (police force)
Park bench	Circulation	CCTV
Dust bin	Accessible to the handicapped.	<u>Vegetation and Landscaping</u>
Waste bin		Tree
Centre debris collection	Parking spaces	Bush
Signage	<u>Views and vista</u>	Meadow
Pit stop		

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Hawker centre	Beach area
Grocery shop	Sea views
	Landscape view

Source: Authors, (2023)

Therefore, field studies to understand the current level of satisfaction towards urban park facilities and amenities provided by the relevant authority. The study area is in the Kota Kinabalu area, namely Taman Awam Teluk Likas.

STUDY AREA

Taman Awam Teluk Likas is next to Jalan Tun Fuad Stephan and faces Teluk Likas beach. It is divided into phases 1, Taman Teluk Likas and 2, Taman Teluk Likas 2. The National Landscape Department funds it under National Development Programme (JLN, 2022) in collaboration with the Landscape Department from Kota Kinabalu City Council (DBKK, 2017).

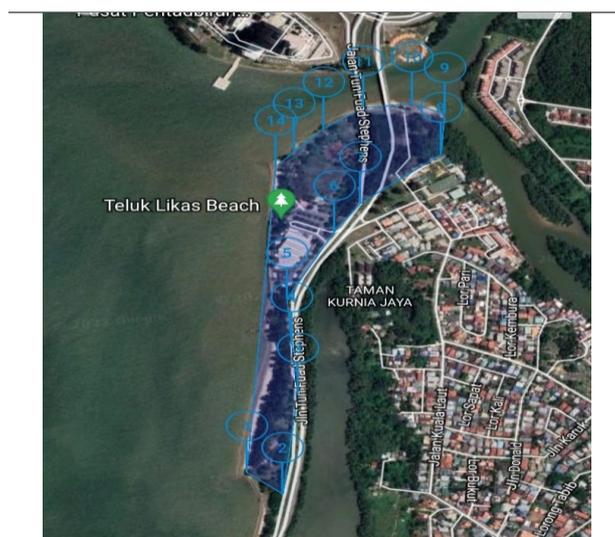


Figure 1: Taman Awam Teluk Likas

Source: Authors, (2023)

The beach is covered with sand and boulders. Some areas with retaining walls at 1 meter high, acting as a buffer against solid waves, especially in shop areas and food courts (Anjung Selera). It is a complete recreation park in terms of leisure and recreation needs. Furthermore, it improved with good safety features, and the same goes for public facilities, including shop lots for small

businesses. A 3 km walking path (Taman Teluk Likas-Taman Teluk Likas 2 – Muara Likas) is shared with a cycling path with an estimated 9-12 feet path width.

METHODOLOGY

This study is non-parametric and uses a descriptive research approach focusing specifically on frequency, mean and Satisfaction Index Analysis (SIA). Random sampling was used to obtain the study population in the study area. Likert scale 5 with the level of satisfaction, namely Very Satisfied (1), Satisfied (2), Fair (3), Not Satisfied (4) and Very Not Satisfied (5,) used to measure the level of satisfaction towards facilities, soft and hard landscape as well as the activities offered from the park. Survey form with three sections: visitor's profiles, covid19 background and SIA assessment, used as a core instrument during data collection. It took about 15–30-minute time to finish the interview session with 187 respondents.

The modification of the satisfaction index was used to rank the critical variables. This vital index was computed using the formula cited by Latip et al. (2022) and Hanafi et al. (2018):

Equation 1:

$$(1) \quad \text{Satisfied Index (SI)} = \frac{5(n1) + 4(n2) + 3(n3) + 2(n4) + n5}{5(n1 + n2 + n3 + n4 + n5)}$$

Were.

n1 = number of respondents who answered, 'very satisfied'
n2 = number of respondents who answered 'Satisfied' n3 = number of
respondents who answered 'Fair' n4 = number of respondents who answered, 'not
satisfied' n5 = number of respondents who answered, 'very not satisfied'

ANALYSIS AND FINDING

Table 3 indicates the frequency analysis for 187 respondents visiting the study area. Most respondents are male at 65.2%, and the rest are female at 34.8%. The age group indicates that 46.5% is the highest group at 31-40 years, followed by the age group at 18-30 years with 30.5% and the rest at 27% from ages group below 18 years and above 41 years. As for education background, 52.9% are undergraduates, followed by secondary school at 29.4%, and the lowest is postgraduates at 2.7%.

Table 3: Visitors Profile
Analysis Frequency (n: 187)

Item	Freq	%	Item	Freq	%
Gender			Purpose visit		
Male	122	65.2	Jogging/running	85	45.5
Female	65	34.8	Zumba	9	4.8
Age Group			Callisthenics	3	1.6
>18	6	3.2	Cycling	35	18.7
18-30	57	30.5	Picnic	15	8.0
31-40	87	46.5	Fishing	6	3.2
41-50	26	13.9	Sightseeing	18	9.6
51 and above	11	5.9	Gastronomy	16	8.6
Education			Companion		
2 nd School	55	29.4	Alone	113	60.4
Undergraduate	99	52.9	Family	41	21.9
Graduate	28	15.0	Friends	33	17.7
Post-graduate	5	2.7	Visitors Origin		
Occupation			Local	127	67.9
Self-Employee	34	18.2	Others District	39	20.9
Government Service	12	6.4	Others State	8	4.2
Private Sectors	99	52.9	International	13	7.0
Student	32	17.2			
At home	10	5.3			

Source: Authors, (2023)

For the respondent occupation, most of the respondent work in the private sector, 52.9%, followed by self-employee at 18.2% and the lowest at 5.3%, which is stay-at-home (housewives). Most respondents purposely visited the study area to jog at 45.5%, followed by cycling activity at 18.7%, sightseeing at 9.6%, and gastronomy at 8.6%. The rest is a picnic, Zumba, fishing and calisthenic at up to 17.6%. Respondent companion indicates that most respondents prefer to come alone at 60.4%, followed by a family companion at 21.9% and the rest with friends. Respondents originally came from local at 67.9%, followed by other districts at 20.9% and the rest, others state and international at a total up to 11.2%.

Table 4: SIA Rank.

Topic (10pt)	Mean	SIA	Rank	Info
Info Signage	1.2995	0.9401	1	Excellence
Emergency signage	1.3690	0.9262	2	Excellence
Warning signage	1.4118	0.9176	3	Excellence
Pit stop (cyclist & runner)	1.4492	0.9102	4	Excellence
Children's play area/equipment	1.5134	0.8973	5	Excellence
Sea views	1.5134	0.8973	6	Excellence
Accessible to the handicapped.	1.7433	0.8513	7	Excellence
Gazebo	1.8770	0.8246	8	Excellence
Exercise Stations	1.9519	0.8096	9	Excellence
CCTV	1.9840	0.8032	10	Excellence
Beach area	2.0107	0.7979	11	Good
Pedestrian route.	2.0267	0.7947	12	Good
Tree	2.0481	0.7904	13	Good
Podium area	2.1283	0.7743	14	Good
Parking spaces	2.1818	0.7636	15	Good
Meadow	2.2139	0.7572	16	Good
Local authority officer	2.2246	0.7551	17	Good
Circulation	2.2299	0.7540	18	Good
Bush	2.2834	0.7433	19	Good
Fast food Restaurant	2.3048	0.7390	20	Good
Hawker center	2.3316	0.7337	21	Good
Landscape view	2.4064	0.7187	22	Good
Bus stop	2.6952	0.6610	23	Acceptable
Park bench	2.7861	0.6428	24	Acceptable
Grocery shop	2.8610	0.6278	25	Acceptable
Patrol car (police force)	2.8824	0.6235	26	Acceptable
Dust bin	2.8877	0.6225	27	Acceptable
Waste bin	2.9358	0.6128	28	Acceptable
Centre debris collection	2.9572	0.6086	29	Acceptable

Note:

Excellence: > 0.8 , Good: $0.79 \leq x \leq 0.70$, Acceptable: $0.69 \leq x \leq 0.50$

Poor: $0.49 \leq x \leq 3.0$, Very Poor: ≤ 2.9

Source: Authors (2023)

Table 4 indicates the Satisfaction Index Analysis (SIA) result in 29 variables from the study area. Generally, out of 29 variables 10 of them fall under excellence performance based on SIA ranks. Followed by good performance with 12 variables and the rest 7 variables are in the acceptable category. Surprisingly none of the variables falls under the poor and very poor categories.

In the excellence category, info signage dictated the highest SIA rank at 0.9401, followed by emergency signage at 0.9262 and warning signage at 0.9176 and the lowest from the category is CCTV at 0.8032. The signage seems very important to the visitors in delivering information concerning the area. As for the good category, the beach area ranks 11 leads with the SIA index at 0.7979, followed by the pedestrian route at 0.7947 and surrounding trees at 0.7904. The lowest for the category is landscape views at 0.7187. The detail for the category can be referred to the Table 4. Acceptable categories indicate that the existing conditions of the bus stop are at the highest point in the 0.6610 SIA index, followed by the park bench at 0.6428 and the grocery shop at 0.6278. The lowest of the categories is the centre debris collection point at 0.6086.

Overall, the reading of the SIA Index indicates that the study area is in compatible mode and meets the visitors' standard in terms of facilities and amenities provided.

CONCLUDING REMARK

Generally, visitors to the study area are satisfied with the current physical conditions of public facilities and amenities provided by local authorities. Furthermore, the place demonstrates the optimal usage of the space area and accommodates recreational activity and small business integration. Significantly, the local authority's approach to providing amenities and facilities to the area considerably sustains and integrates with the satisfaction level of visitors to the Taman Awam Teluk Likas.

ACKNOWLEDGEMENT

The authors would like to acknowledge Universiti Malaysia Sabah (UMS) and Borneo Institute for Indigenous Studies (BorIIS) for providing financial support to conduct this research.

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Received: 18th May 2023. Accepted: 20th July 2023



PLANNING MALAYSIA:

Journal of the Malaysian Institute of Planners

VOLUME 21 ISSUE 4 (2023), Page 302 – 309

ECONOMIC CONTRIBUTION OF TOURISM IN GILGIT-BALTISTAN, PAKISTAN

Rehmat Karim¹, Attaullah Shah², Normah Abdul Latip³, Faqeer Muhammad⁴, Mehfooz Ullah⁵, Kasim Mansur⁶, Syamsul Azizul Marinsah⁷

¹*Department of Tourism and Hospitality Management,*

²*Karakoram Graduate School,*

KARAKORAM INTERNATIONAL UNIVERSITY

³*Borneo Institute for Indigenous Studies,*

UNIVERSITI MALAYSIA SABAH

⁴*Chinese Study Centre,*

⁵*Institute of Professional Development,*

KARAKORAM INTERNATIONAL UNIVERSITY

⁶*Faculty of Business, Economic and Accountancy,*

⁷*Faculty of Islamic Studies,*

UNIVERSITI MALAYSIA SABAH

Abstract

This study aims to assess the economic impact of tourism in Gilgit-Baltistan, Pakistan, focusing on its contribution to key economic indicators. The study uses a comprehensive research methodology and data collection techniques to examine tourism's direct and indirect effects on the local economy. The research encompasses various tourism-related sectors, including accommodation, transportation, food and beverage, and attractions. The study employs the Tourism Satellite Account (TSA) framework and Granger Causality to find the data and causal relationship among the variables, which allows for a systematic analysis of tourism's economic impact. It investigates indicators such as gross domestic product (GDP), tourist arrivals and spending. Primary data is collected through baseline surveys, while secondary data is obtained from government reports, statistical databases, and industry and research publications. Preliminary findings reveal that tourism significantly affects the region's economy. It contributes to GDP growth by stimulating tourism, generating employment opportunities, and attracting investments. Additionally, tourism-related activities contribute to tax revenue, enhancing public infrastructure and services. Overall, this study provides valuable insights into the economic impact of tourism, offering a comprehensive analysis of its contribution to the Gilgit-Baltistan economy. The findings can guide policymakers, destination management organisations, and tourism stakeholders in formulating strategies to maximise the economic benefits of tourism while addressing associated challenges.

Keywords: Tourism Economics, Tourists Arrival, Granger Causality, Gilgit-Baltistan, Pakistan

³ Corresponding author: normah.abdullatip@ums.edu.my

INTRODUCTION

Tourism has emerged as a significant driver of economic development in the modern globalized society. It plays a crucial role in generating income and employment in the economy's formal and informal sectors. Globally, the tourism industry accounted for approximately one out of every eleven job positions in 2016, resulting in a staggering 277 million jobs (UNWTO, 2017). In the case of Pakistan, tourism makes a notable contribution to the country's economy, constituting 2.8% of the total GDP, equivalent to Rs. 328 million (WEF, 2015). Recognizing the immense potential of tourism, the current Government of Pakistan is dedicated to giving it special attention and maximizing the benefits of this sector. It has set an ambitious goal of tourism contributing Rs. 1 trillion to the economy by 2025. The government's commitment to promoting tourism highlights the recognition of tourism's role in economic growth and its potential to create employment opportunities, stimulate entrepreneurship, and attract foreign investment. Pakistan is poised to become a significant player in the global tourism market with its diverse landscapes, rich cultural heritage, and untapped potential. Gilgit-Baltistan is famous for tourism and hospitality (Latip et al., 2021; Karim et al., 2020). This region is blessed with a unique cultural heritage, beautiful landscape, biodiversity and mighty mountains that attract tourists worldwide. The world-famous mountain ranges- Hindukush, the Himalayas and the Karakoram (HKH)- are located in northern Pakistan (Gilgit-Baltistan). The flow of tourists to Gilgit-Baltistan is at increasing trend as during the year 2007, total 23770 domestic and 10338 foreign tourists have visited this region whereas, the figures have reached to 6,9000 and 10000 for domestic and foreign tourists respectively. During 2017 and 2018, the total number of tourists visit this remained at 1.8 million and 2. Million, respectively (Express Tribune, 2019). These statistics indicate tourism has grown greatly in Gilgit-Baltistan, and it has a greater economic impact on the region. The tourism industry's economic activities are not explicitly classified in the standard industrial classification of all economic activities. However, there is a growing recognition of the importance of the tourism industry's economic contributions (David & Philippe, 2011). A major challenge in measuring the economic impact of tourism spending is that the tourism sector is not treated as a distinct entity in national accounting. Instead, tourism-related activities are often embedded within other industries. Additionally, the informal sector plays a significant role in tourism through production and consumption, further complicating measurements (Odunga et al., 2019). Furthermore, Beynon et al. (2009) argue that data on different segments of tourism-related economic activities are often dispersed and fragmented within the statistical infrastructure. As a result, the value added by the tourism sector is typically underestimated in national economic data used by decision-makers in both government and non-governmental organizations (Odunga et al., 2019). To

address these challenges, the System of National Accounts (SNA) suggests the development of a satellite account within its framework, focusing specifically on the tourism aspect of an economy (Kolli et al., 2014). By implementing a tourism satellite account, the economic contributions of the tourism industry can be better captured and analyzed, providing decision-makers with more accurate information for policy formulation and resource allocation.

METHODOLOGY

Tourism is the primary source of foreign exchange, income, and job prosperity in many developed and developing countries. Various macroeconomic and quasi-methodologies have been used to estimate the economic impact of tourism. The majority of research that has attempted to quantify the demand for tourism has employed single equation models to explain the demand as measured by aggregates, cross-country tourist revenues or arrivals (Archer, 1976; Johnson & Ashworth, 1990). The tourism demand equation has been specified differently in several types of research. For the demand for tourism, (Sinclair, 1998) used the AIDS model. the predicted flexibility values for the assortment of locations. The proportionality values for Canadian demand for US travel to the rest of the globe were computed by Gray's study from 1966. In some studies of tourism, expansion is related to economic growth, which used time series analysis ADF, Philips Perron unit root test and J.J co-integration test to check the long run relationship between tourism receipts and GDP for Spain (Balaguer & Jorda, 2002) and Granger causality, VAR also used by (Chi-Ok Oh, 2003) for Korean economy to check the contribution of tourism and economic growth with the development of tourism. The new approach to cointegration ARDL is used by (Halicioglu, 2010) for Turkey to calculate the aggregate demand for travel and long-term elasticities. After that Input-output analysis are widely used in tourism studies in both developed and developing economies. The expansion of the tourism industry input-output analysis is also limited for this kind of study so a new approach has been introduced by the economists that are the Computable General equilibrium (CGE) model which analyze the travel and tourist problem and estimates the economic and environmental impact of tourism. The methodology which is used for economic impact assessment is the "Granger Causality" to check the causal correlation between GDP and Tourists Arrivals (Domestic and Foreign).

RESULTS AND DISCUSSION

The data has been generated by using the World Bank Report, 2010 to estimate the GB Per capita income and GDP which provides basis to calculate the contribution of tourism in the GB economy. The statistics show a significant variation in Pakistan's per capita income between 2010 and 2021. However, the largest per capita income was computed in 2018, when almost 1,678 USD was

produced. This is a huge increase over the previous two years, which saw revenue increases of 1,632 USD and 1,540 USD, respectively. The economy of Pakistan benefits greatly from tourism. Additionally, there has been a slight variation in Pakistan's PCI between 2010 and 2015; the values determined throughout the five years are 987 USD, 1,165 USD, 1,198 USD, 1,209 USD, 1,251 USD, and 1,357 USD, respectively.

Similarly, the report shows that GB Per capita income is raised continuously for six years from 2010 to 2017, the estimated GB Per capita income is 888, 1,049, 1,078, 1,088, 1,126, 1,221, 1,386, 1,469 USD respectively. The rate of GB PCI dramatically increased in 2018 with the highest growth of 1,510 USD and a sudden decrease is calculated in GB PCI 2020 with 1,224 USD. Meanwhile, the figures again raised to 1,384 in 2021. The overall PCI growth rate of GB is considerable. In addition, the estimated annual population growth rate of GB is 2.56%. On average two million mothers give birth to young ones annually. The global bank study showed that the population of GB increased consistently over the 12 years (2010 to 2021) as 1.197, 1.228, 1.259, 1.292, 1.325, 1.359, 1.393, 1.49, 1.528, 1.567, 1.607, and 1.649 million, respectively. Moreover, the report shows that the tourism industry in GB is evolving and it has a significant impact on the annual GDP of GB and the economic development of Pakistan. The data shows little variance in the average growth rate of GB GDP (USD) over the years from 2010 to 2015. However, it experienced a tremendous increase in GDP in 2018 with approximately 2,307,585,600 USD which is considered a huge contribution of tourism in bringing sustainable development to the region. Following, 2021 comes the second year where the estimated growth of GB GDP is recorded at 2,282,545,800 USD. Meanwhile, 2017, 2019, 2020 are at a third, fourth and fifth place where approximately 2,188,512,000 USD, 2,090,064,600 USD and 1,966,968,000 USD annual GDP was calculated by the GB government. Comparably, the average GDP calculated in billion USD is 1.06 billion USD. In the years 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2020, and 2021, there were 1.29 billion, 1.36 billion, 1.41 billion, 1.49 billion, 1.66 billion, 1.93 billion, 2.19 billion, 2.31 billion, 2.09 billion, 1.97 billion, and 2.28 billion USD. In the years 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2020, and 2021, the average exchange rate in the GB was calculated to be 85.11 billion Pakistani Rupees, 86.27 billion, 93.28 billion, 92.67 billion, 101 billion, 105 billion, 105.32 billion, 121.47 billion, 150 billion, 161.61 billion, and 162.62 billion. The data show that the GDP of GB is increasing from top to dawn, the lowest GDP growth (90.50) recorded in 2010 while it has raised to approximately 371.19 billion in 2021. For twelve years, the GDP of GB has grown significantly. In the years 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2020, and 2021, there were 111.08 billion Pakistani rupees, 126.62 billion, 130.28

billion, 150.67 billion, 170.31 billion, 202.72 billion, 230.49 billion, 280.30 billion, 313.51 billion, and 317.88 billion.

Table 1: Tourism Economy of Gilgit-Baltistan

Year	Domestic Tourists Arrival (DTA)	Foreign Tourists Arrival (FTA)	Total No. Tourists	Average Spending of Tourists (PKR)	Total tourist Spending in billion PKR	Tourist Spending % of GDP
2010	45300	7728	53,028	61,529	3.26	3.61%
2011	61233	5242	66,475	62,250	4.14	3.73%
2012	28893	4324	33,217	63,833	2.12	1.67%
2013	51914	4501	56,415	65,239	3.68	2.83%
2014	50304	3442	53,746	65,593	3.53	2.34%
2015	200651	4082	204,733	68,886	14.10	8.28%
2016	439685	4773	444,458	68,010	30.23	14.91%
2017	781224	6212	787,436	67,783	53.38	23.16%
2018	1391628	9027	1,400,655	67,084	93.96	33.52%
2019	1023023	10828	1,033,851	63,197	65.34	20.84%
2020	633242	1098	634,340	63,790	40.46	12.73%
2021	893129	3237	896,366	70,674	63.35	17.07%

Source: GBTD, 2022; Authors' Own

A comprehensive baseline survey was carried out to determine the visitor's spending pattern in 2021 across GB. Average spending per trips amounted Rs. 70674, whereas historical data was calculated by inflation adjustment in the last 10 years. According to the baseline survey, the number of visitors visiting the GB has grown, it is revealed that an average of 53,028, 66,475, 33,217, 56,415, 53,746, 204,733, 444,458, 787,436, 1,400,655, 1,033,851, 634,340, and 896,366 people visited the region annually in 12-year. The spending patterns of these visitors show that more tourists visit GB on an annual basis and that their numbers are gradually increasing. The most visited year is 2018, with around 1,400,655 tourists in GB. Accordingly, 1,033,851 travellers made GB their destination in 2019, the second most popular year for travel. The GB received 33,217 tourists in 2012, the fewest number of visitors ever recorded. In addition, the data shows that with the inflow of more tourists, the annual expenditures of tourists also increased during their journey. On average, visitors spend more than 60 thousand rupees annually. The number of money tourists spend in Pakistan between 2010 and 2020 has been rising significantly. 61,529 PKR, 62,250 PKR, 63,833 PKR, 65,239 PKR, 65,593 PKR, 68,886 PKR, 68,010 PKR, 67,783 PKR, and 67,084 PKR, with a little decline in 2019 and 2020, which are 63,197 PKR and 63,790 PKR, respectively. However, tourist expenditures increased once again and peaked in 2021 with a spending of 70,674 Pakistani rupees. Moreover, the figures for total tourist spending show

minimal spending in billion PKR, however, the total spending increased slightly in the following years 2010 (3.26 billion PKR), 2011 (4.14 billion PKR), 2012 (2.12 billion PKR), 2013 (3.68 billion PKR), 2014 (3.53 billion PKR), and 2015 (14.10 billion PKR). After 2015, the total spending of tourists in billion PKR doubled for the following years 2016 and 2017 with an increase of 30.23 and 53.38 spending in billion PKR. The spending then increased to 93.96 billion PKR in 2018, setting a new record for spending. The total amount spent by visitors in the next three years, 2019, 2020, and 2021, drops slightly to 65.34 billion Pakistani rupees (billion PKR), 63.35 (billion PKR), and 40.46 (billion PKR) respectively.

GRANGER CAUSALITY

The conventional method for determining which variable caused the other has been to use the Granger framework. The Granger causality test entails estimating the equations that follow:

$$GDP_t = \beta_0 + \sum_{i=1}^n \beta_{1i} GDP_{t-i} + \sum_{i=1}^n \beta_{2i} Tour_{t-i} + u_t \quad (1)$$

and

$$Tour_t = \alpha_0 + \sum_{i=1}^n \alpha_{1i} GDP_{t-i} + \sum_{i=1}^n \alpha_{2i} Tour_{t-i} + v_t \quad (2)$$

Where *Tour* is the tourism receipts, *U_t* and *V_t* are uncorrelated and white noise error term series. Causality may be determined by estimating

equation 1 and 2 and testing the null hypothesis that $\sum_{i=1}^n \beta_{2i} = 0$ and $\sum_{i=1}^n \alpha_{1i} = 0$ against the alternative hypothesis that $\sum_{i=1}^n \beta_{2i} \neq 0$ and $\sum_{i=1}^n \alpha_{1i} \neq 0$ for equation (1) and (2) respectively.

Three assumptions are explored regarding the connection between tourism and economic growth in Gilgit-Baltistan.

- (1) The theory of tourism-driven economic expansion.
- (2) The theory of economic-driven tourist expansion; and
- (3) The combined two-way causal theory of (1) and (2),

Correlations				
		GDP	TI	TTA
GDP	Pearson Correlation	1	.850**	.850**
	Sig. (2-tailed)		.000	.000
TI	Pearson Correlation	.850**	1	1.000**
	Sig. (2-tailed)	.000		.000
TTA	Pearson Correlation	.850**	1.000**	1
	Sig. (2-tailed)	.000	.000	

** . Correlation is significant at the 0.01 level (2-tailed).

Source: Authors (2023)

Model Summary ^b										
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.850 ^a	.722	.695	51.67586	.722	26.013	1	10	.000	.726

a. Predictors: (Constant), TI

b. Dependent Variable: GDP

Source: Authors (2023)

CONCLUSION

The relationship between tourism and economic expansion may be causal in either direction. The development of various tourism marketing strategies and policy choices will be significantly impacted by identifying a causal relationship between international and domestic tourism and economic growth. Tourism-led economic growth is feasible if a clear unidirectional causal relationship exists between tourism expansion and economic growth. The results indicate a different causal relationship; then economic development might be required for the growth of the tourism sector. Next, if the causative process is bi-directional, and tourism and economic growths have a reciprocal causal relationship, then a push in both areas would be beneficial. The statistics show a huge impact on the total tourist spending in terms of GDP percentage by the number of tourists visits, average spending, and total tourists' spending. However, the data shows that tourist spending % of GDP was minimal in 2012, when only 1.67 % growth was calculated. Moreover, from 2013 to 2018, the percentage increase in tourist expenditure as a percentage of GDP is 2.83%, 2.34%,

8.28%, 14.91%, 23.16%, and 33.52%, respectively. The GDP growth rate increased to 20.84% in 2019, the greatest growth rate ever.

ACKNOWLEDGMENT

The authors would like to acknowledge the Higher Education Commission of Pakistan and Karakoram International University for research support.

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Received: 28th Feb 2023. Accepted: 31st March 2023



PLANNING MALAYSIA:
Journal of the Malaysian Institute of Planners
VOLUME 21 ISSUE 4 (2023), Page 310 – 321

THE IMPACT OF GREEN ENERGY & WATER PRACTICES ON THE DEVELOPMENT OF SUSTAINABLE TOURISM: A CASE STUDY OF 5-STAR HOTELS IN HURGHADA AND MECCA

Adel Abou Amer¹, Diana Mohamad², Ruhizal Roosli³

School of Housing, Building and Planning,
UNIVERSITI SAINS MALAYSIA

Abstract

This present study examined whether 5-star hotels in Hurghada, Egypt, and Mecca, the Kingdom of Saudi Arabia (KSA) implement green energy and water practices and how they perceive the development of tourism in relation to the adoption of green practices. A qualitative research method was used to examine hotels in Hurghada and Mecca only. The target population of hotel managers, owners, and heads of departments was selected using purposive sampling. The sample size was limited to 10 respondents. The tools and techniques used were focus group discussions (FGDs) and semi-structured interviews (SSIs). The findings indicate that 5-star hotels in Hurghada and Mecca have provided their staff with multiple different training on green practices, displayed signboards, decreased the use of electrical equipment, and transitioned to solar-powered energy systems. They have also installed electricity-saving air conditioning units in their rooms, covered air conditioners, and set the temperature of air conditioners to ambient temperature. Their gardens are cultivated with plants that do not consume water and are watered, if necessary, only at sunset. They also ration their use of water. Guests are also provided with luxury products that are environmentally friendly and do not use plastic packaging. Awareness was found to be the most important factor for the only in hotels but in general.

Keywords: Hurghada, Mecca, Green Practices, Water & Energy, Environmentally Friendly

² Lecturer at Universiti Sains Malaysia Email: diana_mohamad@usm.my

INTRODUCTION

This present study inspects the impact of green energy and water practices on the development of sustainable tourism by examining selected 5-star hotels in Hurghada, Egypt, and Mecca, the Kingdom of Saudi Arabia (KSA). Egypt and the KSA's tourism industries are booming, with many big cities serving as tourist destinations, particularly Hurghada and Mecca, respectively. Therefore, the governments of Egypt and the KSA have developed green policies for urban tourists. They have also issued strict standard operation procedures (SOPs) that hotels must adhere to preserve the environment and biodiversity of their regions. Tourism, undoubtedly, contributes to the economy of Hurghada and Mecca. However, there is a gross lack of environmental awareness and proper tourism management, which harms the environment and affects the use of water and energy. Due to strict monitoring and effective SOPs, 5-star hotels in both these cities have adopted green energy and water practices; such as water recycling, proper waste management and recycling, adopting clean and green energy, and shifting to solar-powered electrical systems.

However, the government should also prioritize providing hotel owners and tourism workers with education and awareness programs that teach them about moderate-flow toilets, low-flow sinks, water-efficient and greywater recycling appliances, good sanitation, and shifting towards solar energy to understand the importance of green practices and sustainable tourism development. They should also be made aware of energy-saving appliances, HVAC settings, and key-card control systems as well as renewable energy sources and solar plants. They should also be told to turn lights off in the middle of the night, pre-set all appliances in the rooms, change towels less frequently, display all green products, and group re-lamping to save energy resources and increase energy use efficiency.

LITERATURE REVIEW

Hospitality Industry and Environmental Sustainability Awareness

Owing to increasing awareness of environmental issues, more and more hotels, holiday destinations, and tourism-related industries are developing, implementing, and adopting green energy and water practices to promote sustainability and decrease their negative effects on the environment and biodiversity of the region (Ibnou-Laaroussi & Wong, 2020; Ibnou-Laaroussi, Rjoub & Wong, 2020; Baloch et al., 2023; Herrero et al., 2022; Zhong et al., 2011). Tourism is a vital sector for the social and economic development of any country. According to Juvan and Dolnicar (2017), tourism-related activities are responsible for approximately 10.4% of the global gross domestic product (GDP). It also accounts for almost 7% of global exports and 10% of employment around the globe. Nevertheless, tourism-related activities are responsible for roughly 8%

of greenhouse gas (GHG) emissions, which not only negatively affects biodiversity and the environment but human health as well (Lenzen et al., 2018).

Hotels consume significant resources for their daily operations and functions. This adversely affects the environment as well as the sustainability of tourism development as it is costly (Verma & Chandra, 2016, 2018; Legrand et al., 2016). As such, tourism-related companies and industries have prioritized environmental and tourism sustainability in their marketing strategies (Legrand et al., 2016). This is evidenced by an uptick in the number of hotels adopting green practices to impress potential guests as well as promote the development of sustainable tourism. The adoption of green practices by 5-green star hotels helps achieve the sustainable development goals (SDGs) of the United Nations (UN) (Ahmed et al., 2021).

The purpose of the Green Star criteria was for hotels to display their commitment to environmental and tourism sustainability by adopting pro-environmental measures that do not harm the environment (Abdou, Hassan, & Dief, 2020). Hotels and tourism-related industries have also launched various initiatives that indicate their willingness to support sustainability in the tourism industry. This includes displaying eco-labels on products that are used daily, implementing green human behaviours and practices that are sustainable, and implementing environmental management systems (EMS) to strengthen existing green tourism policies and strategies. If the hotel and tourism industries do not integrate sustainability and the conservation of sources and resources as the core of their business cultures, these industries will not be able to move forward as concerns over their pollution of the environment can impair their development (Abdou, Hassan & Dief, 2020; Fauzi, Hanafiah & Kunjuraman, 2022).

Green Hotel Practices

The global hospitality industry currently faces numerous challenges as the numerous environmental changes have heightened competition (Ozgit & Zhandildina, 2021). The Egyptian hospitality industry is no different. The 2011 Egyptian Revolution had a significantly negative effect on the Egyptian tourism and hospitality industries; namely, high employee turnover and severe competition among hotels and tourism businesses (Abu-Elhassan, Elsayed, & Soliman, 2016). As such, Egyptian hoteliers launched campaigns to create new ideas that enhanced the quality of their products and services. The government and organizations have also, over the past few decades, paid more attention to environmental issues. Present-day hospitality consumers expect hospitality businesses to be more aware and experienced in handling environmental issues, especially in Hurghada (Chikodzi et al., 2020).

Green hotel practices are ecologically and environmentally friendly programs or initiatives that mitigate the adverse impacts on the environment by

conserving finite energy and water resources. This includes installing energy-efficient appliances, recycling greywater, implementing renewable energy programs as well as decreasing water consumption by installing water-efficient devices, and implementing linen and towel reuse programmes. It also involves executing waste management and reduction strategies; such as recycling programmes and using durable and longer-lasting reusable items rather than disposable ones (Abdou, Hassan & Dief, 2020). Therefore, the motivation for tourism and tour planning is the effective use of resources to position business operators in a suitable position to adapt to the impacts (Mohamad et al., 2016). According to the World Tourism Organization (WTO), the United Nations Environment Programme (UNEP), and the World Meteorological Organization (WMO), in 2012, the hotel industry was the largest emitter of GHGs while it and the tourism industry were responsible for 21% of all carbon dioxide emissions.

Many hotels now provide luxury environmentally friendly products; such as green soaps, shampoos, and lotions to name a few; that are in plastic-free packaging. They also use paper napkins, towels, and disposable cups to promote the development of sustainable tourism by adopting practical green practices (Mbasera et al., 2016; Alsayat, 2023; Hashish et al., 2022). Apart from wastewater recycling efforts, hotels in Hurghada and Mecca also practice energy saving by installing energy savers, relying on renewable energy sources and solar plants, turning lights off from midnight, using key card control systems, changing towels less frequently, displaying their green products, controlling settings in lobbies, covering pools and hot tubs to decrease heat loss, and practicing group re-lamping to save and efficiently use energy, all of which are important to the development of the tourism industry.

According to El-Sayed and Abed (2021), hotels have invested in lighting technologies and arrangements that are as energy-efficient as possible to attract green-conscious customers. Hotels and tourist resorts have also installed medium-flow toilets, low-flow sinks, smart taps that reuse greywater, and water-efficient appliances as well as practicing good sanitation in hotels to save water (Ihalawatta, Kurupparachchi, & Kulatunga, 2015; Chiziterem & Nonyelum, 2020).

Research Questions

- What are the green energy and water practices that 5-star hotels in Hurghada and Mecca have implemented?
- How do the challenges of implementing green energy and water practices affect the development of sustainable tourism?
- How does the successful implementation of green energy and water practices benefit the development of sustainable tourism at 5-star hotels?

RESEARCH METHODOLOGY

The selection of an appropriate research design is a significant part of research as it dictates the path of achieving the goals of a study and systematically outlines the procedures to be used (Tranfield, Denyer & Smart, 2003; Kothari, 2004; Dubois & Gadde, 2002). This present study conducted a qualitative study that was limited to the city of Hurghada in Egypt and Mecca in the KSA. The participants were managers, higher-level management staff, and admin-related staff in the hotel industry. Questionnaires were used to conduct semi-structured interviews (SSIs) while interview guides were used to conduct focus group discussions (FGDs) and collect the required data. Both purposive and convenient sampling were used to select the participants.

The sample size of this present study was 10. All 10 participated in the SSIs while four, two from each city, participated in the FGDs. Both informal and face-to-face in-depth interviews were conducted, and a few observations were also noted. Thematic analysis is a method of analysing qualitative data and categorizing responses into themes. It is usually applied to a set of texts; such as an interview or transcripts. The data was closely examined to identify repeating themes, topics, ideas, and patterns. The collected data was mapped into a meaningful format and thematically analysed to determine the correlations between the variables to fulfil the research objectives.

RESULTS AND DISCUSSION

Challenges Faced by 5-Star Hotels in Water & Energy Management

The 5-star hotels in Hurghada and Mecca currently face numerous challenges. Hotels also consume higher quantities of water as there are no restrictions on the usage of water by guests. Tourists with less knowledge of the importance of efficient water usage use more water than required. FGD respondents stated that: (1) *“Most of the water is used for guest amenities, landscaping, kitchen, and the rooms as well as for cooking and other purposes, such as bathing”*, (2) *“The higher cost of the initial green energy and water savings practices implementation can be expensive ...”*, (3) *“Guest satisfaction minimizing the cost protect the environment and safe revenue”*, (4) *“For the hotels in Hurghada, there is only one source of water, the water pipes from the nearest governorate in Qena. Investors must implement green practices in their daily operations to save costs, which is their primary target above all other goals. The implementation of green practices enhances and facilitates tourism activities.”*, and (5) *“The higher quality water is being used in guests’ amenities-landscaping-kitchen and rooms for cooking and other purposes like bathing, etc.”*

The high cost of implementing and maintaining green practices are among the several barriers limiting the implementation of green practices and their benefits for sustainable development in Mecca and Hurghada. Despite this,

5-star hotels have successfully adopted green practices for water and energy conservation, such as using renewable energy and installing energy-efficient systems, HVAC systems, and low-flow fixtures as well as adopting water-saving technologies with proper planning, investment, and collaboration between stakeholders to further strengthen green campaigns. A manager from Mecca who participated in the SSIs stated that: *“In the kitchen, we operate with electricity. So, there is high consumption, and it must be controlled.”*

The SSIs where experts have also highlighted some of the most important challenges from both Hurghada and the Holy Mecca. The experts from both cities have agreed that hotels and the tourism sector in both cities faced numerous challenges which did not let the hotels completely adopt green practices in hotels. These challenges are limited resources or access to green technologies and practices, and cost constraints, such as installing a solar panel or upgrading to energy-efficient appliances, which can be challenging for hotels with limited budgets. Moreover, lack of awareness among guests and staff maybe not be aware of the importance of green practices, and regulatory challenges related to implementing green practices such as obtaining permits for solar installations or navigating complex disposal regulations. Furthermore, seasonal Fluctuations where the hospitality industry in Hurghada and Mecca may experience seasonal fluctuations in demand. Which can make it challenging to maintain consistent energy and water usage levels throughout the year.

Green Practices in 5-Star Hotels in Hurghada and the Holy Mecca

The tourism sector plays a significant role in the social and economic development of many countries, with many depending on it for socio-economic sustainability (Rasool, Maqbool, & Tarique, 2021; Manzoor et al., 2019). Although the tourism sector is financially profitable, it emits high levels of harmful GHGs that negatively affect not only biodiversity but also human health. As such, many hotels and tourist destinations have adopted green practices (Camarda & Grassini, 2003), primarily to assuage the environmental concern of tourists who are driven by pro-environmental decisions when traveling or booking hotels. According to one FGD participant: *“Many international tourists from developed countries look for environmentally friendly hotels to spend their leisure time with their families ”.*

Hotels play a larger role as they inefficiently consume natural resources to facilitate tourism. Although many studies have concluded that the Earth's water and other energy resources are dwindling day by day (Baloch et al., 2023; Alsayat, 2023; Nayak et al., 2022), there are no significant policies with which to manage the wasting of water and energy resources, even in developed countries. The situation is even more precarious in developing countries. According to two of the respondents:

Two FGD respondents stated that: (1) *“Water and energy resources are, undoubtedly, important in the present context. The higher costs and a lack of public awareness about conserving water and energy is a major reason for our dwindling natural resources”*, and (2) *“Mecca is always very crowded, and many pilgrims do not know how to use the hotel's facilities. As such, we frequently encounter misuse of energy water, and even food. The service is the most important, which is why we check the air conditioning and electricity daily to ensure that they are all under control”*.

Nevertheless, 5-star hotels in Hurghada and Mecca have some internal checks and policies in place to control water and energy usage and alternative methods of preserving energy and water resources. According to the manager of a hotel in Mecca: *“All our hotels prioritize energy saving and water conservation. All our equipment is controlled by a central BMS [building management system] system and we have managed all the required management from one place... We are implementing integrated green practices in our hotel by installing savers on all water mixers in rooms and public bathrooms and checking daily the usage of water and energy”*. Another FGD respondent also agreed that hotels in Hurghada have a diverse strategy to implement green practices in hotels to make sure the protection of the environment.

Three SSI respondents from Hurghada stated that: (1) *“Some hotels in Hurghada have installed solar panels on their rooftops or nearby land to generate the electricity that is used to power their operations. Some have also installed wind turbines to generate electricity or purchase renewable energy from off-site sources; such as wind”*, (2) *“All the lights on the hotel's roads and in its gardens operate on a motion sensor system. So, it is off all the time and only turns on when it detects traffic or human motion. This decreases the amount of time that the lights are on. The same system is used in the public bathrooms”*, and (3) *“We have water mixing valves installed in our mechanical rooms. They provide the required temperature in the rooms. We also have [VFD] water pumps that maintain sufficient pressure in the line”*.

Additionally, hotels promote green practices through efficient management and usage of water and energy resources in hotels. The efficient usage of these resources minimizes the operational cost as well, which has ultimately impacted the development of the tourism sector. Moreover, proper training and awareness sessions have also been implemented in hotels regarding the importance of water and energy-saving strategies (Liu et al., 2022). In this regard, all labourers have been trained in the nature and importance of saving power and how to work on them to save water and energy resources efficiently. Also, guiding signs have been placed in the guest rooms in hotels. They indicate the importance of preserving the green environment, reducing power and detergent usage, and also explain that only the towels that are thrown on the floor

will be changed. A manager of the hotel stated that: *“We have conducted some awareness programs for our employees and many of them are trained in implementing green practices. We have a section which only designs green tourism as per the demands of clients/tourists”*.

Some of the practical integrated methods to adopt green practices and tourism development by developing a sustainability plan that outlines specific goals and objectives related to water conservation. To educate employees about the importance of water and energy this can be training on water-saving measures and waste reduction practices. Further, SSI respondents stated that: (1) *“To involve guests in the implementation of green practices by providing information and encouraging them to participate in the conservation efforts and monitor performance to ensure that green practices are being implemented effectively and to identify areas when improvements can be made”*, and (2) *“Consciously improve, consciously improve sustainability efforts by identifying areas where additional improvement can be made such as the implementation of new technologies or the adoption of more ambitious sustainability goals”*.

Current Self-Evaluation and Way Forward for Hurghada and Holy Mecca

The majority of participants during FGDs in Mecca and Hurghada have identified many benefits of the successful implementation of green practices in the tourism sector. The benefits of green practices are saving costs, environmental safeguards, and the saving of inadequate natural resources. The successful implementation of green practices means promoting the UN's vision to achieve sustainable development goals. Furthermore, carrying capacity assessment and economic valuation were also conducted to evaluate the eventuality of sustainable tourism development (Mohamad & Marzouki., 2018). The FGD with the top management of the Marriott group of hotels also found that they have a lot of programs to protect the environment and save energy and water, one of the programs called (*Mesh*) Marriott environment sustainability hub. This has also promoted green tourism and it has also a close connection between the hotel business and sustainable tourism development authorities (Tiwari, Dambhare & Tripathi, 2020; Prakash et al., 2022). Two FGD respondents stated: (1) *“There are a lot of ways like spreading awareness about saving energy and protecting the environment, for example, we place a lot of awareness posters inside the guest room to save water and use towels for more possible time, reduce AC temperature to the minimum required level, informing the pilgrims about food waste and avoidance the hotel management /owner and stockholders they are a concern and awareness about the green practices and everyone focus on it as these are one on the UN (SGDs)”*, and (2) *We did an action plan to save the cost, protect the environment, train the employees about the green practices, especially in water and energy elements as well as participation in all these regulations with the guests”*.

Similarly, another SII's participant has also found that the successful implementation of green practices (water and energy) enhances productivity and minimizes the operational cost of hotels: (1) *"Firstly, many green practices are designed to conserve resources, which can lead to cost savings on utility bills, by using energy-efficient lighting and appliances. By implementing green practices hotels can enhance their brand image and reputation, which can increase business and revenue the long-term cost saving, and potential revenue benefits can make them a sound investment for a hotel looking to reduce their environmental impact and improve their bottom line"*, and (2) *"Firstly, in my point of view I will be focusing on the two elements (water and energy) of Egypt of course, water, and energy are most significant in all life processes. Nowadays let me confirm that people are more aware of the importance of conserving water and saving energy, especially the energy is so expensive and so is water"*.

The hotel management plays a main role in spreading the idea about green practices, as well as the owner and stockholders they are focused on such elements to reduce the cost and protect the environment, and the main goals of the hotel image and the benefits (Abdou, Hassan & El Dief, 2020; Pereira, Silva & Dias, 2021). Moreover, it can also be added that the main target for the owners is the benefits, and this is one of the hurdles in the operation process. Everyone is responsible for the development of green practices elements it is everybody's job in 5-star hotels to implement green practices. A SSI respondent in Mecca stated that: *"Some hotels may offer sustainability tours or educational programs for guests to learn about sustainability practices. In addition, the management may educate their employees and raise their awareness about green practices and their benefits"*.

The question regarding the ways to increase sustainable tourism development in Hurghada and Holy Mecca. The participants were optimistic about the current tourism sector development and the sustainability of hotel businesses in terms of earnings. The majority of participants have agreed that the proper security system in hotels, social and community level development and upliftment of small tourism-related businesses, women empowerment, and cooperation between hotels companies and other stakeholders, community and government, price minimization, and location of hotels are the few ways to enhance and increase the sustainable tourism development.

In addition, the usage of energy savers, renewable energy sources, installation of solar plants, off lights from mid of night, key-card control system, control of every appliance in rooms, changing towels, display of green products, ventilating and the air conditioning settings in lobbies, covering the pools and hot tubs to diminish heat loss and group re-lamping to save energy resources and efficient usage in the tourism sector. All these programs make sure sustainable tourism development in Mecca and Hurghada region.

The conclusion of the interviews (SSIs) found that using renewable energy sources such as solar energy, installing motion sensor lights that are on and off when required automatically, using natural lights, which operate through sunlight, planting trees and shrubs strategically, and promoting the billion-tree project in Mecca, educate yourself and others regarding the importance of a green environment and the positive implication of adopting these measures. Moreover, smart thermostats use energy-efficient appliances to save energy, install a rainwater harvesting system at hotels and residential areas, fix water leaks in the washroom, etc., and use low-flow water fixtures at households, hotels, etc.

CONCLUSION

Hotels in Hurgada and Holy Mecca provide training to the staff regarding green practices in hotels. In this regard, hotels in both selected cities displayed guiding signs, reduced the usage of electric equipment, activated operating schedules for lighting and air conditioning, swimming pool heating temperature adjustment, used motion sensors, irrigation at sunset, cultivated gardens with plants that do not consume water, and rationing water usage. Moreover, the saving energy and water resources through installing energy-efficient appliances, recycling consumed water & reuse, and implementing renewable energy programs, and decreasing water consumption levels that are by installing water-efficient devices & equipment. In addition, usage of paper napkins, paper towels, and disposable cups are also installed in hotels to promote sustainable tourism development through practical green practices. It's not only the responsibility of the hotels to implement green practices but also the clients or customers must know the importance of green practices for the future generation and development of the tourism sector in both cities.

ACKNOWLEDGEMENT

The authors would like to thank Project Code: 1001.PPBGN.AUPSE00211 (SDG5 INTERVENTION PROJECT: UPSKILLING AND RESKILLING WOMEN IN AGRICULTURE WITH ICT (BJIM)) and the School of Housing, Building and Planning, Universiti Sains Malaysia, for financially supporting this research.

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Received: 26th June 2023. Accepted: 11th August 2023



PLANNING MALAYSIA:
Journal of the Malaysian Institute of Planners
VOLUME 21 ISSUE 4 (2023), Page 322 – 333

THE EFFECT OF PLACEMAKING ATTRIBUTES ON TOURISM EXPERIENCES: A CASE STUDY OF PETALING STREET IN MALAYSIA

Tan Hwee Xiang¹, Diana Mohamad²

¹ *PARKROYAL COLLECTION & Pan Pacific Serviced Suites Kuala Lumpur*

² *School of Housing, Building and Planning,
UNIVERSITI SAINS MALAYSIA*

Abstract

Cultural heritage tourism, a form of tourism in Malaysia that is vital for identity and place attachment, has a positive influence on the country's economy and society and helps individuals build a strong sense of place. Petaling Street is a well-known traditional street in Malaysia. However, in light of the tremendous increase in tourism and urbanisation, it now faces the threat of losing its Chinese cultural heritage due to commercialisation and touristification, which also affects the tourism experiences (TEs) of its tourists. Although placemaking is a relatively new concept in Malaysia, it is becoming an increasingly important component of the community as it is able to create a bond between a place and people. As such, the government is pushing for the concept to be included in urban regeneration. The findings indicated that placemaking attributes (PAs) may actually influence TEs at cultural heritage sites. This present study also identified three new factors. As the results indicate that PAs closely relate to TEs, it can be concluded that Petaling Street's TEs would be enhanced if it were to provide the appropriate services and facilities; which are considered PAs.

Keywords: Placemaking, Petaling Street, Cultural Heritage Tourism, Tourism Experience

² Lecturer at Universiti Sains Malaysia Email: diana_mohamad@usm.my

INTRODUCTION

Cultural heritage tourism plays an important role in the formation of identity and place attachment. It not only has a significantly positive impact on the economy and society but helps people develop a strong sense of place. It can also assist in the effective management of the preservation of Petaling Street. This can be accomplished by using culture as a major resource to promote understanding between people and support its culture (Ismail et al., 2014). According to the International Council on Monuments and Sites (ICOMOS), the collective memory and unique heritage of a locality or community are irreplaceable and sets the foundation for all current or future developments. Meanwhile, the identity of a location distinguishes it from others, thereby, making it distinct and symbolic. Differentiation is essential as it represents the identity of a location (Shamsuddin & Ujang, 2018). Tourist attractions draw a large number of visitors due to the pull of the culture itself. Therefore, cultural heritage tourism is an important global industry that significantly impacts the economy of a country and also contributes to its identity.

Petaling Street is one of the oldest streets in the city of Kuala Lumpur. These streets, which were traditionally retail-oriented, have retained their physical and social identity by maintaining their street activities and human interactions. These factors play a crucial role in shaping the city's character and economic vitality, particularly in the tourism industry. However, Petaling Street's reputation as Kuala Lumpur's Chinatown is presently at risk of losing its ties to the Chinese culture. Some the factors contributing to this scenario include the recent proclivity of migrant traders working and setting up enterprises along the street, the local Chinese community moving out to be replaced by modern businesses as well as a lack of concern for the historical preservation of the street (Ahmad et al., 2015). Therefore, the preservation of Petaling Street's Chinatown reputation must be prioritised as a matter of historic concern as it is an important component of good placemaking and yields many benefits.

LITERATURE REVIEW

Street Markets

According to Gemzoe (1999), street markets originated in metropolitan towns that had economic links to rural communities, particularly in terms of agriculture. By blocking off a street for pedestrian use, street markets make it possible for people to exchange products and connect with each other. It also transforms a thoroughfare, that often receives vehicular traffic, into an area for human activities (Balsas, 2019). Multiple studies as well as point-prevalence surveys (PPSs) have fundamentally examined the factors affecting the quality of pedestrian streets, particularly in terms of tourist marketing, and public spaces throughout the world (Pimamorn & Nutthachai, 2021). According to Azmi et al. (2020), a journey is incomplete if shopping is not involved as it is a significant

motivating factor for tourists to reach their destinations. Therefore, walking a street market may play a crucial role in the development of the tourism sector (Swanson & Horridge, 2006). Zhao et al. (2020), however, state that the term “identification” has a narrower connotation than “feeling” or a “sense of place.” Lynch (1964) defined “identification” as the degree to which a person can distinguish a place as distinct from others; such as being special in their own style. If this is true, individuals may recall a place based on its unique characteristics and that place has a distinct “a sense of place” (Pimamorn & Nutthachai, 2021).

Cultural Heritage Tourism

Cultural heritage tourism intersects culture, tourism, and experiences in the tourism consumption process (Zhang et al., 2020). Academic studies on cultural heritage tourism are not new and provide insights into idea definitions, cultural or heritage contexts, marketing segmentation, as well as visitor perceptions and experiences. These types of travels also enable visitors to become acquainted with and immersed in indigenous practices, ways of life, heritage, and cultures. In terms of demand, cultural heritage tourism reflects the desire of many modern tourists to personally experience and consume various past and present cultural landscapes, performances, cuisines, handicrafts, and participate in activities. Apart from the economic benefits, cultural heritage tourism may also help revitalise local cultures and traditions, instil a sense of pride in its people, and create more engaging experiences for tourists. Therefore, by recognising the characteristics that contribute to the “sense of place” of a destination, it may help the destination identify, maintain, and develop assets that contribute to its character (Rajala et al., 2020).

Place Identity, Place Attachment, & Placemaking

Place identity is inextricably tied to the meanings and perceptions that people have of their surroundings. A loss of identity hinders the formation of a profound meaning, attachment, and diversity of experiences at a destination. It also alludes to a lack of connection between the physical landscape and the meaning of the place, which is embedded in its broader physical, cultural, and emotional context (Timothy & Boyd, 2006). The meaning of a place relates to its social development, particularly psychological development, which affects the perceptions that people have of it. The identity of a place relates to the culture and way of life of the locals while the cultural characteristics of a place is the first component to affect the development of a place's image identity, which is critical for tourism (Anuar et al., 2021). New developments in traditional city centres, undoubtedly, modify a space as well as the meanings and attachments associated with its society and culture. As such, it is imperative to maintain the elements and identity of a cultural heritage as they contribute to self-identification, a sense of community, and a “sense of place.”

The identify of a place affects the attachments that are formed to it, which can be used to create a “sense of place” (Maricchiolo et al., 2021). Therefore, place identity is defined by the relevance of the place attachment. Both these factors contribute to the development of the emotive attachment that tourists form to a place during their visit. It also affects their emotion, knowledge, beliefs, behaviours, and actions. In other words, place attachment may affect the ability of a place image to be influenced by experiences and culture. Apart from influencing the identity of people; be they tourists or the local community; the environment of a place creates and reinforces the correlation between sociocultural values and way of life (Anuar et al., 2021).

The concept of placemaking was introduced in the 1960s by urban planners Jane Jacobs and William Whyte. Academic interest in placemaking increased in the 1990s across a variety of disciplines, including architecture, urban planning, landscaping, geography, social sciences, and tourism (Zhao, 2019). Placemaking demonstrates that the development of a place transcends its tangible elements and involves its sociability, uses, activities, access, connections, comfort, and image to form bonds between people and a “sense of place.” Placemaking and cultural ecosystems were developed to address urban issues by creating better environments for people to live, work, visit, explore, and enjoy in place-specific ways (Cheer et al., 2022). Although the terms “space” and “place” are frequently used interchangeably, they indicate very different things, depending on the context. The act of placemaking gradually enhances an area over a lengthy period of time by implementing numerous minor initiatives and activities.

RESEARCH METHODOLOGY

This qualitative research was conducted by using survey questionnaire as the data collection instrument. The dependent variable (DV) was tourism experiences (TEs) while the independent variable (IVs) was placemaking attributes (PAs). A number of extraneous variables; such as socio-demographic characteristics; were also examined. The items of the survey questionnaire were constructed based extant studies on the correlation between placemaking and TEs. A pilot study was conducted in the first week of April 2022 before the actual data that was used in this present study was collected in the middle of April 2022. In 2021, the total number of domestic tourists in Kuala Lumpur was 9.1 million people (Census and Economic Information Centre (CEIC), 2022). Krejcie & Morgan’s table was used to determine the required sample size based on this population. Therefore, this present study gathered and analysed 384 samples for the data collection.

A descriptive data analysis was conducted to summarise the socio-demographic characteristics of the respondents in percentages and frequencies in a table format and a brief explanation. An exploratory factor analysis (EFA) was used to identify factors from the observable variables. As the data comprised a

large number of variables, an EFA was used to minimise the number of variables and combine those that shared similar characteristics. The correlation between the IV and DV was demonstrated by means of graphs in a Spearman correlation analysis while multiple regression was used to test the hypothesis and build a suitable model, as identified by the F-ratio and t-test statistics.

Respondents' selection criteria are as follows: (1) the study demands that the respondents must be older than 18 years old, as adults have the ability to make appropriate judgement. (2) The second criteria is that respondents have visited Petaling Street recently (2021-2022) in order for them to have an accurate perspective of the current issues in the area. (3) The third criteria is the respondent has to be domestic tourist, as this study was exclusively focuses on the domestic tourists than foreign tourists, the responders must be locals.

The study area is approximately 12.8 hectares in size. Jalan Tun Tan Cheng Lock surrounds the area from the north to the end of Jalan Petaling in the south, while Jalan Sultan borders the area from the east to Sungai Kelang in the west. These streets define as parts of Kuala Lumpur Chinatown where pre-war shophouses and other new development were built on top of existing shophouse lots along the main roads of Jalan Tun Tan Cheng Lock, Jalan Tun HS Lee, Jalan Petaling, and Jalan Sultan. There are numerous pocket spaces of alleys at the rear and sides of the building blocks that are used for street activities and pedestrian circulation. Petaling Street, or Jalan Petaling, is Kuala Lumpur's oldest traditional street, cutting through the study area and intersecting with Hang Lekir Street.

ANALYSIS AND DISCUSSION

Reliability test

Reliability is the consistency of the results produced by a research instrument. That is, whether the measuring instrument can reliably measure the property or variables. Therefore, this study assess the measurement items' consistency using the coefficient from the pilot test analysis. In general, when Cronbach's reliability coefficient is more than 0.70, the data reliability is acceptable. The Cronbach's α values for the preceding five sections are all greater than 0.9 (Table 1), indicating that the actual data questionnaire's question reliability is high and strong. Meanwhile, the corrected item-total correlation (CITC) value for all items are more than 0.5, meaning that no items need to be removed, implying that all items are accepted. As a result of the above analysis, it can be conclude that the questionnaire has a high degree of reliability. Thus, it can be use it for further analysis.

Table 1: Factor loading results

Construct	N of items	Item delete	Cronbach's Alpha
IVs			
Uses & Activities	10	-	0.956
Comfort & Image	10	-	0.956
Access & Linkages	7	-	0.909
Sociability	7	-	0.941
DVs			
Tourism Experience	14	-	0.968

Respondent profiles

Of the 369 respondents [1], 44.4% were women and 55.6 % were men [2] aged 25 to 34 (50.9%), 35 to 44 (16.5%), 18 to 24 (14.6%), 45 to 54 (11.4%), 55 to 64 (4.9%), and above 65 (1.6%) [3]. In terms of education, 76.7 % had completed tertiary education, 16.1% had secondary education, 3.8% had primary education, and 3.5% had no formal education [4]. In terms of occupation, 20.9% were self-employed, 13.6% were government staff, 12.7% were students, 7.3% were unemployed, and 45.5% worked in the private sector [5]. Of the 369 respondents, 49.1% had visited Petaling Street more than three times, 27.1% had visited it twice, and 23.8% had visited it once in 2022.

Relationship between Comfort & Image, Uses & Activities, Accessibility and Tourism Experiences

The Kaiser-Meyer-Olkin (KMO) measure was 0.972, which is extremely close to 1 and excellent. As the p-value passed Bartlett's test ($p < 0.05$), the data was suitable to be further analysed using EFA. As seen in Table 2, three factors had Eigenvalues greater than 1. Items that had a factor loading of less than 0.6 according to the factor analysis were excluded. Post-rotation, the variances of these three components were 30.491%, 22.311% and 21.670%. Furthermore, the cumulative variance that was explained following the rotation was 74.472%. The total percentage of variance indicated that the three components were able to extract 74.472% of the informational content of the 34 items in the survey questionnaire.

As seen in Table 2, 13 items recorded a high factor loading for Factor 1, which reflected Comfort & Image (CI) in the context of this study; seven items recorded a high factor loading for Factor 2, which reflected Uses & Activities (UA) in the context of this study; and six items recorded a high factor loading for Factor 3, which reflected Accessibility (A) in the context of this study.

Table 2: Factor loading results

Items	Factor 1	Factor 2	Factor 3
Petaling Street has clear signage to access the place.	0.617	0.154	0.491
Petaling Street has a clear information board to access the place.	0.805	0.209	0.261
Petaling Street has a good flow of traffic.	0.707	0.040	0.388
Petaling Street is comfortable to walk in.	0.716	0.319	0.297
Petaling Street feels safe to walk in.	0.791	0.292	0.157
Petaling Street is clean enough to walk in.	0.841	0.258	0.129
Petaling Street respects historical preservation and conservation.	0.765	0.463	0.191
Petaling Street provides a historical experience.	0.729	0.476	0.206
Petaling Street has suitable places to enjoy the environment.	0.819	0.332	0.185
Petaling Street's communities respect their identity.	0.684	0.479	0.298
Petaling Street's communities respect their culture.	0.708	0.466	0.257
Petaling Street has engaging and interactive street cultural activities.	0.717	0.456	0.271
Petaling Street's communities have a positive attitude that makes you feel like home.	0.790	0.308	0.206
Petaling Street has a variety of cultural experiences to choose from.	0.367	0.733	0.340
Petaling Street has a variety of activities to choose from.	0.405	0.729	0.268
Petaling Street businesses are run by locals.	0.309	0.623	0.379
Petaling Street provides opportunities for people to gather and enjoy the activities.	0.479	0.752	0.212
Petaling Street celebrates cultural festivals.	0.436	0.720	0.268
Petaling Street has social activities (Market Street), which affects its sense of place.	0.432	0.736	0.301
Petaling Street's communities maintain its original/traditional activities for future generations.	0.609	0.616	0.175
Petaling Street provides easy access to different cultural places (e.g.; temple, museum).	0.101	0.253	0.861
Petaling Street is walkable for all social group (e.g.; elderly, differently-abled individuals).	0.300	0.130	0.788
Petaling Street has easy access to public transportation.	0.181	0.173	0.848
Petaling Street provides good access to public places (e.g.; restaurant, retails shop, workplace).	0.266	0.244	0.831
Petaling Street has multiple uses (e.g.; business, entertainment, recreation, education).	0.354	0.378	0.630
Petaling Street has a variety of food to choose from.	0.036	0.588	0.675

Source: Author's Calculation

Table 3 shows the correlation between Comfort & Image, Uses & Activities, Accessibility and Tourism Experiences. It is learned that Comfort & Image recorded the highest correlation with Tourism Experiences ($r=.908^*$, $p=.000$). Meanwhile, Accessibility and Tourism Experiences, which had the least correlation strength ($r=.827^*$, $p=.000$). Therefore, Accessibility to a place had the least impact on Tourism Experiences. According to Guildford’s Rule of Thumb, each of the IVs had a highly significant correlation. It was also determined that all of the IVs had a positive and strong linear correlation with Tourism Experiences as well as the three IVs, which were Comfort & Image, Uses & Activities, and Accessibility.

Table 3: Correlation between placemaking and tourist experiences

		CI	UA	A	TE
CI	Pearson Correlation	1	.842**	.733**	.908**
	Sig. (2-tailed)		.000	.000	.000
	N	369	369	369	369
UA	Pearson Correlation	.842**	1	.807**	.870**
	Sig. (2-tailed)	.000		.000	.000
	N	369	369	369	369
A	Pearson Correlation	.733**	.807**	1	.827**
	Sig. (2-tailed)	.000	.000		.000
	N	369	369	369	369
TE	Pearson Correlation	.908**	.870**	.827**	1
	Sig. (2-tailed)	.000	.000	.000	
	N	369	369	369	369

Source: Author’s Calculation

Despite the high correlation seen in Table 2, the computed means were not, similarly, positive. A 5-point Likert scale, with 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, and 5 = strongly agree was used. As the computed mean of CI was 2.612, tourists felt that Petaling Street did not maintain its Comfort & Image. As the computed mean of Uses & Activities was 2.838, tourists felt Petaling Street did not really provide them with a cultural heritage experience while the computed mean of Accessibility (3.270) indicated that

tourists had neutral feelings about Petaling Street providing great Accessibility to cultural heritage goods and places. Lastly, the computed mean of Tourism Experiences (2.868) indicated that tourists felt that Petaling Street did not provide them excellent Tourism Experiences throughout their visit.

The objective of multiple regression analysis is to use the independent variables whose values are known to predict the value of the single dependent value. In the context of this study, it is used to determine the value/strength of each assessed factor (Comfort & Image, Uses & Activities, and Accessibility) in influencing Tourism Experiences. The multiple regression results indicated that the coefficient of determination (R^2) of the model was 0.889. Therefore, the Placemaking Attributes assessed were able to explain 88.9% of the variance in Tourism Experiences. As the model passed the F-test ($F = 970.167$, $p = 0.000 < 0.05$), it, therefore, had a substantial model fit with a high variance within that scope. This indicates that, at least, some of the Placemaking Attributes affected Tourism Experiences. Therefore, there was a significant correlation between the IVs and DV, where a 1-unit change in TEs increased Comfort & Image by 5 units ($B = 0.566$, $SE = 0.034$), Uses & Activities by 1 unit ($B = 0.184$, $SE = 0.038$), and Accessibility by 2 units ($B = 0.287$, $SE = 0.032$). The Placemaking Attributes revealed that Comfort & Image was the most significant attribute affecting Tourism Experiences as its t (16.867) was higher than that of Uses & Activities (4.846), and Accessibility (9.090). Therefore, the new equation was:

$$Y = -.073 + 0.566 (CI) + 0.184 (UA) + 0.287 (A) + e$$

Y: Tourism Experiences (TEs)

bo: Interception or constant value

b1: Comfort & Image (CI) unstandardised coefficients value

X1: Comfort & Image (CI) slope

b2: Uses & Activities (UA) unstandardised coefficients value

X2: Uses & Activities (UA) slope

b3: Accessibility (A) unstandardised coefficients value

X3: Accessibility (A) slope

e: Error terms

CONCLUSION

Tourist walking and movement activities can be maximised by creating a movement network that has readable, convenient, and secure designs as well as user services. Fair access, public transit, and related services should also be provided to places and if they affect the mobility and safety of individuals. These suggestions were derived from well-explored links to locations and various modes of transportation. Streets play an important role in the development of public spaces as they facilitate social interaction and are avenues for cultural expression. Samir et al. (2019) and Mohamed et al. (2020) reported similar

findings. Cultural and heritage places should provide authentic experiences and activities to make such places liveable, memorable, and enjoyable as well as help tourists and visitors have better TEs during their visit.

The literature review indicated that the cultural element correlates with the concept of placemaking as they both encompass a number of characteristics. Culture should not be classified as a single category as, when it is dissected into its component concepts, its terms are clearly dispersed over all four categories of the placemaking diagram. Furthermore, the historic core of a city is, typically, what distinguishes one place from another, generates a “feeling of place”, its identity, and offers authentic experiences. Although this essential feature of placemaking, typically, relates to the Comfort & Image of a specific area, it also commonly relates to other aspects of placemaking. For instance, this is why some towns and cities prioritise emphasising their historical character to attract tourists. Therefore, this present study verifies that the Tourism Experiences of tourists are highly influenced by Placemaking Attributes.

The original model differs from the new model as the former was mostly adapted to an entire city while the latter primarily focuses on specific cultural heritage sites within a city; such as Petaling Street. This is because the respondents had different perceptions of the city and the cultural sites. Most of the Placemaking Attributes did not significantly affect existing Tourism Experiences at Petaling Street as it, currently, does not provide sufficient facilities and amenities. However, Placemaking Attributes would significantly impact Tourism Experiences at Petaling Street in the future if sufficient facilities and amenities are provided. The tourists also reported moderate feelings about A to Petaling Street significantly affecting their Tourism Experiences while visiting the place.

ACKNOWLEDGEMENT

The authors would like to thank Fundamental Research Grant Scheme with Project Code: 203.PPBGN.6712097 (Establishing Economically- And Socially-Sustained Neighborhood Indicators for The Development of Penang Island's 20-Minute Neighborhood Guideline) and the School of Housing, Building and Planning, Universiti Sains Malaysia, for financially supporting this research.

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Received: 26th June 2023. Accepted: 11th August 2023



PLANNING MALAYSIA:
Journal of the Malaysian Institute of Planners
VOLUME 21 ISSUE 4 (2023), Page 334 – 348

THE EFFECT OF TOURIST EXPECTATIONS AND TOURIST EXPERIENCES ON TOURIST SATISFACTION WITH HERITAGE ATTRIBUTES: A CASE STUDY OF HỘI AN, VIETNAM

Ho Ngoc Minh¹, Suraiyati Rahman², Tran Cam Thi³

^{1,3}Faculty of Cultural Industries,

THU DAU MOT UNIVERSITY, VIETNAM

²School of Housing, Building and Planning,

UNIVERSITI SAINS MALAYSIA, MALAYSIA

Abstract

Hoi An, Vietnam is a heritage town that offers many attractions and amenities attracting many domestic and international tourists. Along with the satisfaction studies conducted in Hoi An, the concern on how tourists' expectations and experiences influence tourist satisfaction with destination attributes is not well explored. The present study determines the extent to which tourist expectations and tourist experiences affect tourist satisfaction with destination attributes; such as heritage attractions, price, people, tourist amenities, and safety. A quantitative research method was used to collect data from international and domestic tourists who had visited and stayed in Hội An, Vietnam for at least one night. Of the 275 responses received, 269 were usable. The findings indicate that tourist experiences with staff, safety, and tourist amenities had the biggest impact on tourist satisfaction in Hội An while tourist expectations did not significantly affect tourist satisfaction. This study also contributed to the strength of Hội An in the hopes that tourism stakeholders in Hội An will use these findings to take proactive steps to increase the competitiveness and attractiveness of Hội An.

Keywords: Destination attributes, heritage tourism, Hội An Cultural/ Heritage destination, tourist experience, tourist satisfaction

² Senior Lecturer at Universiti Sains Malaysia. Email: suraiyati@usm.my

INTRODUCTION

Cultural tourism is one of the fastest-growing tourism markets worldwide (UNESCO, 2019), of which heritage tourism, a form of cultural tourism (Timothy & Boyd, 2006); is growing in popularity as well (C.-F. Chen & Chen, 2010). Being assigned as a UNESCO World Heritage Site gains a destination global attention as it indicates that it has outstanding cultural and natural attributes (Wang et al., 2015). To date, Vietnam is home to eight UNESCO World Heritage Sites. Hôi An Ancient Town is a historic district in Hôi An City where the buildings and architecture of the site are exceptionally well-preserved (UNESCO, 2018). However, recent statistics indicate an imbalance in the tourism sector of the heritage site. Firstly, although the number of tourist arrivals has steadily increased since the 2010s, between 2014 to 2019, more than 50% of these tourists were day-trippers (Hai, 2014; Linh, 2016, 2019a, 2019b; Nguyen & Loc, 2017). Secondly, the influx of tourists in recent years has created opportunities for petty crimes and pickpockets to thrive (Smile, 2019). Lastly, the quality of Hôi An tourism is reported poor service quality (Binh, 2019; Dung, 2018). Therefore, in order to overcome these issues, stakeholders should not only focus on what Hôi An can offer but on tourist needs and wants. However, prior to improving tourism planning and traditional heritage tourism products, it is vital to understand tourist experiences in Hôi An and how it affects tourist satisfaction. In fact, not many have examined tourist expectations, tourist experiences, and tourist satisfaction with the attributes of Hôi An. This study, thus, examined the effect of tourist experiences; in terms of heritage attractions, price, people, tourist amenities, and safety; on tourist satisfaction.

LITERATURE REVIEW

Cultural and Heritage Tourism

Of the many explanations of the term “heritage”, the most popular is that heritage is what we take over from the past, use for today and try our best to protect for future generations (Ashworth, 2003). Therefore, heritage tourism exploits both tangible and intangible factors. As heritage tourism has grown in popularity, its diverse aspects have drawn the attention of many scholars. This has led to a significant increase in studies on heritage management (Garrod & Fyall, 2000), inter-stakeholder conflicts in heritage destination management (Rahman, 2013). Tourism demand has been identified as central and crucial in developing the tourism industry as it provides destination managers with a detailed understanding of whom they are serving. The main themes include heritage tourist segmentation (Formica & Uysal, 1998; Huh et al., 2006), tourist behaviours, tourist expectations, tourist motivations, and tourist experiences (Chen & Chen, 2010; Huh & Uysal, 2004).

As is the case with the rest of the world, heritage tourism in Vietnam has become more popular in recent years as well. According to the Vietnam Tourism Product Development Strategy, the heritage tourism industry is the country's second largest attraction for international tourists after its sea-sand-sun tourism industry (Nhung, 2018). Along with this, multiple studies have examined destination management (Bui and Lee 2015), brand equity (Vinh et al., 2019), local attitudes toward tourism development (Adongo et al., 2017), and tourist perceptions of authenticity (Trinh et al., 2014).

As tourist demand is widely accepted as important in heritage tourism, studies on the subject have primarily investigated tourist motivation and segmentation (Poria et al., 2006). Not many studies have examined the correlation between tourists and the destinations that they have visited even though it plays a significant role in efficiently managing a tourist destination (Poria et al., 2006). Furthermore, although multiple studies have investigated tourist satisfaction at cultural and heritage destinations, studies evaluated tourist satisfaction using the attributes of a cultural and heritage destination are limited (Huh et al., 2006). Similarly, in Vietnam, not many studies have evaluated tourist satisfaction using the attributes of these destinations.

Measuring Tourist Satisfaction

Multiple marketing and psychology studies have examined consumer satisfaction. As such, there are conflicting opinions on the determinants of tourist satisfaction and how to accurately measure it (Oh & Parks, 1997). Of the diverse theories and models that have been proposed and empirically tested, performance only, expectation-performance, importance-performance, and expectancy-disconfirmation are the most widely accepted methods of measuring tourist satisfaction (Kozak, 2001). Of these measurement methods, the expectancy-disconfirmation model (Oliver, 1980) is the most widely accepted as it is applicable to many fields, particularly tourist satisfaction. Tourist satisfaction is measured by comparing pre-trip expectations and post-trip perceptions (Chen & Chen, 2010). According to the expectancy-disconfirmation model (Oliver, 1980), consumers buy products and services with pre-purchase expectations of how well a product or service will perform. If a product or service meets these pre-purchase expectations, satisfaction is confirmed. Conversely, if a product or service does not perform as expected, disconfirmation will occur (Churchill & Surprenant, 1982). Although multiple diverse fields have used the expectancy-disconfirmation model, its formation and the correlation between its core components have been called into question (Chen, Li & Song, 2016). Multiple studies have proven that pre-trip expectations are irrelevant (Boo & Busser, 2018; Ye et al., 2019) and that post-trip experiences are only a strong predictor of satisfaction (Yoon & Uysal, 2005).

It is significantly challenging to measure tourist satisfaction as tourism products and services are intangible and abstract in nature. Moreover, satisfaction is dynamic and complex. Therefore, multiple dimensions should be used to more accurately measure tourist satisfaction (Reisinger & Turner, 2003). As a result, pre-trip expectations should not be completely excluded from the measurement of tourist satisfaction as it provides valuable contextual information (Parasuraman et al., 1985). Tourist satisfaction-based studies commonly use the expectancy-disconfirmation model to explain the difference between pre-trip expectations and post-trip perceptions (C.-F. Chen & Chen, 2010; Huh et al., 2006). The expectancy-disconfirmation model can also be used to measure tourist satisfaction using the attributes of a destination. As an illustration, Huh (2002) used the model to examine the correlation between destination attributes and tourist satisfaction at cultural and heritage destinations while Bi et al. (2020) employed this model as a theoretical basis to investigate consumer satisfaction towards different attributes in the hotel industry.

In Vietnam and particularly in Hôi An, only a handful of studies have examined tourist satisfaction. Most of these studies used the service quality (SERVQUAL) scale to measure tourist satisfaction in different places such as in Bao Loc City (Giao et al. 2020), at a Wooden Trading Village in Hôi An (Giao and Son 2015), or in Hôi An Ancient Town (Giao et al. 2018). There are limited studies measure tourist satisfaction with specific destination attributes. A better understanding of tourist satisfaction will facilitate a more sustainably develop a tourism destination and there is a lack of studies that have measured tourist satisfaction using destination attributes. Thus, this present study used destination attributes to examined the extent to which tourist expectation and experience affect tourist satisfaction.

Correlation between Tourist Expectation, Experience, Destination Attributes, and Satisfaction

Satisfaction is subject to significant attention as it is a vital research area in the tourism, marketing, and psychology industry. Multiple experts have varying interpretations of satisfaction. Oliver (2014) defines satisfaction as “a consumer's fulfilment response. It is a judgment that a product or service feature, or the product or service itself, provides a pleasurable level of consumption-related fulfilment” and deems it to be a comparison between pre-trip expectations and post-trip experiences. As for expectation, Parasuraman et al. (1988) characterise expectations as the "desires or wants of consumers, i.e., what they feel a service provider should offer rather than would offer". According to Carman (1990), expectations of service quality comprise a "norm" that varies as each consumer has different backgrounds and needs. As other economic sectors view tourists as consumers, their tourist experiences are defined as consumer experiences. Tourist

experiences are defined as the correlation between the activities that tourists participate in at a tourism destination and the service efficiency of the destination (Quan & Wang, 2004). However, tourism providers cannot create tourist experiences but only circumstances in which tourists can create their own experiences (Mossberg, 2007). Tourist experiences are also affected by the information that they receive, their past experiences, and pre-trip expectations.

Multiple studies agree that it is effective and essential to explore consumer demands and service-related feedback to assess and enhance consumer satisfaction. Accordingly, it is important to regularly examine consumer demands, expectations, and feedback to serve them better. Expectations indirectly influence tourist satisfaction via disconfirmation with service performance (Oliver, 1980). This disconfirmation can be both positive and negative depending on real-life experiences versus consumer expectations. Sharmini Perera et al. (2015) used diverse destination dimensions, such as staff and site facilities, to investigate the expectations and perceptions of tourists at the Sigiriya World Heritage Site in Sri Lanka. The findings highlighted a lack of understanding tourist expectations, which is an essential factor when determining the success of a destination. Turner and Reisinger (1999) examined the importance of destination attributes and tourist expectations of Japanese tourists visiting Hawaii, America, and the Gold Coast, Australia based on a comparison of tourist expectations and the importance of the destination attributes, but with a priority on tourist expectations. Meanwhile, Omar et al. (2017) examined tourist satisfaction on Penang Island, Malaysia, by assessing the differences between their experiences and expectations. The study concluded that excellent tourist experiences with specific destination attributes provide a satisfactory tourist experience at the destination. Similarly, Ye et al. (2019) found that tourist experiences with destination services positively and directly influence tourism satisfaction. Therefore, extant studies have indicated that tourist experiences with destination attributes play a crucial role in increasing overall tourist satisfaction during a trip. These studies also confirm the effect of tourist experiences with destination attributes on tourist satisfaction.

Cultural and Heritage Destination Attributes

A destination is generalised as “an area with different natural attributes, features, or attractions that appeal to non-local visitors; i.e., tourists or excursionists. Past studies have used various aspects and strengths of the attributes of a destination to measure tourist satisfaction in different contextual settings. At cultural and heritage destinations, Kung (2018) examined the significant influence of tourist expectations; such as expectations with humanity, landscape, psychology, environment, and traffic; on tourist satisfaction and revisit intention at Hsinchu County Hengshan Township Bay; a cultural destination in Taiwan with a set of

17 attributes. Meanwhile, Huh et al. (2006) examined the correlation between tourist expectations, satisfaction, and four destination attributes; cultural and heritage attractions, general attractions, shopping attractions, and informational attractions; at the Historic Triangle in Virginia, America. Jusoh et al. (2015) used heritage attractions; such as traditional sites, architectural and historical buildings, music, dance, food, and local people; to examine the expectations and satisfaction of first-time and repeat tourists in Malacca, Malaysia. Some studies have used destination attributes to investigate tourist satisfaction in Vietnam. For example, Truong and Foster (2006) used attributes; such as safety, food prices, historical sites, friendly staff and locals, cheap souvenirs, and crowd attractions to name a few; to examine tourist satisfaction in Vietnam while Long and Vinh (2013) investigated the correlation between tourist expectations, satisfaction, and destination loyalty at the capital of Hanoi; a wealthy cultural destination. Khuong and Nguyen (2017) used cultural and historical sites, local food, price, safety, infrastructure, nature, entertainment, negative factors, and destination image to investigate the effect of tourist satisfaction on revisit intention. Lastly, Nhan and Dua (2019) examined the factors affecting cultural tourist satisfaction at Bac Lieu province. Therefore, it is evident that every destination has a combination of multiple attributes and unique selling points with which to promote tourism development.

METHODOLOGY

Study Area: Hôi An World Heritage Site

Located in Central Vietnam, Hôi An Hôi An; which is home to 1068 old houses (Vietnam National Administration of Tourism, 2019); is the only place in Vietnam to preserve 100% of its original buildings and architecture. When it first became a tourism destination in 1999, Hôi An only welcomed 100,000 tourists. However, at present, an average of 2.3 million people visit it annually (Vietnam National Administration of Tourism, 2019). Approximately 3.22 million visited Hôi An in 2017 (Hôi An World Heritage Center, 2018), *4.99 million in 2018* (Linh, 2019a), and *5.35 million in 2019* (Linh, 2019b).

A quantitative case study research design was used to examine tourist expectations as well as tourist experiences in terms of attributes; such as heritage attractions, price, local people, amenities, and safety; and their effect on tourist satisfaction in Hôi An. To develop a research instrument, a set of 23 attributes were retrieved from extant studies and divided into five main categories: (1) heritage, (2) price, (3) people, (4) tourist amenities, and (5) safety (Huh et al., 2006; Jusoh et al., 2015; Khuong & Nguyen, 2017; Nhan & Dua, 2019; Perera et al., 2015; Truong & Foster, 2006; Turner & Reisinger, 1999). A 5-point Likert scale that ranged from 1 = *very strongly disagree* to 5 = *strongly agree*, 1 = *very poor* to 5 = *excellent*, and 1 = *strongly dissatisfied* (1) to 5 = *strongly satisfied*

was used to collect the tourist expectations, tourist experiences, and tourist satisfaction of the respondents. The eligibility criteria included tourists who were above the age of 18 and had stayed in Hoi An Ancient Town for at least a day in the past 6 months. The data was collected using on-site. All the respondents were first asked if they had stayed in Hoi An for at least a day. Due to the constraints of time, the data collection process was terminated once 275 responses had been collected. Of this number, 269 of the responses were usable; which is 70% of the required sample size of 384. IBM® SPSS® Statistics was then used to analyse the collected data. A descriptive analysis was first conducted to determine the level of tourist satisfaction. A correlation analysis was then intentionally performed before regression to determine the extent to which tourist expectations and tourist experiences with each group of attributes affect tourist satisfaction. A multiple regression analysis was then conducted to determine the extent to which tourist expectations and tourist experiences affect overall tourist satisfaction at Hoi An Ancient Town.

RESULTS

Demographic characteristics

Table 1 shows the respondents' demographic features encompassing gender, age, levels of education, origin, and income. First, the number of females (50.6%) and males (49.4%) were accounted an even proportion of respondents. Most of respondents were from the age of 25 to 44 (78.1%) while the older groups of 45 - 54 years old (15.2%), and the above 54 years old (6.7%) were small. Undergraduate was the largest percentage of level of education (37.9%), Diploma/ Degree (23.4%), high school students (19.7%) and Master/ PhD (19.0%). Next, most of respondents were domestic tourists (84.4%).

Table 1: Demographic information

Variable	Frequency	Percentage (%)
Gender		
Male	133	49.4
Female	136	50.6
Age (years old)		
18 -24	58	21.6
25 - 34	77	28.6
35 - 44	75	27.9
45 – 54	41	15.2
Above 54	18	6.7
Education levels		
High school	53	19.7
Undergraduate	102	37.9

Variable	Frequency	Percentage (%)
Diploma/Degree	63	23.4
Master/ PhD	51	19.0
Origin		
Southern	64	23.8
Central	71	26.4
Northern	92	34.2
Western	39	14.5
Asia	1	0.4
Africa	2	0.7

Correlation Analysis

Table 2 depicts the correlation between tourist expectations and overall tourist satisfaction as well as tourist experience and overall tourist satisfaction. The first section illustrates the correlation coefficients of tourist expectations and overall tourist satisfaction; which were insignificant as five of the six factors had $p > 0.01$ (2-tailed). More specifically, the Pearson correlation between tourist expectations and overall tourist satisfaction at heritage attractions was 0.205 and $p = 0.001 < 0.01$. Therefore, only the heritage attractions expectation factor significantly affected overall tourist satisfaction as the other five expectation factors; price, local people, staff, tourist amenities, and safety; had $p > 0.01$.

Table 2: Correlations analysis of overall tourist satisfaction

Variables		Correlations						
		Heritage	Price	Local People	Staff	Amenities	Safety	
Overall satisfaction	Expectation	Pearson Correlation	.205**	.123*	.115	.086	.076	.014
		Sig. (2-tailed)	.001	.044	.059	.162	.213	.822
		N	269	269	269	269	269	269
	Experience	Pearson Correlation	.569**	.684**	.649**	.699**	.693**	.664**
		Sig. (2-tailed)	.000	.000	.000	.000	.000	.000
		N	269	269	269	269	269	269

Note: ** $p \leq 0.01$

The second section of Table 2 depicts the correlation analysis of tourist expectations and overall tourist satisfaction, which was, generally, strong, positive, and significant a $p = 0.01$ (2-tailed). More specifically, all six experience factors had $p = 0.000 < 0.01$, indicating significant correlations. Furthermore, the

Pearson correlation of heritage attractions was 0.569, price was 0.684, local people was 0.649, staff was 0.699, tourist amenities was 0.693, and safety was 0.664.

Multiple Regression Analysis

Table 3 shows the regression results of tourist expectations, tourist experiences, and overall tourist satisfaction. In summary, F ratio = 2.852, p of the F test = 0.010 > 0.001, tolerance ranged between 0.295 to 0.594, and the variance inflation factor (VIF) ranged between 1.684 to 3.928 < 10. Five of the six factors; with the exception of the heritage attraction factor ($p = 0.03 < 0.05$); were deemed insignificant as the p of the t-test > 0.05. The insignificant results of the F test and t-test indicated the significance of tourist expectations in explaining the variance of overall tourist satisfaction for the overall data.

The second section depicts the regression results of tourist experience and overall tourist satisfaction. As the F ratio = 75.080, p of F test = 0.000 < 0.001, tolerance ranged between 0.335 to 0.524, VIF ranged between 1.910 to 2.983 < 10, it indicated the appropriateness and significance of tourist experience in predicting the variance of overall tourist satisfaction. As the adjusted $R^2 = 0.624$, it suggests that up to 62.4% of the variance of the overall tourist satisfaction dependent variable was explained by the six independent variables; tourist experiences with heritage attraction, price, local people, staff, tourist amenities, and safety. This was further verified as all six factors had p of t-test < 0.05, which indicated their significant influence on overall tourist satisfaction. In descending order, the experience factors with the most significant influences were staff ($\beta = 0.221$, $t = 3.541$, $p = 0.000 < 0.05$), price ($\beta = 186$, $t = 2.914$, $p = 0.004 < 0.05$), safety ($\beta = 0.170$, $t = 2.957$, $p = 0.0030 < 0.05$), tourist amenities ($\beta = 0.163$, $t = 2.524$, $p = 0.012 < 0.05$), and local people ($\beta = 0.148$, $t = 2.571$, $p = 0.011 < 0.05$). Only the heritage attraction experience factor had an insignificant influence as $p = 0.305 > 0.05$. Therefore, of the five factors, staff, price, and safety most significantly affected overall tourist satisfaction.

Table 3: Regression tourist expectations, tourist experiences, and overall tourist satisfaction

Coefficients									
Model		Unstandardised Coefficients		Standardised Coefficients	t	Sig.	Collinearity Statistics		Model summary
		B	Std. Error	Beta			Tolerance	VIF	
Expectation	(Constant)	3.030	.301		10.079	.000			R= 0.248 R ² = 0.061 Adjusted R ² = 0.040 F ratio = 2.852 Significance F= 0.010
	Heritage	.259	.087	.231	2.970	.003	.594	1.684	
	Price	.112	.114	.089	.980	.328	.437	2.288	
	Local people	.091	.108	.086	.838	.403	.342	2.928	
	Staff	-.064	.116	-.061	-.554	.580	.295	3.390	
	Amenities	.012	.121	.011	.102	.919	.296	3.375	
	Safety	-.187	.097	-.181	-1.924	.055	.407	2.459	
Experience	(Constant)	.245	.188		1.304	.193			R= 0.795 R ² = 0.632 Adjusted R ² = 0.624 F ratio = 75.080 Significance F= 0.000
	Heritage	.064	.062	.053	1.027	.305	.524	1.910	
	Price	.207	.071	.183	2.914	.004	.356	2.812	
	Local people	.152	.059	.148	2.571	.011	.423	2.362	
	Staff	.220	.062	.221	3.540	.000	.360	2.780	
	Amenities	.164	.065	.163	2.524	.012	.335	2.983	
	Safety	.174	.059	.170	2.957	.003	.423	2.363	

Note: Sig F test < 0.001
Sig t-test: p < 0.05

DISCUSSION

Generally, the level of overall tourist satisfaction was high and the percentage of tourists who felt satisfied and strongly satisfied was large. The correlation analysis indicated that tourist expectation factors had a weaker correlation with overall tourist satisfaction than tourist experience factors, which had strong, positive, and significant correlations with overall tourist satisfaction. More specifically, the staff, tourist amenities, and price experience factors had the highest Pearson correlation values. These results were corroborated by that of the regression analysis, which indicated that five of the six experience factors

significantly affected overall tourist overall satisfaction. Of these five factors, staff, tourist amenities, and safety were the most significant. Tourists prioritise safety when choosing a holiday destination (Thapa & Lee, 2017). Furthermore, it is believed to be a criterion with which to evaluate the success of a destination's tourism development (Athula, 2015). In the same vein, as tourism is a "people-to-people" service industry, the human element has always played a vital role in the efficient performance of the tourism industry and tourist satisfaction Yoon & Uysal, 2005). Finally, tourist amenities include any and all facilities that cater to needs of tourist (Omar et al., 2017; Oviedo-García et al., 2019) and supports every tourist activity at or between destinations; such as transportation, tourist assistance centres, relaxation, shopping, toilets and washrooms, parking lots, and resting spaces. Tourists always demand easily accessible, available, reliable, and standardised amenities that support their actives during a trip (Huh et al., 2006; Maghsoodiv Tilaki et al., 2017).

CONCLUSION

The purpose of this present study; which was to ascertain the extent to which tourist expectations and tourist experiences at heritage attractions, price, people, tourist amenities, and safety; affect tourist satisfaction. The findings indicate that the tourist experiences with staff, safety, and tourist amenities significantly affect tourist satisfaction in Hôi An. However, this study found that role of tourist expectations in measuring tourist satisfaction did not align with that of expectancy-disconfirmation model. However, tourists need to contextually outline their expectations as this information is crucial in understanding what they expect from a destination. This study provides insight into tourist behaviours; especially tourist expectations, tourist experiences, and tourist satisfaction. Therefore, tourism management stakeholders in Hôi An can use this information to develop effective marketing plans and activities. Furthermore, an understanding of what tourists expect and think about Hôi An is important as it can be used to develop products and services that satisfy tourists' needs and increase the competitiveness of Hôi An. The case study of Hôi An is evidence that tourism development is possible at world heritage sites. At such sites, tourists prioritise the heritage factor as they hope to garner experiences, however, local people, tourism staff, tourist amenities, and price also affect tourist satisfaction. Further research is needed to examine tourist behaviours under normal circumstances, after the many hardships of the early 2020s. As such, future studies should combine different domains; such as motivations and destination choice behaviour; attitudes and satisfaction; personality and decision-making; and perception, satisfaction, and loyalty to name a few; to better understand the complexities of tourist behaviours instead of examining a single feature.

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Received: 26th June 2023. Accepted: 11th August 2023



PLANNING MALAYSIA:

Journal of the Malaysian Institute of Planners

VOLUME 21 ISSUE 4 (2023), Page 349 – 363

MALAYSIA ASSESSMENT MEASURE FOR MODERN RURAL DEVELOPMENT (MAMRD): APPRAISAL INDEX AND INTERVENTION

**Mohd Fadzil Abdul Rashid¹, Seng Boon Lim², Muhamad Asri Abdullah Kamar³,
Muhamad Azrul Azwan Azman⁴, Hafriz Suhairi Mohd Rejab⁵**

*^{1,2,3,4}Department of Built Environment Studies and Technology,
College of Built Environment,*

UNIVERSITI TEKNOLOGI MARA, PERAK BRANCH, MALAYSIA

⁵IZM Consultant,

SHAH ALAM, SELANGOR, MALAYSIA

Abstract

Technology disruption makes it difficult for rural areas to cope with digital infrastructure and people's readiness to embrace changes. Indeed, technological advancements provide greater opportunities to transform rural areas into instinctive living environments - destinations to invest, work, live, and visit. However, a significant question arises: how far has this innovative technology been practised in rural activities? The current paper aims to demonstrate the application of a Malaysia Assessment Measure for Modern Rural Development (MAMRD); it incorporates the rural technology practices for appraising the score (index) towards a modern rural approach, thereby enabling lessons to be learned for further improvements. From this measurement, it was found that the aqua-tourism and smart community-based village (Kampung Padang Rumbia, Pekan, Pahang) scored 55.92% in the overall index, which could put it into a three-star rating village. The fishing-based village (Kampung Tepi Sungai, Sungai Muda, Kedah) gained two-star with 30.51%. The results become the self-checked intervention for them to move towards a modern rural approach. In the end, MAMRD shall assist all stakeholders who rely on rural and community transformation, such as Institute for Rural Enhancement (INFRA) and Jawatankuasa Pengurusan Keselamatan Kampung (JPKK). Undeniably, this paper also reveals the agendas of Sustainable Development Goals (SDGs) towards societal harmony and happiness.

Keywords: Modern rural, MAMRD, Resilient-liveable-and-smart, Technology practices, Rural actors' behaviour

¹ Associate Professor at Universiti Teknologi MARA Perak Branch. Email: mohdf032@uitm.edu.my

INTRODUCTION

A future transition-living environment of rural areas in Malaysia is characterised by two essential national policies, namely Dasar Perancangan Fizikal (DPF) Desa Negara 2023 with the vision of rural prosperity, nation prosperity (DPF Desa Negara, 2017) and Dasar Pembangunan Luar Bandar (DPLB) 2030, which promote a prosperous, inclusive, sustainable, and holistic rural transformation (DPLB, 2018). Both policies put a special recognition on rural transformation, and they remain as the upfront agenda in Malaysia's development blueprint. The biggest challenge today is to narrow the gap between urban and rural living standards; it is the core issue to be appropriately planned and it requires urgent intervention. However, the development progress towards creating a modern rural area is paramount as the digital technology practices, such as IoT (Internet of Things), have already been captured in rural footprint, especially in agricultural, business and tourism activities.

The term 'modern' has been added in rural development agendas for a long time since in 1971 under the National Economic Policy (NEP, 1971-1990) which promotes rural modernisation approach by bringing modern techniques into agricultural cultivation, improving drainage and irrigation for agricultural lands, the establishment of institutions for credit and marketing facilities, the development of rural infrastructure facilities, new transportation and communications facilities and the introduction of new secondary schools in the rural areas (Bruton, 2007). Then, the agenda continued with the strategies of people empowerment under the *Falsafah dan Strategi Baharu Pembangunan Luar Bandar* in 1994, that advocates the catalyst of programme *Gerakan Desa Wawasan* towards making villages more advanced, attractive, and beneficial through the process of raising awareness and changing the attitude of rural people towards rural transformation. In 2010, a strategic action plan blueprint for the so-called *Pelan Induk Pembangunan Luar Bandar* (PIPLB) was introduced to promote rural development based on three thrusts: sustainable and advanced economy, prosperous society, and environmental sustainability (KKDW, 2010). This effort has been put forward in the current policies of the DPF Desa Negara 2030 and DPLB 2030 with specific niches and discoveries.

Inspired by that, this research introduces a modern rural approach to link it to technology disruption in rural development, particularly IoT, robotics and big data analytics used in various fields. These technologies are expected to lead, support and solve many everyday life problems in different sectors in rural regions, such as farming, SMEs, energy usage, and healthcare (Alabdali et al., 2023). In this case, the term smart is added to both terms used in the DPF Desa Negara 2030, namely resilient and liveable rural becoming a modern rural based on the three dimensions namely, resilient, liveable, and smart. Rashid (2021) and Rashid et al. (2021) provided the details on this matter. Based on the reports found

in the DPF Desa Negara 2030 and DPLB 2030, the technology practices in rural activities are less emphasised. The smart concept is adopted from the smart village approach. It is about rural communities taking the initiative to find practical solutions to enhance livelihoods – both to the severe challenges they face and, significantly, to exciting new opportunities that transform rural areas (Figure 1) often using the power of digital technologies and innovative thinking beyond the village itself.



Figure 1: Smart village approach
Source: Rashid (2021)

From this, the MAMRD is formulated as a synergising tool for rural development transition to a modern approach. It is a tool that complements PLANMalaysia's Spatial Characteristics of Rural Malaysia System (S-CHARMS) by incorporating innovative technology practices for a star rating index. Hence, this paper attempts to demonstrate the applications of the MAMRD to appraise the score (index) towards a modern rural approach, which will enable lessons to be learned for further improvements and expediting rural transformation, societal harmony and happiness to cope with the SDGs aspiration (United Nation, 2015).

MALAYSIA ASSESSMENT MEASURE FOR MODERN RURAL DEVELOPMENT (MAMRD)

The MAMRD refers to the modern rural measurement tool (Figure 2) developed by Rashid et al. (2020) that is tailored to the future rural assessment in Malaysia. It offers a measurement tool for synergising rural change to meet the rural

people’s desires within the three dimension-objectives measure: D1-Resilient (Rural economic booster and catalyst infrastructures), D2-Liveable (Rural characters and social well-being infrastructures), and D3-Smart (Smart and green technology practices). It is constructed on the 141 performance criteria from the dimensions above (Figure 3). The formulation of the MAMRD is the missing approach for implementing existing government policies, such as the DPF Desa Negara 2030 and DPLB 2030. Rashid et al. (2021) and Rashid (2021) further explained the framework for the MAMRD formulation.

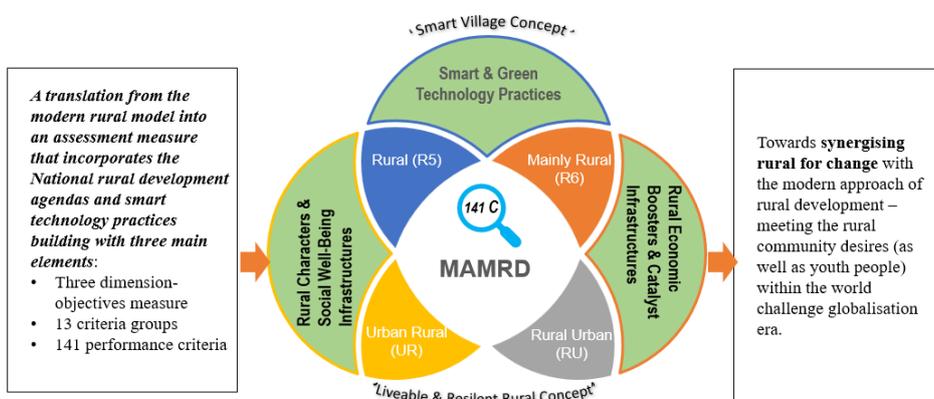


Figure 2: The MAMRD’s three dimension-objectives measure for village index
 Source: Rashid (2021)

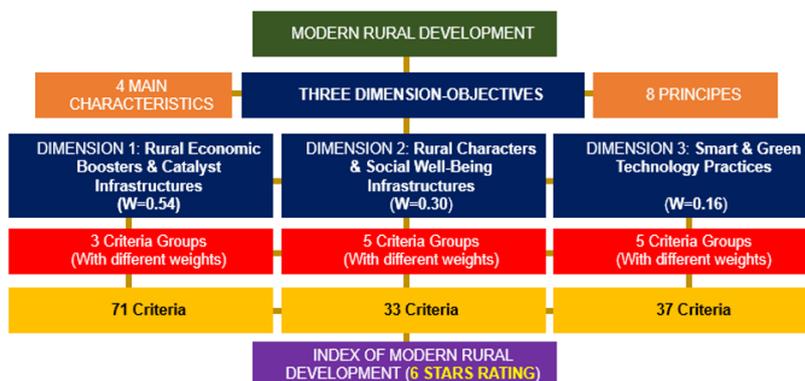


Figure 3: MAMRD’s structure
 Source: Rashid (2021)

Based on Figure 3, Resilient criteria (D1) rely on the readiness and preparedness of rural areas and their community in all aspects (physical, social, economic, etc.) to face uneven scenarios like disasters - ability to recover or speed

of recovery (fast). Liveable criteria (D2) involve preserving rural characters, attractiveness, comfort, adequate infrastructures and supports, and economic opportunities as desired by all, including entrepreneurs, investors and urban residents. Moreover, Smart criteria (D3) rely on smart technology practices (intelligent rural supports), providing solutions to enhance livelihoods, increasing rural productivity, new job creation, income, rebranding, marketable products, and rural visibility, nationally and globally. Thus, the MAMRD exercise shall benefit all stakeholders who rely on rural transformation, particularly in assisting their decision-making on budget and resource allocation, utilising the available digital technology, designing training programmes, improving needed services, and so on. The relevant stakeholders are Institute for Rural Enhancement (INFRA), *PLANMalaysia*, *Jawatankuasa Pengurusan dan Keselamatan Kampung* (JPKK), and others. This research shall reveal the agendas of Sustainable Development Goals (SDGs) towards achieving societal harmony and happiness and KEGA 10 of the Shared Prosperity Vision 2030 - which aims to empower centres of excellence in synergising rural areas for changes.

METHODOLOGY

The Application Process

The application of the MAMRD is made through the Focus Group Discussion (FGDs) (Figure 4) on two case studies: Case 1 *Kampung Padang Rumbia* – as aqua-tourism and smart community-based village, and Case 2 *Kampung Tepi Sungai* – as a fishing-based village. Rashid (2020) in his study provided details on the FGD implementation. The primary purpose is to determine the score (index) for each participating village in order to move towards a modern rural approach, in which lessons are offered to be learned for further improvements.

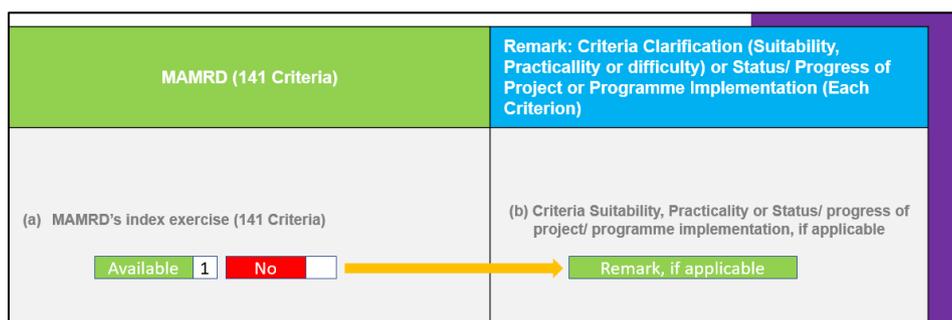


Figure 4: MAMRD application through an FGD

As shown in Figure 4, each criterion's availability in the case study would be assigned one point. The total score was then weighed according to the

dimensions and criteria groups. Dimension 1 is worth 54% of the total marks, Dimension 2 is 30%, and Dimension 3 is 16%. All marks were added together and summed to determine the final score or overall index for each case study. The village is assigned a star rating based on its final score, which reflects its MAMRD index performance. As shown in Table 1, the star ratings range from 0 to 6, and this corresponds to a score of 0 to 100.

Table 1: Star rating to pursue in the MAMRD index

Star Rating	*MAMRD Rating Range (%)
☆☆☆☆☆☆	>90 - 100
☆☆☆☆☆	>75 - <90
☆☆☆☆	>60 - <75
☆☆☆	>45 - <60
☆☆	>30 - <45
☆	>15 - <30
	>0 - <15

Note: *This star rating is adopted from Malaysia Research Assessment Instrument (MyRA) – an established rating index in Malaysia.

Source: Shamsir (2021)

Introduction to the Case Studies

Case 1: Kampung Padang Rumbia – As Aqua-Tourism and Smart Community-Based Village

Kampung Padang Rumbia is located in Penyor Mukim, Pekan District, Pahang. It is categorised as a main village with less than 2,500 people. The basic economy for this village is based on palm oil plantation, farming, and caged fish farming, which has been receiving high demand for fish such as Patin and Kelah. Moreover, aqua-tourism activities are expanding in line with the integration of caged fish farming and floating chalets: there are also ATV activities on the small islands and boat rentals for fishing. In fact, it is the first village in Malaysia to become the pilot for a smart village project based on flood sensor devices installed along the Sungai Pahang to prepare for evacuations. The government has also installed a Wi-Fi substation for surveillance systems in 10 community hotspots, including schools, clinics, police stations, mosques, fish farms, computer centres, and Sungai Pahang. Local people using a smartphone will be notified through an application (App) when the river in their area reaches a critical level.

Case 2: Kampung Tepi Sungai – as a fishing-based village

Kampung Tepi Sungai is a small fishing village in the Township of Kuala Muda, located at the mouth of Sungai Muda. As a fishery collection centre and selling market, this fishing village contributes significantly to the local economic

development. Historically, Kuala Muda is an essential port in Kedah, and it is well known for its whispering market (Pasar Bisik), which is named after the whispering sales practice, which is found only in a few places around the world. However, this fishing village suffered the effects of the Tsunami in 2004 which had left the community and their village devastated.

RESULTS AND DISCUSSIONS

Results for Overall Index

An overall index (a composite score) for the MAMRD is calculated similarly to other index measures by adding all dimension scores derived from the overall weighted scores of the criteria groups. Table 2 displays the overall MAMRD index score for Kampung Padang Rumbia and Table 3 for Kampung Tepi Sungai. It is known as the overall composite index, and it is the sum of the final sub-total score of each dimension. The marks for each final sub-total score are the sum of the weighted scores for each criteria group. Each criteria group derives its scores from the sum of the total criteria score, which is determined by the availability of measured criteria on the site.

Table 2: Overall MAMRD’s index gained for Kampung Padang Rumbia and observations

Dimensions	Final Score Gained	Criteria Groups	Raw Score Gained (%)	Observations
D1: Rural Economic Boosters & Catalyst Infrastructures <i>Weight = 0.54</i>	31.89	CG1-D1: Economic and Rural Services Centre (Small Town) <i>Weight = 0.50</i>	41.67	There is no small town located within 20-40km to Kampung Padang Rumbia, thus, people obtain their goods and services in Pekan, Pahang. So, the score gained is referred to the services offered by the Pekan town.
		CG2-D1: Rural Growth Centre (RGC) <i>Weight = 0.25</i>	6.67	There is no dedicated RGC developed for the community within the Pulau Manis Mukim. Kampung Padang Rumbia has the potential to be promoted as an RGC with economic-services enhancement. The score gained is based on the existing functions served by Kampung Padang Rumbia.
		CG3-D1: Rural economic cluster (agricultural, entrepreneurial, tourism) <i>Weight = 0.25</i>	10.71	Only 3 out of 7 criteria were available. To diversify rural economic activities and infrastructures, there is a room for potential exploration offered by the MAMRD.
Sub-Total Score			59.05	
Reduced to 54%			31.89	Or only 59% achieved

Dimensions	Final Score Gained	Criteria Groups	Raw Score Gained (%)	Observations
D2: Rural Characters & Social Well-Being Infrastructures <i>Weight = 0.30</i>	18.37	CG1-D2: Rural spatial characters and heritage <i>Weight = 0.064</i>	2.40	Only 3 out of 8 criteria were available. Follow MAMRD's proposed criteria to enhance the rural characters and heritage.
		CG2-D2: Transportation networks of rural-town-city, and rural accessibility <i>Weight = 0.275</i>	15.71	Only 4 out of 7 criteria were available. Follow MAMRD's proposed criteria to improve and strengthen rural-town-city linkages.
		CG3-D2: Efficient infrastructure <i>Weight = 0.402</i>	26.80	Only 6 out of 9 criteria were available. Follow MAMRD's proposed criteria to enhance rural infrastructures concerning sustainable community practices.
		CG4-D2: Internal village amenities <i>Weight = 0.098</i>	5.60	Only 4 out of 7 criteria were available. Follow MAMRD's proposed criteria to accommodate everyone with suitable support services.
		CG5-D2: Rural governance (JPKK) and database <i>Weight = 0.161</i>	10.73	Only 2 out of 3 criteria were available. Rural village database is required to enhance rural governance.
Sub-Total Score			61.25	
Reduced to 30%			18.37	Or only 61% achieved
D3: Smart & Green Technology Practices <i>Weight = 0.16</i>	5.66	CG1-D3: Rural agricultural, infrastructures, technologies and innovations <i>Weight = 0.40</i>	16.67	Only 5 out of 12 criteria were available.
		CG2-D3: Rural entrepreneurial technologies and innovations <i>Weight = 0.29</i>	8.29	Only 2 out of 7 criteria were available.
		CG3-D3: Rural marketing and e-commerce <i>Weight = 0.13</i>	3.25	Only 1 out of 4 criteria were available.
		CG4-D3: Village smart and green technology practices <i>Weight = 0.12</i>	6.00	Only 4 out of 8 criteria were available.
		CG5-D3: Community-IoT-based smart technology practices <i>Weight = 0.06</i>	1.20	Only 1 out of 5 criteria were available.

Dimensions	Final Score Gained	Criteria Groups	Raw Score Gained (%)	Observations
Sub-Total Score			35.40	
Reduced to 16%			5.66	Or only 35% achieved
Overall Index (Overall Composite Index)			55.92	3 Stars

As indicated in Table 2, Kampung Padang Rumbia scores 55.92% in the overall index, which can put it into a three-star rating village (see Table 1). It carries a good score for Dimension 1 (D1), which is 31.89% out of 54%, followed by 18.37% out of 30% (D2) and only obtains 5.66% out of 16% for D3. The fact that the low-level result for D3 is already expected is due to multiple factors, such as the readiness of rural actors for the adoption of the technologies (Salemink et al., 2017, Abdul Rashid, 2016), the inadequacy of digital infrastructures, mindset, and behaviours, as well as others (Alabdali et al., 2023). This indicates that the MAMRD distinctively assesses the strengths and weaknesses of Kampung Padang Rumbia's performance with regard to the specific dimension measure. It shows that Kampung Padang Rumbia exhibits a positive example in developing the village for rural modern living, besides the future initiatives or strategies in providing infrastructures, facilities and services of higher standards. For that matter, the MAMRD matches this aspiration for synergising and boosting rural areas and community changes.

Table 3: Overall MAMRD's index gained for Kampung Tepi Sungai and observations

Dimensions	Final Score Gained	Criteria Groups	Raw Score Gained (%)	Explanations
D1: Rural Economic Boosters & Catalyst Infrastructures <i>Weight = 0.54</i>	20.62	CG1-D1: Economic and Rural Services Centre (Town) <i>Weight = 0.50</i>	26.04	Only 25 out of 48 criteria are available for this group. The criteria related to economic services have not fulfilled the conditions for the MAMRD such as gas station, souvenir shop, hotels, and others. Furthermore, the infrastructure facility criteria such as recreational park and playground were also unavailable.
		CG2-D1: Rural Growth Centre (RGC) <i>Weight = 0.25</i>	5.00	It was learnt that weak sub-criteria of economic development, infrastructure facilities, services and human development centres cause the RGC of that village to not be working and accommodating for the local residents.
		CG3-D1: Rural economic cluster (agricultural, entrepreneurial, tourism)	7.14	The Whispering Market becomes the pulse of this criterion, but it was not supported by other criteria. Only 2 out of 7 criteria were available.

Dimensions	Final Score Gained	Criteria Groups	Raw Score Gained (%)	Explanations
		<i>Weight = 0.25</i>		
Sub-Total Score			38.18	
Reduced to 54%			20.62	Or only 38% achieved
D2: Rural Characters & Social Well-Being Infrastructures <i>Weight = 0.30</i>	9.36	CG1-D2: Rural spatial characters and heritage <i>Weight = 0.064</i>	3.20	Only 4 out of 8 criteria were available. Follows MAMRD's proposed criteria to enhance the rural characters and heritage.
		CG2-D2: Transportation networks of rural-town-city, and rural accessibility <i>Weight = 0.275</i>	11.79	All 7 criteria were available. No bus stop is provided because public transportation is no longer provided and it does not enter the village area.
		CG3-D2: Efficient infrastructure <i>Weight = 0.402</i>	13.40	Only 3 out of 9 criteria were available. Infrastructure facilities are still insufficient, especially IT-related services and sites for solid waste disposal and recycle centre.
		CG4-D2: Internal village amenities <i>Weight = 0.098</i>	2.80	Only 2 out of 7 criteria were available. The provided facilities are unable to satisfy the residents' needs, especially places for recreation, transit in the event of disaster and other suggestions in the MAMRD.
		CG5-D2: Rural governance (MPKK) and database <i>Weight = 0.161</i>	0.00	All criteria were unavailable.
Sub-Total Score			31.19	
Reduced to 30%			9.36	Or only 31% achieved
D3: Smart & Green Technology Practices <i>Weight = 0.16</i>	0.53	CG1-D3: Rural agricultural, infrastructures, technologies and innovations <i>Weight = 0.40</i>	3.33	Only 1 criterion was available which is drainage management. The respondents agreed that it is the time to prepare the village environment towards modern rural orientation that can attract the youths to involve in the village development.
		CG2-D3: Rural entrepreneurial technologies and innovations <i>Weight = 0.29</i>	0.00	All the evaluated criteria were not available. The criteria in MAMRD are extremely required by the villagers to improve their youth and the development in the village.
		CG3-D3: Rural marketing and e-commerce <i>Weight = 0.13</i>	0.00	All the evaluated criteria were not available. The criteria in the MAMRD offers the local residents facility to improve the village's business and economic activities, as

Dimensions	Final Score Gained	Criteria Groups	Raw Score Gained (%)	Explanations
				well as accommodate the bumiputra entrepreneurs.
		CG4-D3: Village smart and green technology practices <i>Weight = 0.12</i>	0.00	All the evaluated criteria were not available. The criteria in the MAMRD enables youths to have the basics, as well as knowledge and skills required by the village. Furthermore, the village was once hit by a tsunami in 2004, hence, the disaster risk warning is crucial.
		CG5-D3: Community-IoT-based smart technology practices <i>Weight = 0.06</i>	0.00	All the evaluated criteria were not available. The criteria in the MAMRD could broaden the village youths' mind and its implementation is suggested thoroughly.
Overall Score			3.33	
Reduced to 16%			0.53	Or only 0.3% achieved
Overall Index (Overall Composite Index)			30.51	2 Stars

Furthermore, Table 3 shows that Kampung Tepi Sungai scores 30.51% in the overall index or achieves a two-star rating. It was learnt that Kampung Tepi Sungai was left behind in D3 with 0.3%. It indicates the lack of the younger generation involvement in rural economic livelihoods and programmes. Moreover, three groups of criteria in D2, which are efficient infrastructure, internal village amenities, and rural governance (JPKK) and database, also score low. For D1, there is also a group of criteria that recorded a low score, which is the rural economy cluster (agriculture, entrepreneurial, tourism) because most of this group's criteria do not exist. The same situation is recorded for the criteria of the provision of infrastructure facilities to offer the best service to residents.

Additionally, both case studies indicate that the younger generation lacks skills and trainings. They are also less involved in the rural development activities. A fundamental issue is to address this need for knowledge sharing by the concerned parties, local champions, and experts, particularly on the most recent technologies and agricultural equipment. This issue has been well addressed in the MAMRD criteria and it has also dedicated programmes, particularly sharing tips and methods from successful entrepreneurs (among villagers or outsiders), as well as benchmarking trips, which could improve the relevant individuals' way of thinking and technology practices in agriculture and other ventures. Hence, JPKK has a significant role in being proactive by acting and turning an issue into an opportunity for the welfare and prosperity of the community. Efforts to transform those in rural areas must be managed by the community and the corresponding agencies collectively.

Implications and Interventions

From the above discussions, the implementations of the MAMRD for both case studies have led to the following implications and results would also point to intervention strategies for rural change. They are summed up as follows:

- The RGC is dysfunctional and to an extent, inexistent. The community has to rely on the nearest town or city centre to get goods and services. This issue is also highlighted in the DPF Desa Negara 2030 (The DPF Desa Negara, 2017).
- The future focus should be more on D3 (smart and green technology practices) to ensure that rural development will lead to the emergence of modern village and knowledge-based society, which is believed to amplify productivity, income, investment, and prosperity of the rural community living. This matter is given less focus in the DPF Desa Negara 2030 and the DPLB 2030.
- The MAMRD is applied to assess modern rural characteristics and is applicable for all village types.
- Implementing the MAMRD brings rural actors towards implementing strategies and action plans outlined in the DPF Desa Negara 2030 and the DPLB 2030 – the missing link is the significant approach at the implementation stage.
- Now is the time to build a society based on passion, compassion, and Islamic values to ensure responsible and productive rural future generations.

To the best of our knowledge, the MAMRD is a pioneer project in Malaysia providing a rating tool index for rural development progress towards modern approach-incorporating technology practices for rural livelihoods and solutions. As the above-mentioned, the current measurement by PLANMalaysia through S-CHARMS only focuses on the spatial characteristics of rural areas, which have nothing to do with the rating index, which is the most crucial dimension of rural progress assessment.

Furthermore, there are crucial issues of rural actors' behaviours, especially the youths: only some have been proactive and not many are interested in accelerating rural transformation programmes by joining sectors such as entrepreneurship, agriculture, and tourism (Abdul Malek et al., 2022; Rashid et al., 2021). Both case studies find similar scenarios among the youths. Therefore, this issue calls for an urgent study to assess the relationship between rural actors' behaviour and rural development progress in materialising the rural transformation agendas, namely closing the rural-urban gap (remain one of the UN DESA agendas) (UN DESA, 2021) and increasing household income and

rural prosperity. However, rural transformation progress crucially relies on the planning and execution levels, as well as specifically on the way rural actors proactively respond (take action) to the government's agendas. This is a big challenge in rural transformation assessment which will be the next research project in the path of achieving a society 5.0@rural Malaysia – societies' behaviours, are capable of expediting the rural transformation - the adoption of high technology, learning society, global minds set, modern-society attributes, business and SMEs minded, market profiteering, and the others will provide a shift from a government-centric to rural-actor-centric initiatives or actions.

CONCLUSIONS

This paper has discovered the capabilities of MAMRD to assess rural change by using a modern approach that reflects the three main dimensions namely resilient, liveable, and smart. The results show rural development progress, particularly the case studies, requires future interventions to cope with its weaknesses, especially in the technology practices and local champions or experts as well as the youth participation in driving rural transformation. With the 141 performance criteria, the MAMRD can be a pocket master checklist promoting a modern rural approach and guiding the concerned rural parties for their full support in rural transformation. Therefore, this research has significant impacts on Quintuple Helix that are listed as follows:

- a. Society: The formulation of the MAMRD directly empowers the rural actors and society as a whole, where the index measure would guide them on how to respond to find rural solutions.
- b. Academia: It has added to the new theoretical knowledge and knowledge expansion regarding the modern rural approach and the best practices to cater to the rural transformation agendas.
- c. Government: As stated, the MAMRD is tailored to rural national government policies at the implementation level as a monitoring/assessment tool for rural progress towards a modern rural approach.
- d. Industry: This research forms linkage and collaboration activities between academia, and industry/agencies to find solutions for rural development based on the win-win partnering benefits.
- e. Environment: The model also provides guidelines for preservation strategies for Malaysian rural characters.

Future research would focus on the behaviours of rural actors in utilising and empowering a people-centric approach by adopting and innovating digital technologies in materialising rural development agendas in Malaysia. This

can still be incorporated with the MAMRD exercise to optimise the rural transition towards a modern rural@resilient-liveable-and-smart.

ACKNOWLEDGEMENT

This paper is part of a project funded by Fundamental Research Grant Scheme (FRGS), Ministry of Higher Education, Malaysia. File No: 600-RMC/FRGS 5/3 (137/2022).

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Received: 26th June 2023. Accepted: 11th August 2023



PLANNING MALAYSIA:
Journal of the Malaysian Institute of Planners
VOLUME 21 ISSUE 4 (2023), Page 364 – 375

INFLUENCING FACTORS OF NEIGHBOURHOOD ATTACHMENT: A CASE STUDY OF PENANG, MALAYSIA

Teu Yu Han¹, Mohd Ismail Isa², Massoomeh Hedayati Marzbali³

School of Housing, Building and Planning,
UNIVERSITI SAINS MALAYSIA

Abstract

Many studies have examined the influencing factors of neighbourhood attachment. However, there are relatively lesser empirical studies regarding the influencing factors of neighbourhood attachment in the aftermath of COVID-19. This study investigates the influencing factors of neighbourhood attachment in two Penang Island, Malaysia neighbourhoods. Neighbourhood attachment is a second-order factor structure assessed by a first-order factor structure that includes place dependence and social bonding. A questionnaire survey with a Likert scale was used to measure the residents' assessment of economic, physical and social factors as well as neighbourhood attachment level. The findings were then analysed by Partial Least Squares Structural Equation Modelling (PLS-SEM). These results support the theoretical findings in the literature that economic, physical and social factors affect neighbourhood attachment. Social factors are the most substantial influencing factors of neighbourhood attachment among the three factors. Neighbourhood attachment comprises multiple factors and processes rather than just one. Social interactions, cultural practices, environmental factors, and other experiences all contribute to the development of attachment. It can encourage residents to stay for a more extended time or permanently by fostering neighbourhood attachment. Therefore, this study can serve as a guide for community stakeholders to design attractive neighbourhoods that evoke pleasant memories and sentiments, which in turn encourage a sense of neighbourhood attachment.

Keywords: Economic factor, Physical factor, Social factor, Neighbourhood attachment

² Professor at Universiti Sains Malaysia: mohdismail.isa@usm.my

INTRODUCTION

Place attachment is a feeling that reflects their desire to maintain a close attachment to the place (Hidalgo & Hernández, 2001). It is more dynamic as it is modified based on the change in the individuals' experience gained over the period (Brown. et al., 1992). Place attachment has been disrupted since the SARS-CoV-2 pandemic because people have difficulty connecting with the environment due to government measures (Counted et al., 2020). The COVID-19 pandemic has caused long-term negative impacts on social life, the economy and health (The British Academy, 2021). In Malaysia, Penang used to be one of the most popular destinations for migrants in 2016 (Department of Statistics Malaysia, 2017). However, Penang's net migration decreased from 3.3 thousand in 2018 to -1.4 thousand persons in 2020 (Department of Statistics Malaysia, 2021b, 2021a), according to Fattah et al. (2020)'s study in Penang, those who intend to move out of the neighbourhood their attachment level lower than the respondents who intend to stay. Penang's high rate of out-migration intention to leave demonstrates that their attachment has been disrupted. Experiencing a hardship like COVID-19 can lead to a change in their place attachment level. Therefore, it is essential to understand their current degree of neighbourhood attachment and the influencing factors.

RESEARCH BACKGROUND

Neighbourhood attachment

Neighbourhood attachment involves the interplay between affect and emotions, knowledge and beliefs, and behaviour and action concerning a place (Altman & Low, 1992). Place attachment contributes to effective place-making (Abdul Latip et al., 2023). Place dependence refers to the functional or goal-directed connections (functional attachment) to a setting; for example, it reflects the degree to which the physical setting provides conditions to support an intended use (Schreyer et al., 1981). It indicates a place's ability to provide opportunities to fulfil specific goals or activity needs (Stokols & Shumaker, 1981). Social bonding is defined as feelings of belonging or membership in a group of people, such as friends and family, and emotional bonds based on shared history, interests, or concerns (Hidalgo & Hernández, 2001). Raymond et al. (2010) classify social bonding into family bonding (connections to place based on family relationships) and friend bonding (connections to place based on friend relationships).

Influencing factors of neighbourhood attachment

The residents regard *economic factors* as more important than other visitors (Brown et al., 2007). Economic factors that affect neighbourhood attachment include place of livelihood and affordability (Lestari & Sumabrata, 2018) (Alawadi, 2017). The residents' *economic livelihood* values are regarded as one

of the predictors of place dependence (G. Brown et al., 2015). Static users, such as residents, have a stronger sense of belonging to the places due to economic dependence, providing them with income sources (Ujang, 2012) and opportunities to be involved in home-based businesses (Adewale et al., 2020). Graham Brown et al. (2004) found that newcomers portray high attachment levels mainly because of housing *affordability* and other economic reasons.

Physical factor. Inadequate *green space* will likely adversely affect neighbourhood attachment (McGuire, 1997). Due to the proximity to open spaces, residents could access the park or open spaces for physical activity, community involvement and utilisation of local facilities, which are vital for building links between individuals and their local environment (Manzo & Perkins, 2006). A need for *safety and security* drives neighbourhood attachment. In some research, a sense of safety in the neighbourhood is identified as one of the essential factors and the most positive indicator of place attachment (Lewicka, 2010). Fear of crime can lead to a decrease in neighbourhood identity (Makroni et al., 2015). The *upkeep and cleanliness* of a neighbourhood predict a stronger sense of security (Lewicka, 2010). Lack of maintenance contributes the most negative impact on neighbourhood attachment among all physical and social factors (Kamalipour et al., 2012). Appealing physical characteristics enhance place attachment by enticing and engaging individuals in a place (Mesch & Manor, 1998).

Social factors. *Social support* is described as supportive interpersonal relationships. The support can be in three forms: personal (emotional), instrumental (functional), and informational. Social support was positively connected to place attachment in the research by B. Brown et al. (2003). A sense of *trust* in other residents and the community will result in a positive emotional connection to the community, such as place attachment (Wu et al., 2019). Stedman (2003) discovered that firmly attached residents are more likely to have a higher level of trust in their neighbourhood. Based on the above discussion, we propose the hypothesis below:

- H1. Economic factors are positively associated with neighbourhood attachment.
- H2. Physical factors are positively associated with neighbourhood attachment.
- H3. Social factors are positively associated with neighbourhood attachment.

MATERIALS AND METHOD

Study area

The selection of research regions is limited to Penang Island in Malaysia to reduce the likelihood of inaccurate or biased data. Each neighbourhood is chosen from the South-west and North-east Districts to gather more reliable data and accurately reflect the population. The chosen neighbourhoods meet the following requirements: a more significant proportion of Chinese people, landed homes

valued between RM 400,000 and RM 1,000,000, and at least one green space for residents. The study areas were neighbourhoods of Tanjung Tokong and Bandar Bayan Baru.

Survey instrument

For the pilot survey, 15 respondents were chosen at random. According to the SPSS results, all construct reliabilities of the pilot study are good because all alpha values were over 0.70. They varied from 0.790 to 0.922. The final questionnaire survey contains 43 questions, including 8 items of respondents backgrounds from (Lestari & Sumabrata, 2018), 5 items of place dependence from G. Brown & Raymond (2007), 2 items of social bonding from (Kyle et al., 2005) and another three items from (Raymond et al., 2010), 4 items of economic factors were from (Mishra et al., 2010)(Zhu et al., 2021), 7 items of green area from (Bonaiuto et al., 2003; Malek et al., 2018; Rahimiashtiani & Ujang, 2013), 3 items of sense of safety were from (Hedayati Marzbali et al., 2017), 4 items of upkeep, cleanliness and maintenance were from (Bonaiuto et al., 2003; Poortinga et al., 2017), 4 items of social support and another four items for social trust (Curley, 2010). All items were measured on a five-point Likert scale (from 1- strongly disagreed to 5- strongly agreed), but social support items were assessed by rating the availability of support in their neighbourhoods from 1- little available support to 5- much support.

RESULTS

Respondent profiles

There are 362 respondents in total. The respondents are 41 years old on average (SD=17.44). The average period of residency is 17.7 years (SD=13.3). 98.3% of these respondents are Malaysians, 51.4% are male, and 68.2% are homeowners. Regarding racial composition, 49.2% of the respondents are Chinese, 39.5% are Malay, 9.4% are Indians, and 1.9% are other races. Besides, 58.6% have a university or college education, 32.6% have a secondary education, 4.7% have a primary education, and 4.1% have a non-formal education. In terms of monthly household income, 26.8% of the respondents make less than RM3000, 26.5% make between RM 3001 and RM 5000, 18.8% make between RM 5001 and RM 7000, 8.0% make between RM 7001 and RM 9000, 8.0% make more than RM 9001 and 11.9% have no idea.

Measurement model results

As shown in Table 3, all the loadings are above 0.70 (Henseler et al., 2016) except the SB5, GA1, GA5, GA7 and UMC4. The threshold values of Cronbach's alpha and composite reliability are 0.7 (Henseler et al., 2016). AVE should be 0.50 or greater (Hair et al., 2014). Table 1 shows that all constructs fulfil the criteria. Discriminant validity was assessed by (1) (Fornell & Larcker, 1981) criterion, (2)

the heterotrait-monotrait (HTMT) (Henseler et al., 2015), and (3) cross-loading (Garson, 2016). The square root of AVE was more significant than the intercorrelations of the constructs in the model (Table 1), the HTMT ratios were less than 0.90 (Table 2), and the variable's loading on its construct was higher than its correlation with any other variables (Table 3).

Table 1: Results of Fornell-Larcker criterion and reliability assessment.

	AF	GA	LO	PD	SOS	SB	SS	ST	UMC
AF	0.896								
GA	0.186	0.739							
LO	0.262	0.248	0.909						
PD	0.266	0.361	0.256	0.799					
SOS	0.282	0.391	0.070	0.380	0.865				
SB	0.192	0.339	0.295	0.644	0.261	0.813			
SS	0.189	0.360	0.277	0.378	0.295	0.564	0.810		
ST	0.311	0.327	0.198	0.418	0.413	0.578	0.676	0.871	
UMC	0.298	0.375	0.174	0.437	0.603	0.391	0.363	0.491	0.762
α	0.754	0.859	0.791	0.858	0.831	0.868	0.825	0.894	0.752
CR	0.754	0.870	0.792	0.859	0.832	0.876	0.828	0.898	0.771
AVE	0.803	0.546	0.827	0.638	0.748	0.661	0.655	0.759	0.580

Note: AF = Affordability, GA = Green Area, LO = Livelihood Opportunities, PD = Place Dependence, SOS = Sense of safety, SB = Social Bonding, SS = Social Support, ST = Social Trust, UMC = Upkeep, Maintenance and Cleanliness

Table 2: Results of HTMT ratios.

	AF	GA	LO	PD	SOS	SB	SS	ST	UMC
AF									
GA	0.231								
LO	0.338	0.302							
PD	0.331	0.422	0.310						
SOS	0.355	0.451	0.087	0.451					
SB	0.235	0.402	0.358	0.748	0.308				
SS	0.237	0.426	0.343	0.446	0.350	0.666			
ST	0.378	0.374	0.237	0.478	0.482	0.650	0.779		
UMC	0.385	0.451	0.224	0.539	0.767	0.479	0.448	0.597	

Table 3: Results of cross-loadings and outer loadings.

	LO	AF	GA	PD	SOS	SB	SS	ST	UMC
ECO1	0.914	0.265	0.235	0.226	0.036	0.277	0.251	0.204	0.177
ECO2	0.904	0.211	0.215	0.240	0.092	0.259	0.252	0.155	0.138
ECO3	0.237	0.897	0.223	0.256	0.316	0.209	0.228	0.339	0.293
ECO4	0.233	0.895	0.110	0.221	0.189	0.135	0.111	0.217	0.241
GA1	0.143	0.035	0.698	0.164	0.170	0.241	0.165	0.194	0.170
GA2	0.162	0.086	0.778	0.260	0.278	0.308	0.301	0.286	0.200
GA3	0.187	0.124	0.846	0.252	0.325	0.269	0.331	0.322	0.293
GA4	0.196	0.207	0.803	0.321	0.400	0.231	0.254	0.251	0.416
GA5	0.156	0.154	0.681	0.217	0.347	0.174	0.216	0.166	0.322
GA6	0.228	0.199	0.723	0.294	0.261	0.177	0.277	0.179	0.261
GA7	0.213	0.135	0.619	0.361	0.182	0.388	0.316	0.292	0.226
PD1	0.182	0.186	0.327	0.752	0.331	0.531	0.314	0.382	0.313
PD2	0.229	0.204	0.281	0.827	0.272	0.509	0.267	0.301	0.328
PD3	0.243	0.241	0.306	0.804	0.322	0.505	0.332	0.337	0.433
PD4	0.133	0.225	0.213	0.781	0.316	0.458	0.290	0.317	0.317
PD5	0.229	0.207	0.310	0.826	0.279	0.564	0.306	0.334	0.355
SAF1	0.050	0.248	0.326	0.372	0.852	0.222	0.244	0.364	0.570
SAF2	0.078	0.267	0.361	0.292	0.881	0.252	0.288	0.385	0.504
SAF3	0.052	0.215	0.327	0.322	0.860	0.202	0.233	0.322	0.490
SB1	0.197	0.171	0.288	0.543	0.236	0.802	0.418	0.474	0.353
SB2	0.261	0.170	0.267	0.578	0.269	0.849	0.499	0.545	0.378
SB3	0.275	0.223	0.337	0.544	0.201	0.870	0.462	0.478	0.294
SB4	0.223	0.084	0.244	0.463	0.147	0.872	0.488	0.512	0.299
SB5	0.244	0.124	0.237	0.485	0.206	0.651	0.423	0.318	0.255
SUP1	0.255	0.166	0.349	0.360	0.296	0.526	0.822	0.594	0.337
SUP2	0.235	0.138	0.273	0.306	0.156	0.413	0.800	0.471	0.240
SUP3	0.207	0.114	0.238	0.219	0.171	0.428	0.800	0.483	0.196
SUP4	0.200	0.189	0.298	0.330	0.316	0.453	0.815	0.624	0.387
TRU1	0.212	0.255	0.272	0.342	0.407	0.413	0.508	0.810	0.485
TRU2	0.145	0.308	0.225	0.363	0.377	0.472	0.594	0.891	0.437
TRU3	0.179	0.279	0.301	0.368	0.317	0.556	0.623	0.894	0.397
TRU4	0.160	0.242	0.341	0.384	0.349	0.564	0.623	0.888	0.402
UMC1	0.126	0.233	0.342	0.400	0.505	0.368	0.361	0.488	0.817
UMC2	0.237	0.259	0.322	0.319	0.357	0.258	0.203	0.306	0.744

	LO	AF	GA	PD	SOS	SB	SS	ST	UMC
UMC3	0.108	0.321	0.283	0.364	0.497	0.316	0.312	0.389	0.853
UMC4	0.054	0.065	0.178	0.229	0.480	0.232	0.210	0.290	0.610

Structural model results

All VIF outputs are significantly below the standard cut-off threshold of 3.0 and near 1.0. The impacts of economic factors on neighbourhood attachment (H1; $\beta = 0.129$, t-value = 2.843, $p < 0.05$), physical factors on neighbourhood attachment (H2; $\beta = 0.240$, t-value = 4.419, $p < 0.01$) and social factors on neighbourhood attachment (H3; $\beta = 0.422$, t-value = 7.759, $p < 0.01$) are positive and significant. Following earlier research, economic, physical and social factors affect neighbourhood attachment (Brown & Raymond, 2007) (Lewicka, 2010) (Brown & Perkins, 1992). The R^2 value of the neighbourhood attachment is 0.414; this model explains 41.4% of the variation in neighbourhood attachment. According to Chin (1998), the f^2 value 0.02 represents a small, 0.15 represents a moderate, and 0.35 represents a substantial effect size. Economic and physical factors show small effects on neighbourhood attachment with effect size values of 0.024 and 0.070, respectively, while social factors moderate neighbourhood attachment (0.215). Table 4 presents the results of the VIF, path coefficient of direct relationships and effect size. The fold, k and repetitions used in this study are 10. The Q-square, Q^2 values for all constructs are greater than 0. Thereby suggesting that the model has sufficient explanatory power and predictive relevance.

Table 4: Results of path coefficient and hypothesis testing (direct effects).

Hypo thesis	Relationship	β	T value	P value	Decision	f^2	VIF
H1	EF -> NA	0.129	2.843	0.004	Supported	0.024	1.173
H2	PF -> NA	0.240	4.419	0.000	Supported	0.070	1.413
H3	SF -> NA	0.422	7.759	0.000	Supported	0.215	1.416

Note: EF = Economic Factors, PF = Physical Factors, SF = Social Factors, NA = Neighbourhood Attachment

DISCUSSION

According to the results, the average neighbourhood attachment score is 3.784. Place dependence and social bonding had average measurement values of 3.930 and 3.638 out of 5.0, respectively. A strong sense of attachment is demonstrated through nearly 80% of the respondents who think their neighbourhoods are the best places to do what they like and are satisfied with living there instead of other places. People feel attached to a place when they have a functional dependence (Stokols & Shumaker, 1981) and connection to social networks (Low & Altman, 1992).

According to the questionnaire, most respondents claimed they could afford the goods and property prices. This direct impact of economic factors on neighbourhood attachment is supported by previous studies (Alawadi, 2017). Regarding the direct influence of physical factors on neighbourhood attachment, green areas have a positive impact, in agreement with the research conducted by Alrobaee & Al-Kinani (2019). Sense of safety is fostered when they feel secure living and walking alone around the neighbourhood day and night (Loukaitou-Sideris, 2006). Upkeep, cleanliness and maintenance are essential in building a liveable neighbourhood and ultimately affect attachment; this aligns with the study (Lewicka, 2010). Mesch & Manor (1998) found that residents feel attached to their neighbourhoods when the community supports their needs, which aligns with this study's findings. Lewicka (2010) discovered that people who were more place-attached tended to have higher levels of social trust; this conclusion is consistent with this study.

Theoretical and practical implications

Studies of economic effects on neighbourhood attachment are comparatively lesser. However, economic factors were included in this study to provide a comparatively comprehensive idea of the influencing factors of neighbourhood attachment. This study confirmed that economic, physical and social factors impact neighbourhood attachment by using this scenario-based study in the Penang context. The study's practical contributions are expected to offer direction for all stakeholders in developing neighbourhoods, such as local governors, developers, urban planners and designers. They may learn about what to consider from the residents' standpoint when developing a neighbourhood that promotes attachment to it.

Limitations and Direction for Future Studies

Those who reside in the Penang Island neighbourhoods are the only participants in this study's sample. A larger sample of residents from different locations can be suggested because the outcomes elsewhere differ. Additionally, the analysis only included three factors to be studied, which are economic, physical and social. It is also suggested that, depending on the criteria looked at in the study, research on other aspects or factors may produce different final results. This research only discusses neighbourhood attachment after the event of COVID-19 pandemic. Thus, comparing before and after an event is another comparison that could be performed, such as assessing the place attachment before and after urban renewal.

ACKNOWLEDGEMENTS

The authors would like to thank the Universiti Sains Malaysia under Short Term Grant Scheme with Project Code: 304/PPBGN/6315315 and the School of

Housing, Building and Planning, Universiti Sains Malaysia, for financially supporting this research.

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Received: 26th June 2023. Accepted: 11th August 2023



PLANNING MALAYSIA:

Journal of the Malaysian Institute of Planners

VOLUME 21 ISSUE 4 (2023), Page 376 – 389

INTERRELATIONSHIP OF NETWORKS, KNOWLEDGE, AND PERFORMANCE OF BUSINESSES THROUGH THE LENS OF COASTAL DESTINATION DEVELOPMENT

Muaz Azinuddin¹, Nur Shahirah Mior Shariffuddin², Ahmad Puad Mat Som³, Muhammad Arfin Muhammad Salim⁴, Buntu Marannu Eppang⁵

^{1,2,3}Faculty of Applied Social Sciences,

UNIVERSITI SULTAN ZAINAL ABIDIN, MALAYSIA

^{4,5}Tourism Department,

TOURISM POLYTECHNIC OF MAKASSAR, INDONESIA

Abstract

The sustainable future of coastal destination development is mainly reliant on performance of small and medium sized tourism enterprises (SMTEs) since they are the main catalyst of tourism growth. Given SMTEs' operational sizes, the need to enhance their knowledge base through their networks to stay competitive is heightened. This research examines how the absorptive capacity (AC) affects the dynamic between formal and informal networks and business management performance of SMTEs. The study focuses on four sub-sectors in Terengganu, Malaysia: hotels and resorts, travel agencies, restaurants, and handicrafts. The study analysed survey data from 119 entrepreneurs using a hierarchical regression model. The results showed that the nexus between the use of formal networks and business management performance is significantly mediated by AC, while no significant relationships were found with the use of informal networks. The study emphasizes the importance of formal actors in promoting knowledge flows and enhancing coastal destination development and competitiveness.

Keywords: Formal network, informal network, knowledge transfer, absorption capacity, business management performance

¹ Senior Lecturer at Universiti Sultan Zainal Abidin. Email: muazazinuddin@unisza.edu.my

INTRODUCTION

Tourism has always been seen as a complete experience by visitors, even though it involves the participation of many different stakeholders (Mariani & Baggio, 2020; Solvoll et al., 2015). This requires collaboration between policymakers and various stakeholders to provide tourism products and services that contribute to successful destinations (Beltramo et al., 2021; Zee & Vanneste, 2015). In other words, the complementary activities implemented by the actors within a local co-producing system can be deemed as a representative of a destination (Elvekrok et al., 2022; Haugland et al., 2011). Such collaborative outlooks are illustrative of the tourism networks' importance in the context of destination management studies (Nieves & Diaz-Meneses, 2018). In fact, analysis of previous research in the last two decades shows that scholars are increasingly focusing on tourism networks, particularly in relation to destination-based planning and management and organization (Azinuddin et al., 2022a). Furthermore, it is argued that there is still to be adequate empirical evidence on tourism networks to be synthesised by various stakeholders (Elvekrok et al., 2022).

The relationships between stakeholders in a tourist destination are complex, involving complementary products such as activities, accommodations, transport, and food, as well as supporting activities and infrastructure (Pavlovich, 2003). This can be attributed to the interdependency of actors within tourism system as they need to work together in producing a cohesive tourism products and services. In fact, the networks also enable destination stakeholders to be systematic, resilient and adaptable to any potential changes and crises (Hall et al., 2018). For this reason, such links and relations may bring success to the individual organizations, which in turn, contributes significantly to the sustainable future of a destination (Azinuddin et al., 2022b; Elvekrok et al., 2022).

Therefore, a prosperous destination that can be characterised by active networks of businesses may lead to generation of opportunities to the various tourism stakeholders (Merinero-Rodríguez & Pulido- Fernández, 2016; Aarstad et al., 2015). This explains the reason why the issues of network effects and interdependencies between relationship outcomes have become a main issue especially in the context of destination development (Sainaghi & Baggio, 2017). From this, it can be understood that networks are important for any destination development since small and medium-sized tourism enterprises (SMTEs) are considered as economic engines for any destination, and there is a pressing need to go beyond their boundaries and establish external relations to increase their performance (see Azinuddin et al., 2020; Elvekrok et al., 2022).

It is posited that the connection between these businesses facilitates the transfer and sharing of knowledge, driving innovation and competitiveness (see Presenza & Cipollina, 2010). Thus, networking activities are seen as key for

SMTEs to obtain knowledge and resources necessary for growth and sustainability (Hoang & Antocic, 2003; Morrison et al., 2004). Besides, contribution to destination development can be attributed to the network relations that bring new knowledge and enhancement of tourist satisfaction (Elvekrok et al., 2022). Therefore, the networks' importance is heightened considering the smallness of their firms which led to the constraint of resources, knowledge and financial capital, subsequently hindering them to achieve optimal growth and influence the overall direction of a destination development (see Azinuddin et al., 2020).

For this reason, there is growing attention to tourism networks as a mechanism for legitimization, economic benefits, and social well-being (Romeiro & Costa, 2010; Shaw & Williams, 2009), given the importance of analysing networks in relation to destination-based planning and management (Mariani & Baggio, 2020). However, there is a scarcity of research on the absorptive capacity (AC) of actors within these networks (Azinuddin et al., 2020; Binder, 2018). This is due to tendencies of studies to focus on knowledge sharing within the structures of tourism organizations at the destination level (Presenza & Cipollina, 2010), rather than on individual firms and their formal and informal networks (Azinuddin et al., 2022a). Scholars have noted that entrepreneurs' commitment to different types of networks varies, with differing preferences for formal networks (FNs) which includes associations, joint ventures, trading groups, and buyer-supplier agreements, or informal networks (INs) such as links among families, relatives, and friends (Grossman et al., 2012; Shaw & Williams, 2009).

Both networks are crucial for SMTEs and tourist destinations as their success is dependent on valuable external knowledge that can provide them the competitive edge. Despite the importance, there is insufficient of tourism network studies that provide empirical evidence on how the AC of SMTEs can bring positive impacts on their performance (Azinuddin et al., 2022a). Accordingly, this study aims to examine the mediating role of AC on different types of networks which can act as a catalyst for knowledge transfer, and how such dynamics shape the SMTEs performance and subsequently, destination development.

LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

Establishment of relations that go beyond organizational boundaries are common practices amongst various tourism stakeholders within the realm of destination management (Elvekrok et al., 2022). Identified as "social ties", such relations constitute the building block of a network that links wide spectrum of actors within tourism industry. There are many forms of these relations that are

universally identified as a network in tourism, which include partnerships, strategic alliances, coalitions, or cooperative agreements, all of which are commonly referred to as a "network" in tourism (Albrecht, 2013).

Accordingly, actors that form the tourism network usually comprised of managers, entrepreneurs, owners, organizations, associations, communities, or public agencies (Johanisson, 2000). Various motives of friendship, collaboration, market penetration, strategic alliances, research and development, or resource exchanges are the foundation behind the establishment of relations between the actors (Schoonjans et al., 2013; Watson, 2007). In fact, the need to enhance knowledge management within organizations has led to employment of network analysis by scholars and industry practitioners (Elvekrok et al., 2022). Since networking enables businesses to gain access to vital knowledge efficiently, this indicates the increasing needs to build and sustain network relations within the context of tourism industry (Azinuddin et al., 2022a).

Networks, Absorptive Capacity and Business Management Performance

Tripartite components of entrepreneurs, network structure and characteristics of their resources are often considered as main contributors to the success of knowledge transfer in a network (Bruderl & Preisendorfer, 1996; Jenssen & Greve, 2002). Size is considered as one of the network structure's important dimensions as it enables formulation and reformulation of novel ideas and actions (Fernandez-Perez et al., 2013; Obstfeld, 2005). However, the size of a network does not always determine the extent to which entrepreneurs use their network's resources to improve the success of their business.

To fill this theoretical gap, trust and the frequency of business meetings with acquaintances and family members in an entrepreneur's network are important. Frequent communication with network actors can facilitate the transmission of crucial intelligence (Chua, 2001; Grant, 1996). From this dynamic, the importance of external relations is vital in the process of organizational learning as the attributes of social interactions are argued to be the central element of AC since it facilitates businesses to learn from others (Binder et al., 2018). Deemed as the descriptor of organizational routines and procedures by which an entity acquires, assimilate, transform and exploit knowledge to obtain and maintain competitive edge, AC is considered as the rational outcome of networking activities given its aim to leverage knowledge amongst the SMTEs' entrepreneurs (see Azinuddin et al., 2020; Binder, 2018; Zahra & George, 2002).

In this sense, small businesses often rely on informal connections in the early stages of entrepreneurship. Centred on relations that are socially entrenched, these informal ties can provide resources at a lower cost as compared to the formal networks (Grant & Baden-Fuller, 2004; Zehrer & Raich, 2010). However,

it is believed that informal connections may not substantially impact business performance (Lechner et al., 2006). Instead, various forms of formal networks, namely joint ventures, long-term supplier-buyer partnerships, and other enduring ties are seen as more valuable in gaining access to valuable knowledge that is unavailable within internal resources (Shaw & Williams, 2009; Gulati et al., 2000).

Nonetheless, it is counterintuitive that entrepreneurs who prefer informal networking would continue to maintain this approach, even if it does not necessarily benefit their business growth and sustainability. Therefore, the hypotheses proposed are as follows:

H1: FN influences AC.

H2: IN influence AC.

H3: FN influences business management performance.

H4: IN influences business management performance.

Mediating Effects of Absorptive Capacity on Networks and Business Management Performance

Knowledge sharing through networks can enhance business performance by creating an extra-institutional space for innovation (McLeod et al., 2020; Fadeeva, 2004). To enhance the business management performance through values that are leveraged and transformed from the knowledge transfer, AC is vital for firms to enable this process (Flatten et al., 2011; Valentina & Passiante, 2009). For this reason, internal and external knowledge is considered important as it shapes the AC's level within any organizations (Valentina & Passiante, 2009). This is especially relevant for tourism firms, which rely heavily on external knowledge, particularly from suppliers, due to the sector's demand for collaboration among stakeholders (Kale et al., 2020; King, et al., 2014).

Based on this premise, SMTEs rely on informal and formal networks of relatives, friends, suppliers, and customers for assistance or advice (Laursen & Salter, 2014; Mina et al., 2014). As a result, more research is needed to determine how network capabilities support the acquisition, retention, and application of skills (Azinuddin et al., 2022a; Hamel, 1991). Given the potential overlap of this concept with various formal and informal networks and their impact on business management performance, Thomas and Wood's (2014, 2015) empirical works on AC should be extended in light of the conceptual relationship between the processes of knowledge transfer and absorption (Czernek, 2014). Based on these arguments, three hypotheses were developed:

H5: AC influences business management performance.

H6: AC mediates the relationship between FN and business management performance.

H7: AC mediates the relationship between IN and business management performance.

METHODOLOGY

The aim of this study is to evaluate the role of AC in mediating the relationship between formal networks (FN) and informal networks (IN) on business management performance among small and medium-sized tourism enterprises (SMTEs). The research framework and hypotheses are illustrated in Figure 1. The study employs a quantitative research design and a cross-sectional approach to collect data from SMTE entrepreneurs in two districts of Kuala Terengganu and Kuala Nerus in the state of Terengganu. Situated in the east coast of Peninsular Malaysia, Terengganu has the longest coastline in the country which makes the State as one of the main coastal destinations. In this sense, both districts were selected based on their significant tourism business activities and their geographic concentration of various public and private tourism establishments, making them a suitable coastal city-based destination to investigate SMTE networking.

The sample frame for the study consists of four different types of SMTEs, including hotels and resorts, travel agencies, handicrafts, and restaurants, manually constructed by referring to the list provided by Tourism Terengganu and TripAdvisor. The final list of qualified businesses population comprises 156 SMTEs, all of which were approached to participate in the study since the number is relatively small. Purposive sampling was used for data collection based on predetermined criteria, including small and medium-sized businesses with independent ownership managed by entrepreneurs in a personalized manner.

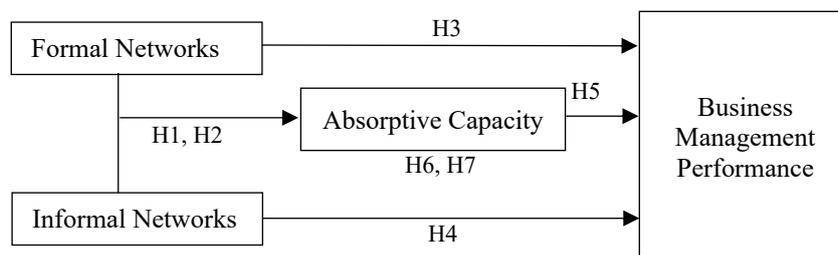


Figure 1: Research Framework
Source: Author

The survey questionnaire consists of four sections including; (1) the entrepreneurs' demographic profile, and sections that measure (2) FN and IN (Fernandez-Perez et al., 2013; McLeod, 2010), (3) AC (Thomas & Wood, 2014; 2015), and (4) business management performance (Flatten et al., 2011). For both FN and IN, all the items centred on three dimensions of size, trust and frequency of communication as suggested by scholars (see Bruderl & Preisendorfer, 1996; Fernandez-Perez et al., 2013). While the items of AC include four different dimensions of acquire, assimilate, transform and exploit. This is consistent with conceptualisation of AC by Thomas and Wood (2014; 2015). A 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree) was used to measure the constructs. Prior to actual data collection, a pilot study was conducted involving 20 SMTEs, which yielded an acceptable threshold value as per Hinton et al. (2004).

The raw data from the questionnaire were analysed using descriptive statistics and inferential statistics, including hierarchical linear and multiple regression analyses. This study will test the mediating effect of absorptive capacity by adhering to the recommended procedure by Baron and Kenny (1986). There are three steps to analyse the function of AC as a mediator, which comprise of: (1) the need to establish significant relationship between independent variable and dependent variable through the accounted latter's variation by the former; (2) the need to verify the significant influence of mediator on dependent variable; (3) the significant relationship between independent and dependent variable becomes insignificant from previously significant outcomes after the dynamics within first and second steps are controlled.

RESULTS

Descriptive Statistic

Most of the SMTEs involved in this research (35.8%, n= 43) originates from the handicraft sector, then followed by restaurants with 34.2% (n= 41). Hotels and resorts constitute 19.2% of respondents with travel agencies the smallest group at 10.8% (n= 13). Furthermore, most of the respondents are male (50.8%, n=59), married (88.3%, n= 106), high school leavers (53.3%, n=54%) and have no experience in any formal tourism business training (71.7%, n=86). In terms of their business attributes, most of them have been in business more than 25 years (30.8%, n=37) and have business plan (50.8%, n= 61).

Inferential Statistic

The hierarchical regression analysis shows that there is a significant relationship between FN and AC with the total variance explained by the overall regression model estimation was statistically significant at 20.1% ($R^2 = .201$), $F(9, 109) = 3.05$, $p < 0.01$. For the relation between the FN and business management

performance, the regression model estimation was also statistically significant at 16.6% ($R^2 = .166$), $F(9, 109) = 2.41$, $p < 0.05$. According to Cohen (1988), the R^2 values indicate that the models have moderate goodness-of-fit, indicating that FN is quite effective in predicting the variance of AC and business management performance. This means that H1 and H3 is supported.

On the other hand, IN has no significant relationship with AC or business management performance. However, there is a significant relationship between

AC and business management performance at 51.6% ($R^2 = .516$), $F(9, 109) = 12.93$, $p < 0.001$, with the final regression model achieving a satisfactory level of goodness-of-fit ($R^2 = .516$, $p < 0.001$) as per Cohen (1988). This indicates the support of H5 and not for H2, H4 and H7 since there is an insignificant impact between; (1) IN and AC and, (2) IN and business management performance.

Finally, the mediation testing confirms that the FN has a significant impact on AC, which in turn has a significant impact on business management performance (see Table 1). In the same vein, the statistical significance level between FN and business management performance decreases from significant ($p < 0.02$) to not significant ($p < .808$), suggesting that AC mediates the relationship between the two variables.

Table 1: Steps of mediation testing

Step	Dependent Variable	Independent Variable	Model Regression, R^2	Model Statistical Significance	Regression Coefficient, β	Regression Statistical Significance
1	Absorptive Capacity	• Use of Formal Networks	.201**	.003**	.353***	.000***
2	Business Management	• Absorptive Capacity	.516***	.000***	.656***	.000***
3	Business Management	• Use of Formal Networks	.166*	.016*	.215*	.024*
	Business Management	• Use of Formal Networks • Absorptive Capacity	.517***	.000***	-.019 .662***	.808 .000***

According to Baron and Kenny's (1986) theory, the regression model estimation that incorporates the mediator should render the initial significant effect of independent variable to shift into insignificant influence. Accordingly,

the study verifies that AC mediates the relationship between FN and business management performance, as there is a significant increase in the variance of business management performance explained from $R^2 = .166$ ($p < .05$) to $R^2 = .517$, ($p < .001$) when AC is added to the regression model with FN. This finding means H6 is supported which strengthens the argument for the strong mediation influence of AC on the relationship between FN and business management performance.

DISCUSSION

This study aimed to analyse the interrelationships between FN, IN, AC, and business management performance among four different types of small and medium-sized tourism enterprises (SMTEs) in Terengganu, a region with potential for tourism growth. The tourism industry requires communication between stakeholders to produce competitive products and services, making networking crucial for SMTEs (Azinuddin et al., 2022a). The outcomes of hierarchical multiple regression analyses showed that AC plays a significant mediating role in the relationship between FN and business management performance. This, to a certain extent is comparable to the finding of Binder (2018) as it is revealed that quality and size of the network relations positively influence the tourism businesses capacity to assimilate and exploit the knowledge to improve their innovation performance. Specifically, valuable knowledge generated from formal relations with intrinsic knowledge can be facilitated by AC, which leads to new business insights that improve business management, such as product or service development, operations, customer retention, and growth of SMTEs.

IN, on the other hand, did not have a significant relationship with business management performance. This finding supports the argument that businesses need to embrace external resources accessed from various forms of strategic formal relations such as joint collaborations or ventures, trainer and trainee relationships, key destination associations and others. The study's results highlight the importance of AC in facilitating the transfer and sharing of knowledge from the formal networks to entrepreneurs and SMTEs in the tourism industry.

CONCLUSION

This study makes a significant contribution to applied research by analysing all variables through the insights of inter-sectoral lens, which advances the understanding of the role of networking in business management performance in the tourism industry. This is especially crucial since there is a scarcity of research on networks in Asian countries, and the selection of Terengganu as the research

setting provides a unique perspective. Despite this, the employment of purposive sampling calls for cautious treatment of the result since it cannot be generalised beyond this study population.

Considering the limitation, the outcomes of this research still can be used to formulate policies, design and improve training programs as well as organizational initiatives to cultivate collaborations and willingness to exchange knowledge among entrepreneurs in Terengganu. This is because the cultivation of collaboration and knowledge sharing can lead to overall business performance enhancement across Terengganu as a whole. Through networking activities in the shape of mentoring programs, workshops or trainings, SMTEs will be better equipped to adapt to rapid dynamics of market conditions and make full use of the knowledge available within their formal networks. From such networks, clusters should be developed at destination level in order to form groups of SMTEs with shared expertise and complementary knowledge to collaborate and foster competitiveness within the region. A well-connected and knowledge-driven network can assist the destination planners in formulating branding strategies as well as inform policy decisions and strategic allocation of resources. This would facilitate a creation of destination image that would differentiate it from other competitors and subsequently create a sustainable business environment which is based upon healthy collaboration and networking amongst tourism stakeholders.

Based on this premise, it is suggested that future empirical endeavours should focus on insights of public stakeholders on networking activities, extend the work into different contextual settings, and integrate other variables such as organizational loyalty and motivations for researchers and industries to analyse the fundamental dynamics between networks and AC. The integration of leadership theories into the interrelationship between networks and AC can also be considered as one of the crucial avenues which can be further investigated within the realm of tourism. All these variables are suggested given their traits which possess the predisposition to strategically contribute to business performance.

ACKNOWLEDGEMENT

This research was supported by Universiti Sultan Zainal Abidin through Special Research Grant Scheme – International Collaboration (SRGS-IC) UniSZA/2021/SRGS-IC/03, titled ‘The Impacts of Prolonged COVID-19 Pandemic on Coastal Small and Medium Sized Tourism Enterprises (SMTEs) in Terengganu, Malaysia and South Sulawesi, Indonesia: A Comparative Study’.

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Received: 26th June 2023. Accepted: 11th August 2023



PLANNING MALAYSIA:
Journal of the Malaysian Institute of Planners
VOLUME 21 ISSUE 4 (2023), Page 390 – 401

MEDIATING ROLE OF SENSE OF BELONGING IN THE RELATIONSHIP BETWEEN SOCIAL FACTORS AND NEIGHBOURHOOD ATTACHMENT: A CASE STUDY OF PENANG, MALAYSIA

Teu Yu Han¹, Mohd Ismail Isa², Massoomeh Hedayati Marzbali³

School of Housing, Building and Planning,
UNIVERSITI SAINS MALAYSIA

Abstract

Many studies have examined the impact of social factors on neighbourhood attachment. However, more studies need to be on the mediating effect of the sense of belonging in a built environment. This study aims to investigate its mediating role in the relationship between social factors and neighbourhood attachment in two neighbourhoods in Penang Island, Malaysia. A sample of 362 residents was requested to answer a questionnaire survey with a Likert scale to measure the residents' assessment of social factors, neighbourhood attachment level and sense of belonging. Neighbourhood attachment is a second-order factor structure assessed by a first-order factor structure that includes place dependence and social bonding. The social factor is also a second-order construct with two dimensions: social trust and social support. The findings were then analysed by structural equation modelling. These results support the theoretical findings in the literature that social factors significantly affect the sense of belonging and neighbourhood attachment. The results also support the mediating role of a sense of belonging in the relationship between social factors and neighbourhood attachment. Fostering social trust and support within neighbourhoods is crucial for promoting neighbourhood attachment. This can be achieved through community-building activities and community-shared places. By fostering social trust and support, neighbourhoods can become vibrant, thriving communities where individuals feel a sense of belonging and connection.

Keywords: Social factors, Neighbourhood attachment, sense of belonging

² Lecturer at Universiti Sains Malaysia: mohdismail.isa@usm.my

INTRODUCTION

A cognitive-emotional bond that individuals or groups develop towards places people feel connected to is known as place attachment (Hidalgo & Hernández, 2001). According to specific research, social interaction is lower in urban neighbourhoods. Because of public health initiatives, the situation has deteriorated during COVID-19. It prohibited people from engaging in social, cultural, and religious activities as they had done prior to the epidemic (Pfefferbaum & North, 2020). Less social interaction can affect their attachment to places (Jaśkiewicz & Besta, 2018). Social impacts refer to the net influence of activity on a community and the welfare of its residents (Leh et al., 2017). This study focuses on social support and social trust (Carpiano, 2006; Putnam, 2000). Trust promotes frequent interaction in the community, resulting in reciprocal relationships (Sapountzis et al., 2013). Increased social trust is associated with good neighbour relationships (Li et al., 2005) and involvement in informal social networks (Delhey & Newton, 2003). Community-based supportive relationships may result in greater place attachment (Curley, 2010).

Place attachment contributes to effective place-making (Abdul Latip et al., 2023). A sense of belonging reinforces a person's sense of "feeling at home" (Seamon, 2015; Smith, 2017). Thus, this study explores the impacts of social factors on neighbourhood attachment and the mediating role of a sense of belonging in the relationship between social factors and neighbourhood attachment in the Penang context.

RESEARCH BACKGROUND

Social factors and sense of belonging

The frequency of interaction among residents is referred to as social support (Weenig & Schmidt, 1990). Sociologically, social trust is best understood by stressing its crucial relational attribute (Nahapiet & Ghoshal, 1998). Neighbourhood belonging refers to people's connections to their neighbourhood (Fone et al., 2006). Ann Game (2001) defines belonging as the process that helps people experience a sense of "coming home". According to a study by Richmond and Smith (2012), aboriginal youth are less likely to have a sense of belonging since they are likely to ask for support if they trust the support. Social support and trust can be fostered through interaction with people (Ter et al., 2009). Social interactions are critical in shaping and maintaining belonging (Ralph & Staeheli, 2011). People who engage in good interpersonal and social connections exhibit a strong sense of belonging and vice versa (Malone et al., 2012). For example, migrants with local friends in the area are more likely to say they have a strong feeling of belonging than establishing connections with non-local friends (Liu et al., 2022). Based on the above discussion, we propose the following hypothesis:

H1. Social factors are positively associated with a sense of belonging.

Social factors and neighbourhood attachment

In some studies, social factors tend to significantly impact neighbourhood attachment more than physical factors (Hidalgo & Hernández, 2001). Social support can be in three forms: personal (emotional), instrumental (functional), and informational. Personal support decreases social isolation while increasing a sense of belonging. The studies by Brown and Perkins (1992) found that social support was positively related to place attachment, such that people who received more social support from either friends or neighbours reported a more robust attachment. A sense of trust in other residents and the community will result in a positive emotional connection to the community, such as place attachment (Wu et al., 2019). Stedman (2003) also found that people with a higher level of trust in their community are more likely to have a stronger attachment to their residence. Based on the previous works and discussion, we propose the following hypothesis:

H2. Social factors are positively associated with neighbourhood attachment.

Sense of belonging and neighbourhood attachment

A sense of belonging represents the foundations of attachment to a place (Inalhan & Finch, 2004). On the other side, Temkin & Rohe (1998) reveal that attachment is one of the crucial components of neighbourhood belonging. A sense of belonging has always been used as one of the concepts of place attachment. (Giuliani, 2003). Occasionally, the terms "belonging" and "attachment" are used interchangeably to describe one another. For example, Pardede et al. (2021) state that a sense of belonging is attached to an environment. Inalhan & Finch (2004) describe place attachment as an experience of having a sense of belonging at a particular time. No proof shows that a sense of belonging might affect place attachment. However, abundant statements or research indicate they have some connection. Based on the discussion, we propose the following hypothesis:

H3. Sense of belonging is positively associated with neighbourhood attachment.

Although the sense of belonging and place attachment are always studied together, the mediating effect of the sense of belonging has yet to be examined on the relationship between social factors and neighbourhood attachment. Its mediating role is examined in the relationship between marital status and suicidal ideation by McLaren et al. (2015) and school bullying and academic performance by Huang (2022). According to previous research, the connection between social factors and neighbourhood attachment has been researched by Ujang (2012).

Evidence suggests that exposure to social factors could affect the development of a sense of belonging to the place (Vasovic et al., 2012). Thus, based on these previous works, we propose the hypothesis as follows:

H4. Sense of belonging mediates the relationship between social factors and neighbourhood attachment.

MATERIALS AND METHOD

Study area

To minimise misleading or biased results, the selection of study areas is only focused on Penang Island, Malaysia. Each neighbourhood is selected from the Southwest and Northeast Districts. The chosen housing type in this study is only limited to landed houses because living in different housing types might lead to different living experiences. The property values of the selected neighbourhoods are medium to high range, approximately between RM 400,000 to RM 1,000,000. Tanjung Tokong and Bandar Bayan Baru are identified as the study areas of this study.

Survey instrument

A questionnaire survey was administered amongst 362 respondents in both neighbourhoods to collect the data. The respondents were selected via multi-stage cluster sampling. It involved two stages which were stratified sampling and simple random sampling. The respondents were requested to answer 30 questions, including demographic backgrounds, assessment of neighbourhood attachment, sense of belonging and social factors. The first section of the questionnaire included eight socio-demographic questions that included nationality, race, gender, age, education level, household income, ownership status and length of residence (Kao & Sapp, 2020; Lestari & Sumabrata, 2018).

Neighbourhood attachment was assessed in two sub-dimensions, place dependence and social bonding, with ten questions. Place dependence was measured by adapting five items from the survey by G. Brown & Raymond (2007). Next, two items of social bonding from (Kyle et al., 2005) and three items from (Raymond et al., 2010) were modified to fit the neighbourhood context. Four items are selected from the study of Abdullah et al. (2013) to assess a sense of belonging. To operationalise social factors, 4 items, each social trust and support (Curley, 2010), were applied. All items were measured on a five-point Likert scale, with respondents being asked how strongly they agreed or disagreed with each statement (from 1- strongly disagree to 5- strongly agreed), except social support items that were assessed by rating the availability of support in their neighbourhoods from 1- little available support to 5- much support.

RESULTS

Respondent profiles

There are 362 total responses. The respondents are, on average, 41 years old (SD= 17.44). 17.7 years are spent in residence on average (SD= 13.3). 51.4% of these respondents are men, 98.3% are Malaysian, and 68.2% own homes. 49.2% of respondents identify as Chinese, 39.5% as Malay, 9.4% as Indian, and 1.9% as belonging to other races. In addition, 58.6% have a university or college degree, 32.6% have a secondary degree, 4.7% have a primary degree, and 4.1% have a non-traditional degree. According to the respondents' monthly household incomes, 26.8% make less than RM3000, 26.5% between RM 3001 and RM 5000, 18.8% between RM 5001 and RM 7000, 8.0% between RM 7001 and RM 9000, 8.0% make more than RM 9001 and 11.9% have no idea.

Measurement model results

As for the indicator reliability, all the loadings are above 0.70 except the Social Bonding 5, which only recorded 0.651 (Table 3). Next, the threshold values of Cronbach's alpha and composite reliability are 0.7 (Henseler et al., 2016) to assess internal consistency reliability. Then, to measure convergent validity, an acceptable AVE value is 0.50 or higher (Hair et al., 2021). Table 1 shows that all constructs fulfil the requirements. Discriminant validity was assessed by (1) (Fornell & Larcker, 1981) criterion, (2) the heterotrait-monotrait (HTMT) (Henseler et al., 2015), and (3) cross-loading (Garson, 2016). The square root of AVE was more significant than the intercorrelations of the constructs in the model (Table 1), the HTMT ratios were less than 0.90 (Table 2), and the variable's loading on its construct was higher than its correlation with any other variables (Table 3). In short, all results proved this model's reliability and validity.

Table 1: Results of Fornell-Larcker criterion and reliability assessment.

	Place Dependence	Social Bonding	Sense of Belonging	Social Support	Social Trust
Place Dependence	0.799				
Social Bonding	0.644	0.813			
Sense of Belonging	0.658	0.751	0.815		
Social Support	0.378	0.564	0.479	0.810	
Social Trust	0.418	0.578	0.495	0.676	0.871
α	0.858	0.868	0.830	0.825	0.894
CR	0.859	0.876	0.833	0.828	0.898
AVE	0.638	0.661	0.664	0.655	0.759

Table 2: Results of HTMT ratios.

	Place Dependence	Social Bonding	Sense of Belonging	Social Support	Social Trust
Place Dependence					
Social Bonding	0.748				
Sense of Belonging	0.778	0.887			
Social Support	0.446	0.666	0.577		
Social Trust	0.478	0.650	0.572	0.779	

Table 3: Results of factor loading and cross loading.

	Place Dependence	Social Bonding	Sense of Belonging	Social Support	Social Trust
PD1	0.752	0.531	0.478	0.314	0.382
PD2	0.827	0.509	0.508	0.267	0.301
PD3	0.804	0.505	0.567	0.332	0.337
PD4	0.781	0.458	0.494	0.290	0.317
PD5	0.826	0.564	0.577	0.306	0.334
SB1	0.543	0.802	0.609	0.418	0.474
SB2	0.578	0.849	0.638	0.499	0.545
SB3	0.544	0.870	0.646	0.462	0.478
SB4	0.463	0.872	0.626	0.488	0.512
SB5	0.485	0.651	0.526	0.423	0.318
SOB1	0.561	0.638	0.840	0.359	0.437
SOB2	0.565	0.612	0.861	0.407	0.436
SOB3	0.460	0.588	0.758	0.409	0.370
SOB4	0.555	0.610	0.796	0.390	0.365
SUP1	0.360	0.526	0.486	0.823	0.594
SUP2	0.306	0.413	0.349	0.800	0.471
SUP3	0.219	0.428	0.326	0.800	0.483
SUP4	0.330	0.453	0.382	0.815	0.624
TRU1	0.341	0.413	0.373	0.508	0.810
TRU2	0.363	0.472	0.408	0.594	0.891
TRU3	0.368	0.556	0.454	0.623	0.894
TRU4	0.384	0.564	0.484	0.623	0.888

Structural model results

All VIF outputs are significantly below the standard cut-off threshold 3.0 (Hair et al., 2019). Moreover, near 1.0. as shown in Table 4. For the direct relationships, the impacts of social factors on the sense of belonging (H1; $\beta = 0.533$, t-value = 12.173, $p < 0.01$) and neighbourhood attachment (H2; $\beta = 0.243$, t-value = 5.005, $p < 0.01$) are positive and significant. The results are in accordance with earlier research (Ralph & Staeheli, 2011) (Hidalgo & Hernández, 2001). As hypothesised, a sense of belonging also positively and significantly impacts neighbourhood attachment (H3; $\beta = 0.650$, t-value = 15.406, $p < 0.01$). The results show that the indirect relationship is positive and statistically significant (H4; $\beta = 0.347$, t-value = 9.379, $p < 0.01$). The Variance Accounted For (VAF) value is 58.8%, which suggests that social factors partially mediate neighbourhood attachment through a sense of belonging. Table 4 presents the results of the hypothesis testing of all relationships.

The R^2 values of the sense of belonging and neighbourhood attachment are 0.284 and 0.650, respectively. This indicates that this model explains 28.4% of the variation in the sense of belonging and 65.0% of the variance in neighbourhood attachment. According to Chin (1998), the f^2 value 0.02 represents a small, 0.15 represents a moderate, and 0.35 represents a substantial effect size. Social factors substantially affect the sense of belonging (0.397), while moderate effects on neighbourhood attachment (0.121). Sense of belonging is proven to have a substantial effect on neighbourhood attachment (0.865), as shown in Table 4. The fold, k and repetitions used in this study are 10. The Q^2 values for place dependence ($Q^2 = 0.174$), social bonding ($Q^2 = 0.379$), sense of belonging ($Q^2 = 0.278$), social support ($Q^2 = 0.810$) and social trust ($Q^2 = 0.863$) are more significant than 0. In short, this model's explanatory and predictive powers are deemed adequate.

Table 4: Results of path coefficient and hypothesis testing (direct and indirect effects).

Hypo thesis	Relationship	β	T value	P value	Decision	f^2	VIF
H1	SF -> SOB	0.533	12.173	0.000	Supported	0.397	1.000
H2	SF -> NA	0.243	5.005	0.000	Supported	0.121	1.397
H3	SOB -> NA	0.650	15.406	0.000	Supported	0.865	1.397
H4	SF -> SOB -> NA	0.347	9.379	0.000	Supported	-	-

Note: NA = Neighbourhood Attachment, SOB = Sense of Belonging, SF = Social Factors

DISCUSSION

The mean value of neighbourhood attachment is 3.78 out of 5.00 scale. Neighbourhood attachment was assessed by two variables: place dependence and

social bonding (Kyle et al., 2005; Stokols & Shumaker, 1981). According to the results of SPSS, the mean score of place dependence, which was recorded at 3.93 on a scale of 5.00, is slightly higher than the mean score of social bonding, which indicated 3.64 out of 5.00 scale. This shows that most of the residents have a high level of attachment to their neighbourhoods.

The neighbourhood attachment level is proven to be positively associated with social factors. Mesch & Manor (1998) found that residents feel attached to their neighbourhoods when the community supports their needs, which aligns with this study's findings. In society, people rely on friends or neighbours to get support when they are not with their family. Lewicka (2011) found that place-attached persons tended to have a higher level of trust in people; it somehow showed a relationship between social trust and neighbourhood attachment, which aligns with this study's finding.

Social factors are proven to mediate neighbourhood attachment via the sense of belonging partially. Although social factors could directly impact neighbourhood attachment, the relationship can also be indirectly impacted by a sense of belonging. The study has confirmed the significance and presence of the mediator. The higher the sense of belonging, the higher the residents' neighbourhood attachment level.

Theoretical and practical implications

As mentioned, only some studies on the sense of belonging as a mediator are conducted in the residential context. Little is known about its mediation effect, specifically in the relationship between social factors and neighbourhood attachment. Thus, the main theoretical implication of this study is to clarify how social factors, sense of belonging and neighbourhood attachment relate to each other using this scenario-based study in the Penang setting. The study's practical contributions are expected to offer direction for local governors, developers, urban planners and designers, improving residents' attachment and sense of belonging towards their neighbourhoods in Penang.

Limitations and Direction for Future Studies

The only participants in this study's sample are those living in Penang Island's neighbourhoods. The results might not apply to those who live in other parts of Malaysia or other regions. It can be proposed to collect a more comprehensive sample of residents from other places because it can generalise public opinion. Besides, it is also suggested that other mediators or moderators be considered in future research. Future studies may further look at this mediating role in other settings or among people from varied demographic backgrounds to confirm the study's findings.

ACKNOWLEDGEMENTS

The authors would like to thank the Universiti Sains Malaysia under Short Term Grant Scheme with Project Code: 304/PPBGN/6315315 and the School of Housing, Building and Planning, Universiti Sains Malaysia, for financially supporting this research.

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Received: 26th June 2023. Accepted: 11th August 2023



PLANNING MALAYSIA:

Journal of the Malaysian Institute of Planners

VOLUME 21 ISSUE 4 (2023), Page 402 – 423

STUDY ON THE NEXUS OF CSR AND SOCIAL MEDIA ENGAGEMENT ON TOURIST DESTINATION LOYALTY IN SUSTAINABLE DEVELOPMENT NATURE-BASED TOURISM

Mona Fairuz Ramli^{1,3}, Nurwati Badarulzaman², Samshul Amry Abdul Latif⁴

*^{1,2} School of Housing Building and Planning,
UNIVERSITI SAINS MALAYSIA*

*³ Faculty of Business and Science Management,
KOLEJ UNIVERSITI ISLAM PERLIS, MALAYSIA*

*⁴ Department of Tourism, Kulliyah of Languages and Management,
INTERNATIONAL ISLAMIC UNIVERSITY MALAYSIA*

Abstract

The purpose of this study is to examine the relationship between Corporate Social Responsibility (CSR), and destination brand loyalty and social media engagement, which is not well understood. This particularly occurs in the sustainable development context of nature-based tourism in managing the negative impact on the environment, which is rather challenging. Moreover, the current research aims to develop a simple model for investigating the interrelationship of CSR as well as destination loyalty by incorporating social media engagement as a moderating variable. This is to investigate the impact mechanism of CSR activities of tourists towards tourists' destination brand loyalty in the context of nature-based tourism. The data for this study were obtained from 285 tourists who visited a popular marine park site in Malaysia. The researchers used the partial least squares structural equation modeling technique to analyze the collected data. The findings revealed that both CSR and social media engagement had an impact on destination brand loyalty. These findings have important implications for destination operators, suggesting that incorporating CSR activities into their strategies can be a strategic approach for achieving sustainable success.

Keywords: CSR, Social media engagement, destination loyalty, marine park

¹ Corresponding author Email: monafairuz@kuiips.edu.my

INTRODUCTION

Coastal and marine destination refers to the nature-based tourism product, which are also known as among the rapidly growing sectors within the global tourism industry (Marasinghe, Perera, Simpson, & Newsome, 2021). In this context, the European Union (EU) has acknowledged the capacity of this sector to promote sustainable development as part of its EU Blue Growth Agenda (Dimitrovski, Lemmetyinen, Nieminen, & Pohjola, 2021) as well as the EU Blue Economy studies (European Commission, 2019). Moreover, the United Nations (UN) General Assembly, in 2015, developed a set of 169 targets known as the Sustainable Development Goals (SDGs), which aim to monitor progress towards global sustainability. The 17 Sustainable Development Goals (SDGs), which encompass various areas of global development, must be achieved by the year 2030. One of these goals, Goal 14: Life Below Water, focuses on the preservation and sustainable use of seas, oceans as well as marine resources, with the aim of safeguarding marine ecosystems for future generations. These goals were developed through collaborative efforts across different disciplines worldwide, and they provide countries with the flexibility to choose context-specific solutions that align with their needs and circumstances.

According to Andolina, Signa, Tomasello, Mazzola, & Vizzini (2021), achieving sustainable development is challenging due to environmental as well as social obstacles, including limited resources, fragmented management of resources, and pollution. Meanwhile, Ghaderi, Mirzapour, Henderson, & Richardson (2019) emphasizes the importance of addressing these challenges by implementing effective CSR activities among outbound operators and tourists. In this scenario, customers engaging in nature-based tourism demonstrate a heightened awareness and concern for the importance of preserving the Earth's environmental resources. With a focus on environmental health, biodiversity conservation, and minimizing negative impacts, particularly in marine ecosystems, there is a growing recognition of the need to sustain these resources (Sayre et al., 2020; Schuhmann et al., 2019). Considering the pivotal role of tour operators in the tourism industry, they strive to incorporate specific CSR initiatives to meet stakeholder expectations and address these environmental concerns (Olajide, 2014). Similarly, Interviewee & Commentary (2020) stated that studies on CSR indicate a rising trend in consumer interest towards CSR.

The majority of research findings indicate that customers hold the belief that business or companies operators should participate in social initiatives, and these activities are beneficial for the firms (Lee, Ham, & Koh, 2019). Previous empirical studies have demonstrated a positive correlation between CSR and loyalty, yet no mediating variables have been identified (Kataria, Saini, Sharma, Yadav, & Kohli, 2021). The authors also suggested that adopting an integrated approach would provide a comprehensive conceptual framework to address these

issues. Studies have found that most of the CSR research revolves around hotel and image (Martínez, Pérez, & del Bosque, 2014), branding and decision-making (Ferrell, Harrison, Ferrell, & Hair, 2019) and organization (Martínez, Pérez, & Rodríguez del Bosque, 2014). However, there are limited studies available that provide a conceptual framework pertaining to the impact of CSR on loyalty within the travel industry (Chubchuwong, 2019) and recognize the existing gap in understanding the relationship between CSR and customer loyalty. Past research have recommended that future research should explore the influence of social media engagement on CSR activities, particularly in the context of ecotourism products, to better understand its impact on customer loyalty (Loureiro & Lopes, 2019).

The present study employs signalling theory to construct and test a model that provides better insight into destinations' CSR corporate social responsibility. Furthermore, it focuses on how CSR at the tourist destination level connects to critical relationship variables such as social media and, ultimately, tourist destination loyalty. The association between CSR and marketing outcomes has lately appeared in the literature; nonetheless, several study gaps remain. Initially, the existing research on the influence of CSR initiatives on customer loyalty is insufficient and incomplete (Fan, Haq, Moeriera, & Virk, 2018; Islam et al., 2023; Martínez, Pérez, & del Bosque, 2014)..This suggests that there is a limited comprehension of the mechanism that underlies the connection between CSR and customer loyalty (Ahmad et al., 2021; Gupta et al., 2021).

This study makes three contributions to academia and management practice. The concept of CSR is developed from the literature on corporate reputation. For the first time, this research develops an integrated model to test and explain how received CSR influences outcomes essential to both the general functioning of tourist social media engagement and destination loyalty. To address a significant yet unresolved query, the present study aims to explore the correlation between CSR and social media engagement towards destination loyalty. This relationship remains inadequately understood, especially in the realm of sustainable development in nature-based tourism, which further complicates the management of environmental impact. The study seeks to develop a concise model that examines the interconnectedness of CSR and destination loyalty, incorporating social media engagement as a mediating variable. By investigating the impact mechanism of stakeholder CSR activities on tourist destination brand loyalty within a nature-based tourism context, the study aims to shed light on this subject.

LITERATURE REVIEW

Signalling Theory

The concept of signalling theory arose as a solution to the common issue of information imbalance regarding the attributes of service providers and their capability to adequately meet customer needs (Connelly et al., 2011). Moreover, the theory has found widespread application in various domains as a means to elucidate the phenomenon of customer decision-making (Boateng, 2019). Service providers frequently employ communication strategies to shape their customers' future intentions by conveying information about the quality of their services as well as products. They effectively transform this information into signals and employ diverse channels to transmit these signals to their customers.

The concept of signalling theory involves three essential components: the signaller, the signal as well as the receiver (Connelly et al., 2011). Here, signalers are individuals who possess privileged information about a product that is not accessible to external parties (Kirmani & Rao, 2000). Signals are information indicators disseminated by signalers with the intention of influencing preferable outcomes (Taj, 2016). Receivers are individuals external to the product or service who possess limited information and are open to receiving such information (Connelly et al., 2011). Moreover, the utilization of the signaling theory in this study stems from the recognition that the interaction between tourists as well as CSR involves the exchange of signals.

In detail, these signals serve as conduits for transmitting novel information that can subsequently influence future behavior (Busenitz et al., 2005). In particular, the signal (i.e., CSR) has a direct impact on a tourist's loyalty towards marine park sites. Therefore, the observability of the signal plays a crucial role in signaling theory, representing the degree to which the signal is perceptible or observable.

Corporate Social responsibility (CSR)

The European Commission (2020) describes CSR as the deliberate incorporation of social and environmental considerations into the activities and engagements of businesses, with a focus on stakeholders. Understanding CSR classification is extremely important before moving further with the current investigation. Meanwhile, Carroll (1999) defined social responsibility as the set of expectations placed upon organizations by society, encompassing economic, legal, ethical, and discretionary (philanthropic) dimensions.

CSR is an innovative strategy for addressing social and environmental concerns (Henderson, 2007). CSR research in the tourism industry is currently limited and falls behind the broader research on CSR in other industries (Coles, Fenclova, & Dinan, 2013; Ayuso, 2006). Conclusions made regarding CSR in one organization are seldom directly applicable to similar organizations, let alone

across different industries (Dahlsrud, 2008). Additionally, research on CSR conducted in industries outside of tourism is unlikely to be relevant to the tourism industry. Although CSR research in tourism has primarily focused on visitor behavior at the individual level, there is limited understanding of employee behavior. CSR serves as a strategy to minimize the adverse effects of tourism on the cultural, natural as well as social environments.

CSR initiatives are long-term investments rather than monetary burdens for businesses. These activities are known to be more profitable for businesses than advertising, in which they can also attract consumer interest through CSR initiatives. Customers' heightened awareness of social and environmental issues prompts them to demand the preservation of historical and cultural sites they have visited. Although research has focused extensively on CSR activities, there are gaps in our understanding of the CSR impact towards consumer loyalty.

CSR and Social Media Engagement

As a result of following improvements in modern communication technologies, the way organizations plan and carry out their CSR activities has changed. Given that individuals employ social media platforms as a means to voice their perspectives on company policies and ethical considerations, social media has appear as a potent as well as efficient tool for establishing enduring corporate communication (Hussain et al., 2019).

In conclusion, social media serves as an efficient communication medium for sharing information about CSR endeavors and educating consumers about various CSR initiatives. Numerous scholars have highlighted the significance of utilizing social media as a platform for communicating social responsibility, whether through expressive or collaborative means, as it can contribute positively to shaping brand perception and image (Wang & Huang, 2018). This can also be accomplished by fostering customer trust in the brand. Social media platforms enable the swift dissemination of information, as consumers can share their views and engage with others regarding the social practices of different companies. It is vital to recognize that social media has reduced the costs associated with implementing CSR programs and activities for stakeholders while providing them with an interactive and dynamic environment. This study examines how CSR communication via social media influences tourists' decisions to visit tourism sites that communicate their CSR efforts via social media.

This study built upon the research conducted by Van Asperen et al. (2018) by examining tourist engagement from an online standpoint. Specifically, it focused on social networking platforms like Twitter, LinkedIn as well as Facebook, which are widely used and prominent tools for tourists to connect and share their experiences (Heller Baird and Parasnis, 2011). According to the

classifications of Men and Tsai (2013) and Pagani et al. (2011), the engagement of tourists on these platforms can be categorized into two primary components: active engagement, which involves actively contributing to social media content through actions like reacting, conversing, sharing, recommending as well as adding; and passive engagement, which involves the consumption of social media content by reading, watching and viewing. This study specifically focuses on the active and passive engagement of tourists on social media platforms, particularly in relation to corporate operations such as CSR. The aim is to examine how effectively CSR messages are and targeted and communicated stakeholders, as successful communication can transform stakeholders into advocates. Conversely, ineffective execution may lead stakeholders to become adversaries (Zizka, 2017).

H1a: There exists a positive relationship between CSR and passive social media engagement

H1b: There exists a positive relationship between CSR and active social media engagement

CSR and Destination Loyalty

Customers who had knowledge of a company's CSR initiatives had a more positive opinion of the company's employment practises and investment behaviour while purchasing their products (Creyer, 1997; Sen et al., 2006). The results of their study demonstrated that CSR factors such as the environment, mission, and vision significantly influenced the preferences of these visitors regarding their stay, their willingness to pay, their evaluation of service quality, and their perception of the brand. Previous research has also recognized the influence of the CSR environmental aspects on customer perceptions and their inclination to make purchases. For instance, Laroche et al. (2001) highlighted customers' strong intentions who seek a rather environmentally conscious lifestyle to support brands that are associated with eco-friendly practices.

H2a: There exists a positive relationship between CSR and affective loyalty

H2b: There exists a positive relationship between CSR and cognitive loyalty

Social Media Engagement and Destination Loyalty

Several studies conducted in the tourism industry indicate a positive correlation between engagement in social media and tourist loyalty. Laroche, Habibi, and Richard (2013) discovered that social media brand communities indirectly influence customer loyalty through the establishment of trust. Additionally, research has shown that the social media activities of tourism destinations possessed a positive impact on sales and consumer loyalty (Stephen & Galak,

2012; Erdomuş & İçek, 20). By facilitating interactions, collaborations, information sharing, discussions, and co-creation of experiences and opinions, social media platforms encourage tourists to connect, engage, and actively contribute to their experiences with various entities, including businesses, on an unprecedented scale.

The Internet has become a vast platform for social interaction, collaboration and empowered consumers as a result of social media, with travellers playing a crucial role in both consumption and co-creation concerning their experiences. Despite the fact that businesses utilize social media extensively, little is known about how social media use by businesses affects customer loyalty. According to research by Hudson et al. (2016), social media can affect the emotional connection of customers to a travel brand and, consequently, their likelihood to recommend the business to others. According to Crofton and Parker (2012), utilizing social media as an efficient marketing strategy has a positive influence on a company's ability to enhance customer loyalty and influence purchasing behavior. Building upon this analysis, the subsequent hypotheses are formulated:

H3a: There exists a positive relationship between passive social media engagement and affective

H3b: There exists a positive relationship between passive social media engagement and cognitive loyalty

H3c: There exists a positive relationship between active social media engagement and affective loyalty

H3d: There exists a positive relationship between active social media engagement and cognitive loyalty

The Mediating of social media engagement

As previously said, most research in social media has concentrated on the effectiveness of promotional messages, the primary aims of which are to promote items or brands; however, understanding how CSR communications operate in social media is still in its early stages. Although several studies (Sánchez-Casado, Artal-Tur, & Tomaseti-Solano, 2019; van Asperen, de Rooij, & Dijkmans, 2018) discovered the mediating mechanisms in the association that exists between employee outcomes and CSR, (Yasin, Huseynova, & Atif, 2023) suggested that psychological factors, such as organizational identification as well as affective commitment, significantly mediate the relationship between employee outcomes as well as CSR. The present study investigates the mediating role of active as well as passive social media engagement, which refers to "the degree to which tourists actively or passively engage with social media like Facebook, Instagram, and Twitter" to communicate tourism destinations'

social responsibility towards environmental protection between stakeholders and visitors. Relying on the claims given above as well as past findings, the following hypotheses argue that passive/active media social interaction mediates the correlation that exists between CSR as well as attitudinal and behavioural loyalty. Thus, the hypotheses given below are formulated:

H4a: Passive social media engagement mediates the effect of corporate social responsibility on tourist affective loyalty

H4b: Active social media engagement mediates the effect of corporate social responsibility on tourist affective loyalty

H4c: Passive social media engagement mediates the effect of corporate social responsibility on tourist cognitive loyalty

H4d: Active social media engagement mediates the effect of corporate social responsibility on tourist cognitive loyalty

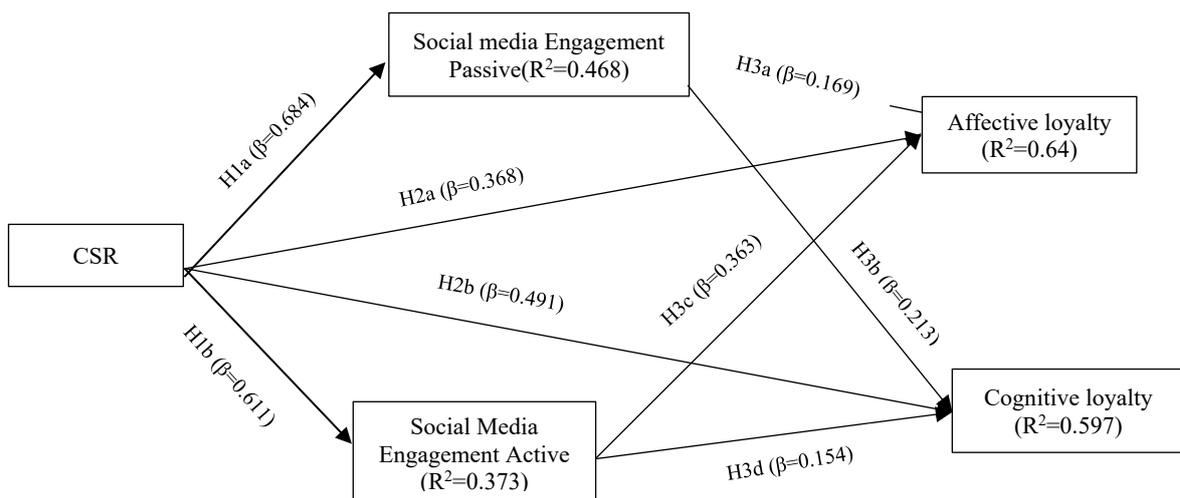


Figure 1: Research Framework

METHODOLOGY

Data Collection and Sample

The current study's approach includes the utilization of questionnaire surveys via a social media platform. The data collection for this research involved administering a questionnaire survey to 350 respondents using convenience methodology, employing a cross-sectional data collection approach. After removing incomplete surveys, 285 acceptable questionnaires were gathered and analyzed, yielding an 81.4% response rate. The participants of the present study

consisted of both outbound as well as inbound tourists who visited popular marine park sites in Malaysia in the month of June 2021. Additionally, the data collected was analysed using the PLS-based structural equation modeling (SEM) technique to evaluate the data and test the hypotheses formulated to address the research question.

Individual inbound and outbound tourists over the age of 18 who visited a marine park served as the unit of analysis with regard to this research. Data was collected through the utilization of an online survey questionnaire and structured interviews. The survey link was shared on WhatsApp, Facebook, and Instagram groups of marine parks and travel agents who have direct sales packages on marine park activities, and respondents were asked if they had visited any marine park destination. A total of 285 valid responses were collected and subjected to empirical analysis. The statistics revealed that females (57.5%) outnumbered males (42.5%). Meanwhile, 71.2% of respondents were between the ages of 20 and 24, followed by 25-28 years (15.8%) and over 46 years (1.1%). The majority of respondents (81.4%) had a college or university degree, with 11.9% obtaining a higher education. Furthermore, monthly family income ranging from RM500 to RM999 was the most common (82.8%), followed by RM2000-RM2999 (6.0%) and RM3000-RM4999 thousand (3.9%). Married respondents (84.6%) outnumbered single respondents (15.4%). The majority of visitors were domestic (99%) and international (1%). Respondents' occupations varied and were well dispersed across occupational levels.

Measurement of the construct

In this study, all constructs are included in the proposed model, and the measurement of the items is based on previous work to address content validity difficulties. The items comprise content type use, CSR, destination loyalty as well as social media engagement. CSR was adapted from (Liu, Wong, Rongwei, & Tseng, 2014; Öberseder, Schlegelmilch, Murphy, & Gruber, 2014; Rodrigues, Borges, & Vieira, 2020) and assessed employing a 7-point Likert scale, ranging from "strongly disagree" (1) to "strongly agree" (7). Kataria et al., 2021 and van Asperen et al., 2018) created a set of seven social media engagement measuring items, which were also employed in this study. Social media participation was assessed employing 7-point Likert scales ranging from "strongly disagree" (1) to "strongly agree" (7). On the other hand, destination loyalty was adapted from (Kataria et al., 2021). Common method variance (CMV) in self-report surveys may impair the reliability as well as the validity with regard to the components and hypothesis relationship model. To eliminate and assess CMV, the researcher used a procedural remedy technique, maintained the item basic and concise, and reduced item ambiguity.

DATA ANALYSIS

This research utilised partial least squares (PLS) modeling using the SmartPLS 4 version (Ringle et al., 2022) as the statistical tool to examine the measurement and structural model as it does not require normality assumption and survey research is normally not normally distributed (Chin et al., 2003).

Common method variance

Since data was collected using a single source, we first tested the issue of Common Method Bias by following the suggestions of Kock and Lynn (2012), and Kock (2015) by testing the full collinearity. In this method all the variables will be regressed against a common variable and if the VIF ≤ 3.3 then there is no bias from the single source data. The analysis yielded VIF less than 3.3 thus single source bias is not a serious issue with our data.

Table 1: Full Collinearity Testing

CSR	SOMEA	SOMEPE	AL	COL
1.399	3.225	2.562	2.141	1.600

Note: CSR = Corporate Social responsibility, SOMEA = Active Social Media Engagement, SOMEPE = Passive Social Media Engagement, AL = Affective loyalty, COL = cognitive loyalty

Measurement Model

The measurement model followed the evaluation steps suggested by Hair et al. (2017). To ensure reliability and validity of the constructs in the measurement model, the indicator loadings and significance were assessed. The standardised loadings should have a value of at least 0.708 and an t-statistic above ± 1.96 to be significant for a two-tailed test at the 5% level (Hair et al., 2020). Loadings ranging between 0.400 and 0.700 “should only be considered for removal from the scale if deleting this indicator leads to an increase in composite reliability above the suggested threshold value” (Hair et al., 2011, p. 145). It is recommended that Cronbach's Alpha (CA), Composite Reliability (CR), Average Variance Extracted (AVE) and Heterotrait-Monotrait Ratio (HTMT) be reported. The scores for CA should be 0.708 or more. This is followed with the examination of internal consistency, where the CR should be greater than 0.700, but lesser than 0.950 (Hair et al., 2020). Based on these results, Table 2 and Table 3, we can conclude that the model is sufficiently reliable and consistent. Table 2 shows the loadings, CA, CR, and AVE of all constructs.

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Table 2: Measurement Model for the First Order Constructs

First Order Constructs	Items	Loading	Alpha	CR	AVE
Corporate Social Responsibility Community (CSRC)		0.919	0.87	0.66	
	CSRC1	0.801			
	CSRC2	0.809			
	CSRC3	0.827			
	CSRC4	0.816			
	CSRC5	0.812			
Corporate Social Responsibility Society (CSRS)		0.804	0.89	0.67	
	CSRS6	0.727			
	CSRS7	0.879			
	CSRS8	0.840			
	CSRS9	0.840			
Corporate Social Responsibility Environment (ENVD)		0.943	0.94	0.64	
	ENVD1	0.699			
	ENVD2	0.734			
	ENVD3	0.798			
	ENVD4	0.825			
	ENVD5	0.862			
	ENVD6	0.841			
	ENVD7	0.806			
	ENVD8	0.862			
	ENVD9	0.868			
	ENVD10	0.787			
	EVD11	0.701			
CSRST (stakeholder)		0.901	0.92	0.71	
	CSRST12	0.803			
	CSRST13	0.776			
	CSRST14	0.873			
	CSRST15	0.889			
	CSRST16	0.887			

Note: AVE= average variance extracted, CR=composite reliability

Sources: Developed by authors

Table 3: Measurement Model for the Second Order Constructs

Second Order Constructs	Items	loading	Alp ha	CR	AV E
Social Media Engagement Active (SOMEA)			0.90 4	0.93 2	0.7 76
	SOMEA4	0.871			
	SOMEA5	0.91			
	SOMEA6	0.902			
Social Media Engagement Passive (SOMEA7)	SOMEA7	0.839			
			0.90 7	0.84 3	0.9 42
	SOMEA1	0.923			
	SOMEA2	0.945			
Social Media Engagement Passive (SOMEA3)	SOMEA3	0.886			
			0.89 8	0.90 2	0.7 13
Affective Loyalty	AL1	0.754			
	AL2	0.850			
	AL3	0.882			
	AL4	0.862			
	AL5	0.885			
Cognitive Loyalty			0.91 2	0.93 8	0.7 91
	COL6	0.902			
	COL7	0.887			
	COL8	0.926			
	COL9	0.842			
Corporate Social Responsibility			0.94 7	0.96 3	0.8 66
	CSRSC	0.947			
	CSRS	0.924			
	CSRSTH	0.941			
	ENVED	0.927			

Table 4: Discriminant Validity (HTMT)

	1	2	3	4	5
1. Affective loyalty					
2. Cognitive loyalty	0.817				
3. CSR	0.761	0.782			
4. Active Social media Engagement	0.795	0.679	0.652		
5. Passive Social media Engagement	0.780	0.736	0.734	0.861	

Structural Model

Assessment of Structural Model

Following the guideline proposed by Hair et al., (2017), the assessment of the structural model comprises of a set of procedures. However, the assessment for the model's predictive relevance Q^2 and q^2 are not included, following a recent recommendation against its usage (Sarstedt et al., 2022). As such, the assessment for structural model is limited to four steps as follows:

Step 1: Assessing the Structural Model for Collinearity

Table 5 demonstrates the outcome of the lateral collinearity test. The variance inflation factor (VIF) score for each individual construct is lower than the offending value of 3.3 (Diamantopoulos & Siguaw, 2006), indicating that collinearity is not an issue in the model.

Step 2: Assessing the Path Coefficients

Table 5 presents the results of path co-efficient assessment for each hypothesized relationship. All eight hypothesized relationships are significant at 99% and 95% confidence interval (p value < 0.01 and < 0.05) with t -values ranging from 1.802 to 15.461. This indicates that the eight hypotheses (H1a, H1b, H2a, H2b, H3a, H3b, H3c and H3d), of the relationships between the constructs are supported. Refer to Figure 2 below for the bootstrapping results.

Step 3: Assessing the Variance Explained in the Model (R^2)

Coefficient of determination or R^2 is commonly used measure to evaluate the structural model's predictive power. There are four endogenous variables: AL, COL, SOMEA, and SOMEPE. The variance explained (R^2) for all the four endogenous constructs. The R^2 value of 0.640 (Affective loyalty) and 0.0597 (Cognitive loyalty) shows that all the exogenous constructs; CSR, SOMEA and SOMEPE explains 64% of the variance for AL and 59.7% for COL, whereas the R^2 value of 0.468 shows CSR explains 46.8% of the variance for SOMEPE. The R^2 value of 0.373 shows CSR explains 37.3% of the variance for SOMEA. Overall, it shows that the relationships between the constructs under investigation are at the moderate level (Hair et al., 2017).

Step 4: Assessing the Effect Size (f^2)

The strength of the structural model link can also be measured by the mean effect size using the R^2 value. The f^2 effect size expresses the change in the R^2 value when a specific predecessor construct is excluded from the model. It differs from the path coefficient, which results from regression and endogenous construct on its immediate predecessor constructs. To examine the impact of exogenous

variables on endogenous variables, effect size (f^2) is used. Based on the results in for effect size of R^2 was explain that CSR has medium size on AL (0.1944), and COL (0.3077). Hence the effect size of SOMEA and SOMEPEP has a small effect on AL (0.0222), and COL (0.0347). The effect size indicates that all the exogenous latent variables are crucial in explaining the endogenous latent variables.

Mediation Analysis

In addition, the results provide information regarding the specific indirect effect in order to test the mediation effects of SOMEA and SOMEPEP in the relationship between CSR on AL and COL. As presented in Table 6, all specific indirect effects were found to be positive and statistically significant, supporting the mediating effects of SOMEPEP (t-value = 1.887 and $p < 0.05$ and t-value=2.140, $p < 0.05$) and SOMEA (t-value = 4.533 and $p < 0.01$, t-value = 1.776 and $p < 0.05$, and) in the relationships between CSR on AL and COL. Therefore, the hypothesis H4a, H4b, H4c, and H4d were confirmed.

Table 5: Hypothesis Testing Direct Effects

Hypothesis	Relationshi p	Std Beta	Std Error	t- values	p- values	BCI LL	BCI UL	f^2	VIF
H1a	CSR → SOMEPEP	0.68 4	0.04 4	15.46 1	0.000	0.60 4	0.75 2	0.87 9	1.00 0
H1b	CSR → SOMEA	0.61 1	0.04 4	13.86 9	0.000	0.53 4	0.68 0	0.59 6	1.00 0
H2a	CSR → AL	0.36 8	0.06 6	5.591	0.000	0.26 5	0.48 2	0.19 5	1.93 3
H2b	CSR → COL	0.49 1	0.08 8	5.610	0.000	0.34 3	0.63 0	0.31 0	1.93 3
H3a	SOMEPEP → AL	0.16 9	0.08 6	1.953 2.280	0.025 0.011	0.02 2	0.30 0	0.02 5	3.17 7
H3c	SOMEPEP → COL	0.21 3	0.09 3	4.819 1.802	0.000 P<0.00	0.04 8	0.35 8	0.03 6	3.17 7
H3d	SOMEA → AL	0.36 3	0.07 5		1	0.24 3	0.49 0	0.13 8	2.64 7
	SOMEA → COL	0.15 4	0.08 6			0.01 4	0.29 7	0.02 2	2.64 7

Note: Note: Effect size of Impact indicator f^2 values: 0.35 (large), 0.15 (medium) and 0.02 (small). R^2 values of 0.75 is considered as substantial, 0.5 as moderate and 0.25 as weak, of which higher values indicate higher levels of predictive accuracy (Hair et al., 2017). The 95% confidence interval with a bootstrapping of 10,000

Table 6: Hypothesis Testing Indirect Effects

Hypothesis	Relationship	Std Beta	Std Error	t- values	p- values	BCI LL	BCI UL
H4a	CSR → SOMEP → AL	0.11 5	0.061	1.887	0.030	0.019	0.216
H4b	CSR → SOMEA → AL	0.22 2	0.049	4.533	0.000	0.147	0.307
H4c	CSR → SOMEP	0.14	0.068	2.140	0.016	0.033	0.257
H4d	→ COL CSR → SOMEA → COL	6 0.09 9	0.053	1.776	0.038	0.009	0.183

DISCUSSION AND CONCLUSIONS

Theoretical Contribution

The influence of CSR and engagement on social media platforms towards destination loyalty can contribute to environmental sustainability. This research provides substantial evidence supporting the notion that social media participation plays a significant mediating role in the relationship between CSR initiatives and customer loyalty in tourist destinations, aligning with previous studies (Bigne et al., 2019). Additionally, the study demonstrates that active involvement on social media reflects the impact of Marine Park's CSR activities, which subsequently affects customer loyalty. Mohammed and Mohammed & Al-Swidi, (2019) highlight that CSR practices have an immediate impact on consumer choices and encourage active engagement on social media platforms, where customers share their holiday experiences with family and friends.

This study has various theoretical ramifications. First, it contributes to the field of destination tourism by establishing the importance of CSR and active/passive social media participation in attracting tourists to return to a destination. This study differs from (Ahmad et al., 2021) in that it focuses on CSR and adoration as sources of consumer loyalty, whereas Mohammed & Al-Swidi, (2019) investigated the impact of perceived value, CSR as well as social media towards customer loyalty. Second, our study confirms the mediation function of active and passive media involvement, which had not previously been investigated. Third, this research contributes towards the knowledge on destination loyalty by confirming that CSR is one of the elements that contribute to the environmental sustainability of tourism destinations. Fourth, it contributes to signalling theory by demonstrating that when and focuses on active and passive social media involvement, tourists become more devoted to marine parks as their future tourist destination, sending favourable signals to existing stakeholders and tourists. Moreover, this study makes a valuable contribution to the field of signaling theory by demonstrating that CSR acts as an affect-based signal that

may be elucidated through tourists' engagement on social media platforms and their loyalty towards the visited marine park site.

Marine parks frequently disseminate information about CSR actions to maintain the environment as well as services with the aim of influencing the future intentions of tourists, in addition to preserving their maritime biodiversity. The marine park crew converts this data into signals that are properly conveyed to visitors via various channels. The implication is that stakeholders in ecotourism destinations serve as a significant and transparent signal that should be acknowledged and taken seriously in the relationship between visitors as well as their loyalty towards marine park sites.

Managerial Implication

In summary, the results indicate that destination managers of marine parks should allocate greater resources to socially responsible initiatives, specifically focusing on environmental activities. This is because visitors tend to appreciate and endorse marine park conservation and restoration efforts that are perceived as socially responsible, leading to the establishment of loyalty towards these destinations. Given the existing evidence and the rising emphasis on environmental preservation, this study reinforces the significant role of environmental CSR endeavors in sustaining and nurturing long-term customer relationships. Examples of such initiatives include green production/service, pollution prevention as well as energy conservation.

The core values of CSR extend beyond profitability, encompassing principles of righteousness, justice, and fairness. In the context of the Malaysian nature-based tourism sector, visitor and stakeholder engagement through social media plays a crucial role in mitigating information asymmetry. Destination managers need to recognize the significance of each element in relation to customer loyalty to gain a comprehensive understanding of their individual contributions. The study's results highlight that among the three components examined, the environment stands out as the sole factor that directly and significantly influences customer loyalty. Environmental activities are frequently observed as an important component in attracting clients and retaining repeat patronage in the nature-based tourist industry (Cheng & Wu, 2015).

LIMITATIONS AND FUTURE STUDY DIRECTION

This study has significant drawbacks. First, there are tourism and marine parks. In the present analysis, Facebook was the most popular social media network. According to research, an increasing number of tourists are switching from Facebook to other social media platforms, for instance, YouTube as well as Instagram, in communicating with their circle of family and friends. WhatsApp is presently the most used social media platform among the social population

(Meltwater, 2023). As a result, future research might use WhatsApp as an alternate venue to investigate the CSR effects messages on stakeholders' perceptions. Another disadvantage of the study is that the hypothesis is tested with marine park visitors using adequate samples from the Langkawi islands in Malaysia. Additional research is required to validate the proposed model using a larger and more diverse sample or in alternative contexts, such as different sectors within the tourism industry. This would enable the generalization of findings regarding destination image and perceived quality, as suggested by Sigala (2016), and enhance the explanatory capability of the model. Furthermore, employing mixed methods in future studies could offer deeper insights into the concepts and relationships examined in this research. It could shed light on questions related to customers' active engagement with hotels on social media and their specific concerns regarding CSR activities, particularly environmental initiatives.

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Received: 26th June 2023. Accepted: 11th August 2023



PLANNING MALAYSIA:

Journal of the Malaysian Institute of Planners

VOLUME 21 ISSUE 4 (2023), Page 424 – 437

RESIDENTS' PERCEPTION TOWARDS THE ENVIRONMENTAL IMPACTS OF RURAL TOURISM DEVELOPMENT — THE CASE STUDY OF DA LAT CITY, VIETNAM

Nguyen Thi Ngan Anh¹ and Suraiyati Rahman²

¹THU DAU MOT UNIVERSITY, VIETNAM

²UNIVERSITI SAINS MALAYSIA, MALAYSIA

Abstract

Tourism development in any destination can bring about positive and negative impacts on the natural environment and social and economic aspects. Da Lat, an emerging tourist destination in Vietnam, is confronted with the positive and negative environmental impacts of tourism, especially in rural areas. Several studies have explored the effect of tourism. However, only few studies have focused on the environmental impacts of tourism development in the rural area of a developing country. On this basis, this research aims to: (i) investigate residents' positive and negative perceptions of the environmental impacts of tourism development in the rural areas of Da Lat city, (ii) examine the influences of age, gender, length of residence, economic dependency on their perception, attitude and supportiveness; and (iii) investigate the influences of the independent variables (residents' socio-demographic features, perception and attitude) on residents' supportiveness. This work involved a case study of four rural communes, namely, Xuan Truong, Xuan Tho, Ta Nung and Tram Hanh at Da Lat City, and a stratified sampling technique was used. This study utilised a quantitative research method by using face-to-face questionnaires with a total of 305 usable responses. The findings revealed that the residents' perception on the environmental impacts of tourism are influenced by age, length of residence and economic dependency. Majority of the residents' demonstrated a positive perception on the environmental impacts of tourism and support the tourism development even though the actual environmental effect is visible at Da Lat city. Attitude is the most significant variable that affect residents' supportiveness. This empirical study may provide the current situation on the supportiveness of residents in Da Lat destination that may benefit the decision-maker in conserving environmental sustainability as a tourism destination.

Keywords: Residents' perception, residents' attitude, residents' supportiveness, environmental impacts, rural tourism

² Senior Lecturer at Universiti Sains Malaysia. Email: suraiyati@usm.my

INTRODUCTION

Tourism has become a vital need in cultural and social life due to the development of modern transportation and globalisation, and it is one of the important economic sectors of several countries, including Vietnam. Vietnam is honored to be the only Southeast Asian country ranked third in the top 10 global destinations with the fastest growing number of visitors in 2018 (Rosen, 2018). Vietnam has been named Asia Leading Destination at the 2018 World Trade Award for the first time (Vietnam Briefing, 2019). Da Lat, a small town situated approximately 290 km away from Ho Chi Minh City and Lam Dong province, has long been one of the most famous tourist attractions in Vietnam. This city continuously attracts visitors throughout the years and significantly contributes to the national tourism industry. Despite these positive contributions, tourism development without a proper plan is a significant concern. Da Lat rural tourism is attractive to visitors and boosts people's awareness of responsible tourism because of its fresh air, good weather conditions for agriculture and intact landscapes. However, the rural regions of Da Lat city, which are rapidly developing to create wealth for the city tourism (Vietnam National Administration of Tourism, 2015), is facing environmental problems, such as illegal forest demolition, erosion, flood, greenhouse effect or water pollution. Local residents' perspectives have been proven to be related to their support and willingness for tourism development (Afthanorhan et al., 2017; Kim et al., 2014; Nyaupane & Thapa, 2006) because they are those who are indirectly or directly influence by tourism. Jackson (2008) highlighted the significance of understanding the opinions and attitudes of local residents as a strategy for developing a sound tourism plan that can mitigate negative impacts and maximise its benefits. This matter is relevant for not only developed countries and urban areas but also developing nations and rural regions. However, here are still limited academic work has been dedicated to developing ones, and majority of them are interested in developed countries where tourism has greatly progressed (Almeida-García et al., 2016; Liu & Li, 2018; Nepal, 2008; Pham, 2014; Pham & Kayat, 2011). This work aims to examine residents' perception towards the environmental impacts of rural tourism in Da Lat city, Vietnam and identify the factors that affect their perception, attitude and supportiveness for further tourism development by using a quantitative research method.

LITERATURE REVIEW

Environmental Impacts of Tourism Development

Environmental dimensions consist of pollution conditions, water, waste and recycling and land use (Nevado-Peña et al., 2015). The relationship between the tourism industry and the environment is complicated. Tourism development is considered a two-sided sword. Numerous scholars have studied the positive and

negative perceived environmental impacts of tourism development. Majority of studies have applied social exchange theory and focused on residents' perception because they are those who are directly or indirectly influenced by the impacts of tourism (Abdollahzadeh & Sharifzadeh, 2014; Abera & Assefa, 2020; Amuquandoh, 2010; Hammad et al., 2017). Researchers have explored certain aspects of environmental impacts associated with the natural landscape, living environment and resource management. Nyaupane and Thapa (2006) examined the perceptions of ecological impacts in a protected area in Nepal. The authors focused on waste management, deforestation, water quality and sanitation, wildlife population and natural conservation. Amuquandoh (2010) considered environmental awareness, environmental protection, historical and cultural site preservation, noise level, water pollution, soil quality, forest and landscape loss and agricultural land loss as indicators. The academic article carried out by Almeida-García et al. (2016) in Spain addressed concerns related to environmental awareness and conservation, waste management, landscape preservation and noise pollution. Hammad, Ahmad and Papastathopoulos (2017) studied residents' perception of tourism impacts in the United Arab Emirates. They identified wastewater, soil quality, noise pollution, environmental pollution, landscape loss, living environment and littering as amongst the components of residents' perceptions. Abdollahzadeh and Sharifzadeh (2014) discussed waste management, water quality and sanitation, residents' living environment and environmental conservation in their study. Tichaawa and Mhlanga (2015) conducted a study in Zimbabwe, wherein they identified attributes, such as noise pollution, air pollution, soil pollution, environmental protection, people and vehicle movement, power and water supply, protected area management and cleaning of public spaces. Abera and Assefa (2020) explored noise, water, waste, pollution and natural resource conservation in their study. Several researchers have explained the perceived tourism impacts and residents' attitudes by using some models/theories, such as the tourist area life cycle model of Butler, Irridex model of Doxey or social exchange theory. Social exchange theory is widely used by numerous scholars (Abera & Assefa, 2020; Andereck, Valentine, Knopf, & Vogt, 2005; Sirakaya et al., 2002; Y. Wang & Pfister, 2008). This theory is relevant in this study as it is utilised to investigate the perceptions and attitudes of residents towards the positive and negative environmental impacts of rural tourism development in Da Lat, Vietnam and their support for further tourism development. Butler and Doxey's models focus on the relationship between tourism development stages and residents' perception. However, such models did not address the heterogeneity of communities in which the interests and elements that affect their attitudes varied.

Conceptual Framework

The conceptual framework of this study, which is adapted from Pham and Kayat (2011), is depicted in Figure 1. In this framework, only four variables are chosen for socio-demographic characteristics. According to a previous literature review, the socio-demographic features of residents influence their perceptions, attitudes and supportiveness towards tourism development. Age, gender, length of residence and economic dependency are the four variables widely used in the study of residents' perceptions (Amuquandoh, 2010; Pham & Kayat, 2011). Scholars have studied the positive and negative perceptions of residents on the environmental impacts of tourism. Based on a previous literature review and the actual condition of a case study, the attributes for residents' perception of the environmental impacts are natural landscape preservation, living environment, environment protection awareness, sanitation, water quality and waste management.

This study aims to answer three research questions as follows:

1. What are the residents' perceptions of the environmental impacts of tourism development in the rural areas of Da Lat city?
2. What is the relationship between socio-demographic attributes (age, gender, length of residence and economic dependency) and residents' perception, attitudes and supportiveness towards tourism development?
3. What is the relationship between the independent variables (socio-demographic, perception and attitude) and the dependent variable (supportiveness)?

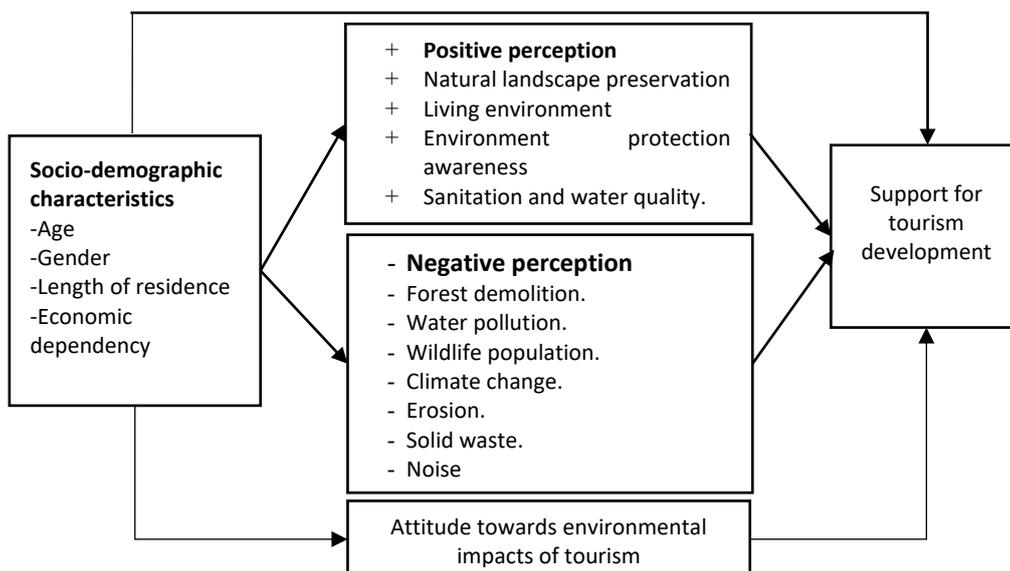


Figure 1: Research framework (adapted from Pham&Kayat (2011), Boonsiritomachai and Phonthanukitithaworn (2019) and Javier (2016))

METHODOLOGY

The study site included the four rural communes: Tà Nung, Xuân Trường, Xuân Thọ and Tràm Hành. The estimated target population in these four rural communes was 20,000 residents. The sample size in this study was 377 respondents (based on Raosoft software). The researcher applied a stratified sampling technique due to the differences in population size and development level of each commune. The number of samples at each commune was equally set. Self-administrated and face-to-face questionnaires were used as the research instruments to collect the data. The data were collected over a period of 4 weeks. The questionnaire comprised 37 questions, divided into four parts. Section A comprises eight questions aimed at delineating socio-demographic features. Section B comprises 17 questions about the positive and negative perceptions of residents about the environmental *impacts* of tourism developments by using a five-point Likert scale. Section C includes five questions about the resident's attitude towards the environmental effect of tourism developments. Section D includes seven questions about the supportiveness towards further developments of tourism.

FINDINGS

Socio-demographic Profiles

The socio-demographic characteristics of respondents are shown in Table 1. Amongst the 305 respondents, 61.6% are male and 38.4% are female. Majority of the participants are in the middle age group, from 36 years old to 55 years old (30.8%). The smallest proportion consists of senior citizens (12%), who are aged 60 years old. Approximately 40% of the respondents lived in the area for 16–20 years. Meanwhile, 7.5% of the respondents lived for 6–10 years in the area. A total of 178 respondents were not dependent on tourism industry either directly or indirectly.

Table 1: Respondents' Socio-demographic Profile

Variables	N	Frequency	Percent (%)
Age (in years)	305		
18-25		57	18.7
26-35		82	26.9
36-55		94	30.8
56-60		60	19.7
Above 60		12	3.9
Gender	305		
Male		188	61.6
Female		117	38.4
Length of residence (in years)	305		
≤ 5		81	26.6
6-10		23	7.5
11-15		45	14.8
16-20		96	31.5
>20		60	19.7
Economic dependency in tourism	305		
Yes		127	41.6
No		178	58.4

Residents' Perception on The Environmental Impacts

Majority of the respondents agreed that tourism development has generated revenue to finance natural site restoration (m=3.97), sanitation improvement (m=3.94) and resident awareness enhancement (m=3.86). The other positive impacts include wildlife habitat protection (m=3.82), solid waste management (m=3.79) and the natural beauty of the landscape improvement (m=3.69). Although these residents acknowledged that tourism has caused the loss of natural forest land and a decline in wildlife population (m=3.78), they hold a

contrary viewpoint regarding the statement that solid waste has increased due to rapid tourism development (m=3.18). The local participants expressed their disagreement with various aspects, including noise pollution (m=2.74), soil erosion (m=2.73), water pollution (m=2.78), clean water shortage (m=2.55), air pollution (m=2.58), climate change due to extensive greenhouse projects for agro-tourism (m=2.18) and local resources over-exploitation (m=2.73) (see table 2).

Table2: Residents' perception of environmental impacts

Variables	Mean (m)	Standard deviation
Positive environmental impacts		
Tourism development in rural area at Da Lat city has improved the natural beauty of the landscape.	3.69	1.102
Tourism development in rural area at Da Lat city has contributed to flora and fauna protection.	3.54	1.166
Tourism development in rural area at Da Lat city has improved sanitation state.	3.94	1.318
Tourism development in rural area at Da Lat city has improved solid waste management of the area.	3.79	1.075
Tourism development in rural area at Da Lat city has contributed to wildlife habitat protection	3.82	1.075
Tourism development in rural area at Da Lat city has enhanced residents' awareness of environmental problems.	3.86	1.057
Tourism development in rural area at Da Lat city has created revenue to finance natural site restoration.	3.97	1.112
Negative environmental impacts		
The loss of natural forest land in rural area at Da Lat city has been caused by tourism infrastructure.	3.78	1.214
Tourism development has led to wildlife population decrease	3.78	1.110
Soil erosion in rural area at Da Lat city has been caused by tourism development	2.73	1.077
Solid waste increase in rural area at Da Lat city has been caused by tourism development	3.18	1.067
Water pollution in rural area at Da Lat city has been induced by tourism development.	2.78	1.211
The possibility of clean water shortages has happened due to the overwhelming number of tourists.	2.55	1.183
Air pollution in rural area at Da Lat city has been induced by tourism development.	2.58	1.045
Climate change has been caused by extensive greenhouse projects for agro-tourism development.	2.18	1.168
Noise pollution in rural area at Da Lat city has been caused by overcrowded tourism.	2.74	1.283
Tourism development has led to excessive use of local resources.	2.73	1.161

Relationship Between Age, Length of Residence, Residents' Perception, Attitude and Supportiveness

A one-way ANOVA test is employed to evaluate the influence of age and length of residence on perception, attitude and supportiveness. The results are illustrated on Table 3. Age and length of residence influence perceived environmental impacts. The significant (Sig.) values are all less than 0.05. This value indicates a significant difference in these variables and positive/negative environmental effect perception.

In terms of positive perception, young people view tourism more favorably (Sig.=0.000) than the older generation. In particular, the youngest respondents, who are in the 18–25 age group, present the highest mean value (m=4.09). Regarding the length of residence (Sig.=0.047), respondents who have been living for 16–20 years view environmental effect more positively than the other groups. With regard to negative perception, the older respondents perceived the more harmful environmental impacts (Sig.=0.012). Respondents who are above 60 years old demonstrated agreement on the environmental impacts of tourism development (m=3.85). By contrast, the youngest age group expressed the least negative opinion towards the statements (m=2.38). In terms of the length of residence (Sig.=0.003), the participants with the period of stay ranging from 11 years to 25 years and 16 years to 20 years expressed the highest negative perception amongst all groups (m=3.58 and m=3.44 respectively). Regarding residents' attitude and supportiveness, all the Sig. values are less than 0.05; therefore, statistical differences in attitude and supportiveness exist based on their age and length of residence. The youngest age group (18–25 years old) demonstrated the most favourable evaluation for attitudes (m=4.76) and willingness to support tourism development (m=4.77). Senior citizens aged above 60 years old expressed the least favourable perspectives (m=1.40 for attitudes and m=1.57 for supportiveness). Regarding the length of residence, residents' attitude exhibited a decline, from the mean value of 4.46 for those living in the area for 5 years or less to 3.03 for survey participants who have resided at the study site for more than 20 years. Moreover, the willingness of these individuals to support tourism development reached highest when their length of stay is 5 years or less (m=4.42).

Table 3: ANOVA test results for the impacts of age and length of residence on perceived environmental impacts

Variables		Mean	Standard deviation	Sig.
Positive environmental impacts				
Age (in years)	18-25	4.09	0.898	0.000
	26-35	3.26	0.61	
	36-55	3.06	0.727	
	56-60	3.07	0.742	
	Above 60	3.15	0.148	
Length of residence (in years)	≤ 5	3.35	0.786	0.047
	6-10	3.30	0.848	
	11-15	2.88	0.909	
	16-20	3.37	0.517	
	>20	3.27	1.02	
Negative environmental impacts				
Age (in years)	18-25	2.38	0.749	0.012
	26-35	3.41	0.649	
	36-55	3.54	0.822	
	56-60	3.32	0.671	
	Above 60	3.85	0.051	
Length of residence (in years)	≤ 5	3.29	0.869	0.003
	6-10	3.17	0.762	
	11-15	3.58	0.512	
	16-20	3.44	0.756	
	>20	2.93	0.921	
Attitude				
Age (in years)	18-25	4.76	0.149	0.000
	26-35	4.42	0.272	
	36-55	3.88	0.441	
	56-60	1.84	0.411	
	Above 60	1.40	0.000	
Length of residence (in years)	≤ 5	4.46	0.203	0.032
	6-10	4.26	0.953	
	11-15	4.08	0.100	

Variables	Mean	Standard deviation	Sig.	
16-20	3.77	0.598		
>20	3.03	1.089		
Supportiveness				
Age (in years)	18-25	4.77	0.145	0.000
	26-35	4.41	0.091	
	36-55	3.89	0.266	
	56-60	2.00	0.273	
	Above 60	1.57	0.000	
Length of residence (in years)	≤ 5	4.42	0.367	0.016
	6-10	4.19	0.136	
	11-15	4.14	0.422	
	16-20	3.85	0.763	
	>20	3.11	1.061	

A multiple regression analysis method in SPSS software is used to explore the impacts of the independent variables (positive perception, negative perception and residents' attitude) on the dependent variable (supportiveness). The result is presented in Table 4. The adjusted R square value is 0.694, indicating that the independent variables account for 69.4% of the variance in the dependent variable (supportiveness). The Sig. value is 0.001 (<0.05), indicating that the linear regression model is appropriate. Based on the result, attitude is the most crucial factor in this model because of its highest β value (0.814) (p-value=0.000). A significantly positive relationship is found between attitude and supportiveness. The negative perception is the subsequent factor that affects their willingness to assist in tourism development (p-value=0.486, β =-0.41). The correlation between these two variables is negative because the β value is negative. With β =0.153, positive perception becomes the element that has the least influence in this model (p-value=0.001). This association is recognised as positive.

Table 4: Multiple regression analysis for residents' supportiveness

Variable	P-value	VIF	β	Adjusted R ²	Sig.
- Positive perception	0.009	3.382	0.153		
- Negative perception	0.486	3.383	-0.41	0.694	0.001

Variable	P-value	VIF	β	Adjusted R ²	Sig.
- Attitude	0.000	1.001	0.814		

DISCUSSION

Based on the findings, majority of the respondents perceived that rural tourism development generates revenue to finance natural site restoration, enhance residents' awareness of environmental problems, improves sanitation state and contributes to wildlife habitat protection. In terms of negative statements, despite the slight disagreement to few statements, the respondents also acknowledged that tourism development has caused the degradation of natural forest land in the rural areas and the wildlife habitat. These perceptions are consistent with Vietnamese public articles highlighting environmental problems in Da Lat city, particularly illegal deforestation and forest land encroachment for tourism projects (Saigoneer, 2018). The public raised issues of water pollution, clean water shortage, erosion, solid waste, air pollution and climate change due to the tourism development in Da Lat (Ministry of natural resource and environment, 2019; Saigoneer, 2018; Tran, 2020; Vietnamplus, 2020). However, respondents did not completely agree that the environmental impacts were derived from tourism development. The environment must be sustainably managed by investigating pollution sources and educating residents about the potential tourism-related environmental problems to promptly detect and prevent the risk of contamination.

Age, length of residents and economic dependency are three socio-demographic variables that are found to have impacts on residents' perception and attitude, whereas gender is explored to have no relationship. Other studies at different sites also show consistent results, such as the research in the Lake Bosomtwe Basin, Ghana by Amuquandoh (2010), in Bisoftu town by Abera and Assefa (2020) and in Kashmir by Charag et al. (2020). In terms of the attitude, this finding diverges from a study carried out in Vietnam by Nguyen et al. (2018), which identified no significant difference between residents' attitude and their years of stay. However, this study supports the result that senior residents have a less optimistic outlook on tourism development than juniors. The result for the economic aspect is supported by earlier studies (Abdollahzadeh & Sharifzadeh, 2014; McGehee & Andereck, 2004; Pham & Kayat, 2011). Meanwhile, all socio-demographic variables, including age, gender, length of residence and economic dependency, are found to have influences on residents' attitude and supportiveness. The female participants exhibit a higher degree of supportiveness degree than their male counterparts, which contrasts with the findings of Nguyen et al. (2018) and Pham and Kayat (2011). Economic dependency is another determinant that shows a positive correlation with supportiveness. The residents' willingness to support tourism development is highest when their length of stay

is 5 years or less, and it slightly decreases among respondents who have live at the area for more than 20 years. This finding is not supported by the research of Man Cheng et al. (2021). Residents' attitude emerges as the most significant determinant for their supportiveness towards tourism development, followed by positive and negative perceptions. The more favorable perception they have on tourism environmental impacts, the more support they show, and vice versa.

CONCLUSION

This research has confirmed the social exchange theory, contributing to the theoretical ground, which is helpful in explaining residents' perception and support for tourism development. According to this theory, residents may express a positive attitude towards an exchange if they recognize more benefit in that interaction. The study focuses on positive and negative impacts of the environment only, the aspect that has still inadequately researched, whereas the majority of studies extend their scope to nearly all elements, including economic, social, cultural, and political. Therefore, the environmental impacts from tourism development can be examined comprehensively. Practical implications for Da Lat tourism stakeholders to take imperative strategies to reduce impact of tourism development in Da Lat. First, despite the pollution problems concerned by the public recently, residents still show a more positive environmental perception of tourism development. It is necessary to intensify environmental management to avoid operations that may produce more pollution. Stakeholders should take their role to encourage residents to adopt an environmentally friendly lifestyle. Second, besides positive perception, this research finds that the loss of natural forest land and wildlife population decrease due to tourism projects are the most residents' negative concerns. To enhance residents' supportiveness and sustainable tourism, it is recommended to control development at sensitive areas and strictly handle violations; reserve natural forest to maintain wildlife flora and fauna population; advise residents to rationally use chemicals in agricultural production to mitigate pollution due to agricultural tourism; develop regulations for tourism activities in sensitive areas in accordance with their carrying capacity, and construct projects that are in harmony with the natural landscape. Lastly, residents tend to underestimate the adverse environmental impacts of tourism development, so the areas may have the possibility to suffer. The government should have campaigns to educate them to comprehend potential tourism-related environmental problems carefully and establish preventative measures to avert the challenges.

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Received: 26th June 2023. Accepted: 11th August 2023



PLANNING MALAYSIA:

Journal of the Malaysian Institute of Planners

VOLUME 21 ISSUE 4 (2023), Page 438 – 451

BUILT ENVIRONMENT AND SOCIAL FACTORS ASSOCIATED WITH CYCLING BEHAVIOUR IN PUTRAJAYA

**Norhazlan Haron¹, Wan Rabiah Wan Omar², Halmi Zainol³, Suharto
Teriman⁴, Noor Syarafina Sallehudin⁵**

*^{1,2,4,5}College of Built Environment,
UNIVERSITI TEKNOLOGI MARA*

³Halmi Z Planning Consultant

Abstract

Cycling as a mode of transport has been identified as one of the solutions to traffic congestion, high carbon emission, and health issues in both urban and residential areas. Lately, cycling is growing in popularity among residents, and many are involved in cycling activities for various personal reasons: now, bicycle is not only for transport, but it is also used for sports' training, exercise, and recreation. This cycling trend offers multiple benefits, and to help increase the momentum, some forms of intervention should take place. Two intervention factors that contribute to cycling behaviours are the built environment and social factor. Thus, this study seeks to explore the built environment and social factors that influence cycling behaviour in Putrajaya area. The respondents were selected among cyclists in Putrajaya using snowball and convenience sampling procedures. Through the use of descriptive analysis and after finalising the suitable variables by Factor Analysis, the finding reveals the suitable and reliable factors for future intervention. The implications and recommendations from this research contribute to the existing body of knowledge on cycling behaviour.

Keywords: Cycling Activity, Behaviour, Built Environment, Social Factor

¹ Senior Lecturer at UiTM Perak Branch. Email: hazlan100@uitm.edu.my

INTRODUCTION

Cycling is considered to have an increasingly important role in transport development due to its environmental and health benefits (Anthony, 2020; Alexandros et al., 2021). It is found that cycling activity is highly concentrated in the areas that are provided with supporting facility and infrastructure. It is also necessary to understand the behaviour of the individuals and their reasons in choosing a particular mode of transport (Marcus et al., 2021).

In Malaysia, sedentary and physically inactive lifestyles have become major issues among the public, especially adults. Such lifestyle has caused the increasing number of people with obesity and chronic illness including coronary heart diseases, stroke, diabetes, as well as colon and breast cancer (Thomas, Jan, & Billie, 2015). Previously, the Malaysians' level of physical inactivity was the highest at 16.5% compared to all of the Western Pacific Region countries. In 2019, World Health Organization (WHO) reported 75.2% of Malaysians were physically inactive (World Health Organization, 2020). The relationship between built environment characteristics in community areas and different dimensions of physical activity has been recently documented. It was found that the general attractiveness of the physical environment, enjoyable scenery, degree of greenness, and perceived levels of safety are significantly correlated with physical activity. Apart from human factors (personal and social factors), it was also reported that natural and built environment characteristics play an important role in an individual's physical activity including cycling. The list of built environment factors drawn from previous research and the situation in Putrajaya are chosen to be used in identifying the suitable situation for people in this community. The main aspect to determine the interaction between all factors will be based on the cycling behaviours of cyclists and their personal characteristics. The objectives of this paper are (i) to identify attributes factors that can enhance the level of cycling activity, (ii) to identify the built environment and social factors that can enhance cycling behaviour and (iii) to analyse the most suitable intention factors that influence cycling behaviour. The outcome of this paper will identify the built environment factors and whether the measurement used is reliable and able to sustain the behaviour of cyclist in Putrajaya.

LITERATURE REVIEW

Cycling Behaviour

Cycling activity has been widely recognised as an environmentally friendly mode of transport and linked to a healthy lifestyle. The activity includes a myriad of advantages for the society, economy, and environment, especially in the transition of motor vehicles era to sustainable mode of transport (Meng et al, 2014). The European Commission (2000) listed four main benefits of cycling: a) social benefits - the social advantages of mobility, greater access and accessibility of all facilities; b) positive ecological impacts - such as opening of new land,

notion of the environment especially for habitat and biodiversity; c) economic benefits - such as reducing household expenditure for vehicles dependant, reducing working hours caused by traffic jams, and reduction of health cost from regular cycling exercise; and finally d) political benefits - reduction of dependency on non-renewable energy. Most of the variables that influence cycling activity will increase urban cycling mobility levels and subsequently this behaviour will give positive impact as it is a great strategy for healthy lifestyle and sustainable cities (Brian et al., 2003). The built environment factors become the major component factors to influence the cycling behaviour and cycling activity. Related items and conditions like surrounding development, existing facilities for cycling, current circulations of road traffic, and conditions of infrastructure within the cycling lane are the list of built environment factors that influence the willingness of people to cycle. A previous study on cycling and built environment factors conducted by Anne, Chanam, and Allen (2005) proved that the characteristics of built environment factors can influence people's selection and choice to cycle (or not) in the selected and dedicated lane. The relation, benefits, and impact of cycling activity behaviour are related with three main purposes and detailing of cycling behaviour: 1) recreation and physical activities, 2) impact and benefit for health among cyclists, and 3) the consequences of transportation aspect.

Category of Cyclists

Cycling behaviour can be classified by the category of cyclist. There are five (5) categories of cyclists namely Non-Cyclist, Lapsed Cyclist, Occasional Cyclist, Regular Sport Cyclist and Utility Cyclist (Fiona et al, 2015). The understanding of cycling behaviour is best explored from the views and experiences from different categories of cyclists using the Social Practice Theory. Table 1 describes details in the categories of cyclist that have been grouped and synchronised by related factors.

Table 1: Group of Cyclists and Description

Type of cyclists	Description
Non-cyclists	Generally male, pro-car, anti-cycling
Lapsed cyclists	May have cycled as children or more recently but do not cycle now. Know the benefits but have no plan to do it. Have low level of contemplation. Non leisure cyclists.
Occasional cyclists	Occasional leisure cyclists (ride once a month/every two-month/during holiday). Have not experienced utility cycling but are contemplating to cycle more. More to having an aspiration at this stage.
Regular sports cyclists	Regular leisure/sport cyclists. Possibly join weekend club riders or regular family outing. Similar but little or no regular cycling.
Utility cyclists	Utility cyclists (cycle to work and daily routine) who are contemplating utility cycling more/using their cars.

Sources: Fiona, Tim, Alan, & David (2015).

Cycling behaviour in Malaysia gained popularity in 2020, when Malaysia was ranked second in Asia in terms of the number of bicycles sold (WHO, 2021). This pattern keeps growing especially after the Covid-19's Movement Control Order (MCO) ended in 2021. The number of cyclists has increased especially for two categories of cyclists namely the occasional cyclists and the regular sports cyclists.

Influential Factors on Cycling Behaviour

Cycling behaviour is fluctuating and has been found to be mainly influenced by Personal Status, Built Environment and Cycling Purpose. Figure 1 shows the ecological model of cycling behaviour by Brian et al. (2003). There are three (3) variables for Personal Status, five (5) variables for Built Environment elements, and two (2) variables for Cycling Purpose. The author also identifies psychological factors such as self-efficacy, perceived benefits, barriers, social support, and enjoyment of cycling activity as factors influencing cycling behaviour. Focusing on the Built Environment Elements such as density, connectivity, and land use mix can significantly influence cycling for mode of transport. However, cycling for recreation or exercise is highly influenced by Safety (traffic, crime, animals), aesthetic and topography. In addition, Personal Status, namely vehicle ownership also influences cycling as a transport mode while income, age and gender are factors which influence cycling for both purposes that are cycling as transport mode and for recreation or exercise. From this model, a more comprehensive investigation of non-built environmental factors is required.

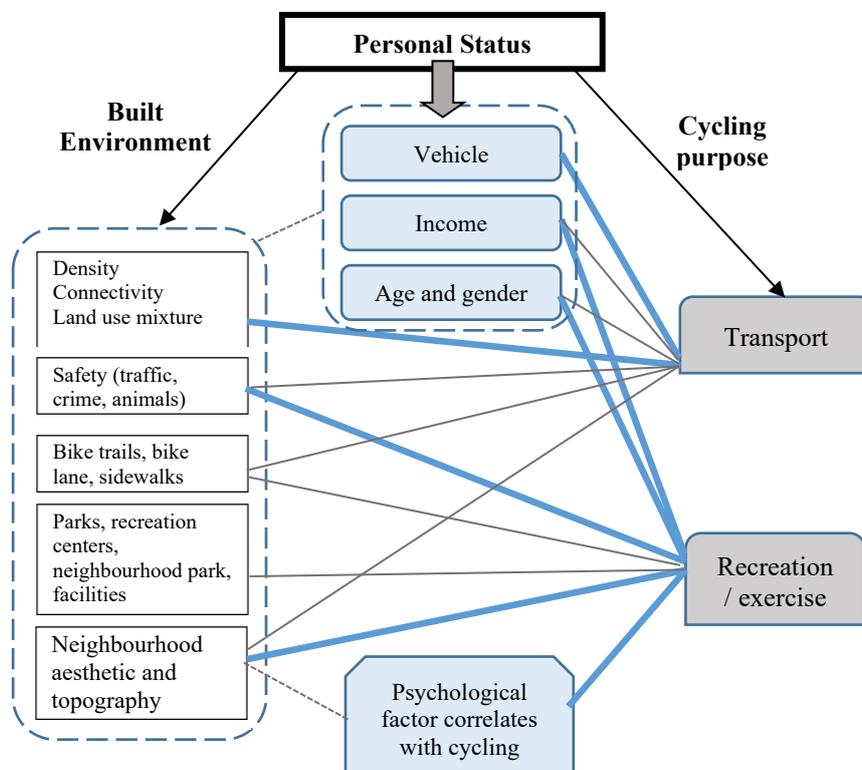


Figure 1: The Ecological Model of environment influences on cycling activity.
 (Brian, 2003)

Built Environment Factors

Research conducted by John and Ralph (2008) highlighted that the built environment factors correlate with cycling behaviour. The presence of trail or cycling lane, in the nearest neighbourhood will increase the behaviour of cycling. Other related factors such as small areas with convenient stores, commercial buildings, offices, and employment centres around that areas also support cycling behaviour. Amiruddin (2014) stated that traffic condition like route related, cycling lanes, traffic speed, traffic volume, number of lanes, topographical conditions, and block size also play a role in cycling behaviour. The facilities that support cycling activity must be associated with cycling-oriented facilities. Investigating the perceptions of people is believed to be important to correlate the reasons for residents or people to cycle. Psychological correlation of physical activity and environmental variables or factors are closely related to the behaviour.

Built environment factors which are the key attributes of cycling behaviour are found to differ by category of cyclist and characteristic of land use and infrastructure (Frank et al, 2005), aesthetic of the surrounding environment (Owen et al., 2004), accessibility to facilities (Leslie et al., 2008), and recreational facilities (World Health Organisation, 2010). All these built environment factors in urban and residential areas are believed to influence the levels of cycling activity. According to Lee and Mouden (2004), cycling activity is also influenced by the existence of built environment barriers factors. Table 2 summarises the general-built environment factors and their relationship with the main barriers. The listed barriers create a lack of high-quality route-related facilities which has an impact on the cycling behaviour among residents. These barriers have been evaluated and defined by several research especially for residential, commercial, and selected community area.

Table 2: General built environment factors in relation to different types of barriers.

Type of barriers	General characteristics activities (Factors)
Opportunity	<ul style="list-style-type: none"> - Availability of facility design suitability - Reducing individual’s opportunity to cycle - Shortening the distance
Access and distance safety	<ul style="list-style-type: none"> - Increasing accessibility - Improving personal security - Improving personal safety - Improving transport safety - Reducing fear of injury, accident, and animal attack
Physical setting	<ul style="list-style-type: none"> - Improving aesthetics appearance, natural sceneries, and environment quality - Increasing comfort level - Provision of supporting facilities

Source: Lee and Mouden (2004)

SOCIAL FACTORS THAT INFLUENCE CYCLING BEHAVIOUR

Prior studies and existing literature highlight on physical factors which affect the selection for cycling as physical activity. There is an urgency and need to assess not only factors that can be observed physically but also those that are related to cyclist’s emotions, feelings, and personal perceptions. In any study on this matter, the focus and intention has to be to identify the social factors, personal factors that stem from the cyclists’ actual behaviour (Ajzen, 1991). Such approach is relevant and useful to gain a better understanding of user’s behaviours towards cycling and determined action for bicycle use. From these factors, the relevant Theory of Planned Behaviour (TPB) is the most important and it concerns with an investigation of human behaviour.

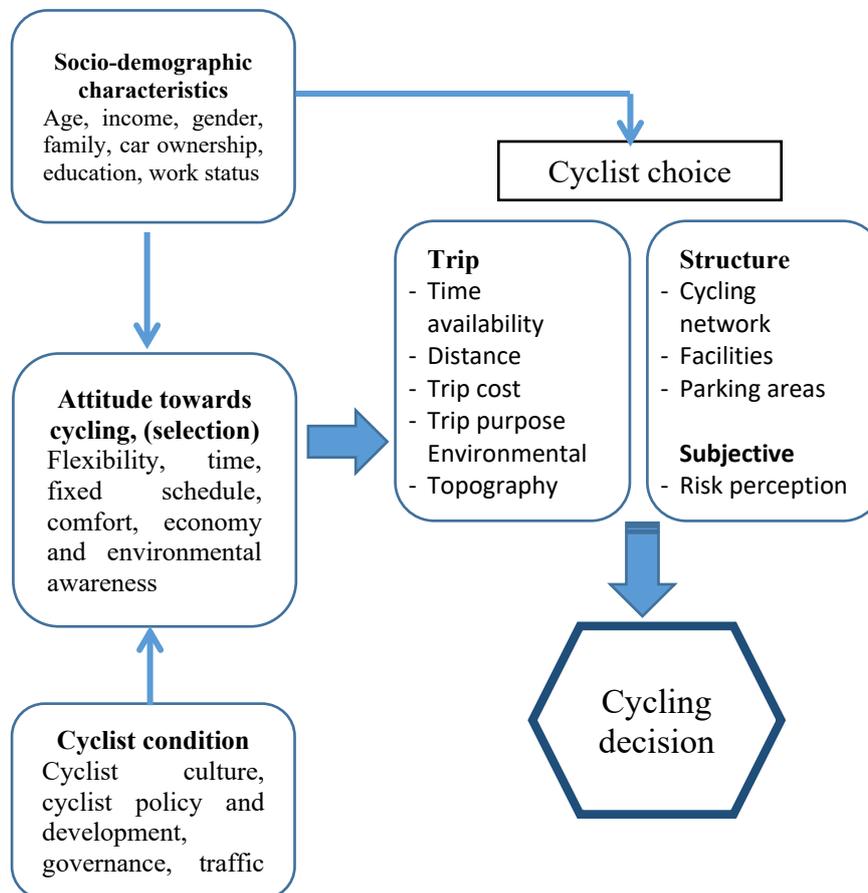


Figure 2: Conceptual Model of Factors affecting cycling use related with Theory of Planned Behaviour (TPB) (Alvaro F.H., et al 2014)

Three independent determinants will be discussed based on the people's perception of their selection to take up cycling. 1) The attitude toward the behaviour, 2) Subjective norms which determine the perception of others to adopt the behaviour of cycling. 3) the perceived behaviour control, or the ability to perform the behaviour of cycling. (Ajzen, 1991).

RESEARCH METHODOLOGY

To suit the research aim, this study uses an explanatory research design and focuses on collecting primary and secondary data. The techniques used in this study are focus group survey, pilot studies, and experience surveys. A focus group survey was conducted among the respondents of the selected cycling clubs.

The collection of data via group survey is easier as the researcher could meet the respondents at a specific location in Putrajaya, right at the cycling station and check points of cyclists' gathering. Using social media tools such as WhatsApp application and Facebook Messenger, the respondents could send their responses easier and faster to the researcher. Detailed practice of using social media application in the process of collecting data is explained in the next paragraph. This technique is related to the technique used in a study conducted by Vivienne et al. (2015). The questions from the survey are also the most prominent data collection tool to validate the collection of data from survey. Survey technique is believed to be a suitable way of assessing people's perception, meanings, and definitions of situations (Jones, 1985).

Phase 1 of the data collection relates to the specific individual personal characteristics as the influential factors for cycling activity. It was measured using the frequency and the scenario of cycling activity in terms of time, distance, and memberships of cycling club. In Phase 2, interviews were conducted to identify the constitution of legitimate problems, solution, and criteria of proof for all the list of identified factors (Cresswell, 2003). The data also supports the validity of questions and instrument used in the survey. The collected suggestions, additional items, and survey content become the reference in the data analysis. Finally, the result from the survey and interview conducted are presented to identify the attributes and the main factors of cycling behaviour that affect cyclists.

ANALYSIS AND DISCUSSION

Built Environment Factors That Influence Cycling Behaviour

Based on the analysis and variables for built environment factors, the factors identified are functional features, trail surface and path, safety and traffic condition, aesthetic, destination, bicycle facilities, views and visibility, and maintenance. All these variables and factors must be measured by considering overall cycling behaviour. The cycling activity situation among respondents was estimated based on the total of cycling per minutes and days per week engaged in any place. The estimation for cycling in neighbourhood areas is based on purpose, distance, and destination. Built environment factors are listed with eight items and divided into several sub-items. The detailed selection of reliable factors is measured similarly with the personal factors based on the value of mean and reliability of sub-items by Std Deviation. Functional features are divided into four sub items like specific route for cycling, type of gradient, intersection design and distance, and lastly the access point between places. The survey results from the respondents were measured according to the Factor Analysis, by using the Kaiser-Meyer Olkin (KMO) sampling adequacy, alpha coefficient for listed items, and sorting from the deleted items by previous analysis. The value of KMO by sample was factorable (KMO = .919). 29 items (sub factors) have been sorted by previous analysis, with the alpha coefficient .701. and the items have relatively high

internal consistency (Creswell, 2008). After Factor Analysis (FA) was carried out, the items were sorted from 42 items to 29 items based on the value of Std. Deviation. Table 3 shows the items for Factor Analysis of built environment. By using the Principal Component Analysis (PCA) to support the FA, 29 items were selected. The FA procedure was conducted repeatedly and returned with a KMO value of .919. This KMO value is more than .50 and suitable for factor analysis. The first factor obtains the largest eigenvalues because it gave the largest contribution to the changes in the total variance in the variables. The results for the factor analysis brought eight factors in a group which together reached at KMO value of 74.95.

Table 3: Items for Factor Analysis for Built Environment

Items	Component			
	1	2	3	4
<i>Sub Factor 1: Functional Feature – cycling lane</i>				
Specific route				.502
Type of gradient	.673			
Access point between places	.725			
<i>Sub Factor 2: Trail surface and path</i>				
Continuity of path	.744			
Comfort, suitable path design	.800			
Location of trail and path	.815			
Level of maintenance	.838			
<i>Sub Factor 3: Safety and Traffic Condition</i>				
Easy crossing between lanes		-450		
Safe from trees and shrubs		-443		
Good lighting	.702			
Safety camera and surveillance		.381		
Safe from water ponding		-424		
Illegal parking		-386		
<i>Sub Factor 4: Aesthetic</i>				
Cleanliness of cycling lane	.838			
Presence and size of trees	.814			
Diversity on natural sight	.661			
<i>Sub Factor 5: Destination</i>				
Commercial facilities			.539	
Bicycle parking facilities			.492	
Public Facilities			.609	
Public Park	.699			
<i>Sub Factor 6: Bicycle Facilities</i>				
Cycling Signage		.331		
Bicycle storage park	.816			
Shelter protection		.415		
<i>Sub Factor 7: Views visibility</i>				
Visibility road and cycling lane	.827			
Presence of hilly area	.581			
Presence of trees, landscape		.391		

Items	Component			
	1	2	3	4
<i>Sub Factor 8: Maintenance</i>				
Clean and clear cycling lane	.826			
Barrier from vehicles	.796			
No overgrown grass and bushes				-.369
Percentage Variance Explained	24.7	21.3	15.4	13.6
KMO	.919			
Bartlett's Test of Sphericity	3868.945			
Total Variance Explained	74.95			

Social Factors That Influence Cycling Behaviour

Social factors are listed with nine items, and this analysis of the situation is based on the cyclist perception. The detailed selection of reliable factors has been measured similarly with the personal factors. Based on the value of mean and reliability of subitems by Std. Deviation, the highest mean for these subfactors is 4.56, which complies with traffic laws. The value for Std. Deviation that has been measured and found to be reliable for six subfactors are: bicycle lane maintenance; traffic laws; feel safe; using cycling lanes; familiar with bicycle lanes; and equipped bicycle lanes. The results for social factors among respondents have been measured by previous analysis. The survey results from the respondents were measured according to Factor Analysis, by using the Kaiser-Meyer Olkin (KMO) sampling adequacy, alpha coefficient for listed items, and sorting from the deleted items by previous analysis. The value of KMO by sample was factorable (KMO = .778). Seven items (subfactors) were sorted by previous analysis, with the alpha coefficient .701. and the items have relatively high internal consistency (Creswell, 2008). After FA was carried out, the items were sorted from nine items to six items based on the value of Std. Deviation. Table 4 shows the items for Factor Analysis of social factor.

Table 4: 20 Items for Factor Analysis for Social Factor

Items	Component	
	1	2
<i>Social Factor</i>		
Bicycle lanes maintenance	.774	
Feeling safe using bicycle lane	.758	
Feeling to use bicycle lane	.748	
Familiar with bicycle lane	.724	
Comply with traffic laws		-.541
Equipped bicycle lane		.716
Percentage Variance Explained	35.3	32.3
KMO	.778	
Bartlett's Test of Sphericity	215.817	
Total Variance Explained	67.61	

By using the Principal Component Analysis (PCA) to support the Factor Analysis (FA), the items were sorted to seven items. The FA procedure was done repeatedly, and it returned with a KMO value of .778. This KMO value is more than .50 and suitable for factor analysis. The first factor obtained the largest eigenvalues because it gave the largest contribution to the changes in the total variance in the variables. The results for the factor analysis have been grouped into eight factors which together explained the KMO value of 67.61. The findings provided sufficient elements and proofs based on the objectives of the study. A confirmatory factor analysis was conducted to identify the specific and various factors that are quite reliable and influential towards the behaviour of the people to cycle in Putrajaya. Using factor analysis, eight main factors have been listed in terms of Perceived Towards Behaviour. For functional features, from the four listed items, only three were selected. For trail path factors, all four listed items were used to evaluate and test for their reliability. In safety factors, seven items from ten factors were selected. Other factors were removed due to the poor and insufficient value for reliability and validity. Aesthetic features listed five items, but only three were selected. Of six items for destinations features, only five were selected. Additionally, three from five items in bicycle facilities were selected. Three from five items were selected in views and visibility features. Lastly, three maintenance factors were selected from six items. The total number of listed built environment factors for evaluation are 45 items (Table 5). Only 31 items remained for hindrance and influential for cycling behaviour. Table 5 presents the results that indicate all of the selected and suitable factors in the conceptual framework that are retained.

Table 5: Reduction of Items

Factors		Independent Variables	Dependent Variable
Built Environment Factors (45 items)		Functional Trail path Safety Aesthetic Destination Bicycle facilities View and visibility Maintenance	Intention and choice for cycling activity
		Items	Items
		45	1
		reduction	reduction
Factor Analysis		31	1

CONCLUSION

The findings and results from this research have provided new information in the discussion on development, strategies, and concepts to enhance cycling behaviour among cyclists in Putrajaya. This study adopted and applied the Theory of Planned Behaviour (TPB) that includes individual characteristics, personal factors, built environment factors, and social factors. The findings from Factor Analysis have added to the existing body of knowledge and represent the scenario of cycling behaviour. This study validates the viewpoint that in the context of built environment factors, there is a need to use the listed types of factors that promote cycling behaviour. Items for each reliable factor can be added with a different set that influences cycling behaviour. The interpretations of this study have contributed to an understanding of the relationship between cycling behaviour and the reliable influential factors for cyclists. The discussion and findings have contributed to the growing body of knowledge, particularly to the understanding of cycling behaviour. Overall, the research findings show that the listed factors are related to the TPB and Factor Analysis implementation. These factors become the guidance for future research and studies in terms of preparation of guidelines of cycling infrastructure, cycling provision of development, and cyclist demand factors.

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Received: 26th June 2023. Accepted: 11th August 2023



PLANNING MALAYSIA:

Journal of the Malaysian Institute of Planners

VOLUME 21 ISSUE 4 (2023), Page 452 – 466

VISITOR WILLINGNESS TO PAY CONSERVATION FEES AT CMC TIGA WARNA IN MALANG, INDONESIA

Huang Zimo¹, Shida Irwana Omar², Syamsul Bachri³, Sumarmi³

*^{1,2}School of Housing, Building, and Planning,
UNIVERSITI SAINS MALAYSIA*

*^{3,4}Faculty of Social Science,
UNIVERSITAS NEGERI MALANG*

Abstract

This paper was aimed at investigating the factors that influence visitors' willingness to pay (WTP) for conservation fees for the Clungup Mangrove Conservation (CMC) Tiga Warna project in Malang, Indonesia. The contingent valuation method (CVM) was used to estimate the amount that visitors would be willing to pay in additional conservation fees to enable improvements to be made to the CMC Tiga Warna area. The results that were obtained from 311 respondents indicated that visitors were willing to pay an additional Rp 12829.58 per person on top of the initial conservation fee of Rp 10,000. In terms of the socio-demographic variables, age and marital status had a significant impact on the willingness to pay. Furthermore, the results indicated that those visitors who had a higher perceived value and a higher level of trust in the managers of the CMC Tiga Warna tended to contribute more to the area. The results of this study will serve as a valuable guide for managers in adjusting prices and making management decisions to ensure the further sustainability of ecotourism at the CMC Tiga Warna area.

Keywords: conservation fees, visitor, willingness to pay, CMC Tiga Warna, Indonesia

² Lecturer at Universiti Sains Malaysia. Email: irwanizar@usm.my

INTRODUCTION

Mangroves are an extremely productive ecosystem that offers numerous economic benefits such as the storage of carbon, food, timber, fuel, and fibre (Murdiyarso et al., 2015; Zhu & Yan, 2022). Additionally, mangroves act as a natural buffer to maintain shoreline stability, prevent coastal erosion and reduce the impact of natural disasters such as tsunamis and typhoons (Arifanti et al., 2022; Saputra et al., 2020). Furthermore, mangroves can serve as a habitat for aquatic and terrestrial life as well as a place of education and recreation for humans (Saparinto, 2007; Saputra et al., 2020).

Despite their importance, mangroves have been declining alarmingly across the globe (Matatula et al., 2019). Indonesia, in particular, has lost 40% of its mangroves in the last few decades, making it the country with the highest rate of mangrove destruction (Leal & Spalding, 2022). As a result of frequent human activities, including deforestation, plantations, aquaculture, and others, the Clungup Mangrove Conservation (CMC) Tiga Warna area in Malang, Indonesia, suffered the most damage to its mangrove conservation between 1998 and 2010 (Retnaningdyah et al., 2021). It must be noted that until 2005, only 15 hectares remained of the mangrove area, while 81 hectares had been damaged. As a consequence of the ongoing damage, mangrove ecosystem services have been reduced, resulting in the loss of biota habitats, coastal erosion, and reduced flood and water productivity (Rahmania et al., 2020).

While the CMC Tiga Warna area suffered significant destruction in 2012, thanks to the "Bhakti Alam Sendang Biru" community team, led by Mr Saptoyo (Sumarmi et al., 2021), the conservation area is now made up of 77.7 ha of mangroves, 10 ha of coral reefs, and 33 ha of protected forest. Moreover, ecological stability has been restored in the CMC Tiga Warna area by controlling the number of daily visitors, limiting vehicle emissions, and checking garbage (Eunike et al., 2018). With its stunningly clear tri-coloured waters and biodiversity, the CMC Tiga Warna area was able to attract 41,061 visitors in 2022, generating a revenue of 1.8 billion Rupiah. Therefore, the CMC Tiga Warna area has been rated as the best-managed ecotourism destination by the Maritime and Fisheries Department of Malang Regency (Riniwati et al., 2019).

However, these problems continue to plague the CMC Tiga Warna area. When it comes to nature, coastal environments are prone to degradation (Dharma et al., 2021). There has been severe damage to the coral reefs in this area, where 80.76 per cent of them have died (Riniwati et al., 2019). Despite human assistance, the mangroves are still at risk of degradation (Bunting et al., 2018). Observations and interviews from an ecotourism perspective indicate that: 1) The location of the entrance gate is unclear; 2) The road for visitors to the beach is long and difficult; 3) There is a lack of safety signs or directions; 4) Due to the large amount of marine litter floating in the sea, it is difficult to clean the Tiga

Warna beach after a rainstorm; 5) The tourism infrastructure remains limited. For example, the restaurant is only open when a lot of visitors are present.

Restoration is one of the most effective solutions to these problems (Amaliah, 2018). Currently, the conservation fee for the CMC Tiga Warna area is Rp 10,000 per person for a donation of one mangrove seed. Pearce et al. (1989) suggested that economic values and the environment interact over time. As a result, to improve the infrastructure at the CMC Tiga Warna ecotourism area and to enhance conservation activities, the conservation fee needs to be increased to support effective management and conservation. Tourists play a crucial role in ecotourism since they are the primary participants and the basis of the local economy. Therefore, estimating the willingness to pay for additional conservation fees is crucial for improving ecological restoration at the CMC Tiga Warna area and promoting sustainable development (Iqbal, 2020). However, at the moment, there are no studies on the willingness to pay (WTP) in the CMC Tiga Warna area. The main studies on the region have been a vulnerability analysis (Riniwati et al., 2019), a water quality evaluation (Retnaningdyah et al., 2021), and a suitability and carrying capacity analysis (Dharma et al., 2021). Therefore, this study used the contingent valuation method (CVM) to calculate the visitors' willingness to pay for additional conservation fees at the CMC Tiga Warna, and the factors that influence the visitors' WTP.

WILLINGNESS TO PAY (WTP)

In general, 'willingness to pay' refers to a person's willingness to pay for resources and services such as for environmental conditions (Yusoh et al., 2022). In the CMC Tiga Warna area, the WTP is the maximum amount of money a visitor is willing to pay for better services and ecological quality. Currently, the CMC Tiga Warna area charges Rp 10,000 per person as a donation for one mangrove seed. The "Bhakti Alam Sendangbiru" Foundation will manage the conservation fee, which will be used for the development of infrastructure and maintenance of the ecotourism area as well as to support the four main conservation activities at the CMC Tiga Warna area (mangrove protection, coral reef protection, seagrass protection, and green belt protection). To ultimately ensure the long-term sustainability of the area, conservation activities and the visitor experience need to be expanded and enhanced (Kamri et al., 2017). Thus, this study was carried out to determine the additional conservation fees to be paid by visitors.

CONTINGENT VALUATION METHOD (CVM)

The contingent valuation method (CVM) is an economic technique that can be applied to estimate both the use and non-use values of ecosystems. As a result, it is now being widely used to determine the economic value or willingness to pay for mangrove ecosystem services (Iqbal, 2020; Mitchell et al., 1989; Novizantara

this study used the random sampling technique to ultimately select 318 respondents.

Data Collection

In this study, data were collected from two main sources, namely, through interviews and questionnaires. Interviews were conducted with the managers and two employees at the CMC Tiga Warna office. The purpose of the interviews was to gain an understanding of the past and present situation at the CMC Tiga Warna area in order to identify the key issues facing the area.

The questionnaire for this study was divided into six sections. In the first four sections of the survey, visitors were asked to assess their ecological cognition, environmental awareness, perceived value, and trust in the CMC Tiga Warna area. In the fifth section, the visitors' WTP was assessed using a payment card to determine its value. In the last section, information was gathered about the visitors' socio-demographic characteristics. This questionnaire was designed to be bilingual to cater to both Indonesian and foreign visitors to the CMC Tiga Warna area. The Indonesian version of the questionnaire was translated and proofread by a PhD student from Universitas Negeri Malang (UM). The questionnaires were completed on-site and were collected by the investigators at the CMC Tiga Warna area. After excluding seven invalid questionnaires, 311 valid questionnaires were collected, thereby giving a response rate of 97.8%.

Data Analysis

In this study, the SPSS 25.0 statistical software was used to process and analyse the data. First, the software was used to conduct a descriptive analysis of the visitors' socio-demographic characteristics, ecological cognition, environmental awareness, perceived value, and trust. Additionally, a binary logistic regression model was used in this study to analyse the factors influencing the visitors' willingness to pay extra conservation fees. Finally, the amount that visitors were willing to pay for the additional conservation fees was calculated.

RESULTS & DISCUSSION

Socio-demographic Characteristics of the Participants

According to Table 1, the socio-demographic characteristics of the visitors to the CMC Tiga Warna area were as follows: There was a very even gender distribution among the visitors, where 48.2% of them were females and 51.8% males, which did not easily lead to bias in the willingness to pay. As far as the age of the respondents was concerned, it was surprising to find that young people were the main force behind the CMC Tiga Warna area, with 81.7% of the visitors being between the ages of 18 and 29 years, which may explain why 82.3% of the visitors were single. Compared to the visitors who were married or married with children, the unmarried visitors might have been less financially stressed, which means

they were more likely to pay the extra conservation fees. In addition, it was noteworthy that 93.2% of the visitors were from Indonesia, while only 5.8% came from abroad. This phenomenon demonstrated the lack of abroad promotion works in the CMC Tiga Warna area, which was consistent with statements from their staff. Furthermore, the visitors generally had a high level of education. Among the visitors, 55.3% of them had a high school diploma, 31.2% had a bachelor's degree, 10% had a master's degree, and 0.9% had a junior high school diploma or a doctor's degree. Among the visitors to the CMC Tiga Warna area, the majority of them were students (63.3%), followed by a small percentage of businessmen (26%), government employees (8.6%), and non-working individuals (1.9%). Since there was a large proportion of students, most of the visitors' incomes were below Rp 2,500,000 (59.8%), while the rest were earning between Rp 2,501,000 and Rp 4,000,000 (13.2%) and above Rp 6,000,000 (9%).

Table 1: Socio-demographic characteristics of the participants (N=311)

Characteristic	Classification	Frequency	Percentage (%)
Gender	Male	150	48.2
	Female	161	51.8
Age	<18 years old	14	4.5
	18 – 29 years old	254	81.7
	30 – 39 years old	34	10.9
Marital Status	Single	256	82.3
	Married with no children	41	13.2
	Married with children	14	4.5
Place of Origin	Malang	84	27
	Indonesia (Outside Malang)	209	67.2
	Outside of Indonesia	18	5.8
Education	Middle school	8	2.6
	High school	172	55.3
	Bachelor's degree	97	31.2
	Master's degree	31	10
Occupation	Unemployed	6	1.9
	Student	197	63.3
	Government Servant	27	8.7
	Self-employed	81	26
Monthly Income	< Rp. 2500000	186	59.8
	Rp. 2500000-Rp. 4000000	56	18
	Rp. 4000001-Rp. 6000000	56	13.2
	> Rp 6000000	28	9

Participant Perceptions of CMC Tiga Warna

The participants were asked to rate their level of ecological cognition, environmental awareness, perceived value, and trust of the CMC Tiga Warna area using a four-point Likert scale, with 1 indicating “strongly disagree/very

unimportant”, 2 indicating “disagree or unimportant”, 3 indicating “agree or important”, and 4 indicating “strongly agree or very important”. The visitors’ stated perceptions are presented in Table 2.

Table 2: Participant perceptions of CMC Tiga Warna (N=311)

Variables	Items	1 (%)	2 (%)	3 (%)	4 (%)	Mean
Ecological Cognition	CMC Tiga Warna is an important ecotourism conservation effort.	0.0	0.3	46.6	53.1	3.53
	CMC mangrove ecosystems (MES) possesses a production function.	0.3	3.5	55.9	40.2	3.36
	CMC possesses a regulatory function.	0.0	0.6	37.9	61.4	3.61
	CMC possesses a support function.	0.3	0.0	57.9	41.8	3.41
	CMC possesses a cultural function.	0.0	4.5	46.3	49.2	3.45
	CMC is a nursery habitat.	0.0	4.2	46.3	49.5	3.45
	CMC is important for human sustainability.	0.0	1.0	46.6	52.4	3.51
	CMC benefits present and future generations.	0.0	0.3	32.2	67.5	3.67
Environmental Awareness	Is it important for you to protect the CMC?	0.3	0.0	27.0	72.7	3.72
	You are responsible for protecting CMC.	0.0	0.6	45.0	54.3	3.54
	Are you willing to participate in the protection of the CMC?	0.0	1.9	57.9	40.2	3.38
	Reasonable entrance fee.	0.6	2.6	72.0	24.8	3.21
Perceived Value	Reasonable price of goods.	0.0	6.1	73.3	20.6	3.14
	Fresh trip experience.	1.0	15.8	44.7	38.6	3.21
	The trip is relaxing and comfortable.	1.6	21.2	42.1	35.0	3.11
	The trip can enhance feelings with fellow travellers.	0.3	9.3	53.7	36.7	3.27
	Recommend the trip for the good memories.	0.0	2.3	53.1	44.7	3.42
Trust	Managers can effectively protect and reserve CMC in the future.	0.0	1.9	56.3	41.8	3.40

In general, the visitors to the CMC Tiga Warna area had a very high level of ecological cognition. Most of the visitors were in full agreement concerning the CMC Tiga Warna ecosystem, including its regulating function (61.4%), cultural function (49.2%), supporting function (41.8%), and product

function (40.2). As the questions progressed, a very interesting phenomenon was observed in terms of the environmental awareness of the visitors. According to the results, 72.7% of the visitors thought that it was very critical to protect the CMC Tiga Warna ecosystem. In contrast, only 54.3% of the visitors felt responsible for protecting the CMC Tiga Warna area. After being asked about their participation in conservation activities, the percentage decreased to 40.2%. Among the four factors, the visitors' perceived value of the CMC Tiga Warna area had the lowest average score of 3.227. The visitors generally believed that the trip to the CMC Tiga Warna area was reasonably priced. More than 15% of the visitors, however, felt that the trip was not fresh enough (15.8%) and not relaxing and comfortable enough (21.2%). The majority of the visitors to the CMC Tiga Warna area believed that the managers were capable of effectively protecting the area. However, more visitors agreed with this statement (56.3%) than fully agreed (41.8%), and six disagreed with it.

Binary Logistic Regression of Willingness to Pay (WTP)

Before a binary logistic regression analysis was performed, one-way ANOVA tests were conducted separately for the factors that might affect the WTP, to screen out those factors associated with the WTP. The test results (sig. < 0.05) suggested that the factors associated with the WTP were Perceived Value (Sig=0.002), Trust (Sig=0.002), Age (Sig=0.006), Education (Sig=0.015), and Income (Sig =0.41). This paper, however, considered adding marital status to the regression analysis since it had been predicted in the previous part of the paper that marital status has a significant impact on the WTP. While the above factors passed the one-way ANOVA tests, this only indicated that they had some correlation with the willingness to pay, which necessitated further significance tests utilizing a binary logistic regression analysis.

From the Omnibus test of model coefficients, Chi-square = 45.089, df = 10, Sig=0.000 <0.05, indicating that at least one variable had a statistically significant OR value, which means that the model was generally meaningful. In the Hosmer and Lemeshow tests, Sig=0.726, which was greater than the detection level of 0.05, thereby indicating that the model was well-fitted. Also, the predictive ability of the model was 69.8%. The logistic regression model incorporated four independent variables (perceived value, trust, age, and marital status), but the effects of other variables (education and income) were not significant and, therefore, were not included in the model.

According to Table 3, perceived value, age, trust, and marital status were significant at the 1%, 5%, and 10% levels, respectively. According to this study, all four variables might have had a significant influence on the visitors' willingness to pay for additional protection. According to the results, perceived value had a positive relationship with the visitors' willingness to pay. As the visitors' perception of the CMC Tiga Warna area increased by one unit, their

willingness to pay increased 2.91 times as well. Accordingly, the visitors were more likely to pay the additional fees if the rates for the CMC Tiga Warna were reasonable and the travel experience was excellent. Furthermore, Duong et al. (2021) found that the visitors' willingness to pay is positively affected by the perceived value of an ecotourism area. Similarly, Woo et al. (2015) found that consumer behaviour can be influenced by perceived value. This is because the visitors' willingness to pay also contributes to the purchase of ecosystem services through their actions. To determine whether or not a service should be purchased, a rational, economical person needs to determine the perceived value of that service. The higher the perceived value, the greater the willingness to pay for the service (Yang et al., 2022).

Table 3: WTP results of the binary logistic regression

Independent Variables	B	S.E.	Sig.	Exp(B)	95% C.I.	
					Lower	Upper
Age			0.035			
Age (1)	1.53	0.63	0.015	4.62	1.35	15.81
Age (2)	3.02	0.87	0.001	20.43	3.70	112.78
Age (3)	22.81	14525.24	0.999	8.06	0.00	.
Age(4)	23.02	40192.97	1.000	9.91	0.00	.
Age (5)	21.01	40192.97	1.000	1.33	0.00	.
Marital Status			0.100			
Marital Status (1)	-0.65	0.45	0.147	0.52	0.22	1.26
Marital Status (2)	-1.63	0.83	0.050	0.20	0.04	1.00
Trust			0.092			
Trust (1)	2.21	1.19	0.063	9.07	0.89	92.55
Trust (2)	2.49	1.20	0.037	12.11	1.16	126.82
Perceived Value	1.07	0.36	0.003	2.91	1.45	5.84
Constant	-4.08	1.31	0.002	0.02		

*Omnibus Tests of Model Coefficients: Sig=0.000; Hosmer and Lemeshow Test: Sig=0.726; Predicted Percentage=69.8%

Age also had a positive influence on the willingness to pay for additional conservation fees. Therefore, as the age of the visitors' increased, they were more willing to pay for extra conservation fees at the CMC Tiga Warna area. More specifically, those visitors aged 18-29 years and 30-39 years were 4.62 times more likely to be willing to pay than visitors below 18 years of age. Data for the remaining age groups were not analytically valuable due to their small

size. Diswandi & Saptutyingsih (2019) confirmed this finding, concluding that age is positively correlated with the willingness to pay for mangroves. When viewed from the perspective of how mangroves can benefit future generations, older individuals with more experience are more likely to pay conservation fees. However, Iqbal (2020) argued that value is inversely proportional to age and that a negative sign of the respondents' age coefficient indicates that older visitors have a lower capacity to generate income and to visit forest-centred visitor attractions on foot. Consequently, older visitors are less likely to contribute to mangrove conservation programs (Reynisdottir et al., 2008).

Trust was another factor that positively influenced the visitors' willingness to pay extra conservation fees. Compared to the visitors who did not trust the competence of the CMC managers, those who trusted them were 0.89 times more likely to be willing to pay, and those who trusted them highly were 1.16 times more likely to be willing to pay. They would be more likely to pay the extra conservation fees to support conservation activities in the CMC area due to the trust that they had in the CMC managers that the conservation fees would be used effectively and reasonably. In conclusion, trust was an important factor in the visitors' willingness to contribute to ecotourism resources (Pengwei & Linsheng, 2018).

In contrast, marital status had a negative relationship with the willingness to pay. In other words, married individuals were more reluctant to pay extra fees than unmarried individuals. It was also confirmed by this point that visitors with heavy family burdens were not interested in this additional cost of protection when the number of children in the family increased. Compared to the married respondents, the single respondents were willing to pay more for conservation (Ramli et al., 2017). Lalika et al. (2017) discovered, however, that married respondents were more willing to pay for the conservation of watersheds. As a result, married people are more likely to consider the survival of the next generation (Diswandi & Saptutyingsih, 2019).

Opinions on Willingness to Pay (WTP) at CMC Tiga Warna

According to Table 4, more than two-thirds of the 311 respondents (65%) were willing to pay extra conservation fees to support the conservation activities of the CMC Tiga Warna area, while 35% of the visitors were unwilling to pay the extra conservation fees. When the visitors selected 'unwilling to pay', they had to indicate the reason for their unwillingness. Table 4 summarizes why 109 visitors did not wish to pay for additional protection. The majority of the visitors (46.79%) believed that they would need more information before they were willing to pay for additional protection. In other words, 46.79% of the visitors were likely to be paying visitors, and it was highly likely that they would be willing to pay the extra conservation fees when the CMC Tiga Warna area provides comprehensive and detailed information on its conservation activities.

Furthermore, 28.44% of the visitors believed that the government was responsible for protecting the environment, 10.9% believed that the conservation efforts of the CMC could be accomplished without their support, and 8.26% did not have the funds to support conservation activities at present.

Table 4: Reasons for unwillingness to

Visitor reasons for unwillingness to pay more	Frequency	Percentage
It is the government's responsibility.	31	28.44%
I have no spare income, otherwise, I would contribute.	9	8.26%
I believe that improvements will occur even without my contribution.	11	10.09%
I need more information before I decide to pay.	51	46.79%
Others	7	6.42%
Total	109	100.00%

Visitor Willingness to Pay (WTP) at CMC Tiga Warna

In total, 202 visitors had a positive WTP ($WTP > 0$) out of the 311 valid questionnaires that were returned. Thus, according to the formula for calculating the positive WTP listed in the previous section, $n = 7$ and $b_i = \text{Rp.}10,000, \text{Rp.}20,000, \text{Rp.}30,000, \text{Rp.}40,000, \text{Rp.}50,000, \text{Rp.}70,000, \text{and Rp.}100,000$. Table 5 shows N as the frequency, while P_i represents the probability that the respondent would choose the corresponding amount. The result of the calculation of the visitors' positive $E(WTP)$ was $\text{Rp.} 19752.48$. Since this calculation of the positive WTP values did not consider $WTP = 0$, therefore, there might have been some deviation between the calculated results and the actual WTP values. As a result, the WTP value was corrected by applying Kriström's spike model (Kriström, 1997) to the following equation:

$$E(WTP) = E(WTP)_{\text{positive}} \cdot (1 - WTPR_0)$$

$E(WTP)$ is the corrected willingness to pay, $E(WTP)$ positive is the uncorrected positive WTP value, and $WTPR$ zero is the zero-payment rate, which is the unwillingness to pay. The final results showed that the $WTPR$ zero was 35.05% and the $E(WTP)$ for visitors was $\text{Rp.}12829.58$.

Table 5: WTP value

	N	Minimum	Maximum	Mean	Std. Deviation
WTP	202	10000	100000	19752.48	14470.3546
WTP	311	0	100000	12829.58	14995.6949

CONCLUSION

This study investigated visitors' perceptions of the CMC Tiga Warna area and their willingness to support conservation activities. Furthermore, the extra conservation fee that visitors were willing to pay for the conservation and enhancement of the CMC Tiga Warna was calculated by using the payment card elicitation format of the CVM. Moreover, the factors that influenced the visitors' willingness to pay the extra conservation fee were examined. The results of this study showed that the majority of the visitors to the CMC Tiga Warna area had high levels of ecological cognition and environmental awareness, and two-thirds of them were willing to contribute monetary funds towards the protection and enhancement of the area, with the average WPT per individual being Rp.12829.58. This study found that the visitors' trust in the CMC Tiga Warna managers, perceived value, age, and marital status were significant at the level of 5% or 10%. According to the results, visitors aged 30-39 years, who were unmarried, and had a high level of trust in the CMC Tiga Warna managers, and high perceived value were willing to pay extra conservation fees to the CMC Tiga Warna area. Overall, the results of this study contribute to the existing literature on the willingness to pay for mangrove ecotourism areas in Indonesia. In addition, it fills a research gap regarding the willingness to pay for the CMC Tiga Warna area. Based on the results of this study, the ecosystem services in the CMC Tiga Warna area are undervalued, and this can be used to guide future price adjustments by the managers of this area. It is also important to note that this study had its potential limitations. A payment card elicitation format was used in this study. This method can overcome the disadvantages of open-ended questionnaires with zero willingness to pay, which can increase response rates (Mitchell et al., 1989). It must be noted, however, that this approach is more likely to collect statements from individuals with a lower WTP (Mitchell et al., 1989). For this reason, it is recommended that in future, the discrete choice double-bounded method of the CVM be used to assess the visitors' willingness to pay for admission to the CMC Tiga Warna area.

ACKNOWLEDGEMENT

The authors would like to extend their appreciation to Universitas Negeri Malang, Indonesia for the International Inbound Research Mobility (IIRM) Program 2023 without which this study and paper would not be possible.

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Huang Zimo, Shida Irwana Omar, Syamsul Bachri, & Sumarmi
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Received: 26th June 2023. Accepted: 11th August 2023



PLANNING MALAYSIA:
Journal of the Malaysian Institute of Planners
VOLUME 21 ISSUE 4 (2023), Page 467 – 480

CONCEPTUALISING RESILIENCE LIVELIHOOD STRATEGIES OF PADDY FARMERS TOWARDS MALAYSIA NATIONAL FOOD SECURITY AGENDA

Wan Mohammad Fazil Asli¹ and Suraiyati Rahman²

*^{1,2}School of Housing, Building and Planning,
UNIVERSITI SAINS MALAYSIA, MALAYSIA*

Abstract

The paddy production in Malaysia is characterised as small-scale agriculture, with modest plots of less than 2 ha and approximately 194,000 farmers employed. Majority of these farmers primarily rely on low-income agricultural production. This situation was exacerbated by the COVID-19 pandemic in the first quarter of 2020, resulting in a 3.11% reduction (17.03 million tonnes) in the overall agricultural output across Southeast Asia. Rural communities are recognised as vulnerable and must adapt to these sudden changes. Despite the vulnerability and shocks experienced by rural communities, especially paddy farmers, the resilience of sustainable livelihood for staple food is the main issue to be taken into consideration. Sustainable livelihoods, which are closely related to rural development communities, serve as the primary force behind the preservation of the economic well-being in rural areas. The primary concern is the lack of imperative strategies to empower the paddy farmers and key stakeholders in the staple food ecosystem in facing uncertainties and shocks. The Sustainable Livelihood Framework has been adopted since 1992 in several countries and international organisations to eradicate poverty. However, this framework raised an issue as a generic concept and required further enhancement to visualise the response to uncertainties and shocks. The framework's adaptability to climatic and non-climatic food insecurity is dependent on the adaptation strategies that are based on socioeconomic and cultural factors, such as household composition, gender, household asset distribution and external instructions.

Keywords: Livelihood Strategies, Resilience, Food Security, Paddy Farmers and framework

² Senior Lecturer at Universiti Sains Malaysia. Email: suraiyati@usm.my

INTRODUCTION

Approximately 8.9% of the global population are experiencing hunger. This trend indicates an increase of 10 million within a year. In 2019, nearly 750 million people, or approximately one out of every ten people, on the planet faced adverse food insecurity. The 2030 Agenda for Sustainable Development's Target 2.1, 'By 2030, end hunger and ensure access to safe, nutritious, and sufficient food for all people, particularly the poor and people in vulnerable situations, including infants, throughout the year', will remain unfulfilled unless relevant stakeholders at all levels, from the subnational to the global, take imperative and consistent actions to overturn the current trends. The COVID-19 pandemic will expose more people to face food insecurity, unless immediate action is taken (FAO, 2020).

In line with the global agenda, Malaysia has undertaken a comprehensive approach to address food security. The demand for food is increasing every year, a scenario that mirrors the challenges encountered on a global scale. In 2017, Malaysia imported 9.7 billion USD of food and beverage products, indicating a rise of 3.5% compared with that in the previous year (MARDI, 2020). Although the country's food production is low, the primary focus must be placed on rice production. Rice is a staple food not only for Malaysia but also for many other Asian nations. At present, Malaysia produces 2.4 million tons of rice. However, the consumption trend of rice to satisfy the local demand is approximately 3.4 million tons annually. Consequently, the country is compelled to import rice from various countries to meet the local demand. In 2018, this additional supply was obtained from rice-producing countries, such as Thailand (48.8%), Vietnam (25%), Cambodia (8.2%), India (7.8%), Pakistan (5.5%), Singapore (2.6%) and Myanmar (1.4%) (Tridge.com, 2020).

The scale of the economy in Malaysia is a contributing factor that poses challenges in achieving 100% rice self-sufficiency (SSL) (R. Badaruddin et al., 2020). In addition, paddy farmers, who play a crucial role in producing the country's staple food, serve a significant role in the supply chain to meet the local demand. Paddy farmers also experience various challenges and uncertainties in operating this sector. Farmers serve as one of the most crucial components in guaranteeing the nation's food security, underscoring the necessity for concerned parties to consider their livelihood. In 2016, Malaysia had a workforce of 14 million people. Out of this total, 1.6 million people worked in Category A (agricultural, forestry and fishing), accounting for 11.4% of the overall workforce. A closer look at the agriculture industry revealed that the food production sub-sector employs nearly 500,000 farmers. Paddy farmers account for approximately 200,000 people in this sub-sector. Previous agricultural policies were efficient in eradicating hard-core poverty over time. However, farmers remained poor compared with their contemporaries in other occupational

categories. According to the 2016 MADA Annual Report, paddy farmers in the region had a monthly household income of RM2,527. In 2016, paddy farmers earned less than the national median household income (RM5,228) and mean household income (RM6,958), with paddy farmers falling into the B40 income group. In an idealistic situation, the issue of a paddy farmer's livelihood should be considered as part of a larger picture, and the effort should holistically address their contribution towards the national food security agenda (Khazanah Research Institute, 2019).

Problem Statement

The primary concern is the lack of imperative strategies to empower the paddy farmers and key stakeholders in the staple food ecosystem to effectively confront uncertainties and shocks. Understanding the fundamental issue to face the emerging issues that hindered the progress of their production's productivity may help in advocating policymakers for future action plans. This research attempts to contribute to the body of knowledge on the expanded model of sustainable livelihood framework, specifically on resilience strategies to empower the livelihood of paddy farmers. Since the establishment of the sustainable livelihood model in 1999, a few more expanded models had been formulated to eradicate poverty. This study attempts to support the direction of global and national policies to address the current issue of food security. A few national policies and global agenda are Sustainable Development Goals (SDGs): SGD 1 (No Poverty), SGD 2 (No Hunger) and SGD 17 (Partnership). In line with the direction of the national policy — the Twelfth Malaysia Plan (12th), which has just started from 2020 to 2025, the core of economic empowerment focuses on strategies to reform the agricultural sector and develop resilient rural areas. The core of social re-engineering also focuses on the vulnerable B40 income elevation and job creation for locals:

1. Rural Development Policy (2019–2030);
2. Rural Physical Planning Policy (2017–2030);
3. National Agro-food Policy 2.0 (2021–2030);
4. National Food Security Action Plan (2021–2025).

LITERATURE REVIEW

Agricultural Sector in Malaysia

The global situation of agricultural transformation is typically not stimulating. The development of the world agricultural sector shows a decrease in the share of agriculture in GDP, whilst the non-agricultural sector successfully increases. Consequently, the declining employment opportunities in the agricultural sector contributed to the limited number of jobs in the rural areas. The transformation

of the agricultural sector in Malaysia is also experiencing the same trend as is happening in the world today. The share of agricultural GDP in the country's total GDP dropped from approximately 46% in 1961 to 7.7% in 2018. Non-farm and non-rural agro-industrial processing provided an additional 6.3% of GDP in 2010. The ratio of agricultural employment to total employment also decreased from 37% in 1980 to 27% in 1991 and 11.1% in 2018. In the 1960s, this ratio accounted for almost two-thirds of the total employment. By 2014, the industry's contribution to the GDP had reached a ratio of 40%. In 1987, production surpassed agriculture as the main sector for the first time: 22.6% compared with 21.7% (World Bank Group, 2019) (**Figure 1**). Since then, the growth of the modern industrial economy has been the main focus of livelihoods amongst the Malaysian population. This opportunity is available in urban areas, acting as a motivating factor to the migration of the rural population in pursuit of continued survival. This pattern is seen as one of the major and significant aspects to be strengthened because its effect would cause the deterioration of the rural agricultural sector over time.

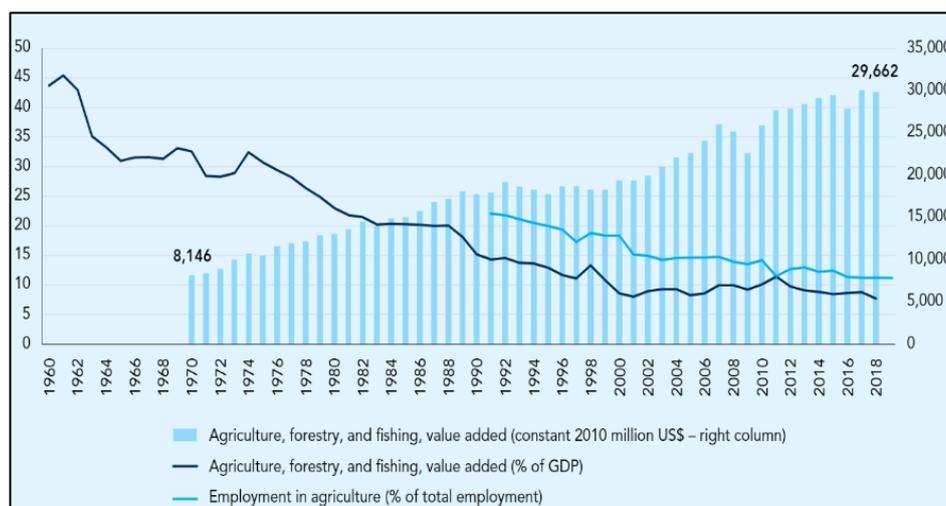


Figure 1: Trends of Agricultural Sector in Malaysia

Source: World Bank Group (2019)

Challenges In Paddy Agriculture as A Staple Food in Malaysia

According to Dardak (2021), Malaysia's agricultural sector is divided into two, namely, plantation and food production. The plantation sector efficiently performs. The value of palm oil in the export reached MYR 90 billion per year. However, the food production is considerably behind the neighbouring countries. Currently, 5.8 million hectares of land is cultivated to oil palm compared with 1 million hectares of land that are left for food crops. In the context of livelihood,

income from cultivating food crops is not promising and fails to attract farmers to engage in this type of agriculture. Modern farmers have begun to feel that palm oil is easier in terms of maintenance, and its price is more stable compared with that of food crops. However, numerous farmers have stopped planting food crops and started working on palm oil plantations, even selling the agricultural land to be developed as an industry, housing and other land uses. In these issues, various factors contribute to the country's food source crops. The lifespan of most food crops is only within a few months and years compared with that of palm oil, which lasts for up to 25 years. Food crops also have a high turnover rate and require substantial amount of human labour. Farmers also need to use fertilisers and pesticides in producing food crops, and the resources to obtain these planting aids must be imported from abroad. The price of this product is also rising due to the volatility and weakness of the purchasing power of the Malaysian currency. Furthermore, the management of these food crops entails dealing with the risk of diseases and pests. Paddy farmers must deal with blast diseases.

Paddy is a staple food in Malaysia. Paddy is Malaysia's most significant crop in the food subsector for two reasons. For instance, rice is the bulk of the population's basic meal. Malaysian adults eat 2.5 dishes of rice each day on average (Kasim et al., 2018). Second, the crop is the principal source of income and livelihood for the paddy farming community, particularly for small-scale farmers and landless agricultural labourers (R. Badaruddin et al., 2020). Malaysia's population increased to 32 million, and it is expected to increase to 37 million by 2030. The government places a high priority on addressing the challenge of ensuring adequate food supply to ensure it remains sustainable and adequate. This aspect can be shown by the SSL percentage indicator as a measure of food security. Rice, which is a staple food, is not at a good level (68.7% in 2018 compared with 73% in 1990) (**Figure 2**). Population growth and demand trends for food, especially staple foods, are very closely linked and have an effect on the country's SSL. This effect can be seen where population growth has changed the SSL rice landscape with a decline yearly. Hence, Malaysia must import more rice from the neighbouring countries, such as Thailand, Pakistan, India and Vietnam, to meet the needs of its population.

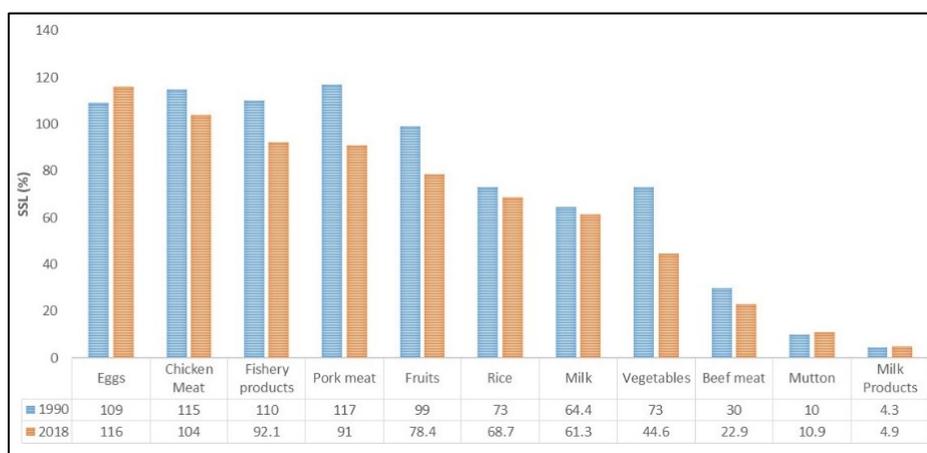


Figure 2: Self Sufficiency Level of Selected Agri-Food Commodities (%) 1990 to 2018
 Source: Department of Agriculture (2019)

Livelihood Challenges of Paddy Farmers

The rural community has been described as the most vulnerable community to climate change due to their reliance on agricultural production towards their livelihoods (Morton, 2007). The socio-economic status of farmers (immediate and most vulnerable) is greatly affected climate change. Climate change causes crop destruction, low productivity and high cost of production, resulting in loss of farmers' incomes, high poverty levels, high inequality and a decrease in farmers' active participation in agriculture (Alam, 2012). The findings of the study also show that the off-farm wage rate is higher than the agricultural profits. Consequently, farmers attempt to engage in part-time farming. The government has formulated rules to produce specific crops in a particular region. However, farmers switch crops due to changes in agricultural profitability. Hence, the paddy production area has been slowly declining over the last few years.

Alam et al. (2020) showed that climate change, crop disease, loss of livestock, loss of fertility of the soil, price variability, floods and deforestation are amongst the sources of risk faced and identified by farmers in Malaysia. Climate change, floods and crop disease are the major risks that farmers face. To adapt, farmers have prepared their strategies to stay afloat in pursuing their livelihood. Amongst the key strategies identified are delaying the sale of crops, off-farm income, different planting dates, working on crop diversification and using more advanced technologies. Although Malaysia strives to be self-sufficient in terms of food production, particularly for rice as a staple food, urbanisation and the moving of rural populations due to migration have resulted in decreased agricultural productivity, which can be attributed to the shortage of manpower to cultivate the land (Marzuki, A., & Jais, 2020). A system that

incorporates stakeholders' integrated roles is required to achieve Malaysia's sustainable agricultural strategic plan. Policymakers and planners play a vital role in the recognition of advantages and other components that contribute to the sustainability of the agricultural system throughout the planning and implementation of integrated support systems for agriculture (Ramaloo et al., 2018).

Malaysian Food Security Agenda

Food security exists when all people have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and preferences for an active and healthy life (FAO,2008). Food security is not a new issue in Malaysian national policy. A long-standing national agricultural policy priority for decades has been to solve food security challenges driven by rice, the country's staple food. This situation explains why the Malaysian government insists on rice self-sufficiency as a critical national policy goal. The government's stance on food security is referred to as complete dependence on domestic production without supplement from external sources. The government made an extraordinary policy decision in its most recent national development plan to pursue an autarky economy in the rice sector, thus closing borders to foreign markets in the future. Thereafter, the government resolved to seek and aim for total rice self-sufficiency by 2020 as part of the national policy goal reformulation. However, under the new Sustainable Development Goals, this goal has been extended to 2050, the National Transformation 2050 (2020–2050) (Tapsir, 2019). Accordingly, more serious efforts are focused on enhancing production, support systems and services and strengthening the food value chain under the Twelfth Malaysia Plan 2021–2025, which will further contribute to the food system's resilience. The agro-food sector will be heavily influenced by modernisation through IR4.0, mechanisation and technological adoption to improve the contribution of total agriculture value-added to the gross domestic product (GDP). The National Agro-Food Policy (NAP) 2021–2030, commonly known as the NAP 2.0, reflects MAFI's commitment to food security (Malaysian Agricultural Research and Development Institute (MARDI), 2021).

In the face of the global pandemic challenge, a short-term action plan in line with the Twelfth Malaysia Plan 2021–2025 has been drafted. The National Food Security Action Plan (2021–2025) is currently being created to address urgent and pressing concerns. This plan incorporates recommendations and ideas derived from discussions amongst several ministries, agencies, academics, private sectors and non-governmental organisations. The developed action plans will catalyse change in the face of the food security crisis. This action plan is formulated with five main thrusts, namely, expansion of technological usage, enhancing study and research, strengthening food security data, expansion of

strategic collaborations and strengthening governance amongst the departments and agencies.

Underpinning Theory: Resilience Theory

Holling (1973) invented the term ‘resilience’ to describe the ability of ecosystems with alternative attractors to maintain their original condition in the face of disruptions (Folke et al., 2010). According to Schoon (2005), the definition of resilience is entirely based on C.S. Holling’s work. Almost all of the literature makes reference to the work of C.S. Holling in some capacity. In essence, resilience theory is concerned with the capabilities that people and systems exhibit to overcome adversity (Duplessis Vanbreda, 2001). A few definitions link resilience to the concept of adaptation, which is a particularly relevant extension of resilience. According to Walker et al. (1981; p. 495), ‘resilience is the ability to adapt to change by exploiting instabilities’, and it is not merely ‘the ability to absorb disturbance by reverting to a stable state after being disturbed’. Adger (2003: p. 1) defined resilience as ‘the ability to persist and adapt’.

Three characteristics are crucial: resilience, adaptability and transformability. These elements are interconnected on different scales. In this sense, resilience refers to an SES’ ability to evolve and adapt throughout time whilst remaining within the key limits. Adaptability is a component of resilience. This component refers to the ability to modify reactions to changing environmental factors and internal processes, allowing for continued development on the existing path (stability domain). Transformability refers to the ability to cross thresholds into new development trajectories. We must concentrate on these three key concepts to completely comprehend resilience theory: thresholds, adaptive cycles and panarchy (Pisano, 2012) (**Table 1**).

Table 1: Three Key Concept of Resilience Theory

Resilience Key Concept	
Threshold (or critical transition)	A change in crucial feedback causes the system to self-organise along a different trajectory—that is, towards a different attractor—due to a change in the level or amount of a governing, generally slowly changing variable.
Adaptive cycle	A heuristic model for social-ecological systems and other complex adaptive systems that depicts an endogenously driven four-phase cycle. The typical path is from a phase of rapid growth (Exploitation or Growth, r), where resources are abundant, and resilience is high, through capital accumulation into a gradually rigidifying phase (Conservation, K). Under this phase, most resources are locked up, flexibility or novelty is reduced, and resilience is low. This cycle culminates in a sudden collapse into a release phase (Creative

Resilience Key Concept	
	destruction or Release) of chaotic dynamics in which relationships and structures are destroyed. The r-K dynamics indicate a relatively sluggish, more or less predictable ‘for-loop’, whereas the dynamics represent a chaotic, quick ‘back loop’ that has a considerable influence on the form of the next for-loop. External or larger-scale stimuli might cause a transition from one phase to the next. The growth and conservation phases together make up a relatively long developmental period with fairly predictable, constrained dynamics. The release and reorganisation phases make up a quick, chaotic period, during which natural, human, social, built and financial capital are lost, and novelty can thrive.
Panarchy	The interactive dynamics of a hierarchical collection of adaptive cycles and a set of hierarchically structured scales (of space, time and social organisation). This concept is also understood in terms of how states and dynamics of (sub)-systems at scales above and below the scale of interest influence certain qualities, such as precariousness, resistance and latitude.

Conceptual Framework

A number of cohesive key models are available to address this problem. One of the models is the sustainable livelihood framework (SLF). The SLF model is constructed around five main categories of livelihood assets, visually represented as a pentagon to illustrate their interrelationships and emphasise that livelihoods rely on a combination of different classes of asset rather than just one category (Figure 3). A significant portion of the analysis involves defining people’s ability to access and effectively use various types of assets (physical, human, financial, natural and social). The framework also provides a method for evaluating how organisations, policies, institutions and cultural norms shape livelihoods by identifying individuals who has access to particular assets and defining the type of livelihood strategies accessible and preferable to people. A framework for sustainable livelihoods serves as the basis for analysing community livelihoods. This framework ultimately encourages authorities, policymakers, academicians and other relevant parties to determine where assistance and intervention can be provided (Farrington et al., 1999).

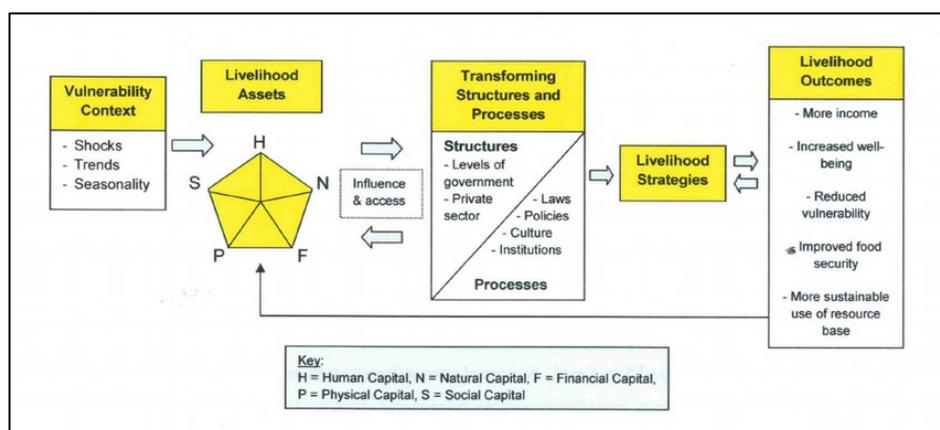


Figure 3: Sustainable Livelihood Framework, DFID (1999)

Although the SLF model has been adopted by a number of previous studies, a section of this model can still be expanded (i.e. in transforming structures and processes). According to DFID (1999), the institutions, organisations, policies and legislation that shape livelihoods are referred to as transforming structures and processes in the livelihood framework. Integration between models is necessary to expand this SLF model, especially in providing resilience livelihood outcomes for paddy farmers. Accordingly, a model introduced by the FAO, specifically to the context of vulnerability, can be integrated with the SLF model. The resilience of the agricultural livelihood model is context-specific and rooted in the community livelihood system (Figure 4). This model leverages a wide range of technical expertise on different types of shocks, agricultural subsectors and the four interconnected priority actions indicated below, which comprise a mix of short-term humanitarian and long-term development and investment interventions (FAO, 2017).

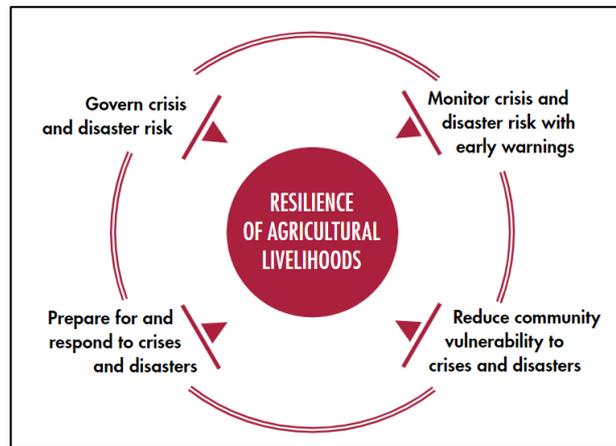


Figure 4: Resilience of agriculture livelihoods model, FAO (2017)

Based on the four main pillars of this model, the vulnerability of paddy farmers must be overcome to achieve long-term and short-term resilience agricultural livelihoods. The description of the four pillars of this model is to govern crisis and disaster risk, monitor crisis and disaster risk with early warnings, reduce community vulnerability to crises and disasters and prepare for and respond to crises and disasters. Furthermore, a model that specialises in integration is essential for stakeholder intervention processes to develop the transforming structure and process section of the SLF model. Accordingly, the model introduced by Wellbrock et al. (2012a) is capable of connecting key stakeholders in a mechanism and process. This model has three large structures (Figure 5), each of which contains several mechanisms or processes. We have the region (rural territory) in the first of these structures, and development actions are generated as a result of the different players' activities and capabilities. A second component is made up of the knowledge and innovation support system (involving academia, private and public institutes, training facilities, consultants, etc.). This system acts as a catalyst for the development of new ideas. Finally, the public sector (which includes a wide range of actors in various public administrations; local, regional and national) is critical to rural innovation processes because it is where a set of public policies and initiatives is planned, organised, directed, implemented and controlled. Such innovation processes are the consequences of the interactions between systems and the numerous players acting in each of them, not merely of mechanisms and actions in each of the three basic systems (Esparcia, 2014).

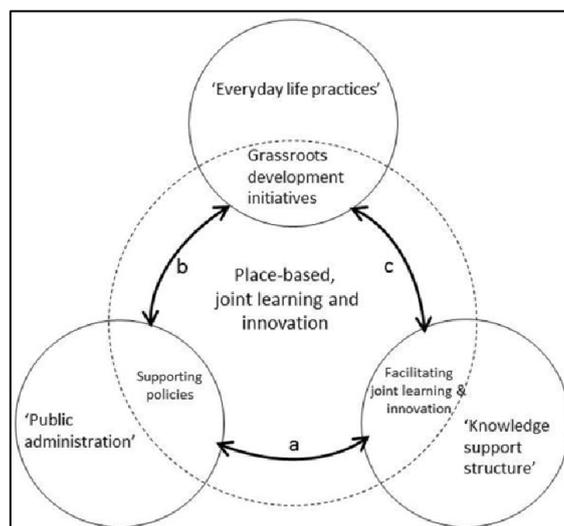


Figure 5: An integrated conceptual framework of rural regional learning (Wellbrock et al., 2012)

The SLF model must be developed and integrated to specifically address the needs of paddy farmers in achieving sustainable and resilient livelihood outcomes. Figure shows the conceptual framework that has been produced through the modification of the aforementioned three models. The first part of this framework focuses on the vulnerability context faced by paddy farmers, particularly addressing the uncertainties that pose challenges to their livelihoods. The second part expands the transformation of structures and processes. The focus will be on shaping influence and access strategies for paddy farmers. In this section, all key stakeholders will be organised and integrated into the paddy farmer's ecosystem. The fourth part of this framework is an intervention or mechanism that acts in the form of a strategy that is applied with a resilience element to produce the outcomes of the livelihoods of paddy farmers (Figure 6). Finally, the primary goal of this framework is to achieve resilience outcomes alongside the livelihoods of paddy farmers. This framework follows an inductive approach in the initial stage to generate a resilience final output in the ecosystem of paddy farmer livelihoods.

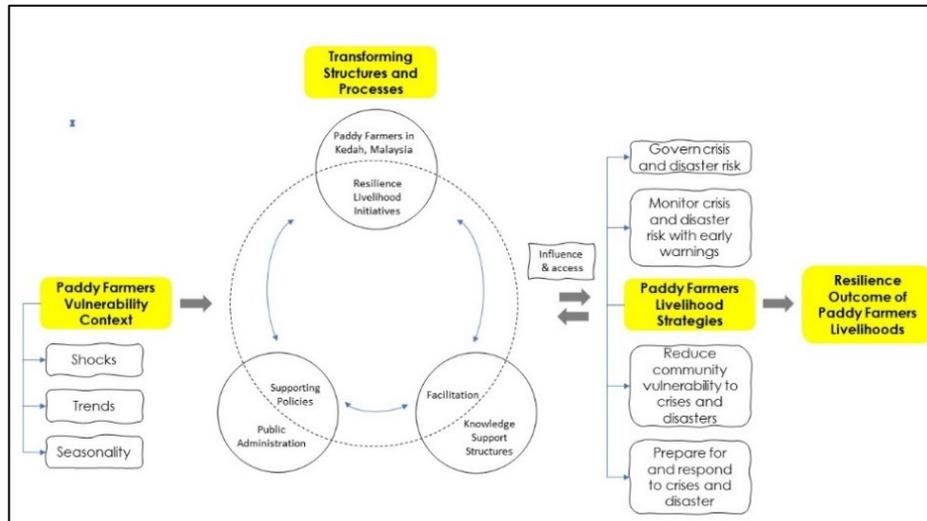


Figure 6: Proposed Conceptual Research Framework

CONCLUSION

This conceptual work aims to address current critical issues, given the heightened importance of food security for the country to ensure a sufficient and dependable national food supply that caters to the needs of all Malaysians. This research approach specifically focuses on the livelihood of paddy farmers, who play a pivotal role in producing rice, which serves as the staple food for the Malaysian population. The proposed conceptual framework has been specifically designed to investigate the vulnerability of paddy farmers, the changes occurring in the structure and processes in the paddy farmer ecosystem, and the livelihood strategies in terms of resilience and adaptability. Lastly, this study has the potential to make practical contributions in enhancing the empowerment of the livelihoods of paddy farmers, who play a vital role in ensuring the security of the country’s staple food. The development of resilience livelihood strategies in the staple food ecosystem may provide the imperative action plans for policymakers to assist in food security assurance. This initiative may help key stakeholders in fostering coordination to achieve the objectives of the food security agenda.

ACKNOWLEDGEMENT

The author(s) would like to extend their appreciation to the Ministry of Higher Education, Malaysia for granting the Fundamental Research Grant entitled ‘STRATEGIC FRAMEWORK FOR RESILIENCE LIVELIHOOD OF PADDY FARMERS TOWARDS NATIONAL FOOD SECURITY AGENDA’ which made this study possible.

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Received: 26th June 2023. Accepted: 11th August 2023



PLANNING MALAYSIA:
Journal of the Malaysian Institute of Planners
VOLUME 21 ISSUE 4 (2023), Page 481 – 495

RESIDENTIAL ENVIRONMENT AND BURGLARY CRIME RISK: A SPACE SYNTAX ANALYSIS OF CRIME AREAS

Idris Isah Iiyasu¹, Aldrin Abdullah² and Massoomah Hedayati Marzbali³

^{1,2,3}School of Housing, Building and Planning,
UNIVERSITI SAINS MALAYSIA, PENANG, MALAYSIA

Abstract

This paper explores the different morphological characteristics of residential neighbourhood spaces to understand the factors that constitute burglary crime risk in the area. The methods used for data collection include field surveys and Block Environmental Inventory. Meanwhile, inferential statistics, Geographic Information System and space syntax tools were used for data analysis. Findings indicated the influence of neighbourhood-built features on burglary crime and the vulnerability of areas to future crime risk. The analysis shows the spatial variation of crime risk factors across the study areas and how that shaped the understanding of burglary activities in the area. The study explores the influence of the permeability of grid iron layouts on vulnerability and explains high and low crime rates in the areas of Perumahan Mahsuri and Perumahan Sunway Tunas, respectively. Overall, the paper suggests further research to correlate these spatial explanations with the socio-demographics of the areas studied.

Keywords: Burglary crime, Permeability, Residential environment, Space syntax, Urban form

² Professor at the Universiti Sains Malaysia: aldrin@usm.my

INTRODUCTION

Environmental criminology contends that physical environmental features play a central role in the formation of crime's spatial distribution (Dwidinita et al., 2018; Frank et al., 2012a; Yue & Zhu, 2021). Different conceptions of crime in relation to research from the perspectives of environmental design, sociology, environmental psychology and criminology indicate an extensive articulation of crime based on the built environment and urban form in the city (Groff & Taniguchi, 2019; Kamalipour et al., 2014). Several decades of studies on urban crime, crime prevention through environmental design and fear of crime indicates an implicit and gradual movement from deterministic to possibilistic propositions in exploring the relationships between urban crime, fear of victimisation and environmental design in theory and practice (Abdullah et al., 2015; Armitage, 2016).

Efforts from several researchers on crime and environment in Malaysia have been mainly focused on understanding the relationship between social forces of crime (high crime rate, poverty, fear of crime and homelessness) and the characteristics of urban environments (housing types, street layout, property types and density) and their role in shaping crime areas as high, medium or low risk or crime hotspots (Zainol et al., 2022). Safety and security issues have recently become an important area of discussion amongst researchers in an attempt to localise the sustainable development goals and mainstream them into the development programmes of Malaysian cities because the urbanisation trend in the country comes at a heavy cost to the quality of life of the people (Matlamat & Mampan, 2019).

As raised by researchers, this paper shares similar research arguments regarding the city as a complex system of people and spaces and the interaction between them as defined by the buildings and street layouts, which shapes criminal activities in place. This paper intends to answer how the city, or rather, the urban spaces, shape criminal activities. The answer can be adequately obtained by examining and understanding urban spaces as a process of complex events rather than as a by-product of buildings and streets. The result of this paper will lie in understanding the different spaces (or parts of the city) that are most affected by crime and the higher vulnerability of some spaces to crime than others. How should planners and designers explore the inherent relationship between space and crime when building urban spaces? The paper applied 'space syntax' as an analytical method that allows the examination and explanation of the systematic analysis of the socio-spatial relationship between criminal activity flows and space for effective crime prevention and management.

LITERATURE REVIEW

Crime and Built environment

Several debates on the relationship between crime and the environment have been presented, the most notable amongst them are studies by Brantingham & Brantingham (1975), Donnelly (2010) and Frank et al. (2012b). The conclusion of decades of studies established that criminal activities are unevenly distributed across urban spaces and are constrained in some cases. Meanwhile, others are supported by the characteristics of the urban environment and the routine flows of people and their activities. Theories were developed to provide an adequate understanding of these relationship patterns between crime and the urban environment. Grounded within the context of environmental criminology, Cohen and Felson's routine activity approach (Cohen & Felson, 1979) and Brantingham's geometry of crime and pattern theories (Brantingham & Brantingham, 1981) have provided extensive theoretical frameworks that explain the complex spatial connections between urban form and criminal activity in the built environment. The theoretical assumption made by the routine activities approach is as follows: for a criminal event to take place, a motivated offender and a suitable target must intersect at the same time and space in the absence of a capable guardian (Felson, 2017). This intersection is influenced by the normal and daily movements of people and their activity systems; these flow patterns are facilitated by the built urban form in place (Felson & Boivin, 2015). Individual routines, which are predictable and can largely overlap with the routine patterns of other urban residents, provide clues to the understanding of crime risk factors in urban spaces. Such clues include the location of potential crime areas in relation to specific land uses and street layouts, determining accessibility, privacy and ease of escape across areas (Boivin & Felson, 2018). The formation of an urban risk island is shaped by the development of a common, shared activity space within which crime events concentrate in predictable locations and at predictable times (Curman et al., 2020). The emerging environmental criminological researchers with strong focus and growing research interest in crime and place have applied, tested and extended these theories to explore the impact of urban form and structure on the spatial pattern of crime in cities (Iliyasu et al., 2022a).

Such research efforts have succeeded in providing substantial insight into the role of built urban form in shaping criminal activities in cities, the characteristics of urban fabric that are typically associated with crime attraction, generation or detraction and the explanation behind the formation of crime risk islands and hotspots (Kalfaoglu & Okkali, 2022; Pitner et al., 2012; Spicer & Fraser, 1991).

Space Syntax

Space syntax is a computer-based technique used to analyse urban spatial configurations (Berghauser Pont et al., 2010). This technique is a set of space logic techniques applied in the representation, quantification and interpretation of the spatial configuration of built urban spaces and settlements (Pont & Marcus, 2015). The measurements made by space syntax correlate urban configurations with the social life of the people. In its initial form, space syntax focused mainly on patterns of movement in buildings and pedestrian flow in cities. Recently, the technique has subsequently been developed to facilitate several other urban operations, such as modelling urban traffic, predicting and modelling air pollution levels, analysing and modelling crime patterns in cities and forecasting the potential for real estate and retail development in the city (Netto, 2015; Ostwald & Dawes, 2018).

The methodology employs mathematical techniques rooted in graph theory, which involve the analysis of the street network to generate accessibility indices and movement intensity measures at the street segment level (Berghauser Pont & Olsson, 2018). Computing space syntax measures aim to understand the following: the degree of integration of street segments and the least path to different areas, which indicate the degree of accessibility, closeness and centrality of activity areas to pedestrian or vehicular movement; the degree of connectivity across areas, which is computed to determine the degree of connectedness of areas in relation to other human activity flows, explaining the choice of areas with through-movement potentials and a high value of betweenness centrality; and the degree of intelligibility, which is computed to measure the link of an area with the entire space or settlement. This degree is derived by measuring the permeability of activity areas using the global connectedness of street segments across all areas (Pont, 2018).

Several studies employed space syntax techniques to examine the influence of the spatial configuration of areas on crime patterns. Most of these studies used street segments as an element of spatial configuration. The following results are presented. Firstly, segments with high integration values have the highest street robbery and violent crime counts, especially at night (Kim, 2018). Secondly, a weak relationship exists between connectivity values and crime counts, as is the case in areas with high integration values (Kim & Hipp, 2020). However, some studies reported a positive relationship between accessibility and criminal events (Irvin-Erickson, 2014). Meanwhile, other reports indicated that areas with low accessibility values register high crime counts, especially robberies per unit of street length (Vandeviver & Steenbeek, 2019).

The emerging debate on the use of space syntax methodology is on its potential limitations, considering the reliability of its measures of the physical characteristics of places as they relate to other social characteristics of such places, particularly in relation to land use (Summers & Johnson, 2017).

RESEARCH METHODOLOGY

The study area

The study areas are the residential neighbourhoods (Perumahan) of Mahsuri and Sunway Tunas areas of Bayan Baru, Penang. These neighbourhoods were selected because they are both residential properties with different development densities and burglary crime intensities but similar spatial configurations (land uses and street layout). The study attempted to measure crime vulnerabilities in residential neighbourhoods to identify the influence of built urban form on burglary crime patterns across areas with similar spatial configurations but with varying incidences of crime. The paper aims to explore and understand the role of spatial configurations of residential areas and their crime vulnerabilities in effective crime prevention. The study utilised GIS and space syntax methods in conducting a detailed quantitative analysis of the areas using QGIS 3.28.1 and depthmapX software.

Data

The paper used crime counts and spatial data sets. The crime data were obtained from the Royal Malaysian Police for a period between 2015 and 2020 (Table 1). The data were used to identify residential neighbourhoods with the highest and lowest crime counts for selection in the study. Meanwhile, the spatial data used were obtained from Google Maps with permission from the vendors for detailed spatial analysis. In the first instance, the attempt was to correlate crime locations with spatial configurations in place to identify factors that shape the variation in crime attractions and define crime risk vulnerabilities in place. However, the spatial attributes were only considered for the examination of crime risk vulnerabilities based on the works of Jubit et al. (2020) and Pont & Marcus (2015) due to the inability to obtain geographic attribute data on crime locations. The analysis presented herein is part of an ongoing research project focusing on exploring the influence of urban morphology on burglary crime patterns in Penang. The study employed space syntax techniques to examine the relationship between human activity flow and crime patterns. The syntactic analysis did not include the crime counts but rather examined the permeability and land use influence on the crime risk areas based on the crime pattern and routine activity theories due to the nature of unit of the study area and the available crime data (Armitage, 2016; Frith et al., 2017).

ANALYSIS AND DISCUSSION

Land use and crime counts.

In an attempt to examine the effect of the built environment on residential burglary risk, this study employed exploratory data analysis to firstly assess the crime incidence of the areas for a period of five years (2015–2020) and the land use pattern of the residential neighbourhoods under study. Table 1 and Figure 1

show the annual distribution of burglary cases in the areas of the Bayan Baru residential district (Mukim 10). The annual distributions are not homogeneous but indicate dwindling distribution patterns amongst the residential neighbourhoods.

Table 1: Statistics of Burglary cases in Bayan Baru Residential neighbourhoods from 2015 to 2020

S/No.	Neighbourhoods	2015	2016	2017	2018	2019	2020	Total	%
1	Perumahan Mahsuri	7	7	10	2	5	5	36	31.0
2	Perumahan Bukit Gedung	1	1	-	-	1	1	4	3.45
3	Perumahan Sunway Tunas	1	-	1	1	-	-	3	2.59
4	Perumahan Jalan Mayang Pasir	12	1	8	2	9	1	33	28.4
5	Perumahan Kampung Jawa	4	2	3	1	-	1	11	9.48
6	Perumahan Jalan tun Dr Awang	4	2	5	4	4	1	20	17.2
7	Kawasan Fiz/Kilang	4	1	1	-	2	-	9	7.76
	Total	37	14	28	10	21	8	116	100

Sources: Royal Malaysian Police, 2022

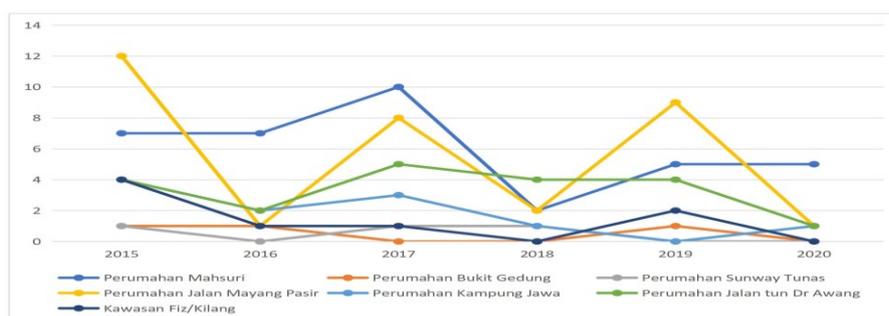


Figure 1: Burglary cases in Bayan Baru Residential neighbourhoods from 2015 to 2020
Sources: Royal Malaysian Police, 2022

The overall data show a favourable reduction in burglary crime incidence across areas and at neighbourhood levels for the five-year period. Hence, the case study areas revealed that Perumahan Mahsuri has the highest crime counts with 36 (31.0%), whilst Perumahan Sunway Tunas has the least crime counts with only 3 (2.59%). Details on the crime distribution pattern in terms of temporal characteristics such as the time-of-day and peak and off-peak periods were not considered. However, the remaining data provide the investigation with a clear picture of crime distribution in the study areas for effective analysis.

Figures 2a and 2b show the land use patterns of the case study areas. From the land use map, the predominant land use in the study areas is residential, followed by green areas and then circulation, as presented in Tables 2 and 3, respectively. The analysis of the land use pattern allowed the establishment of the

most dominant land use in the areas and the examination of its potential for the creation of crime risk vulnerabilities. This conforms with the findings of the study by (Iiyasu et al., 2022b).



Figure 2: a Land use pattern of Perumahan Mahsuri, b Land use pattern of Perumahan Sunway Tunas
Sources: Google Earth, 2022 and Author, 2022

Table 2: Perumahan Mahsuri

S/No.	Land use	Area (M ²)	Area (Ha)	Area (acres)	Percentage of Built up (%)
1.	Residential areas	389,180.79	38.92	96.17	53.03
2.	Commercial areas	31,003.45	3.10	7.66	4.23
3.	Industrial areas	11,748.52	1.17	2.89	1.60
4.	Green areas	151,348.09	15.13	37.39	20.62
5.	Circulation	150,587.7	15.06	37.21	20.52
	Total	733,868.55	73.38	181.32	100

Sources: Google Earth, 2022 and Author, 2022

Table 3: Perumahan Sunway Tunas

S/No.	Land use	Area (M ²)	Area (Ha)	Area (acres)	Percentage of Built up (%)
1.	Residential areas	178,327.16	17.83	44.06	55.06
2.	Commercial areas	1,423.33	0.14	0.34	0.44
3.	Industrial areas	22,090.59	2.21	5.46	6.82
4.	Green areas	84,220.84	8.42	20.81	26.0
5.	Circulation	37,864.37	3.79	9.36	11.68
	Total	323,926.29	32.39	80.03	100

Sources: Google Earth, 2022 and Author, 2022

The analysis results indicated the spatial distribution of the main activities and the land use distribution in the study areas. The results revealed that the variation in burglary crime counts in the areas is connected to that in their respective densities of development, as shown in the pattern of land use distribution in place. Both neighbourhoods show dominance in residential land

uses, green areas and circulation. However, despite the conclusions of other studies such as Yue et al. (2022), this finding is still insufficient evidence for concluding the influence of the established land use distribution on burglary crime risks.

Residential densities and crime count

The relationship between the residential densities of the study areas and the crime counts was measured specifically to establish whether the density has an influence on the variation of crime counts in the areas as established in the literature. Criminological theories, such as social disorganisation, relative deprivation and subcultural deviance and general strain, argue that neighbourhood characteristics such as housing density and overcrowding are key factors that directly or indirectly shape crime patterns by inducing social control or increasing community strain (Porter et al., 2015). Meanwhile, others argue that population density, housing quality and overcrowding are not the main predictors of crime but rather social pathologies in poor neighbourhoods (Xiong, 2016).

Table 4: Comparison of the residential densities of the two study areas

Study areas	Dwelling Unit (Du)	Area (Ha)	Residential Density (Du/Ha)	Density
Perumahan Mahsuri	1844	32.39	103	High density
Perumahan Sunway Tunas	6141	73.38	157	High density

Sources: Penang Structure Plan, 2030 and Author, 2022

The analysis in Table 4 shows the residential densities in the two study areas. The results reveal that both study areas have the same density typology in place despite the difference in spatial layout, area of coverage and density of development because they were found to be within 80 Du/Ha to 250 Du/Ha. This finding indicates that both areas fall into the high-density classification based on Malaysian standards. However, this finding has referred to the above theories in the literature on the influence of residential density on crime rates.

Analysis of residential neighbourhood permeability using space syntax method

Measure of Integration

The measure of spatial integration in the case study areas was syntactically analysed, and the results were compared between the areas to understand the pattern and variation in spatial characteristics of places in the neighbourhoods. The variable used was the average integration value, as shown in Figure 3 and presented in Table 3.

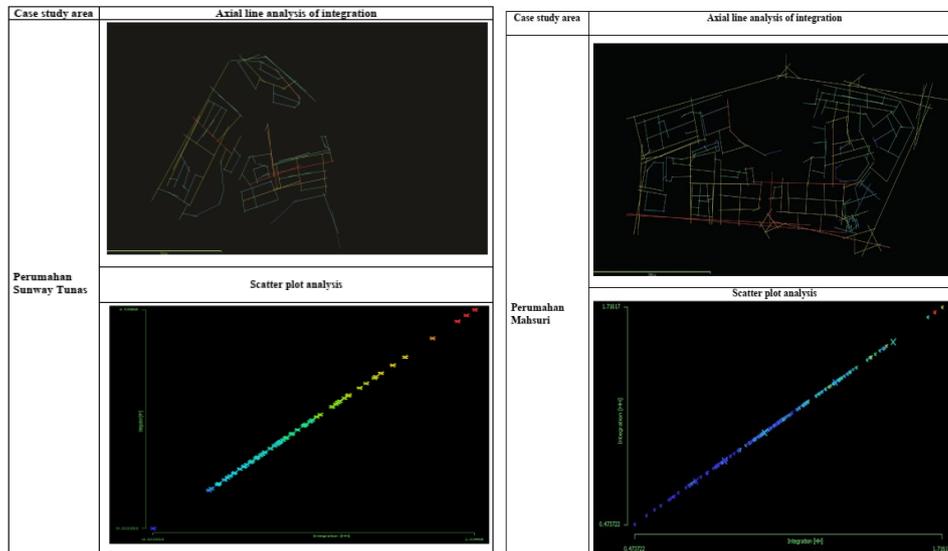


Figure 3: Comparison of integration levels of the study areas using axial line analysis

Table 5: Comparison of the measure of integration in the two study areas

Study areas	Minimum	Average	Maximum	Standard Deviation (SD)
Perumahan Mahsuri	0.473722	1.05482	1.71617	0.243399
Perumahan Sunway Tunas	0.333333	1.28654	2.53968	0.419812

The findings show that case study 2 (Perumahan Sunway Tunus) has the highest integration average with an average value of 1.05482 in comparison with case study 1 (Perumahan Mahsuri), and the spatial arrangement of the road layout in the neighbourhood explained the movement pattern of people and activities in the area better than that of case study 2. In the case of study area 2, the results indicate a poor integration level with an average value of 1.28654, which is due to the poor spatial arrangement of the building blocks and the road layout, in which a recti-linear street pattern was used with numerous disconnected streets and spaces as shown in the axile map. Previous space syntax-based studies suggested that highly integrated areas are safer than those with poor integration (Baran et al., 2006). However, the findings of this study reveal that houses in integrated spaces are less vulnerable to burglary compared to areas that are less integrated. Therefore, the study confirmed the positions in the existing studies.

Measure of Connectivity

The study further investigated the spatial configurations of all the axial lines to determine the degree of connectivity of areas within the neighbourhoods. The

results in [Figure 4](#) and [Table 5](#) show the comparison of the connectivity indices of the study areas based on the average connectivity levels. The analysis reveals high connectivity in case study area 1, with an average of 3.83099, indicating a higher number of nodes in place. By contrast, case study area 2 has a lower level of connectivity with an average index of 3.25532, indicating fewer nodes in place as shown on the exile map and the scatter diagram. Furthermore, when run with radius n (i.e., global integration), the results show that 52% of the lines linking the buildings and activities are less globally integrated ([Figure 4](#)).

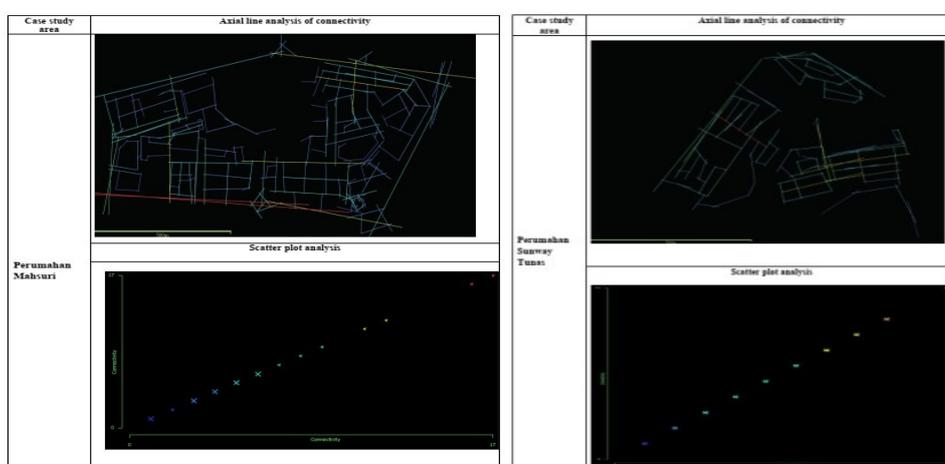


Figure 4: Comparison of connectivity levels of the study areas using Axial line analysis.

Table 6: Comparison of the measure of connectivity in the two study areas

Study areas	Minimum	Average	Maximum	Standard Deviation (SD)
Perumahan Mahsuri	1.0	3.83099	17.0	2.4321
Perumahan Sunway Tunas	1.0	3.25532	11.0	1.78013

Comparison of the results with the crime counts in [Table 1](#) reveals that these lines connect the houses where burglary occurs. Interestingly, 84% of the lines in case study 1, which also has higher crime counts, are more connected compared to those in case study 2, which has fewer connections at 41%. The findings show that areas with more connections are more vulnerable to crime events than areas with fewer connections. This finding disagrees with previous studies that concluded that axial lines with increased connections with other lines are more vulnerable than areas with fewer axial lines and low connections (Kim, 2018; Laouar et al., 2017).

Measure of Intelligibility

The study measures the level of intelligibility by comparing the average of intelligibility and synergy in the case study areas, as shown in [Figure 5](#) and [Table 7](#). The findings reveal that case study 1 has higher intelligibility and synergy with an average value of 2.68133, as compared to case study 2 which has less intelligibility and synergy with an average value of 2.60347. This phenomenon indicates that neighbourhoods in case study area 1 have a higher degree of permeability and are spatially organised better than those in case study area 2.

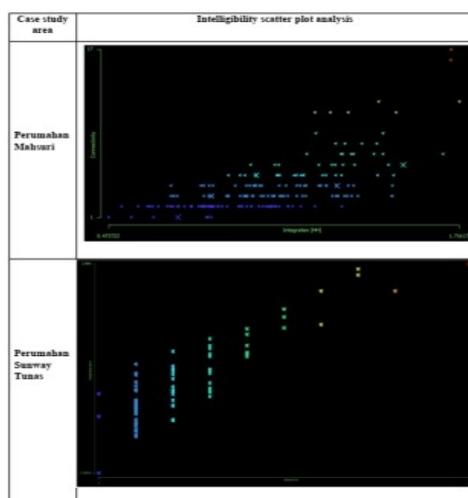


Table 7: Comparison of the measure of intelligibility in the study areas

Study areas	Average
Perumahan Mahsuri	2.68133
Perumahan Sunway Tunas	2.60347

Figure 5: Comparison of intelligibility of the study areas using axial line analysis.

Furthermore, the study showed that out of the case study areas, case study area 1 has a high degree of intelligibility but low synergy values. Meanwhile, case study area 2 has low burglary crime counts but with low values in its intelligibility and high synergy values, whereas areas with low values are those with moderate or minimal burglary counts. A well-configured area could have high synergy value (as in case study 2) where strong social cohesion exists amongst residents and non-residents in the neighbourhood (Abdullah et al., 2015). When the degree of permeability is compared to these values, an area (e.g., case study 1) with the highest degree of permeability may not be highly intelligible but has low synergy levels, which could help reduce its vulnerability. Similarly, an area with remarkably low permeability (e.g., case study 2) can still have good permeability despite its high synergy level but with a moderate degree of intelligibility. However, areas can also be highly vulnerable with moderate and low degrees of permeability despite their high degree of intelligibility and synergy, as in case study 1.

CONCLUSION

The grid-iron pattern has been a common street layout configuration in residential neighbourhoods throughout Malaysia due to the colonial planning legacies. Previous studies, such as those by Frith et al. (2017), Hillier & Sahbaz (2005) and Laouar et al. (2017), have suggested that grid-iron layout is generally safer compared to tree-like layout. However, these studies also identified some space features in the former layouts that constitute vulnerabilities to burglary. Therefore, this paper attempted to examine how various built environmental elements in residential neighbourhoods in Penang, Malaysia, explain vulnerability to burglary crime events.

The findings from the examination at the micro scale have shown that planning and design inputs into the development programmes of these neighbourhoods can influence vulnerability to burglary crimes. Only some factors have a link to burglary when variables of urban morphology are considered independently (as shown in this study), but findings have indicated areas exposed to burglary crime risk. Nonetheless, the findings of this study have shown that at the at the micro scale (street block level), buildings that have a direct connection with the highly permeable streets are highly vulnerable to burglary crime events. These findings further suggest that planners and designers should consider the hierarchy and connectivity of street networks. Accessibility is necessary because it provides convenience to residents; however, accessibility should be limited to avoid a negative impact on its residents' safety. Similarly, having only a few houses along a street segment may also put houses at risk of being burgled. The space syntax tool facilitated the comparison between elements of urban form and burglary counts in the case study areas to understand the spatial indices of vulnerability that attract burglary crime in place, which is otherwise too difficult and impossible. The findings of this study have important implications for future urban development policies and crime prevention and law enforcement systems. This study is exploratory; thus, the findings could not provide a conclusive position because the study is an ongoing project. Moreover, the study is limited to vulnerability to burglary risk but has also explored critical issues that require further studies to rigorously investigate and establish the validity of the claims made in the paper.

ACKNOWLEDGMENTS

The authors would like to thank Universiti Sains Malaysia and Ministry of Higher Education Malaysia for providing financial supports under FRGS (203/PPBGN/6711997) and Reference Code FRGS/1/2021/SSI02/USM/01/2.

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Received: 26th June 2023. Accepted: 11th August 2023



PLANNING MALAYSIA:

Journal of the Malaysian Institute of Planners

VOLUME 21 ISSUE 4 (2023), Page 496 – 509

DEVELOPMENT MODEL FOR VIRTUAL REALITY (VR) TOURISM IN RURAL AREAS: A GIS-BASED APPROACH

**Arina Rahmat¹, Norainah Abdul Rahman², Muhammad Rijal Mohamad³,
Aizazi Lutfi Ahmad⁴, Kamariah Abdullah⁵, Mohd Ismail Isa⁶, Fatin
Nabilah Omar⁷**

*^{1,2,3,4,5,7}Department of Built Environment Studies and Technology,
College of Built Environment,*

UNIVERSITI TEKNOLOGI MARA PERAK BRANCH

*⁶Department of Urban and Regional Planning,
School of Housing, Building and Planning,*

UNIVERSITI SAINS MALAYSIA, PULAU PINANG

Abstract

This paper provides an overview of a development model for virtual reality (VR) tourism using Geographic Information System (GIS) data and spatial distribution analysis of potential tourism products. The study employs a mixed-methods approach, combining qualitative and quantitative data collection techniques. Qualitative methods, such as interviews and focus groups, gather insights from stakeholders, including tourists, local communities, and tourism industry professionals, regarding their perceptions, expectations, and preferences. Quantitative methods, such as surveys and data analysis, provide a comprehensive understanding of visitor demographics, preferences, and the economic impact of VR tourism. The findings of the study focus on identifying and analysing the components of tourism products and data information specifically within the rural area of the Perak Tengah District. Information about tourism products is collected and encoded into a GIS database. The introduction of a new classification system justifies the development model and outlines a detailed process for each stage of the framework's methodologies. The originality and value of this research used a mixed-methods approach to gather qualitative and quantitative data, illustrating the overview of VR tourism development using the GIS tool approach specifically for tourism products in rural areas.

Keywords: Virtual Reality Tourism, Geographic Information System (GIS), Spatial Distribution Analysis, Tourism Products, Rural Areas, GIS Database

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

INTRODUCTION

Tourism planning plays a vital role in ensuring the tourism industry's successful development and sustainable growth. It involves multiple stakeholders, including government agencies at the district, state, and federal levels and private entities. Integrated planning is crucial to avoid conflicts and balance societal needs, cultural preservation, infrastructure development, environmental conservation, and overall physical development. Well-executed tourism planning boosts the influx of domestic and international tourists and stimulates the local economy, benefiting those directly and indirectly involved in the industry. While virtual reality (VR) tourism is gaining momentum worldwide, its establishment in Malaysia remains relatively nascent (LENS.ORG, 2021). Given the current global context and the new normal brought about by the COVID-19 pandemic, this presents an opportune time to develop a VR tourism model in Malaysia. Several previous studies, such as those conducted by Hashim & Jusof (2010) and Schiopu et al. (2021), have utilised qualitative approaches to explore various aspects of tourism research.

This paper aims to address the gap in VR tourism development in Malaysia by proposing a comprehensive model for implementing VR tourism experiences. By leveraging the unique capabilities of VR technology, Malaysia can tap into the growing demand for immersive travel experiences, attracting both domestic and international visitors. The model will emphasise integrating VR technology into existing tourism planning processes, ensuring a seamless and coordinated approach.

The objectives of this paper is (i) to identify the tourism attractions and products available in the Perak Tengah district, (ii) to analyse the GPS coordinates data and integrate the data into a GIS framework, facilitating the visualisation and mapping of tourism attractions and products in the Perak Tengah district and (iii) to develop a model for promoting tourism attractions and products through GIS-based data.

LITERATURE REVIEW

Domestic Tourism in the new normal

The COVID-19 pandemic in 2020 has significantly impacted the global tourism industry, including domestic tourism in Malaysia. Despite the challenges posed by the pandemic, domestic tourism has remained in demand among Malaysians, as indicated by growth from 7.7% to 8.1% per year (Department of Statistics, 2020). The emergence of the "new normal" has necessitated the adoption of specific guidelines and Standard Operating Procedures (SOP) to ensure the safety of travellers. These guidelines include the implementation of 3Ws (wash, wear, and warn) and the avoidance of 3Cs (crowded, confined, and closed spaces) (Ministry of Tourism, Arts and Culture, 2020). Domestic travel bubbles have also

been established to facilitate safe travel within the country. However, with the persistent increase in COVID-19 cases and the implementation of controlled movement, there is a need to explore new approaches and models for domestic tourism that can boost the local economy. Malaysia has experienced a surge in COVID-19 cases, reaching four digits daily (Ministry of Health, 2021). In response, it becomes essential to consider innovative approaches like virtual reality (VR) tourism to cater to the changing needs of domestic tourists.

Virtual Reality Tourism in Malaysia

Despite the potential of VR tourism, there has been limited research on this approach within the Malaysian tourism field in the past five years. However, studies conducted in European countries, such as Arnold's research (2005) on virtual tourism in cultural heritage, have highlighted the potential market for cultural heritage in tourism. In Malaysia, a few lesser-known studies have focused on VR or online approaches. For instance, Sharib (2009) explored the use of digital imagery and products through the Online Virtual Malaysia Walkthrough (MAWA). MAWA employs a team of specialists in 3D graphics, instructional design, multimedia, and internet development to visualise complex data and provide access to remote and inaccessible cultural and natural heritage sites in Malaysia. Regarding research methodologies, Vishwakarma et al. (2020) employed a quantitative approach, utilising the Value-Based Adoption Model (VAM), to examine the importance of perceived immersion and physical tourist value in VR tourism. Hashim & Jusof (2010) employed High Dynamic Range Imaging (HDRI) photography to document historical areas and analyse photo images. Similarly, Schiopu et al. (2021) applied the Technology Acceptance Model (TAM) to combine perceived attraction factors and produce an attractive tourism mapping system. Harun (2018) conducted qualitative research using observation, inventory of resources, focus groups, and interviews to assess the potential of cultural heritage as a new tourist attraction. This study aims to combine both qualitative and quantitative approaches to enhance data collection and analysis, thus producing valuable insights. It is worth noting that there needs to be more evidence of scholars applying such research on VR tourism in Malaysia and utilising Geographic Information Systems (GIS) to develop VR tourism models.

Overall, the existing literature reveals the significance of domestic tourism in Malaysia, especially in the context of the COVID-19 pandemic and the new normal. Furthermore, it highlights the potential of VR tourism as an innovative approach to boost the tourism industry. The studies mentioned offer valuable insights into various aspects of VR tourism, including cultural heritage, perceived immersion, physical tourist value, and attraction mapping. However, there is still a need for further research in this field, particularly in the Malaysian

context, to fill the existing research gap and provide practical recommendations for policymakers, tourism planners, and industry practitioners. Based on the published literature, the following Table 1 and Table 2 show the Distribution of the VR Approach in Tourism Research based on the methodology:

Table 1: Distribution of VR Approach in Tourism Research based on Methodology

Research Study	Methodology Used
Arnold (2005)	A qualitative study on virtual tourism in cultural heritage
Sharib (2009)	Use of digital imagery and products (Online Virtual Malaysia Walkthrough - MAWA)
Hashim & Jusof (2010)	Research modelling using High Dynamic Range Imaging (HDRI) photography
Harun (2018)	Qualitative research using observation, inventory of resources, focus groups, and interviews
Schiopu et al. (2021)	Employed the Technology Acceptance Model (TAM) for analysing perceived attraction factors and producing a tourism mapping system
Vishwakarma et al. (2020)	A quantitative study using the Value-Based Adoption Model (VAM)

The table above presents a distribution of research studies focusing on the VR approach in tourism based on the methodology used. Arnold (2005) conducted a qualitative study on virtual tourism in cultural heritage, providing insights into the potential market for cultural heritage in tourism. Sharib (2009) explored the use of digital imagery and products through the Online Virtual Malaysia Walkthrough (MAWA) platform. Vishwakarma et al. (2020) conducted a quantitative study utilising the Value-Based Adoption Model (VAM) to examine the importance of perceived immersion and physical tourist value in VR tourism. Hashim & Jusof (2010) employed High Dynamic Range Imaging (HDRI) photography for research modelling, specifically in documenting historical areas and analysing photo images. Schiopu et al. (2021) utilised the Technology Acceptance Model (TAM) to combine perceived attraction factors and develop an attractive tourism mapping system. Lastly, Harun (2018) conducted a qualitative study using observation, an inventory of resources, focus groups, and interviews to explore the potential of cultural heritage as a new tourist attraction.

These studies demonstrate the diverse methodologies in VR tourism research, ranging from qualitative approaches to quantitative analyses. Each methodology provides unique insights into different aspects of VR tourism, including cultural heritage, immersion, physical tourist value, and attraction mapping. Researchers can gather comprehensive data and generate valuable findings to inform VR tourism development by combining various research methods.

Table 2: Distribution of VR Approach in Tourism Research based on methodology (ii)

VR approach in tourism (author / year)	Research Modelling	Quantitative Approach	Tools for cultural heritage site interpretation	No of Method Used
Arnold (2005)	✓	✓	✓	3
Yenganaidu (2005)		✓		1
Sharib (2009)			✓	1
Hashim & Jusof (2010)	✓			
Harun (2018)	✓	✓	✓	3
Vishwakarma et al. (2020)	✓	✓		2
Schiopu et al. (2021)	✓	✓		2
Total No. of Authors	5	5	3	

Source: Author's Calculation

CONCEPTUAL MODEL

The conceptual model presented in this research represents a pioneering empirical study that aims to develop a Virtual Reality (VR) tourism model using a Geographic Information System (GIS)-based approach. This model is designed to enhance domestic tourism, stimulate economic growth, and promote a pro-growth agenda in Malaysia, particularly within the local population. This project aims to target industries, practitioners, stakeholders, and the general public to promote tourism products, specifically in rural areas. The framework for developing an integrated virtual reality (VR) model using the Geographic Information System (GIS) tool approach specifically for applying GIS spatial analysis for tourism products in rural areas as shown in Figure 1.

Development of the VR Tourism Model

The development of the VR tourism model revolves around providing comprehensive data and information on tourism products, with a specific focus on the rural areas of Perak Tengah District. The collection of information about tourism products is encoded into a GIS database, enabling efficient storage, analysis, and visualisation of spatial data.

GIS Data Components

The GIS data for the VR tourism model consists of several components that contribute to the overall functionality and effectiveness of the model. These components include:

1. Base Map:

- i. **Administrative Boundary:** This includes delineation of state, local, and mukim boundaries.
- ii. **Land Use:** Existing and committed land use information is incorporated to provide context for tourism development.
- iii. **Land Use Zoning:** This component highlights the zoning regulations and designations related to land use in the target area.
- iv. **Tourism Information:** This category encompasses various types of tourism products, including accommodation, educational institutions, conference facilities, trade and services, food and beverages, and places of attraction.

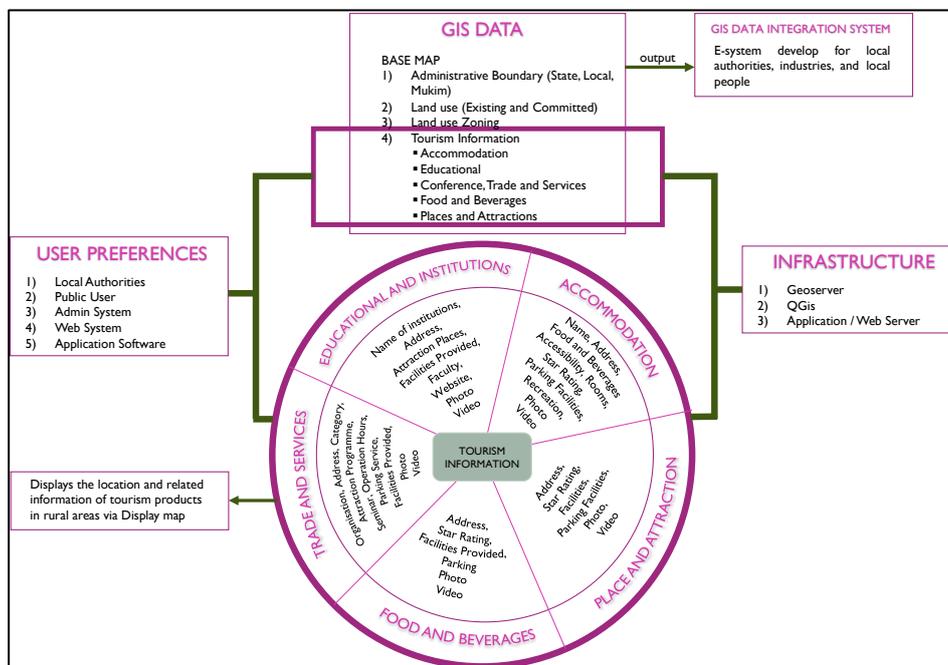


Figure 2: Conceptual Model of Virtual Reality (VR) Tourism Products

2. **GIS Data Integration System:**
All the outputs from the GIS data components are integrated into a GIS Data Integration System, which serves as an electronic system developed for local authorities, industries, and residents. This system facilitates efficient access, management, and utilisation of tourism-related data as shown in Figure 2 and 3.
3. **Display of Tourism Product Information:**

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The VR tourism model showcases the location and pertinent details of tourism products in rural areas through a display map. The display map presents the following categories and associated information on the website application as shown in Figure 3.

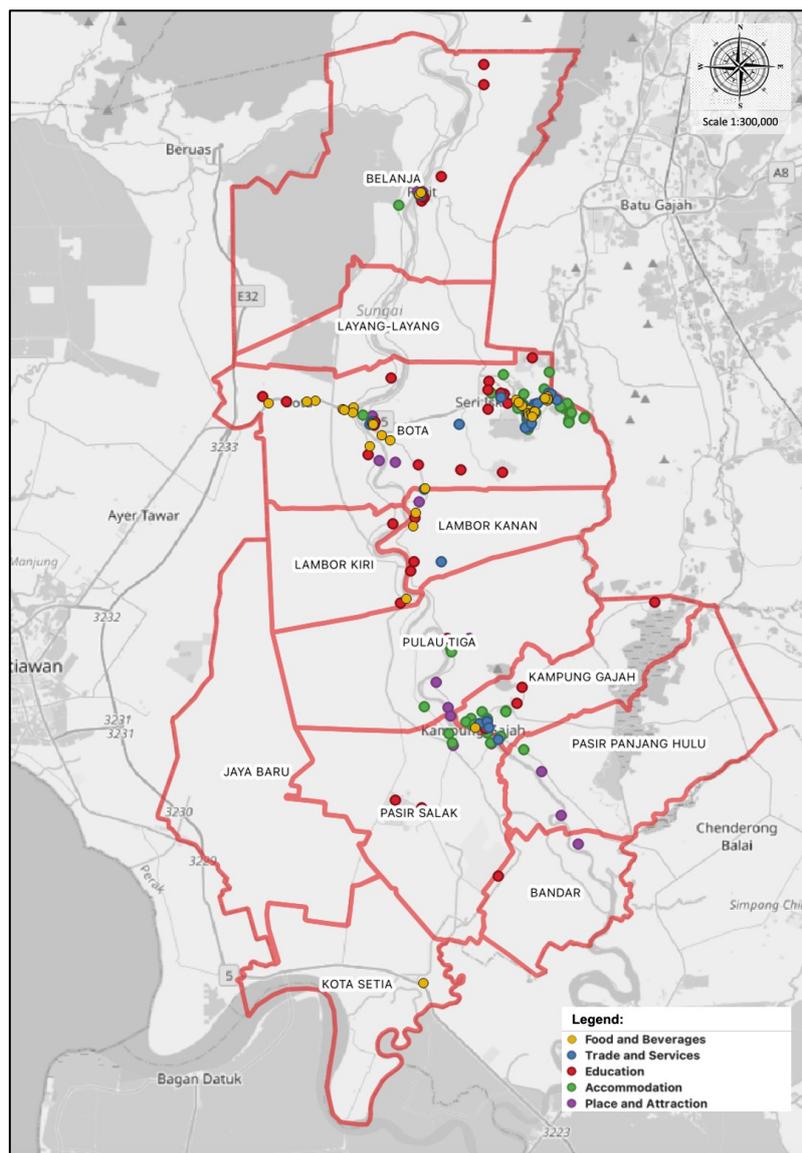


Figure 2: Distribution of Tourism Products in Perak Tengah District

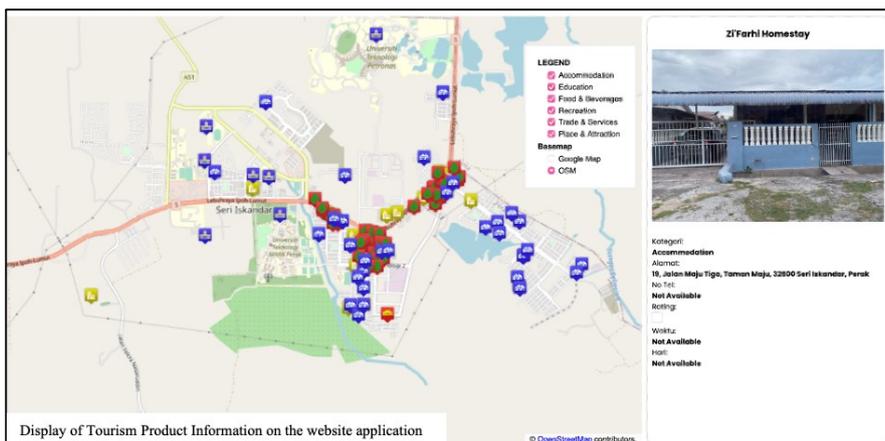
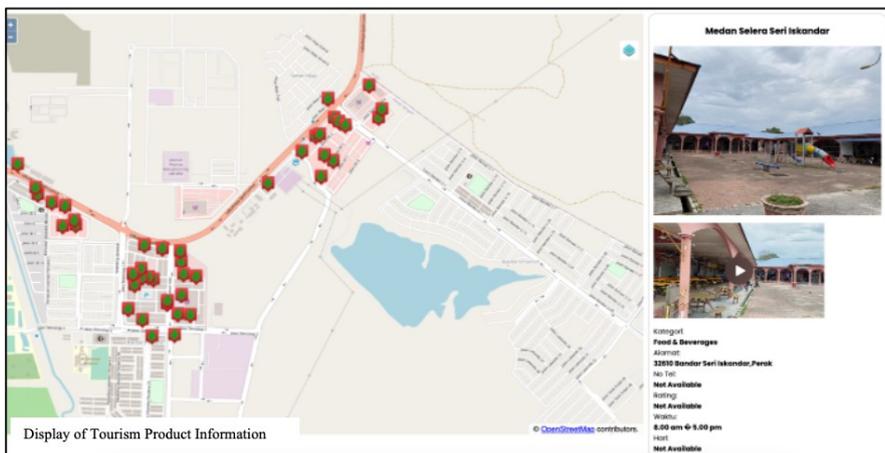
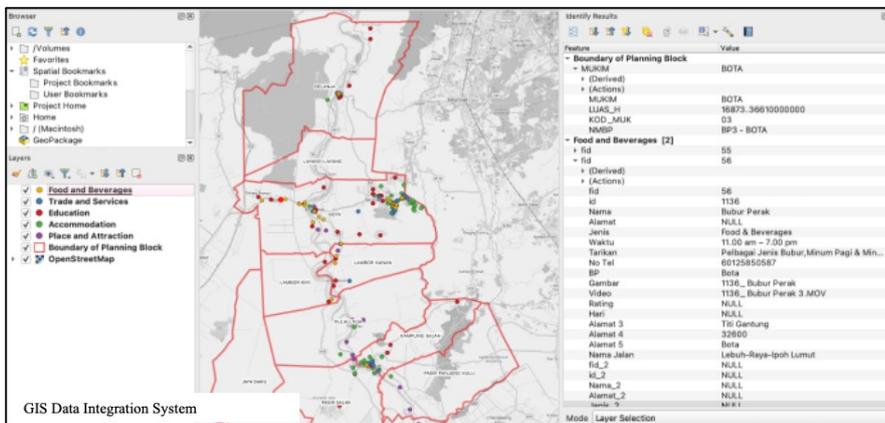


Figure 3: Display of Tourism Product Information

- i. **Food and Beverage:** This category includes address, star rating, provided facilities, parking availability and photos and videos.
- ii. **Place and Attraction:** Information related to address, star rating, facilities, and parking facilities, as well as photos and videos, is provided.
- iii. **Accommodation:** Name, address, available food and beverage options, accessibility, number of rooms, star rating, parking facilities, recreation facilities, and visual media materials are included in this category.
- iv. **Educational and Institutions:** Details encompassing the name of institutions, address, attraction places, facilities provided, faculty information, website link, as well as photos and videos.
- v. **Trade and Services:** This category provides information on organisations, addresses, categories, attraction programs, seminar offerings, operation hours, parking services, facilities provided, and visual media materials.

The development of the VR tourism model using GIS-based data distribution in rural areas represents a significant contribution to the field. By providing an overview of tourism products and leveraging VR technology, this model aims to enhance domestic tourism, stimulate economic growth, and promote the development of rural areas in Malaysia. Integrating GIS data components and incorporating user preferences ensure a user-friendly and informative platform for industries, practitioners, stakeholders, and the general public to access and utilise tourism-related information effectively.

RESEARCH METHODOLOGY

The research follows a systematic data processing approach, incorporating qualitative and quantitative methods to gather and analyse relevant information. The study focuses on the Perak Tengah district in Malaysia and seeks to bridge the gap between tourism offerings and online promotion through the implementation of VR technology. Stage 1 Inputs: The research process begins with a comprehensive literature review and the establishment of a content analysis framework. This stage involves reviewing relevant scholarly articles, reports, and industry publications to gain insights into existing knowledge and identify research gaps. The content analysis framework provides a systematic approach to analyse and interpret the collected data.

Stage 2 Data Collection and Analysis: A combination of methods is employed to gather the necessary data. Inventory surveys are conducted to identify and document the tourism attractions and products available in the Perak Tengah district. Questionnaire surveys are administered to the local community, particularly those familiar with the tourism industry in the area. The surveys aim to gather quantitative data on tourists' and residents' perceptions, preferences, and experiences regarding tourism attractions and products. In addition, GPS

techniques are utilised to accurately record the geographical coordinates of the identified attractions and products. This spatial data allows for integrating GIS technology in the subsequent stages of the research. Furthermore, in-depth interviews and focus group discussions are conducted with key informants, including operators, NGOs, local authorities, and tourism organisations. These qualitative methods provide valuable insights into the challenges, opportunities, and perspectives of various stakeholders in the tourism industry.

Stage 3 Key-in Data (updating data information in GIS-based data spatially): The collected data, including the inventory surveys, questionnaire responses, GPS coordinates, and qualitative insights, are inputted into a GIS-based data system. This spatially encodes the information, allowing for efficient storage, retrieval, and analysis of tourism-related data. Integrating data in a GIS framework facilitates the visualisation and mapping of tourism attractions and products in the Perak Tengah district. Stage 4 Output (Developing Model): The final stage of the research involves developing a model using a spreadsheet-based approach. This model utilises the compiled data to generate insights and recommendations for promoting tourism attractions and products through an online system with VR tourism modelling. The model aids in decision-making processes for industry practitioners, local authorities, and other stakeholders, enabling them to enhance the visibility and accessibility of tourism offerings in the Perak Tengah district.

ANALYSIS AND DISCUSSION

Table 3 provides an overview of the total number and distribution of tourism products in the rural areas of Perak Tengah District. These tourism products are categorised into different types: places and attractions, accommodation, services, education, and food and beverages. The data presented in the table were obtained through the research conducted for this study in 2023. According to the study, 22 places and attraction sites exist in the rural areas of Perak Tengah District. These sites offer visitors various types of tourism experiences and points of interest. They showcase the region's natural beauty, cultural heritage, and historical significance.

Table 3: Total and Distribution of Tourism Products in Rural Areas, specifically in Perak Tengah District

Types of Tourism Products	Total
Place and Attraction	22
Accommodation	54
Trade and Services	26
Educational and Institutions	36
Food and Beverages	80
Total Number of Tourism Products	218

Source: Author's Calculation

In terms of accommodation, there are 54 establishments available in the rural areas of Perak Tengah District. These accommodations cater to the needs of tourists and provide them with comfortable and convenient places to stay during their visit. They offer a range of amenities and services to ensure a pleasant experience for guests. The trade and services sector in the rural areas of Perak Tengah District comprises 26 establishments that offer different types of services to tourists. These trades and services may include transportation, tour guides, recreational activities, and other tourism-related services. They aim to enhance visitors' overall experience and meet their specific needs.

Education plays a significant role in the tourism sector, and in the rural areas of Perak Tengah District, 36 educational institutions contribute to the tourism offerings. These institutions provide opportunities for visitors to learn about the local culture, history, and traditional practices through various educational programs and activities. Food and beverages are an essential aspect of tourism, and in the rural areas of Perak Tengah District, 80 establishments cater to the culinary needs of tourists. These establishments offer diverse cuisines, from local delicacies to international dishes, providing visitors with a taste of the region's culinary heritage. The study identifies 218 tourism attractions in the rural areas of Perak Tengah District. These attractions collectively contribute to promoting and developing tourism in the region. It is important to note that the data presented in Table 3 are based on the research conducted for this study in 2023. The information provides valuable insights into the tourist attractions of the rural areas in Perak Tengah District, highlighting the diverse range of tourism products available for visitors to explore and enjoy.

The data presented in Table 4 (i, ii, iii, iv, and v) demonstrate the significant presence and variety of tourism products in the rural areas of Perak Tengah District. The diverse offerings, including places and attractions, accommodation, services, education, and food and beverages, contribute to the overall tourism experience and showcase the region's rich cultural and natural heritage. This information is crucial for tourism stakeholders, policymakers, and tourists themselves, as it provides a comprehensive understanding of the tourism potential and opportunities in the rural areas of Perak Tengah District.

Table 4 (i): Attribute Displays Information of Tourism Products in GIS-based data, specifically in Perak Tengah District (Place and Attraction)

Types of Tourism	Planning Block	Place of Interest	Quantity (%)
Place and Attraction	Bandar	Heritage (1)	1 (4.5%)
	Belanja	Heritage (1); Business Street Arts (2); Recreation (1)	4 (18.2%)
	Bota	Heritage (3); Wildlife (1), Sports and Recreation (1)	5 (22.7%)
	Kampung Gajah	Heritage (1); Motor Sports and Recreation (1)	2 (9.1%)
	Lambor Kanan	Heritage (1); Motor Sports and Recreation (1)	2 (9.1%)
	Lambor Kiri	Heritage (1)	1 (4.5%)
	Pasir Panjang Hulu	Heritage (1)	1 (4.5%)

Types of Tourism	Planning Block	Place of Interest	Quantity (%)
	Pasir Salak	Heritage and Museum (1), Nursery (1)	2 (9.1%)
	Pulau Tiga	Agro-tourism (1), Crafts (1), Heritage (2)	4 (18.2%)
Number of Tourism Place and Attraction			22

Source: Author's Calculation

Table 4 (ii): Attribute Displays Information of Tourism Products in GIS-based data, specifically in Perak Tengah District (Accommodation)

Types of Tourism	Planning Block	Place of Interest	Quantity (%)
Accommodation	Belanja	Homestay (1); Resort (1)	2 (3.7%)
	Bota	Homestay (27); Hotel (6)	33 (61.1%)
	Kampung Gajah	Homestay (11)	11 (20.4%)
	Pasir Panjang Hulu	Homestay (1)	1 (1.9%)
	Pasir Salak	Homestay (2); Resort (1)	3 (5.6%)
	Pulau Tiga	Homestay (4)	4 (7.4%)
Number of Tourism Accommodation			54

Source: Author's Calculation

Table 4 (iii): Attribute Displays Information of Tourism Products in GIS-based data, specifically in Perak Tengah District (Trade and Services)

Types of Tourism	Planning Block	Place of Interest	Quantity (%)
Trade and Services	Belanja	Bazaar and Night Market (2); Religious Services (1)	3 (11.5%)
	Bota	Tourism Agency (3); Banking (5); Bus Station and Transportation Services (1); Transportation Rental Services (4); Bazaar and Night Market (3); Religious Services (2); Hypermarket (2); Shopping Mall (1)	19 (73.1%)
	Kampung Gajah	Hypermarket (1); Bazaar and Night Market (2)	3 (11.5%)
	Lambor Kanan	Health Services (1)	1 (3.8%)
Number of Tourism Trade and Services			26

Source: Author's Calculation

Table 4 (iv): Attribute Displays Information of Tourism Products in GIS-based data, specifically in Perak Tengah District (Educational and Institutional)

Types of Tourism	Planning Block	Place of Interest	Quantity (%)
Educational and Institutional	Belanja	Secondary Education (2); Secondary Religious Studies (1); Religious Studies (1); Fully Residential School (1)	5 (13.9%)
	Bota	Private Higher Education (2); Secondary Education (4); Primary Education (9); Secondary Religious Studies (1); Technical Education and Vocational Training (TVET) (3)	19 (52.8)
	Kampung Gajah	Secondary Education (2); Technical Education and Vocational Training (TVET) (2); Fully Residential School	4 (11.1%)
	Lambor Kanan	Primary Education (3); Secondary Education (1)	4 (11.1%)
	Lambor Kiri	Secondary Education (1)	1 (2.8%)
	Pasir Salak	Secondary Education (2); Technical Education and Vocational Training (TVET) (1)	3 (8.3%)
Number of Tourism Educational and Institutional			36

Table 4 (v): Attribute Displays Information of Tourism Products in GIS-based data, specifically in Perak Tengah District (Food and Beverages)

Types of Tourism	Planning Block	Place of Interest	Quantity (%)
Food and Beverages	Belanja	Hailam Noodles (3); Breakfast and Lunch (2)	5 (6.3%)
	Bota	Breakfast, Lunch, and Afternoon Drink (8); Cakes, Bread Shop, Desserts (7); Lunch, Malay Food, and Grilled Fish (5); Western, Johor Laksa, Sarang Laksa (1); Arab Cuisine (1); Western Food (7); Various Types of Food & Beverages (3); Thai Cuisine and Tom Yum (6); Gula Apong Ice Cream (1); Fast Food Restaurant (5); Shellout (1); Indonesian Food (1); Kelantanese Breakfast (1); Malay Food, Village Cuisine (1); Nasi Kandar (1); Chicken Rice (3); Satay (2); Various Types of Porridge (1); Various Rice Mixed Dishes, Grilled Fish, Mee Udang (1); Curry Noodles (2)	57 (71.3%)
	Kampung Gajah	Thai Cuisine and Tom Yum (2); Malay Food, Village Cuisine (5); Afternoon Drink, Laksa (1); Breakfast, Lunch, and Afternoon Drink (1); Various Types of Kopitiam Food (1)	10 (12.5%)
	Lambor Kanan	Curry Noodles (1); Breakfast, Roti Canai (1); Evening Snacks, Hungarian Langos Bread (1); Hailam Noodles (1); Tempoyak Curry (1)	5 (6.3%)
	Pasir Salak	Prawn Char Kuey Teow (1); Breakfast, Lunch, and Afternoon Drink (1)	2 (2.5%)
	Kota Setia	Malay Food, Village Cuisine, Big Prawn Char Koay Teow (1)	1 (1.3%)
	Number of Tourism Food and Beverages		

Source: Author's Calculation

CONCLUSION

In conclusion, this study sheds light on the availability and distribution of tourism products in the rural areas of Perak Tengah District. The data collected and analysed provide valuable insights into the region's variety and quantity of tourism attractions. The findings reveal that Perak Tengah District boasts diverse tourism products, including places and attractions, accommodation, services, education, and food and beverages. This signifies the potential for developing and promoting tourism in rural areas. The study emphasises the importance of these tourism products in enhancing domestic tourism, sustaining economic growth, and promoting local development. By focusing on the target audience, which includes industries, practitioners, stakeholders, and the public, the research aims to boost tourism in rural areas and support the growth of the local economy.

The development of a VR tourism model, integrated with a GIS-based data spatial distribution system, is a notable contribution of this research. This model provides a comprehensive overview of tourism products and attractions in the targeted rural area. Incorporating user preferences, such as local authorities, the public, admin systems, web systems, and application software, ensures effective dissemination of information to various stakeholders.

ACKNOWLEDGEMENT

The research was supported by the Ministry of Education Malaysia through Grant Nos. FRGS/1/2021/WAB09/UITM/02/4. It was conducted in collaboration with the Department of Built Environment Studies and Technology, College of Built Environment, Universiti Teknologi MARA, Perak Branch, Seri Iskandar Campus, as well as the Perak Tengah District Council.

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Received: 26th June 2023. Accepted: 11th August 2023



PLANNING MALAYSIA:

Journal of the Malaysian Institute of Planners

VOLUME 21 ISSUE 4 (2023), Page 510 – 524

AN EXAMINATION OF OUTDOOR RECREATION PARTICIPATION CONSTRAINTS AMONG RURAL AND URBAN COMMUNITIES

**Hasnizam Ab Dulhamid¹, Mohd Ismail Isa², Badaruddin Mohammed³,
Muhamad Ferdhaus Sazali⁴ & Nurbaidura Salim⁵**

*^{1,2,3} School of Housing, Building, and Planning,
UNIVERSITI SAINS MALAYSIA*

*^{1,4,5} Department of Built Environment Studies & Technology,
College of Built Environment,
UNIVERSITI TEKNOLOGI MARA PERAK BRANCH*

Abstract

This study examined the relationship between motivational and constraint factors of outdoor recreational participation among rural and urban communities. Questionnaires were used as the main instrument of the research and were distributed to a number of 384 respondents who were among individuals living in rural and urban areas. Based on the Self-Determination Theory (SDT), the analysis revealed that the RII score for each outdoor recreational engagement motivational factor was at the highest level, as the p-value of the index obtained for each item was more than 0.50. The analysis also revealed that the primary constraint for outdoor recreation participation among both sample studies was the factor of time with a value of ($P < .05$). As statistical findings of the study indicated how constraint factors could influence motivational factors in the participation of outdoor recreation, it is crucial that future studies also look into constraint issues of respondents to identify and explore motivational factors in the field of rural and urban planning.

Keywords: Outdoor Recreation, Constraints, Rural, Urban

¹ PhD Candidates at Universiti Sains Malaysia Email: hasni43@uitm.edu.my

INTRODUCTION

The involvement of nature-based recreation and green landscapes has shown improvement in recent decades and is expected to continue to increase (Zeidenitz et al., 2017). This situation explains that outdoor recreational activities have become part of the culture of society (Cordell, 2008) and are often used as a measure in assessing the social well-being of a community (Godbey et al., 1998; Tinsley et al., 2002; Ghimire et al., 2014). Therefore, outdoor recreation is essential and beneficial in people's lives. However, some studies have found that certain groups in the community are less likely to participate in outdoor recreation (e.g. ethnic minorities, women, rural residents, and the elderly) less likely/willing to participate in outdoor recreation than their other counterparts (Bialeschki, 1999; Crespo et al., et al., 2000; Sasidharan, 2001; Kundziņa & Grants, 2014). In other words, the group faced more constraints engaging in outdoor recreational activities than their counterparts (e.g. men, urban areas, youth/teens, and majority groups). Studies analysing the constraints and factors of outdoor recreational participation have started since the 1970s and were significantly expanded in the 1990s (Crawford et al., 1991; Henderson, 1991), a significant field among outdoor recreation researchers. In general, impediments to outdoor recreational participation refer to factors limiting outdoor recreational participation among the community, using recreational facilities services (parks and programs), and enjoying activities (Scott et al., 2004).

Researchers have long identified that each constraint affects outdoor recreational participation differently. The constraints factor is also among the researchers' assumptions and experiences felt by individuals limiting outdoor recreational participation and hindering or prohibiting pleasure/enjoyment in outdoor recreation (Jackson, 2000). Assuming this, the constraints factor is a limiting factor that hinders an individual's desire to fulfil leisure. By looking at it from a broader perspective, outdoor recreation constraints are an explanation for a factor that can prevent a person from participating in recreational activities, reduce the expected benefits as a result of the activities performed, forms of unresolved constraints to recreational participation in leisure, no participation will be done, and serve to reduce participation in different ways (Jackson et al., 1993; Johnson et al., 2001; Scott & Jackson, 2005; Fredman & Heberlein, 2014) which indirectly limits individual satisfaction (Jackson, 1988). Crawford & Godbey (1987) argues by describing constraints influencing participation and involving ownership of leisure options. Thus, the focus of the study needed to be more on discussing the existence of constraint factors. These constraints factors have indirectly generated new insight into aspects of leisure tenaciously considered to have been well understood, such as outdoor recreational engagement, motivation, satisfaction, and conflict (Jackson, 2000).

LITERATURE REVIEW

Outdoor recreation participation is generally motivated by various factors, primarily meeting the leisure time owned (Kondric et al., 2013). Motivation can be seen as an internal force that influences an individual to act in a way that helps them achieve a specific desired experience or outcome (Driver & Knopf, 1977; Whiting et al., 2017), and has an essential position as it helps to determine why individuals engage in recreational behaviour, the way individuals do, understand the benefits of participation and serves as basic knowledge in assisting the planning process and environmental management (Ab Dulhamid et al., 2023). Leading researchers have done studies to identify motivating factors for travel generation and recreational participation (e.g., Cooper et al., 1998). Motivation refers to forces that motivate and direct human behaviour (Iso-Ahola, 1999; Deci & Ryan, 1985). The motivation factor is the will or drive and emotion that leads someone to act and is closely related to the emotion and feel positive if their wishes and desires are achieved, and this will be harmful if otherwise (Ab Dulhamid et al., 2022). For Jackson (2000), the power of motivation for outdoor recreational participation has encouraged individuals to negotiate on inherent constraints factors. Unlike what is described by (Carroll & Alexandris, 1997; Hubbard & Mannell, 2001; Alexandris et al., 2002), most of each existing study that discussed constraints and motivations towards outdoor recreational participation were considered separate and unrelated variables. Carroll & Alexandris (1997) found that concentration correlates positively with motivation. With that in mind, they make the case that 'highly motivated individuals are less likely to feel high levels of obstruction and tend to participate in recreational activities. Highly motivated people strive to overcome constraints and participate more often in recreational activities.

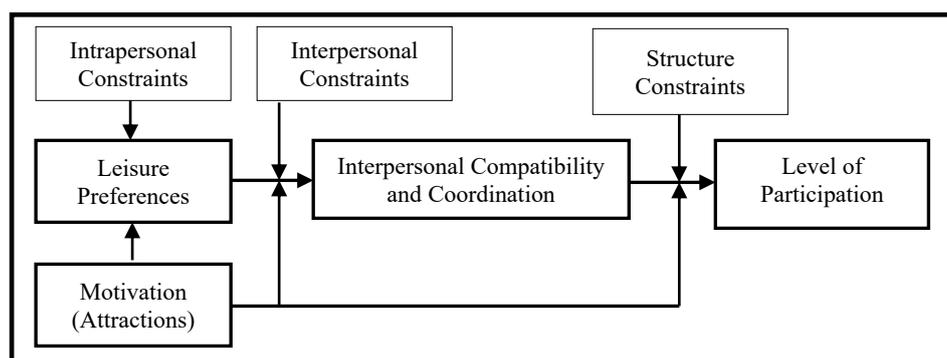


Figure 1: A Hierarchical Model of Leisure Constraints
Sources: Crawford et al., 1991; Jackson, Crawford & Godbey, 1993,

The study of constraints is not a new phenomenon and has been the topic of many studies over the past few decades. It is considered a factor limiting recreational participation (Fredman & Heberlein, 2014) (See Figure 1). Crawford & Godbey (1987) divided each constraint factor into three main categories based on how it affects the relationship between priority and participation (Carroll & Alexandris, 1997; White, 2008), and the categories in the model are 'intrapersonal constraints' (as individual psychological qualities that influence the development of psychological leisure – stress, depression, shame), 'interpersonal constraints' (as social factors that influence the formation of leisure choices – the absence of friends, friends), and 'structural constraints' or also known as 'intervening' (consisting of factors that intervene in the development of time choices leisure and participation – economy, time, and accessibility). Based on the model, Jackson et al. (1993, p.3-4) argued as follows:

- i. *Intrapersonal Constraints*: Leisure options are formed when interpersonal constraints do not exist, or its effects have been encountered through some combination of privilege and the implementation of human will;
- ii. *Interpersonal Constraints*: Individuals are likely to encounter constraints at the interpersonal level. It is only when this type of constraint has been overcome (if appropriate to the activity) and faced with structural constraints; and
- iii. *Structural Constraints*: It will result in no participation or the existence of negotiations through structural constraints.

Models such as in Figure 1 have explicitly suggested that the results of responses to constraints to outdoor recreational participation can be seen as a function of the interaction between constraints and motivations for each type or category of constraints (Fredman & Heberlein, 2005). Individual participation depends on trying to overcome each constraint rather than at a time when there are no constraints (although this may be relevant for a particular person). In negotiations to constraints, each participation can be modified (according to individual suitability) rather than wholly ignored. The best approach to overcoming the constraints of leisure participation is to refer to some form of strategy other individuals have used in exhibiting 'proactive responses' to constraints. On the other hand, if the individual accepts each obstacle and chooses not to participate in leisure activities (fulfilling the requirements), it is considered a 'reactive response' (Jackson et al., 1993). From different perspectives, many studies on outdoor recreational participation's constraints are more descriptive than explanatory, with minimal theoretical development (Walker & Virden, 2005; Scott & Jackson, 2005). Walker & Virden continued the discussion by pointing out some of the constraints factors that received the highest ratings on the study scale, which included lack of time, distance to recreational resources,

overcrowding, lack of information, cost, family commitment, and public facilities are not unkempt, deteriorating into disrepair, and poorly maintained (Ahmad et al., 2022). Constraints to outdoor recreation are similar to other outdoor activities, but some aspects, such as lack of time, are likely to affect outdoor recreation substantially. This is because it requires a commitment to travel time to reach an undeveloped area. Thus, White (2008) classified constraints as having a direct negative impact on outdoor recreational participation. However, the highly motivated are still more likely to overcome challenges and participate actively (Samdahl & Jekubovich, 1997). For each type of constraint that exists, the result of a response to an outdoor recreational constraint can be seen as a function of the interaction that occurs between the constraints and the motivation itself (Fredman & Heberlein, 2014). A robust motivating factor in the self encourages the community to participate in recreation and negotiate constraints factors (Jackson, 2000).

CONSTRAINTS THEORY

The study of constraints is not a new phenomenon. Budget constraints are always the basis of the analysis in the economic field and have significantly impacted countries and societies. However, research on constraint factors began in the 1980s, and recreational researchers (not economists) developed a broader theory of constraints and how such constraints work to limit the participation of recreational activities (Fredman & Heberlein, 2005). The development of these models is an approach to address issues related to participation and obstruction in outdoor recreational activities (Jackson, 1988).

In a study related to constraints, Crawford et al. (1991) integrated types of constraints into a hierarchical model, and a study by Jackson et al. (1993) developed a series of recommendations on how individuals can reduce constraints, as in Figure 1. Intrapersonal constraints are defined as individual psychological states and traits such as stress, anxiety, attitudes, and perceptions of self-skills that may prevent an individual from engaging in outdoor recreational activities. While for Interpersonal constraints are closely related to social interaction with family members, friends, etc., for example, when couples have differences of opinion in terms of their choice of recreational activities. As for the structure constraints, they include economic resources, time availability and accessibility. Thus, recreational participation is overcoming intrapersonal, interpersonal, and structural constraints. Overall, the literature study explains that constraint factors reduce recreational participation in various ways. Perceptions of high costs associated with participation were significantly lower in some of the study findings (e.g., Jackson, 2000; Kay & Jackson, 1991; Shaw et al., 1991). The results of other studies found that the reduction in outdoor recreational participation was due to growing age factors (Alexandris & Carroll, 1997) and low health levels (Shaw et al., 1991).

METHODOLOGY

The focus group from rural and urban areas was determined using Raosoft, Taro Yamane and Calculator.net online sample size calculator. Following the appropriate justification, which is a 95% of confidence level and 5% margin error, the recommended size for the study was 384 (based on the population size of 800 700 (the Ipoh population in 2020). For this study, each respondent was involved in outdoor recreational activities, residing in Ipoh and the surrounding areas. The selection of respondents from these two areas aims to identify motivational and constraint factors that encourage outdoor recreation participation.

DATA COLLECTION

The study used a quantitative approach as the primary attribute to get the correct answers to motivational factors for outdoor recreational participation. The quantitative approach could verify and process information in detail and provide insights outdoors to understand better the phenomenon being studied. In addition, the approach to this method can provide some explanation that may help verify the accuracy and validity of the data that has to do with specific aspects under study. For Patton (2002), this method was also chosen because it allowed researchers to ask questions, understand, and investigate more deeply to discover the reasons for participation motivation and know the constraints. The study participants were recreation users from rural and urban areas aged 18 and above. To select the potential respondents, Convenience Random Sampling was applied to obtain the number of respondents needed in the study. In carrying out this study, the process of collecting study data is to use a form of questionnaire or 'self-administered questionnaire'. Each question in this questionnaire is open and closed, using bilingual Malay and English. These two languages provide understanding and convenience to the respondents to complete the questionnaire, which is done online (Google Form). This questionnaire contains 25 questions and takes 10-15 minutes to complete. Analyses in this paper focused on a subset of data collected. Specifically, survey items focused on constraints to outdoor recreation participation, namely the time factor, economic factor, lack of interest, facilities factor, and individual psychology.

ANALYSIS

Linear regression analysis measures whether there is an influence or how much influence and extent the impression between the two changes, independent variables, on dependent variables, is expressed in mathematical equations (regression) (Pallant, 2005). Multiple linear regression analysis is used because it involves more than one non-leaning changer (obstruction) against the leaner (motivation). The adaptation of the regression analysis for this study is to identify the most influential barrier factors to outdoor recreation engagement for rural and urban communities as used by several outdoor recreation studies (Carroll &

Alexandris, 1997; Johnson et al., 2001; Scott et al., 2004; Alexandris & Stodolka, 2004; Kara & Demirci, 2010).

FINDINGS & ANALYSIS

1. Motivation for Outdoor Recreation Participation Among Rural and Urban Communities

Table 1: Motivation for Outdoor Recreation Participation

Rank/ Area	Rural Area		Urban Area	
	Item Scale	RII	Item Scale	RII
1	<i>Enjoy the peaceful environment</i>	0.861	<i>To relax the mind</i>	0.876
2	To relax the mind	0.86	Outdoor activities with the family	0.872
3	Outdoor activities with the family	0.857	Enjoying natural environment	0.87
4	Enjoying natural environment	0.855	Improve personal health/fitness	0.867
5	Improve personal health/fitness	0.854	Staying physically active	0.862
6	Staying physically active	0.852	Enjoy the peaceful environment	0.861
7	To relax	0.851	To relax	0.858
8	Escape from routine activities of life	0.842	Engage with passive activities (light)	0.852
8	Engage with passive activities (light)	0.842	Exploring the environment	0.847
8	Exploring the environment	0.842	Increase the level of self-confidence	0.835
8	Increase the level of self-confidence	0.829	To be with people of similar interests	0.834
11	To be with people of similar interests	0.817	Engage with active activities (heavy)	0.831

As shown in Table 1, the RII score value for all motivational factors of outdoor recreational engagement is at the highest level, as the value of each index of the RII score obtained for each item is more than .50. The acquisition of the RII score proves that there is a difference in motivational factors between the rural community and the city itself. From the point of view of rural areas, the motivation factor that obtained the highest RII value is item 'p', which is the desire to 'enjoy the peaceful surrounding area' with an RII value of 0.861. A peaceful

surrounding usually refers to a natural environment that is a source of recreation (for example, forests, lakes, rivers, etc.), free from any form of pollution, and this element is a space only found in rural areas. The availability of natural recreational resources, in addition to high opportunities for participation, are among the reasons that are likely to make item 'p' achieve a high-value score among rural communities. This finding has proven that the natural environment is the primary motivation for the community's recreational participation (Skar et al., 2008; Stewart et al., 1996; Walker et al., 2010; Whiting et al., 2017).

2. Constraints for Outdoor Recreation Participation Among Rural and Urban Communities

Table 2 summarises the regression model for the constraint's factors to recreational participation for communities in rural and urban areas. Next, the analysis summarised the regression to the entire constraints factor. Table 5.28 shows a positive linear relationship between the constraints and motivation factors for rural and urban areas with ($R=.313a$) and ($R=.373a$), respectively. The barrier factor (independent variable) explains 9.8% ($R^2 = .098$) of rural and 13.9% ($R^2 = .139$) of the variance inherent in the type of dependent variable (motivational factor). Meanwhile, the remaining value of 90.2% is for rural areas, followed by 86.1% for urban areas, which are influenced by other factors that prevent the participation of outdoor recreation.

Table 2: Summary of the Regression Model of Constraint Factors to Outdoor Recreation Participation

Model Summary				
Location	R	R Square (R²)	Adjusted R Square (R²)	Std. Error of the Estimate
Rural Area	.313 ^a	.098	.075	.762
Urban Area	.373 ^a	.139	.115	.584

The adjusted R-value from the study findings is at .075 or 7.5% (rural) and .115 or 11.5% (urban). The difference in R² and Adjusted R values for rural areas is .023 or 2.3% (rural) and .024 or 2.4%. In addition, the value of the Standard Error of the Estimate (SEE) is .762 (rural) and .584 (urban), which represents that the smaller the SEE value, the better because the model will predict the variable more accurately. This conclusion is made at a significant level $\alpha=.05$ (5%) or at a confidence level (95%). While in Table 3 shows the results of ANOVA analysis where the statistically significant value obtained for rural areas is .001, followed by urban .000, which is smaller than the statistical significance level that has been set, which is $p<.05$. Overall, this shows that there is a significant statistical difference between dependent and independent variables for rural and urban areas.

Table 3: ANOVA Regression Analysis of Constraint Factors to Recreational Participation

Location	Model	Sum of Squares	df	Mean Square	F	Sig.
Rural Area	Regression	12.208	5	2.442	4.203	.001 ^b
	Residual	112.113	193	.581		
	Total	124.321	198			
Urban Area	Regression	9.878	5	1.976	5.790	.000 ^b
	Residual	61.081	179	.341		
	Total	70.959	184			

To complete the regression analysis, Table 4 as a whole show that four variables for rural areas have statistically insignificant values, namely 'economic factor', 'lack of interest factor', 'facility factor', and 'psychological/individual factor'. With that, it can be explained as an independent variable factor that does not significantly affect the motivation of outdoor recreation participation in rural and urban communities. In addition, it is considered as a factor that does not affect the motivation of outdoor recreation participation because the value for each factor is greater than $p=.05$, with each 'economic factor' ($p=.415$), 'less interested factor' ($p=.366$), 'facility factor' ($p=.157$), and 'psychological/individual factor' ($p=.602$).

Table 4: Test Regression Coefficient for Outdoor Recreation Participation (Constraints Factors)

Location	Model	Unstandardised Coefficients		Standardised Coefficients	t	Sig.
		B	Std. Error	Beta		
Rural	Variables	3.169	.235	-	13.496	.000
	Time	.252	.073	.287	3.456	.001
	Economy	-.057	.069	-.080	-.818	.415
	Less interested	-.065	.072	-.091	-.906	.366
	Facility	.085	.060	.133	1.421	.157
	Psychology/ Individual	.040	.077	.053	.523	.602
Location	Model	Unstandardised Coefficients		Standardised Coefficients	t	Sig.
		B	Std. Error	Beta		
Rural	Variables	3.431	.185	-	18.530	.000
	Time	.238	.070	.354	3.391	.001
	Economy	-.071	.065	-.139	-1.086	.279
	Less interested	-.117	.070	-.226	-1.669	.097

Facility	.042	.063	-.077	-.665	.507
Psychology/ Individual	.189	.075	.334	2.527	.012

Table 4 shows that four variables for rural areas have insignificant statistical values, i.e. 'economic factors', 'less interested factors', 'facility facilities factors', and 'psychological/individual factors'. Therefore, these four non-dependent variable factors do not significantly impact the motivating factors of outdoor recreational participation towards rural and urban communities. Hence, it is considered to not contribute to the motivating factor of outdoor recreational participation as the value of each factor is greater than $p=.05$, with 'economic factors' ($p=.415$), 'less interested factors' ($p=.366$), 'facility factor' ($p=.157$), and 'psychological/individual factors' ($p=.602$) respectively. However, there is little difference in urban areas where three factors indicate little statistical value, i.e. 'economic factors', 'less interested factors', and 'facility facilities factor'. Therefore, these three non-dependent variable factors do not significantly impact the motivating factors of outdoor recreational participation towards rural and urban communities. Thus, it can be concluded that the three factors above do not contribute to the motivating factors of outdoor recreational participation as the value of each element is higher than $p=.05$, with 'economic factors' ($p=.279$), 'less interested factors' ($p=.097$), and 'facility facilities factor' ($p=.507$) respectively.

Overall, findings show that two social factors reflect a fundamental influence on the participation of outdoor recreation. First, it can be seen that the factor of time contributes to a statistically significant result on the participation of outdoor recreation for both rural and urban communities with a value of $p<.05$. This indicates that time is the primary constraint for outdoor recreation participation for both the communities (rural $t=3.456$, $p<0.001$), (urban $t=3.391$, $p<0.001$). Secondly, findings also show psychological/individual factors as another main inhibiting factor to the participation of outdoor recreation. However, this hindering factor is related only among urban communities with a statistically significant value of ($t=2.527$, $p<0.012$).

The results above prove that intrapersonal constraints such as fear of injury, threat of crime, absence of recreational friends, and entrance fees are some of the potential psychological/individual factors that may prevent communities from involving themselves in outdoor recreational activities. According to McClellan & Medrich (1969), these factors can be classified as latent demand or demand for facilities that the public cannot access to attend. However, for other factors such as the economy, lack of interest, and the level of facilities, statistical findings show that there is insignificant value in preventing the participation of outdoor recreation. Based on these findings, although studies on motivational factors have been carried out on various subjects such as types of activities, location of activities, ethnic differences, gender, etc., the time factor

is consistently the main obstacle to individual participation in outdoor recreational activities (Carroll & Alexandris, 1997; Johnson et al., 2001; Scott et al., 2004; Alexandris & Stodolka, 2004; Kara & Demirci, 2010). This result can be seen from a positive perspective, where the participation of outdoor recreation continuously and regularly among individuals and communities is significant to equip themselves with discipline, knowledge, and good moral values in spending quality free time and skills for a quality continuous life.

DISCUSSION

Rural and urban areas have different lives and unique spaces, indirectly giving birth to different and unique lifestyles in nature that can be reflected through outdoor recreation participation (Wang et al., 2011; Chen et al., 2017). The participation of rural and urban communities in outdoor recreation activities is spatially clustered, where each activity takes place in facilities such as public parks, neighbourhood grounds, and open spaces. However, each individual's participation faces obstacles to routine activities, and they are becoming more common and part of life. In practice, individuals, communities, and systems are challenged to deal with each obstacle (Palacios Abad et al., 2023). Motivational factors and constraints to recreational participation for each individual may change according to the level of experience and time (that is, how they respond to the activity either during or after it (Ewert et al., 2020)). The external constraints to recreational participation identified in this study are intrapersonal, interpersonal, and structural. Common constraints that occur in outdoor recreation participation are lack of time, lack of facilities, lack of financial resources, and lack of interest (Crawford & Godbey, 1987; Holt et al., 2019; Lovelock et al., 2016; Chick et al., 2022). Each of these constraints is capable of preventing engagement, and on the other hand, these constraints are likely to make engagement more complicated but still have the opportunity to do so. Time constraints are intrapersonal (for example, the busyness of managing a family), and sometimes, at the same time, it becomes structural barrier (for example, a recreation room that operates according to a specific time does not coincide with the free time obtained). This requires individuals to negotiate the time barrier so that it does not continue to hinder recreational participation. For Scott (1991), although the time factor almost causes no participation in outdoor recreation activities, each individual may need to strengthen their will to engage in outdoor recreation by changing their participation or replacing recreational activities with other alternatives. When individuals face time constraints, individuals can increase work efficiency or reduce the time spent on other commitments (Kay & Jackson, 1991).

As a result, even if constraints to recreational participation result in non-participation, individuals can encourage/evoke recreational participation through negotiation and substitution (Crawford et al., 1991; Jackson et al., 1993; Kay &

Jackson, 1991; Scott, 1991). Classification into three categories of constraints is widely accepted in identifying how they affect outdoor recreation participation (Crawford & Godbey, 1987; & Stodolska et al., 2013). Intrapersonal constraints include psychological conditions such as skills, abilities, subjective evaluations of appropriateness and availability of opportunities. Interpersonal constraints are related to interpersonal interactions, including constraints such as finding a partner. Structural constraints are intervening constraints between preference and engagement. This type of constraints includes factors related to the lack of resources needed for engagement (Stodolska et al., 2013). Several studies have suggested that intrapersonal constraints are the most potent predictors of commitment to outdoor recreation participation (Anaza & McDowell, 2013; Chick et al., 2022).

CONCLUSION

This research seeks to build on the existing constraints literature study by examining every change and stability of constraints in recreational areas of rural and urban communities. Each constraint element has been identified as a cause that can prevent participation in outdoor recreational activities and thus reduce satisfaction and achievement outcomes (Jackson, 1988; White, 2008). Constraints to outdoor recreational participation are factors that influence the formation of individual leisure time and recreational activity participation (Jackson, 1990; Jackson & Scott, 1999; Xie & Ritchie, 2019) and can act as a constraint to recreational activity participation. The identification of motivational factors and obstacles includes several items that aim to assess as many 'reasons' that lead to engagement, which are obtained from the literature on motivation based on psychological theory and the hierarchical model of obstacles. Recreational motivation is an essential concept in recreational participation. If different individuals respond similarly to stimuli, then it does not necessarily lead to the concept of motivation. However, on the other hand, if individuals are motivated to engage in outdoor recreation for different reasons, then studying these different reasons and their origins is central to understanding recreational behaviour and the effective management of leisure time (recreation programs). Differences in stimulation and recreational behaviour will provide a clear understanding of the achievement and satisfaction achieved by each individual. Determining the goal of outdoor recreation participation guides each achievement and satisfaction of the result of participation.

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Received: 26th June 2023. Accepted: 11th August 2023



PLANNING MALAYSIA:

Journal of the Malaysian Institute of Planners

VOLUME 21 ISSUE 4 (2023), Page 525 – 537

MODELLING FACTOR OF BUILT-UP SATURATION IN THE CITY CENTRE OF KUALA LUMPUR AND PENANG

Dayang Shahrizat Abang Mahmud¹, Izuandi Yin², Mou Leong Tan³, Diana Mohamad⁴, Adam Aruldewan S. Muthuveeran⁵

^{1,2,4}*School of Housing Building, and Planning,*

³*School of Humanities,*

UNIVERSITI SAINS MALAYSIA

⁵*Faculty of Design and Architecture,*

UNIVERSITI PUTRA MALAYSIA

Abstract

In Kuala Lumpur and Penang City Centres, different built-up patterns have emerged based on the gazetted permitted development for the past few years. Since independence, Kuala Lumpur and Penang have experienced substantial growth and modernization throughout the years. Both cities have rapid growth despite the fact that the character of the cities has evolved in built-up patterns from bungalow and mansion settlements due to transporting tin from the mining area (Kuala Lumpur City Centre) into the golden triangle of Klang Valley; colonial areas and ancient shops due to resource transportation to the harbour (Georgetown) into UNESCO World Heritage Sites. There is development control, which is regulated to protect the distinctiveness of the city, including limiting its ability to grow and controlling the saturation of land. This demonstrates how these two city centres have largely concentrated buildings in Kuala Lumpur while Penang is maintaining its conservation plan. The research was conducted to observe the changes in development for both cities (1km radius) from 2015 until 2023 by using the method of overlay analysis between image processing and remote sensing data using the Geographic Information System (GIS) and the USGS Earth Explorer. This assessment is crucial in determining the saturated area, the pattern of built-up development, and the factor of development force.

Keywords: Built-up pattern, Landsat Image, City Development, Urban Saturation

² Lecturer at Universiti Sains Malaysia. Email: izuandi.yin@usm.my

INTRODUCTION

The national capital and largest city of Malaysia is Kuala Lumpur, sometimes known as KL or the Federal Territory of Kuala Lumpur. Kuala Lumpur is one of Southeast Asia's rapidly growing cities in terms of both population and economic development. (Hua & Ping, 2018). Meanwhile, the city centre of Penang is Georgetown, which is Malaysia's second-largest city. It was the first British outpost in Southeast Asia when it was established in 1786 as an entrepôt (Yang, 2021). The process of creating models using spatial data and a Geographic Information System (GIS) is known as GIS modelling. It is a condensed portrayal of an event or complex system into a clear, straightforward idea of how the real world works. It is a representation of a notion, phenomenon, relationship, structure, system, or feature of the real world that is expressed visually, mathematically, physically, or verbally (Imam, 2019). The pattern of built-up areas has changed as a result of urbanisation's scope and expansion. Conditions related to socioeconomic status and the availability of natural resources may be adversely impacted by land use and cover patterns. (Nuisl & Siedentop, 2021). The most noticeable effect of modern development on the urban system is the irregular built-up pattern of urban growth brought on by the haphazard urbanisation process. Planning and managing urban growth effectively is essential to minimising the negative effects that result from the process of built-up expansion and its driving drivers (Liu, Cao, & Li, 2020). Urban sprawl is the term for the quick and unrestrained expansion of urban or metropolitan areas' boundaries in a way that is detrimental to their economic, social, and environmental well-being. (Amponsah, et al., 2022). The definition of spread, which is similar, is provided as a pattern of urban and regional development characterised by low density, automobile-dependent, exclusive new construction around the periphery of populous areas typically encircling a failing city." (Rubiera-Morollón & Garrido-Yserte, 2020).

PROBLEM STATEMENT

The most prevalent forms of urban sprawl are based on the highest plot ratio, density, floor space, and linear development. Less than three different land uses may be found in most parts of Kuala Lumpur. This shows that urban sprawl is an issue in Kuala Lumpur, though not to a serious degree. Yet, if the existing issue is not addressed properly, Kuala Lumpur's future development may result in more sprawl. This results in an unbalanced allocation of land for usage (Rosni, Noor, & Abdullah, 2016). Due to mining operations in the 1850s, Kuala Lumpur's urbanisation process began in the City Centre (Bank, 2015). According to the Draft Kuala Lumpur Structure Plan 2040, public transportation utilisation is still low because of the last-mile problem, which implies connectivity is still not seamless, making it difficult to travel from one location to another using public

transportation. Poor design and planning are also to blame for any broken connections. This interaction of regulatory, spatial, and behavioural factors can make it difficult for Kuala Lumpur to implement its recently enacted sustainable transport strategy, and it also runs against Malaysia's increasing emphasis on sustainable development (National Transport Policy 2019-2030, 2019).

The areas affected by urban sprawl in Georgetown are described as having lost their rural qualities but still fall outside the urban category. These regions are particularly ambiguous, which presents a number of problems like unchecked urban growth and other uses besides agriculture. Therefore, urban sprawl can be viewed as a border between rural and urban areas. The specific findings of this study indicate that rapid growth in cities, uneven expansion, reasonably priced housing, income and employment opportunities, insufficient facilities, unplanned or poorly executed urban expansion, and poor implementation of development strategies are the main causes of urban sprawl in developing countries. Due to restrictions brought on by growing urbanisation, the procedure for planning is confined to fundamental crisis management because it is unable to forecast the future. In short, government regulation is the primary cause of the emergence of urban sprawl. Errors in planning and policy orientation in development strategies may have a big impact on the issue of urban sprawl as we approach industrialization and sustainable development. (Asli, Rahman, & Salib, 2022).

RESEARCH QUESTIONS

- i. What are the factors of development intensity that affect the saturation of land in Georgetown and Kuala Lumpur City Centre from the year 2015 to 2023?
- ii. What is the comparison of the built-up pattern in Georgetown and Kuala Lumpur City Centre from 2015 to 2023?
- iii. How can the distribution of saturation development be defined by built-up analysis?

PURPOSE OF THE STUDY

This study aims to identify the saturation of built-up areas by evaluating the development control methods employed in Georgetown and Kuala Lumpur City Centre. The following describes the objectives of this study:

- i. To determine the factor of intensity development built-up pattern by assessing remote sensing, image processing, and tools of development control approach for Georgetown and Kuala Lumpur City Centre.
- ii. To comprehend the different built-up patterns that changed between 2015 and 2023.

- iii. To examine the distribution of saturation development defined in the built-up analysis.

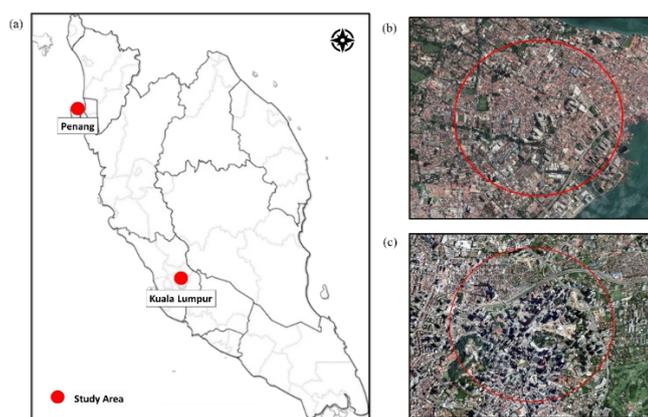


Figure 1. Kuala Lumpur and Georgetown Site Area

Two different cities were selected based on the rapid growth of urban areas (Figure 1): - which is Kuala Lumpur City Centre and Georgetown. Map (a) points out the location of cities in Peninsular Malaysia, while map (b) shows the location of Georgetown, and map (c) Kuala Lumpur City Centre. The red circle on maps (b) and (c) shows the radius of 1 km from the centre of the city and demonstrates how most of the land use area in Kuala Lumpur has commercial as the primary activity in contrast to Penang's area, which focuses on residential land uses while having sporadic commercial activities because the majority of the lands serve as protective buffers around UNESCO heritage building areas.

RESEARCH METHODS

Various observations were made in qualitative research while assessing the designated development control criteria in planning policies as well as the Landsat image using remote sensing techniques. The specified plot ratio and actual floor space are determined through field observation. Site data is utilised for intensity development to establish the overall floor area and built-up size. The total built-up area for each development was then calculated by adding the total land area for both city centres. The Landsat image was produced based on a satellite image by distinguishing between built-up and non-built-up areas using remote sensing technology. The built-up area is used to compute the urban expansion component. A comparison analysis was carried out to estimate the physical growth of both cities by superimposing GIS data and Landsat photos. Secondary data was provided by the local governments of Penang Island City

Council (MBPP) and Kuala Lumpur City Hall (DBKL). Relevant information was gathered to compile statistics on the maximum plinth area, plot ratio, and distribution of land use in 2023, all of which were implemented to control development in the city area by the local government. To calculate the floor area, plinth, the built-up for each building, and the height of the buildings above the surface of the land, observational methods were used within a 1 km radius. The analysis of the data, which was then entered in the GIS, will be used to map each variable over the area of both cities that is currently built-up.

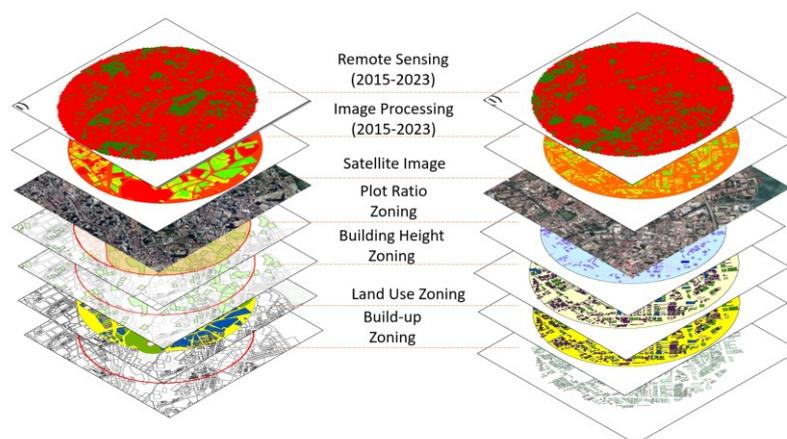


Figure 2. Overlay Built-Up Analysis Kuala Lumpur City Centre (left) and Georgetown (right)

Processing the Landsat image is the second technique applied in this investigation. Using the USGS Earth Explorer to obtain data from different Landsat sensor categories, this inquiry uses four main processes of Landsat image processing (Yin, et al., 2022). The Landsat image was first retrieved from the USGS Earth Explorer. The second step in the image's pre-processing includes subsetting the image, extracting the research region from satellite photographs, calibrating radiometric sensors, and restoring the atmospheric image. The next step is picking an area of interest and producing a ground truth image for classification and precision testing using 50 randomly selected photographs from Google Earth. The classification of the image was done using the maximum probability method. In the following step, picture differentiation is used to identify the expanded urban region. To acquire the most precise shape, it was also necessary to use the sharpest and most steady digital image. Clicking the Create Imagery Layer button in ArcGIS is the first step in producing image processing. Next, the type of layer to create is selected, the layer's attributes are set, the necessary data is input, and the layer is uploaded. The data is now ready for

analysis and visualisation after this is finished. Raster analytics and picture analysis are used at the site, regional, national, and international levels to profit from a user-friendly web experience that gives users the freedom to create unique raster functionalities. Image services are created using the imagery and analysis findings. It is simple to update and interface with the rest of ArcGIS thanks to these services. In this study, these procedures are applied to create an extended urban area for KL and Penang City Centre, which spans the years 2015 until 2023.

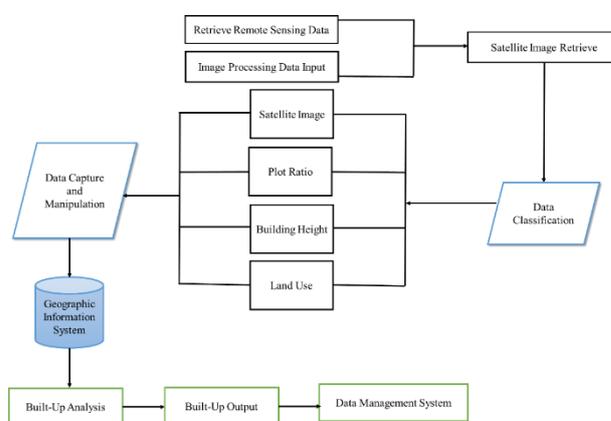


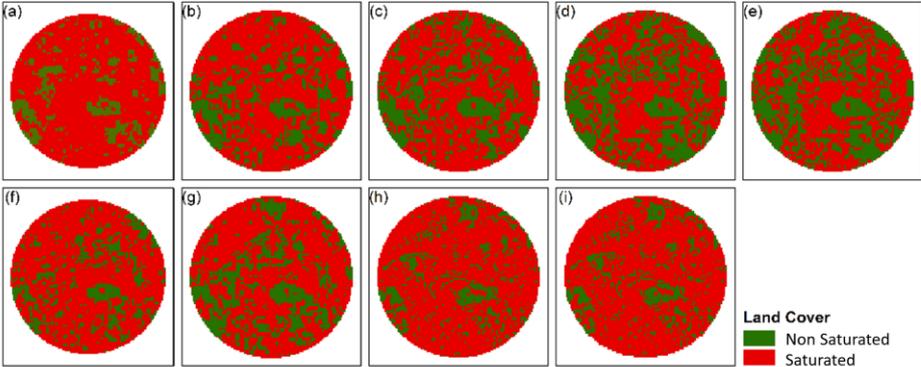
Figure 3. Built-up Saturation Model Development

Figure 3 shows the group of methods in general as well as the system development methodology used for this study. Satellite image retrieval is described in the initial development phase for the data classification, which is retrieving remote sensing data and image processing data input. To get the data ready for analysis, each of these levels must be appropriately identified because they overlap. The preparation of the data capture and manipulation, which consists of the following data satellite image, plot ratio, building height and land use is the next process stage to determine the built-up pattern. After combining spatial and non-spatial data, distribution management may be done with the use of GIS application, to produce built-up analysis on which output will be produced.

BUILT-UP PATTERN ANALYSIS

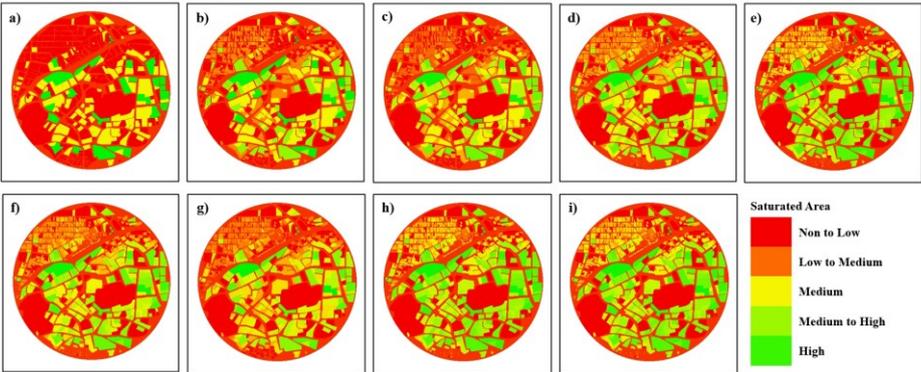
Residential and commercial land uses appear to be the most significant factors determining built-up and non-built-up patterns after analysing the data employing statistical techniques, conducting the regression model, and calculating the results. This study's emphasis is on residential and commercial regions.

Overlay Built-Up Analysis



(a) Year 2015; (b) Year 2016; (c) Year 2017; (d) Year 2018; (e) Year 2019; (f) Year 2020; (g) Year 2021; (h) Year 2022; (i) Year 2023.

Figure 4. Built-Up Pattern of Kuala Lumpur City Centre from Year 2015 until 2023 by Remote Sensing



(a) Year 2015; (b) Year 2016; (c) Year 2017; (d) Year 2018; (e) Year 2019; (f) Year 2020; (g) Year 2021; (h) Year 2022; (i) Year 2023

Figure 5. Built-Up Pattern of Kuala Lumpur City Centre from Year 2015 until 2023 by Image Processing

Table 1: Comparison built-up pattern between remote sensing and image processing of KL City Centre (1 km) from 2015-2023

Analysis	2015 (%)		2016 (%)		2017 (%)		2018 (%)		2019 (%)		2020 (%)		2021 (%)		2022 (%)		2023 (%)	
	Saturated	Non Saturated																
Remote Sensing	81.03	18.97	72.25	27.75	67.22	32.78	56.52	43.48	56.52	43.48	76.14	23.86	67.92	32.08	80.50	19.50	80.50	19.50
Image Processing	63.20	36.80	76.22	23.78	65.78	34.22	78.69	21.31	80.45	19.55	77.41	22.59	74.55	25.45	80.59	19.41	81.65	18.35
Different	17.83	-17.83	-3.97	3.97	1.44	-1.44	-22.17	22.17	-23.93	23.93	-1.27	1.27	-6.63	6.63	-0.09	0.09	-1.15	1.15
Changes			21.8	-21.8	-5.41	5.41	-20.73	20.73	1.76	-1.76	-22.68	22.68	5.36	-5.36	-6.54	6.54	-1.06	1.06

Figure 4 illustrates the use of Landsat image data for remote sensing both saturated and non-saturated areas, while Figure 5 shows the image processing of available built-up patterns using the Geographic Information System (GIS) for the past seven years, which is from 2015 until 2023 in Kuala Lumpur City Centre. Their built-up pattern improved throughout the year, especially in the commercial and residential land uses of their location near the Kuala Lumpur Twin Towers and Kampung Baru. This is due to conversion being updated by the local authorities. Between 2015 and 2016, there were significant changes in saturated areas (21.8%) and non-saturated areas (-21.8%) especially in commercial (31.48%) and residential (20.69%) land uses. This is because in the Jalan Tun Razak area are several condominiums, such as Expressionz Professional Suites, Three28 (643-1,625 sq ft), and KL Trillion, which is a commercial building (1,076-22,562 sq ft). The year of completion of these condominiums was 2018 while KL Trillion was completed in 2015. The changes of the year 2016-2017 in saturated areas were -5.41%, whereas non-saturated areas were 5.41%, especially in open space (0.18%) land uses. Between 2017 and 2018, the changes in saturated area were -20.73% and non-saturated area were 20.73%, which affected more open spaces (0.23%) land uses that led more towards the development of pocket parks. Between 2019 and 2020, the pandemic of COVID-19 happened, and many owners decided to close their businesses, and the buildings became abandoned, especially around commercial (43.01%) land uses in the city centre. Therefore, the buildup pattern fluctuated in the saturated area at -22.68% and non-saturated area at 22.68%, and it rose again from the year 2021-2022 onwards in the saturated area at -6.54% and the non-saturated area at 6.54% since there was new development construction, especially in the residential (33.65%) land uses, which are Sunway Belfield Residence (788-1,337 sq ft), which is 4.4 km, and The Atrium (556-1,227 sq ft), which is 5 km from KLCC. Between 2020 and 2021, the changes in saturated area were 5.36%, and non-saturated area were -5.36% in commercial (35.36%) land uses. In 2022-2023, the changes in saturated area were -1.06%, and non-saturated area were 1.06% in

open space (0.19%) land uses, which shows the least development changes throughout the seven years.

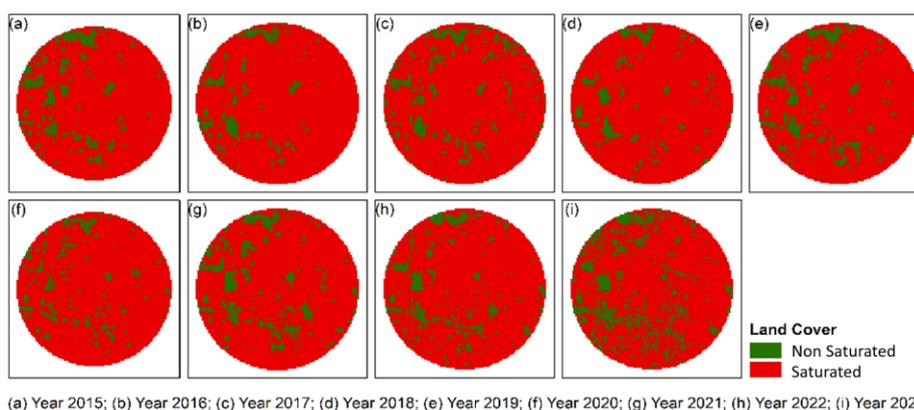


Figure 6. Built-Up Pattern of Georgetown from Year 2015 until 2023 by Remote Sensing

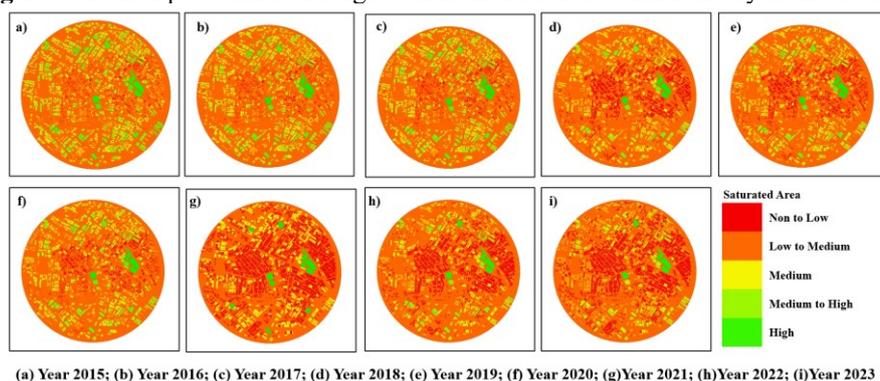


Figure 7. Built-Up Pattern of Georgetown from Year 2015 until 2023 by Image Processing

Table 2: Comparison built-up pattern between remote sensing and image processing of Georgetown (1 km) from 2015-2023

Analysis	2015 (%)		2016 (%)		2017 (%)		2018 (%)		2019 (%)		2020 (%)		2021 (%)		2022 (%)		2023 (%)	
	Saturated	Non Saturated																
Remote Sensing	81.03	18.97	72.25	27.75	67.22	32.78	56.52	43.48	56.52	43.48	76.14	23.86	67.92	32.08	80.50	19.50	80.50	19.50
Image Processing	75.89	24.11	63.54	36.46	63.54	36.46	73.65	26.35	72.11	27.89	71.03	28.97	65.36	34.64	68.44	31.56	68.56	31.44
Different	5.14	-5.14	8.71	-8.71	3.68	-3.68	17.13	-17.13	15.49	-15.49	5.37	-5.37	14.56	-14.56	12.06	-12.06	11.94	-11.94
Changes			-3.57	3.57	5.03	-5.03	20.81	-20.81	-1.64	1.64	-20.86	20.86	-9.19	9.19	2.50	-2.50	0.12	-0.12

Figure 6 illustrates the use of Landsat image data for remote sensing both non-saturated and saturated areas while Figure 7 shows the image processing of available built-up patterns using the Geographic Information System (GIS) for the past seven years which is from 2015 until 2023 in Penang City Centre. Their built-up pattern did not improve much compared to KL City Centre, especially in the Kompleks Tun Abdul Razak (KOMTAR) area since the city centre is protected by UNESCO. This is because the height of each building is restricted. In 2015-2016, the changes in saturated areas were -3.57%, and the non-saturated areas were 3.57%, which affected open space (0.26%) land uses. In 2016-2017, the changes in saturated area were 5.03%, and non-saturated area were -5.03%, which affected residential (13.78%) land uses. In 2017-2018, there were significant changes in saturated area, which was 20.81%, and non-saturated area was -20.81%. This is because new developments have occurred in commercial (36.36%) and residential (19.54%) land uses around Jalan Ceah Choo Yoo, Showtow Land, Jalan Sultan Ahmad Shah, Lintang Macallum and Gurney Drive, which forced development into the city centre. The total build-up area of these developments is 15,721 sq ft, and the year of completion is around 2020-2026. In 2018-2019, the changes in saturated area were -1.67% and non-saturated area were 1.67%, which affected open space (0.23%) land uses. In 2019-2020, there were also significant changes in saturated areas, which are -20.86% and non-saturated areas, which are 20.86%, especially in commercial (34.42%) and open space (0.25%) land uses. This is because several historical buildings have been demolished because they cannot be maintained and a new Light Rail Transit Project will be completed in 2030. One of the locations that has been demolished has been turned into an archaeological park that will be one of the LRT stations, which is Sia Boey Urban Archaeological Park which was completed in 2019. In 2020-2021, the changes in saturated area were -9.19% and non-saturated area were 9.19%, which affected open space (0.26%) land uses. In 2021-2022, the changes in saturated area were 2.50%, and non saturated area were -2.50%, which affected commercial (33.23%) land uses. In 2022-2023, the changes in saturated area were 0.12% and non-saturated area were -0.12% which affected residential (12.88%) land uses.

Built-up & Saturation Findings

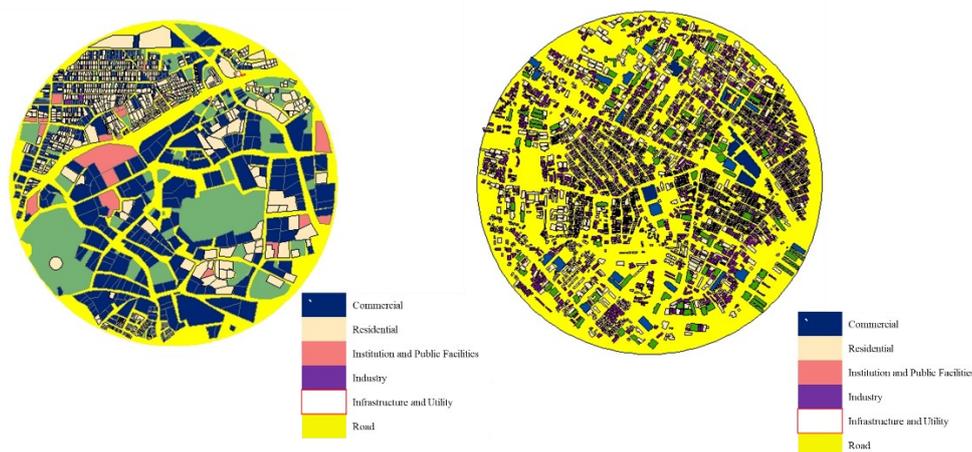


Figure 8. Result from land use observation for Kuala Lumpur City Centre (left) and Georgetown (right) in 2023

Table 3 Comparison tools of development control between KL and Georgetown (1 km) by 2023

Urban Centre	1km Radius of Land Use			Average Plinth Area	Average Building Floor	Total Built-Up Area (Sqm)	Average Plot Ratio	Gross Floor Area	Non-Built-Up Area (Sqm)
	Area (Acre)	Lowest Build-Up	Highest Built-Up						
KL City Centre	247.1	Industry (0.25%)	Commercial (38.5%)	40%	18	151,564	1:8	17,778,760	854,522
Penang City Centre	247.0	Industry (0.068%)	Residential (12.88%)	60%	14	235,510	1:5	11,755,060	766,185
<i>Comparison</i>		0.189%	25.62%	20%	4	83,946	0:2	6,023,700	88,337

Table 3 shows the comparison tools of development control within a 1km radius for the two cities and demonstrates that due to the fact that the majority of the areas are buffer zones for UNESCO heritage building areas, in contrast to Penang's area, Kuala Lumpur's area regulates built-up areas, with commercial being the primary development activity, whose emphasis is on residential land uses while having sporadic commercial activities. In Georgetown, residential zoning is the major land use, which is found at Kampung Makam and Sungai Pinang, while in Kuala Lumpur City Centre, commercial is the highest built-up area, which is located around the Kuala Lumpur Twin Tower

area. The lowest land use built-up area in both cities is industrial, which is near Chulia Street (Penang City Centre) and Kampung Baru (Kuala Lumpur City Centre). Therefore, the comparison of the lowest built-up area is 0.189%, and the highest built-up area is 32.32%. Both regions demonstrate how the plinth area influences the built-up area's size, per the GIS study. By utilising 60% of the average allowable plinth size, Penang has 22.6% of the actual building space, compared to Kuala Lumpur, where the average plinth area is 40% and only 17.5% of the built-up space can be used for structures or buildings. In both cities, the non-built-up area contains a sizable portion of open space and transportation, which are classified as non-structure buildings, at 82.5% and 77.5% for the KL and Penang City Centres, respectively. Development limitations implemented have led to a concentration of buildings in Penang City Centre and growth from the southern to the northern part of the peninsula, especially in coastal regions with historic buildings, which have limited development. Due to the higher densities that the local authorities have permitted in this area, urban areas have now reached Kuala Lumpur City Centre's eastern region.

CONCLUSION

The advantage of this study is that it focused on using spatial data to develop visualisation results through creating multiple types of maps and analysing the outcomes. The built-up area between the two city centres shows different patterns over the past seven years. Kuala Lumpur City Centre shows rapid changes over the years, while Penang City Centre only shows slight but significant changes over the years, especially in commercial, residential, and open space land uses. There were new developments that occurred in saturated areas, mainly commercial and residential land uses, while abolishment buildings happened to build up pocket parks in non-saturated areas, which are open space land uses.

ACKNOWLEDGEMENTS

Thank you to Ministry of Higher Education as the sponsor for this research through Fundamental Research Grant Scheme (FRGS) (FRGS/1/2020/SSI02/USM/03/2). Thank you to authors, contributing department such as Malaysian Space Agency (MYSA), Kampong Bharu Development Corporation, Building Control Department DBKL, City Planning Department DBKL, Department of Valuation and Property Management DBKL, Penang Island City Council, PNB Development Sdn Bhd, SAM Planners Sdn Bhd, CK Development Sdn Bhd, School of Housing Building and Planning, Universiti Sains Malaysia and all other contributed developers.

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Received: 26th June 2023. Accepted: 11th August 2023



PLANNING MALAYSIA:
Journal of the Malaysian Institute of Planners
VOLUME 21 ISSUE 4 (2023), Page 538 – 551

ISSUES, CHALLENGES AND STRATEGIES IN PROMOTING HIGH POTENTIAL TOURISM SPOTS AND PRODUCTS IN PERAK TENGAH

**Muhammad Rijal Bin Mohamad¹, Norainah Abdul Rahman², Kamariah
Abdullah³, Arina Rahmat⁴, Aizazi Lutfi Ahmad⁵, Mohd Ismail Isa⁶, Fatin
Nabilah Omar⁷**

*^{1,2,3,4,5,7}Program of Town and Regional Planning,
Department of Built Environment and Technology,
UNIVERSITI TEKNOLOGI MARA, PERAK BRANCH,
SERI ISKANDAR CAMPUS*

*⁶Department of Urban and Regional Planning,
School of Housing, Building and Planning,
UNIVERSITI SAINS MALAYSIA, PULAU PINANG*

Abstract

The promotion of tourism sector is vital to ensure all existing and new potential areas can be explored successfully. This paper highlights the issues, and challenges in promoting the tourism sector in Perak Tengah. The promotional activities should be organized by all stakeholders which are inclusive of all relevant agencies and local operators. This study applied a qualitative approach through interviews conducted with all relevant agencies to examine the real issues of tourism sector and the development of future enhancements efforts in encouraging and stimulating the tourism sector in Perak Tengah.

Keywords: Tourism Products, Perak Tengah, Malaysia

¹ Lecturer at Universiti Teknologi Mara Perak Branch Email: rijalmohamad@uitm.edu.my

INTRODUCTION

Tourism is one of the strategic sectors which is able to significantly contribute to a nation's economic growth. It also provides 10.4% of Gross Domestic Product (GDP) and 9.9% of employment in the world (Idris et al., 2021). In Malaysia, tourism is one of the biggest contributions to the country's economic growth (Idris et al., 2021). It helps in creating job opportunities for the locals and introducing the local attraction spots to the tourists (Eugenio-Martin et al., 2008; Kim et al., 2016). However, the promotion of tourism in certain areas would be a challenging task for the local authority due to the absence of facilities, readiness of the operators and accessibility to the area (Királ'ová & Pavlíčeka, 2015; Yoo et al., 2017). This paper emphasizes the promotion issues and challenges faced by the authorities in Perak Tengah. Perak Tengah has many potentials for tourism and some of which are still undiscovered and unable to be introduced. In this study, the issue and problems at the tourist spots are also highlighted and commented to improve the visibility and ability of the areas to be promoted. At the same time, the government promotional tools and strategies are also investigated to ensure that the local authorities have a clear direction and appropriate promotional tools to expose Perak Tengah at the greater scale. The vast development of technology must be utilized in supporting this intention.

RESEARCH BACKGROUND

Tourism is the biggest contributor to the Malaysian economy. Ministry of Tourism, Arts and Culture Malaysia (MOTAC) is the responsible authority in managing and implementing all the policies related to tourism development in Malaysia. Local authority is responsible to prepare the proposal for tourism promotions within their administration area. Tourism Malaysia through their branches in every state in Malaysia is one of the agencies that play an important role to introduce the tourist attractions locally and internationally. Hence, a top-down approach has been implemented in tourism sector development in Malaysia. There are many factors in enhancing the tourism area including the accessibility, facilities and amenities provided to support the tourism industry at the area (Borràs et al., 2014; Huang et al., 2017; Királ'ová & Pavlíčeka, 2015). The operators and the tourism site themselves must be well prepared to accept the influx of tourists and offer consistent and interesting activities. The promotional activities also need to be executed aggressively through multiple mediums. The utilization of new information technology should be emphasized and fully adopted for this purpose (Sigala, 2018). The information must be readily available and can be accessed easily and quickly for the tourists (Huang et al., 2017). Rahimi et al., (2020) argued that the tourism promotional activities should not depend on the information technology alone but the conventional tools such as brochures are still relevant and should still be enforced. Nevertheless, internet

accessibility would be the biggest challenge for the implementation of information technology for tourism promotional purposes. Therefore, both conventional and new technologies can be utilized successfully in tourism promotional activities.

METHODOLOGY

In this research, the qualitative method was adopted as the focal methodological approach. This approach involves in-depth interviews which are conducted with a few experts to obtain their opinion. Audio and video recordings were used as supporting instruments to record each interview session. Both instruments are essential to ensure that all the conversations were collected properly and reduce the loss of vital information during the session. Perak Tengah was selected as the case study and a few key stakeholders were identified for the interview. The interviews were focused on the issues, challenges, and potential of tourism in Perak Tengah which is one of the districts in Perak with a huge number of attractions., Unfortunately the number of visitors is still low. Hence, the focus of this paper is on further investigation into the tourism sector in this area. The other topics like the lists of attractions, tourism operators in Perak Tengah and existing activities were excluded from the discussion in this paper.

FINDING AND DISCUSSION

Perak Tengah district has been selected as a case study for an investigation on challenges faced by tourism in the area. As one of the districts in Perak located at the heart of the State, Perak Tengah is an established area and is also known as the education city where major universities namely Universiti Teknologi MARA, Perak Branch, Seri Iskandar Campus, and Universiti Teknologi Petronas (UTP) are located. With all the existing allure, it is disappointing that this vicinity is one of the districts with low numbers of tourism activity in Perak. In fact, Perak is one of the most visited states in Malaysia which had accounted 21.1 million visitors in the 2019 (Department of Statistic, 2020). There are a lot of existing and newly found tourism attraction areas which need aggressive promotion. Even in their local plan, tourism promotion is the focus of the local authority (Perak Tengah District Municipal). Bandar Seri Iskandar in Planning Block of Bota is the central point for Perak Tengah and main economy activities and administration are placed in Bandar Seri Iskandar. Nevertheless, the promotional activities are still slow and need a lot more efforts. There are eleven (11) Planning Blocks in Perak Tengah namely (1) Belanja, (2) Layang, (3) Bota, (4) Lambor Kanan, (5) Lambor Kiri, (6) Pulau Tiga, (7) Kampung Gajah, (8) Pasir Panjang Hulu, (9) Pasir Salak, (10) Bandar and (11) Kota Setia as shown in Figure 1.1 below.



Figure 1: Planning Block Distribution in Perak Tengah

The interview data were transcribed thematically based on the promotion and marketing and Challenges of Promoting Tourism Products literature. The interview sessions involved seven (7) experts and key players of the tourism industry in Perak. These individuals were interviewed to obtain their opinion regarding the promotion of Tourism in Perak Tengah. Details from the interviewees are tabulated in the Table 1.1 below:

Table 1: Respondent’s Backgrounds and Positions

RS	Agencies	Positions
1	MDPT	Director of Tourism Unit Perak Tengah District Council
2	KPLB	Penghulu Tertinggi Daerah Perak Tengah
3	Muzium Pasir Salak	Muzium Pasir Salak Curator
4	MOTAC Perak	MOTAC Director
5	Tourism@Perak	Tourism Marketing Officer

Table 2: Synthesis of interviews questions regarding promotion issues and challenges in Perak Tengah

Promotion and Marketing		
No	RS	Answers
A1: Roles of Organization	1	Our organization is responsible to promote and manage the tourism products in Perak Tengah.
	2	Our organization is not responsible specially in tourism; however, it supports the local operators or entrepreneur especially in the rural areas for economic development and facilities as well as infrastructures.
	3	We are an organization which assists state government such as Tourism Perak, to carry various functions of tourism in Perak Tengah as we do have facilities. However, we are indirectly promoting the tourism in terms of educating and giving knowledges to the public on local cultures and traditions in Museum.
	4	Our organization plays an important role in tourism since we have implemented the policy and strategy from the federal government. At state level, we have three main sectors which are administration, license, and enforcement, and Industrial and infrastructures.
	5	Our organization is under Perak State Government, and we collaborate with several agencies (MOTAC and Local Authorities), and we play big roles in promoting tourism in Perak.
A2: Organization Plan for tourism	1	We also help in managing the local operators to get financial support, training and encounter some problems in terms of land ownership and any technical department related to tourism products in Perak Tengah.
	2	Our organization is helping the remote areas in terms of accessibility, infrastructures and helping the locals for economic developments.
	3	We are welcoming the public, government, private sectors, or researchers to come to visit the museum. Some of the events are usually meant for education such as schools' visits, researchers, and projects which are initiated by the government or private sectors. <i>Lembaga Muzium Negeri Perak</i> is responsible in conducting and promoting the whole Museum in Perak.
	4	The license and enforcement sectors are responsible for managing licenses for accommodations such as hotel and homestays, tour guide, travel agents and tourism bus. Meanwhile, Industrial and infrastructures is specially for Malaysia Tourism Quality Assurance (MyTQA) as an

Promotion and Marketing		
		initiative of the Ministry of Tourism, Arts and Culture (MOTAC) to raise the level of facilities services and quality for Malaysian tourism products. It honours tourism goods and encourages industry participants to place a premium on the calibre of their offerings.
	5	We are managing the tourism promotion for Perak State under the state government.
A3: Promotion Campaign	1	We are ready to establish our tourism logo for Perak Tengah. This logo is a good campaign for tourism Perak to introduce us a tourism destination in Perak. We will insist on our local operators to use our logo for their businesses.
	2	Our organization does not contribute to the tourism promotions. However, we are sometimes being invited by tourism agencies to participate in the events and meet ups when those agencies need any information. However, we have never specifically been called up or set up as a tourism organization.
	3	We had organized some events such as <i>Temasya Budaya</i> . The events always attract the public to come and visit Perak Tengah especially to Kompleks Pasir Salak.
	4	We are an organization which facilitates the policy and strategy from the federal government, but we are not responsible for promotions. However, we usually provide support financially such as in terms of facilities, licenses, training and more which indirectly contribute to tourism promotions. We have several Grants to implement tourism activities such as The Tourism Sector Matching Grant (GSSP) that aims to focus on the organization of tourism programs/events by the private sector, players, and activists' industry.
	5	We also join some agencies especially exhibitions to promote our tourism products in Perak such as at MAHA, <i>Hari Bertemu Pelanggan Kerajaan Negeri Perak Siri 5 Tahun 2022</i> and any activities that are related to tourism in Perak.
A4: Promotion tools	1	As for now, we are using the social media to introduce our tourism products using our official social media and website of Perak Tengah District Councils. In future, we want to establish a page separately from our domain websites and to specifically focus on tourism promotions and activities in Perak Tengah. Others, we also collaborate with tourism agencies in Perak such as Tourism@Perak, to help promote our tourism products and they have started to promote some of them such

Promotion and Marketing		
		<p>as Kopi Mesin, Pulau Misa and more. Then, we also support Perak Pass application which is organized by Tourism@Perak.</p> <p>Besides that, Perak Tengah has become the highlight for Fam Trip, a familiarization trip to promote Perak, besides two other districts such as Kampar and Lenggong. To be in this line, it is also a good move for us to be more active in promoting our tourism products.</p>
	3	<p>We are depending on <i>Lembaga Muzium Negeri Perak</i> and Tourism@Perak for promotion such as in Facebook or any social media platforms. Kompleks Pasir Salak is well-known as this is the first icon for tourism in Perak Tengah. However, we also contribute to certain events and activities for the public which are supported by the state government.</p>
	5	<p>In terms of tools, we are using brochures, news, and social media platforms such as FB, Instagram and Tik Tok.</p> <p>Recently, we are using Perak Pass applications as a promotion tool which captures all tourism products in Perak including in Perak Tengah of which some merchants will offer several vouchers to the public.</p> <p>Meanwhile Perak Pass Plus, advocates digitalization of the travel industry in Perak. It provides a platform for sellers to promote their products and offers multichannel payment.</p>
A5: Policy & Strategy	1	<p>In terms of policy and strategy, we are working on some strategies which have been established. It is true, that Perak Tengah District may lack written strategy for tourism in terms of policy and strategy. However, we need to collaborate with other stakeholders to ensure that we are not left behind from other districts.</p>
	3	<p>We relied on <i>Lembaga Muzium Negeri Perak</i>, to determine themes for museums in Perak. Kompleks Pasir Salak theme, for instance is warriors in Perak and <i>Tanah Melayu</i>. We are also responsible in preserving the local culture and heritage such as identifying and clarifying royal tombs in Perak Tengah, as well as clarifying facts of any discovery within Perak.</p> <p>In addition, in terms of budget and financial support, this institution only can make suggestions on budgets and reports for maintenance for further actions at local and state level.</p>
	5	<p>Previously, we helped the merchandiser such as Kellie's Castle, Muzium Pasir Salak, accommodation and services to give out vouchers. This encourages the tourist to come and visit and help the operators to run their business. Now, we are</p>

Promotion and Marketing		
		moving to Perak Pass Plus applications, where the operators give vouchers to the buyers.

Challenges in Promoting Tourism Products in Perak Tengah		
No	RS	Answers
B1: Potential Products	1	Pulau Misa, is one of the tourism products which are unique in Perak Tengah. Pulau Misa themes is Malay culture. Nowadays, there's a lot of activities had been offered to the tourist who comes to visits.
	2	Parit town in Mukim Belanja, is one of tourism location in Perak Tengah and Pulau Misa.
	3	Kompleks Pasir Salak is one of iconic of Perak Tengah that well known in Perak. Indeed, it is an existing product that should be developed and preserved.
	4	There are many existing and potential products in Perak Tengah especially in terms of heritages and cultures. For example, royal tombs in Perak Tengah should become one of iconic tourism products if there are any efforts such as tourism trails.
	5	Pasir Salak.

No	RS	Answers
B2: Preservations	1	We as an agency is responsible to ensure this product stay unique and preserved. We have Key Performing Index (KPI) or level of measurement to ensure that these products are ready, and their quality is maintained. Hence, we keep visiting the local operators and making sure that they are keeping their quality. Besides, we also engage with the community and ask them to collaborate with us especially for cultural activities. For example, we highlight Malay cuisines in Perak Tengah such as Bubur anak Lebah: in terms of culture, we promote Rebana performances and more. Other efforts involve the promotion of our SME's products.
	3	We need new management and regular maintenance for Kompleks Pasir Salak as well as for accommodations operators and the amphitheatre in Pasir Salak.

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No	RS	Answers
B3: Infrastructure	1	There are some of tourism destinations that are built on private properties, and some do not have proper entrances or facilities. However, we are assisted by several tourism agencies, especially by MOTAC for financial support. With this, it is hoped that the tourism products could attract the tourist to come and visit Perak Tengah.
	2	Infrastructure and facilities are very important for tourists convenience. However, we need to make sure Perak Tengah is ready for infrastructure and facilities.
	3	Some buildings in Komplek Pasir Salak are not in good condition and others may not be safe for the public to come and visit.
	4	We have spent a lot on facilities and infrastructures; however, some projects do not show significant improvements.

No	RS	Answers
B4: Achievement	1	Many among the public recognize and know about our tourism products in Perak Tengah. There are many tourists who have come to visit especially to Pulau Misa.
	3	As for now, the pandemic has caused a serious drop in the number of visitors who come to the museum. Previously, we have had collaborations with Tourism@Malaysia and homestays with the help of voucher to encourage tourists to come and visits.
	5	We could see many activities are carried out to encourage people to come to Perak Tengah. Recently, Hari <i>Aspirasi Keluarga Malaysia</i> and several sports are held here to boost tourist arrivals to Perak Tengah.

No	RS	Answers
B5: Method to promote lesser-known products.	1	At first, we had to approach the local operators who had the potential products. Then, we try to convince the local operators to give a good package for activities, planning of tourism, and giving them financial support planning. These will make them feel assured to follow our planning and become a successful tourism product.
	2	Promotion is very important. Nowadays flyers and posters are not the only promotion. People are promoting through mass media, social media such as application Facebook, Instagram and Tik Tok. Hence, tourism packages should be introduced for tourism in Perak Tengah.

	4	The promotion in Perak Tengah is unsatisfactory. Promotion plays a vital part in terms of promoting lesser-known areas. For example, we have several places in rural areas in Perak, these places emerging even though the places are far from the main cities such as Kampung Beng, Lenggong.
	5	There are many methods to promote the tourism products, which usually involve these lesser-known products which are unique to certain places. We can cluster the products in terms of culture, heritages, and handicrafts. Then, we will promote them, and include them in our itinerary/trail/ our websites and tools for tourism in Perak.

No	RS	Answers
B6: Challenges	1	<p>Firstly, shortage of staff in the organization. In Perak Tengah District Councils, our Tourism Unit is established since 2021 (1 year). Since then, there is no additional staff for our unit. Secondly, the issue is in financial support. We have to seek financial support from tourism agencies especially from the federal government. However, there are many competitions between districts to get those financial support. Because of that, we need the potential products that are interesting and compatible to compete with other products.</p> <p>Besides, there are issues of training of local operators, in terms of management, financial planning, certificate and legalization of their products. These matters if we want to have successful tourism destination. We have to plan for local operators to be introduced and this involve those training for year 2023. We are also very thankful to Tourism@Perak which has helped to organize a main domestic training to our boat operators in Sungai Perak: they are trained for management and safety management while handling boat trip business.</p> <p>Lastly, another issue we face is in collaborations between local operators. These operators need to help us to promote Perak Tengah as one of tourism destinations, rather than promoting their own products. That's why we design a logo for tourism in Perak Tengah to promote tourism in this area.</p>
	2	<p>Firstly, if there are any additional roles in the future specially for tourism in our organization, the challenges are of the lack of staff to carry out their duties. There will be few questions such as who will drive this group? And what are the roles for tourism that we need to tackle?</p>

		As for now, our organization only helps the remote areas in terms of accessibility, infrastructures and helping the locals for economic developments.
	3	Firstly, lack of staff in the organization. We do not have enough staff to manage the museum itself especially for the position of Curators or a person who could guide for exhibition in museum. If we put another additional role for promotion team, then it will challenge us more. Secondly, financial support. We had to find out the financial support from tourism agencies and we are specifically receiving support from <i>Lembaga Muzium Negeri Perak</i> : however, it is usually insufficient to fully support the systems in Pasir Salak Museum as the budget will be usually provided and distributed for other museums in Perak as well.
	4	Collaborations between stakeholders. There are several agencies and units we need to approach to make sure our collaborations are successful. However, the different backgrounds and working nature requires time and planning to make decision. However, it is important for us making sure that these stakeholders are not working in silo.
	5	We are managing the tourism promotion for the whole Perak state, so we need collaboration from every district. We also have a team for marketing and promotion to focus on our goal. Currently, we are working on a project known as Fun Map. This project requires support from tourism organization by local authorities, to create a map that shows point of interest in every district to promote their tourism products. From there, we will attract several travel agencies to make packages for every district. I think collaborations and support is really need and there are challenges to find good terms. In addition, compatible tourism products in terms of convenience, facilities such as parking, surau and toilets need to be provided by the operators before we decide to promote their products.

No	RS	Answers
C4: Challenges to leap into VR	1	Tourism arrivals and tickets selling.
	3	Understanding the functions of the institutions. There are many gaps, and unsatisfactory level of understandings between agencies especially for roles and functions in Perak Tengah. For example, the history of Perak Tengah or Pasir Salak is not in our field as we only restore based on themes for Warrior in Tanah Melayu such as Dato' Maharajalela.

RECOMMENDATION AND CONCLUSION

Table 1.2 shows a few similarities between the agencies. These are associated with (1) promotion tool which is used in promoting tourism products and activities in Perak Tengah. All interviewees had mentioned that the conventional way of promotion was utilized including the preparation of brochures and news. The agencies were also utilising their websites and Facebook as promotional medium. All those methods were not able to capture the public's attention especially among the youngsters. Idris et al., (2021) suggested that the most effective promotional tools for tourism sector are using the most famous and favourable social media influencers and utilisation of information technology systems. The use of new information technology plays a vital role to facilitate the tourism development and all their stakeholders in gaining actual information about tourism destinations including the facilities, accessibility and amenities available (Borràs et al., 2014; Idris et al., 2021; Yoo et al., 2017). Other similarities that were mentioned by all the interviewees were the readiness of the infrastructures as well as the local tourism operators. All the infrastructures were not delivered sufficiently. The issues of ownership had become one of the constraints in providing and maintaining the infrastructure. In addition, the agencies will not be able to provide the infrastructure in the private tourism area without the permission of the operators. Sadly, there are some private tourism areas which were provided with the infrastructure, but the operator failed to maintain it and it fully relied on the government agencies and budget. In different cases, the agencies have furnished the tourism areas with the infrastructure and facilities but unfortunately, the number of tourists who visited the area was still low. Hence, the infrastructure and facilities in the tourism areas should be equipped after the effective promotional works have been done. This means that, the infrastructure and facilities should come after the demand by the tourist to ensure the investment made by the agencies is worthwhile. Providing adequate infrastructure and facilities crucial at the tourism area is essential since they support the tourists' needs (Idris et al., 2021).

As mentioned above, the readiness of the operators is one of the main challenges in tourism promotion activities as it is crucial to ensure that there are a steady stream of activities and products which are produced and maintained by the locals. In Perak Tengah, the tourism operators are fully dependent on the budget from the agencies and the government. After the budget is approved and allocated to them the operators are not serious about the activities and products. Continuous monitoring activities need to be done by the agencies to ensure the operators are maintaining their business. Regrettably, all agencies involved in this sector are facing a shortage of staff for monitoring purposes. For example, Perak Tengah District Council has only one staff for Tourism Department and while the same officer also belongs to the Planning Department.

Based on the discussion above, there are few recommendations that can be proposed. Firstly, the utilisation of new technology system such as virtual reality for tourism purposes (Idris et al., 2021). The virtual reality will function as a fundamental instrument which will be able to provide essential information about the tourism area such as the search for basic information about the tourism site including photos and videos to experience it, hotel and homestay reservation as well as various other needs (Huang et al., 2017). Secondly, the provision of facilities should be focused on after an effective promotional campaign. The information about the basic facilities can be included into the virtual reality (Huang et al., 2017). Lastly, effective classes and benchmarking visit can be organised by the local agencies and authority to spark the interest of local tourism operators and make sure the operators are ready for any consequences from the tourism activities. This benchmarking visits can also give an effective motivation to them.

ACKNOWLEDGEMENTS

We would like to express our gratitude to the Ministry of Higher Education Malaysia for the funding of this research through Fundamental Research Grant Scheme (FRGS) numbered FRGS/1/2021/WAB09/UITM/02/4.

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Received: 26th June 2023. Accepted: 11th August 2023

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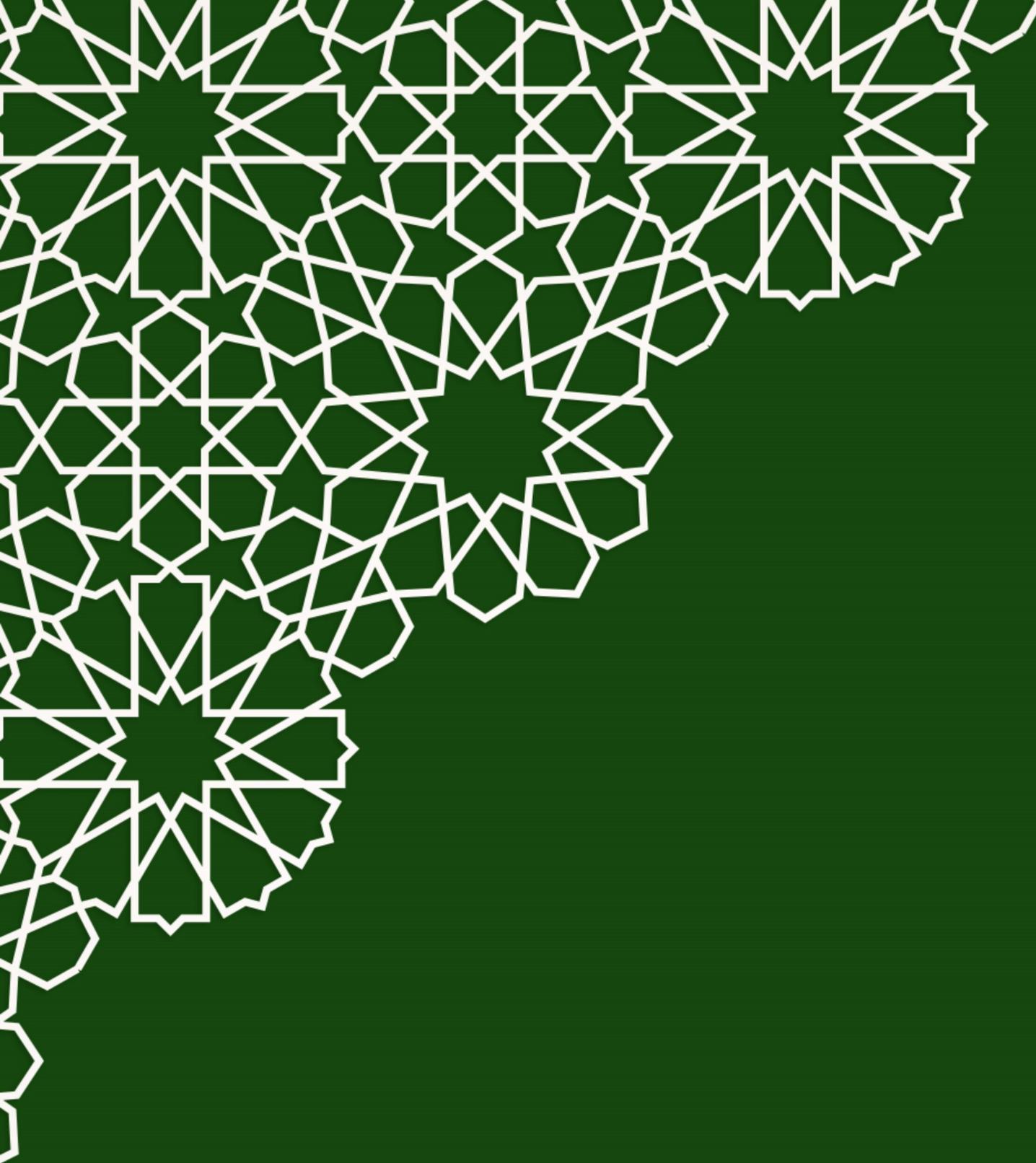
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