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Assessing Job Accessibility and Sustainable Mobility among Low-income Groups in Penang, Malaysia

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Abstract

Sustainable mobility emerges as a more viable approach for addressing urban mobility challenges and enhancing overall quality of life. The primary cause of urban mobility issues may be attributed to the urban built environment, wherein various physical features such as buildings, public infrastructure, and transit systems have significantly contributed to the reliance on private vehicles. Hence, this study examines job accessibility and the background of mobility among the low-income groups who are the urban workers in Penang Island, Malaysia to determine the factor of this target group's dominant transport mode choice. Using the quantitative method, this study was conducted using a questionnaire with 306 respondents selected by stratified random sampling based upon a ratio to represent the low-income households in the northeast and southwest districts of Penang. The study revealed that individuals from low-income backgrounds exhibit a significant reliance on privately owned vehicles. Furthermore, individuals in question exhibit a preference for owning and utilising economically viable, temporally expedient modes of transportation that optimise spatial efficiency, such as motorbikes, for their daily commute to their place of employment. Policymakers may take into account the factors of affordability and punctuality when formulating a transport system that is characterised by both cost-effectiveness and efficiency, thereby addressing the mobility requirements of low-income groups.

Keywords

job accessibility, private vehicle ownership, sustainable mobility

1 Introduction

The transformation of cities into more accessible environments and the adoption of sustainable modes of transport are crucial for addressing the issues associated with urban mobility and ensuring future sustainable mobility (Ministry of Transport Malaysia, 2020). In the context of addressing the urban mobility challenges for achieving sustainable mobility in the future, it is imperative to prioritise the enhancement of job accessibility (Seth, 2023). The ability to access job opportunities is contingent upon the selection of a suitable mode of transportation, which will facilitate the daily commute of workers from their residence to their place of work. The establishment of a sustainable transportation sector that enhances connectivity with public transportation systems is imperative in order to encourage individuals to opt for public transportation as their dominant transport mode for mobility (Malaysian Aviation Commission, 2023). The exacerbation of urban mobility difficulties, such as traffic congestion and road accidents, is a direct result of the absence of a functional public transport system, leading to an increased dependence on private vehicles. As a result, the aforementioned challenges pertaining to urban mobility are likely to give rise to other issues that have the potential to undermine the overall standard of living. These include but are not limited to air pollution, safety risks, inequities in job opportunities, limited access to healthcare, and restricted educational opportunities (Lang et al., 2020). The concept of sustainable mobility encompasses more than simply reducing carbon emissions associated with transportation methods; it also involves considering how individuals can effectively utilise transportation to enhance their socio-economic circumstances (Rodrigue, 2020). Therefore, it is imperative to give priority to the enhancement of job accessibility within the transportation sector. The predominant focus of current research on job accessibility has mostly centered

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on the impact of transport networks in wealthy countries with advanced mass transportation capacities. The investigation of this subject matter holds significant importance in developing nations because of the strong correlation between job accessibility and the advantages offered by the public transport system. Hence, the primary aim of this research was to examine the relationship between the mode of transportation employed by low-income urban workers for their daily commute to their workplace, as well as the factors that influence their decision-making process in selecting a certain mode of transportation. The study was undertaken on Penang Island, Malaysia, which was chosen as a research location due to its designation as a prominent metropolitan hub in Malaysia. However, the primary mode of public transit on the island is the public bus, which is not widely preferred due to the substantial reliance of the population on private vehicles.

1.1 The public transportation system in Penang island, Malaysia

Despite being one of the three major metropolitan states, the principal form of public transit on Penang Island, Malaysia, is limited to the public bus system. To date, no alternative mass transit system, such as Light Rail Transit (LRT) or Mass Rapid Transit (MRT), has been developed. Hence, as stated by Penang Sentral (2014), the optimal means of transportation for facilitating mobility in areas beyond the central city is achieved by utilising automobiles and taxis. One of the factors that significantly contributes to the heavy reliance of the island's people on private automobiles is the aforementioned element. When individuals see a certain level of effectiveness in a method of transportation, they are more inclined to select it. According to Talmizi and Tahir (2021), the concept of effectiveness of public transportation encompasses three key components: trust, comfort, and safety. Trust can be evidenced by factors such as affordable cost, punctuality, and adherence to a regular schedule. The demonstration of comfort can be achieved by the provision of accurate information, favorable waiting situations, and transportation in optimal conditions. The demonstration of safety can be achieved by the effective resolution of user issues, terminal conditions, and vehicle conditions. Norhisham et al. (2022) conducted a comprehensive investigation of the performance of bus services in Penang as part of their study. Norhisham et al. (2022) found that although the perceived quality of these services is satisfactory, there is a requirement for strategic interventions to improve passengers' perceptions and promote the selection of public buses as their preferred transportation method. To promote the utilisation of public buses over privately owned vehicles, the Penang government implemented a complimentary bus service in 2021. In both 2021 and 2022, the Penang government distributed renewable public bus pass cards to 10.000 and 7.500 commuters, respectively, with a value of USD 10.52 each (Sekaran, 2021). The allocation of USD 1.578.117.00 to prolong the public bus pass card programme in 2023 by the Penang government is expected to incentivise a greater number of individuals to transition to public transport (Mok, 2022). Regrettably, despite the implementation of an extensive project with a substantial allocation, Penang Island continues to grapple with urban mobility challenges characterised by a significant reliance on private transportation and severe traffic congestion.

1.2 Sustainable mobility initiatives in Penang

A sustainable transport system facilitates the provision of essential necessities in a secure manner, while ensuring minimal negative impacts on human well-being and the environment, and fostering intergenerational equity (Eltis, 2019). Regardless of the specific context, sustainable transport such as public transport plays a pivotal role in attaining sustainable mobility objectives (Sehmi and Sariera, 2019). This is primarily due to its capacity to significantly diminish energy consumption, alleviate traffic congestion, enhance air quality, and foster more livable and inclusive urban environments.

The Penang government demonstrates a strong commitment to addressing the issue of sustainable transport by actively promoting the development of communities that prioritise sustainable mobility. The Penang administration had formulated plans to enhance the transport networks inside the state with great determination, as a means to accomplish this objective. The primary endeavor associated with these objectives involves the execution of the Penang Transport Master Plan (PTMP), a comprehensive and efficient strategy aimed at establishing an integrated and contemporary transport system encompassing both land and sea modes of transportation (Penang State Government, 2019). This plan incorporates multiple transportation modes, such as light rail transit (LRT), bus rapid transit (BRT), tram, taxis, and ferries, with the primary objective of promoting the adoption of public transportation among the communities of Penang. In addition, the plan delineates a comprehensive transit network that aims to enhance the long-term capability for promoting

public transport utilisation in Penang. In conjunction with the enhancement of public transportation infrastructure, this plan incorporates additional measures aimed at optimising road and highway networks to foster comprehensive advancement and enhance the convenience of individuals utilising these roadways (Penang Infrastructure Corporation, 2021). Thus far, the residents of Penang have exhibited a strong inclination towards utilising privately owned modes of transportation, such as automobiles and motorcycles, for their mobility needs. If the plan is successfully implemented, it is anticipated that the provision of efficient and sufficient public transport will serve as a compelling incentive for communities to choose public transport as their preferred mode of travel.

On the other hand, due to limited awareness of car-sharing within communities, Penang, despite being the second smallest state in Malaysia, exhibits a significant reliance on privately owned vehicles, particularly single occupancy vehicles. This reliance exacerbates the issue of severe traffic congestion, as approximately 70% of vehicles on the road are driven by lone drivers (Focus Malaysia, 2022). In order to address the issue of traffic congestion, particularly during peak periods, Rapid Bus Sdn Bhd, the exclusive public bus service provider in Penang, will implement a novel transit service called demand response transit (DRT) (Ian, 2023). This initiative is being undertaken in collaboration with the Penang government and private enterprises. DRT involves the utilisation of vans and mobile app technology to facilitate shared rides for up to 12 passengers. The implementation of on-demand transportation technology has the potential to decrease reliance on privately owned vehicles by dynamically adjusting routes in response to specific transportation demands, hence eliminating the need for fixed routes or scheduled travels.

2 Methodology

The research approach employed in this study is the quantitative methodology. Consequently, the present study employs a survey methodology utilising a questionnaire as the major means of data collection, thereby adopting an inferential approach. The quantitative method was selected due to its generally acknowledged better degree of impartiality in comparison to qualitative data.

2.1 Study area

The study area for this research consisted of the northeast and southwest districts of Penang, Malaysia as shown in the map of Fig. 1. Out of a pool of five districts, these two districts were chosen due to their smaller size and higher level of urbanisation in comparison to the remaining three districts (Lim, 2015). According to the Penang State Government (2019), the land area of the northeast district is 124 km^2, whereas the southwest district is 175 km^2. The northeast section of Penang underwent urbanisation and subsequently emerged as the capital of the state of Penang. Subsequently, the southwest district saw urbanisation as urban sprawl extended to this area subsequent to the establishment of the free industrial zone (Taib, 2000). Hence, these districts represent the regions that underwent urbanisation the earliest.

2.2 Primary data collection

The survey form was distributed directly to participants, who were given a specific period of time to complete it before it was collected. The research methodology utilised in this study was the distribution of questionnaires to a sample size of 306 participants. The participants in this research were selected using a stratified random selection technique. This method was employed to ensure representation of the low-income population in the northeast and southwest districts of Penang, Malaysia, who were enrolled in the eKasih Penang welfare programme during the year 2016 (Department of Social Welfare, 2016). Therefore, the individuals selected as respondents were those who were enrolled in the eKasih initiative and have received welfare assistance through the programme. The participants of the eKasih initiative in Malaysia are documented in the national poverty data bank. This database was created to compile information on those residing in poverty, regardless of their location in rural or urban regions within the country. Based on eKasih programme's participants list in the northeast and southwest

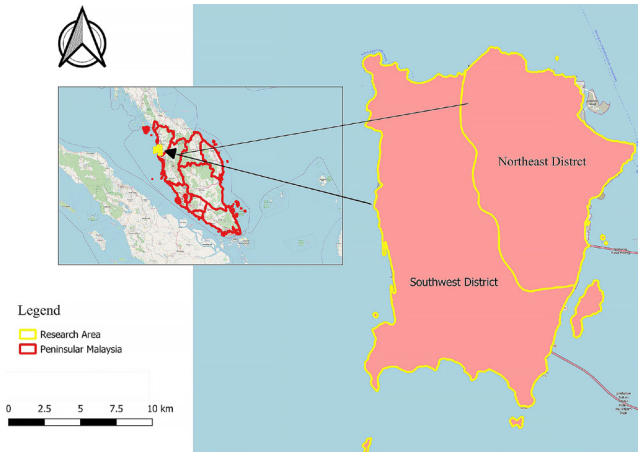

Fig. 1 Map of northeast and southwest districts, Penang, Malaysia

districts of Penang in 2016 it was revealed that the total of 1.546 households with low-income status were registered in the programme (Department of Social Welfare, 2016). In order to determine the optimal sample size to represent the real population, reference is made to the Morgan Table, as shown in Table 1.

However, Table 1 represents a subset of the whole Morgan sampling table, which has been adapted to meet the specific requirements of the study. Based on the findings of the Morgan table, the sample size of 306 respondents was selected for the population consisting of 1.546 low-income households. Following the determination of the appropriate sample size, the stratified random sampling technique was employed, taking into account the various ethnicities, as depicted in Table 2.

According to the data presented in Table 2, the predominant demographic group among the respondents is Malay men, accounting for 34.64% in the southwest area and 30.39% in the northeast district, respectively. In contrast, the demographic subgroup with the lowest representation consists of Chinese women, accounting for 0.98% in each of the separate districts.

3 Findings and discussion

The data that was gathered was subjected to analysis using SPSS, which stands for Statistical Package for the Social Sciences. The study included descriptive statistics analysis and cross-tabulation techniques to examine the demographic features, job accessibility, and workplace mobility of low-income workers. These data would subsequently be utilised for multiple regression analysis. In this study, a multiple regression analysis was conducted to examine the association between individuals' chosen mode of transportation and the influencing factor.

Table 1 Morgan sampling table
Modified from Krejcie and Morgan, (1970)

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

Table 2 Sample size selected from low-income group in Penang

Ethnicity	Southwest district (%)		Northeast district (%)	
	Male	Female	Male	Female
Malay	34.64	13.40	30.39	5.23
Chinese	1.31	0.98	1.63	0.98
Indian	4.25	2.94	2.94	1.31
Total	40.20	17.32	34.96	7.52

3.1 Demographic characteristics

Table 3 presents the ethnic composition and household income of the low-income groups in this study. The predominant ethnic group in both the northeast district, accounting for 35.62% of the population, and the southwest district, comprising 48.04% of the population, is the Malay community. Subsequently, the Indian population in the northeast area accounts for 4.25%, while in the southwest district it constitutes 7.19%. According to the data, it can be observed that the Chinese ethnicity has the lowest representation among the respondents. Specifically, the northeast district has a Chinese population of 2.61%, while the southwest district has a slightly lower percentage of 2.29%. In contrast, a significant proportion of low-income households in the northeast district (37.58%) and southwest district (54.25%) had a household income below USD 528.49, as indicated by the findings of this study.

3.2 Job accessibility

In order to evaluate the level of job accessibility among low-income households, a comprehensive analysis was undertaken to examine the geographical proximity between their home and their respective workplace

Table 3 Demographic characteristics of the respondents

	Northeast		Southwest	
Ethnicity	*n*	Percentage (%)	*n*	Percentage (%)
Malay	109	35.62	147	48.04
Chinese	8	2.61	7	2.29
Indian	13	4.25	22	7.19
Total	130	42.38	176	57.52
Household income	*n*	Percentage (%)	*n*	Percentage (%)
Less than USD 528.49	115	37.58	166	54.25
USD 528.49–USD 669.91	13	4.25	8	2.62
USD 670.12–USD 839.02	2	0.65	2	0.65
Total	130	42.48	176	57.52

Table 4 Distance from house to the workplace (DHW)

Distance (km)	Northeast district (%)	Southwest district (%)
<15.0	26.80	17.97
16.0–30.0	8.17	32.68
31.0–45.0	5.23	4.90
46.0–60.0	2.29	1.96
Total	42.49	57.51

as shown in Table 4. Based on Table 4, it is evident that a considerable percentage, specifically 26.80%, of households with low income in the northeast district are situated within a proximity of less than 15.0 km from their respective workplace. Within the southwestern region, there exists a notable proportion, precisely 32.68%, of individuals who fall under the low-income demographic and are situated within a distance range of 16.0 to 30.0 km from their respective place of employment.

3.3 Sustainable mobility

Emission-free cities are characterised by the implementation of sustainable mobility solutions. Hence, this study aimed to investigate the types of vehicles used as the dominant transport mode for their mobility to the workplace (refer Table 5). According to Table 5, it can be observed that the motorcycle serves as the dominant transport mode in both the northeast and southwest regions, accounting for 29.08% and 42.81% of the total transportation share, respectively. In addition, the ownership status of the vehicles used as the dominant transport mode among low-income group to commute from home to the workplace was projected in Table 6. Based on Table 6, the majority of the low-income group from both districts are dependent on their own vehicle for mobility to the workplace. The reason is that of the respondents, 37.91% in the northeast district and 51.31% in the southwest district owned their own vehicle and used it as the dominant transport mode to go to the workplace.

Table 5 Types of vehicles used as dominant transport mode for commuting to the workplace (DTM)

Transport mode	Northeast district (%)	Southwest district (%)
Public bus	1.63	3.92
Motorcycle	29.08	42.81
Car	8.82	8.50
Employer's vehicle	2.94	2.29
Total	42.47	57.52

Table 6 Ownership status of vehicle used as transportation mode to the workplace (OS)

Ownership of the vehicle (%)	Northeast district (%)	Southwest district (%)
Public transport	1.96	2.61
Privately owned vehicle	37.91	51.31
Car-pooling	1.31	0.00
Employer's vehicle	1.31	3.59
Total	42.49	57.51

Table 7 Monthly commuting cost bear by the low-income household (MCC)

Commuting cost (%)	Northeast district (%)	Southwest district (%)
Less than USD 42.79	21.24	26.14
USD 43.04 – USD 64.01	16.01	22.88
USD 64.41 – USD 85.59	2.94	6.54
USD 85.80 – USD 106.99	1.63	1.63
Greater than USD 106.99	0.65	0.33
Total	42.47	57.52

Additionally, Table 7 presents the monthly commuting expenses incurred by the low-income groups. Based on the data shown in Table 7, it can be observed that the majority of low-income groups incur a monthly commuting expense that is below USD 42.79. In the northeastern area, a significant proportion of the low-income groups, specifically 21.24%, incurs a commuting expense of less than USD 42.79. Additionally, 16.01% of this group bears a commuting cost ranging from USD 43.04 to USD 64.01. A mere 0.65% of the low-income groups within this district incur commute expenses above RM500. In the southwest area, a significant majority of 26.14% of the low-income groups bear a commuting cost that is less than USD 42.79. Subsequently, a total of 22.88% of the low-income groups in the aforementioned district incur monthly commuting expenses ranging from USD 43.04 to USD 64.01 for their transportation to their respective workplaces.

Moreover, Table 8 presents the anticipated annually maintenance cost of the dominant transport mode for the low-income groups. Based on Table 8, the low-income group in the northeast area comprises 10.46% of the population, while in the southwest district it accounts for 13.73%. These individuals typically incur an annual maintenance expense for their primary vehicle ranging from USD 43.04 to USD 64.01. In contrast, an analysis was conducted to determine and record the distance between the location of the respondents' home and the nearest public transport station. The findings of this analysis were then organised

Table 8 The annual dominant transportation mode's maintenance cost (AMC)

Annual maintenance cost (%)	Northeast district (%)	Southwest district (%)
Less than USD 42.79	9.15	11.11
USD 43.04 – USD 64.01	10.46	13.73
USD 64.41 – USD 85.59	8.17	13.07
USD 85.80 – USD 106.99	5.56	8.17
Greater than USD 106.99	9.15	11.44
Total	42.49	57.52

Table 9 Distance from the house location to the nearest public transport station (DHP)

Distance (km)	Northeast district (%)	Southwest district (%)
0.5–5.0	25.49	39.54
6.0–10.0	12.42	16.99
11.0–20.0	3.59	0.98
20.0–30.0	0.98	0.00
Total	42.48	57.51

and presented in Table 9. The majority of the low-income groups were located within a proximity of 10 km from public transport hubs. The majority of the low-income groups in both districts were located within a range of 0.5 to 5.0 km from the nearest public transit nodes. Specifically, 25.49% of the low-income groups in the northeast district and 39.54% of residents in the southwest district fell within this proximity. A mere 0.98% of the low-income groups residing in the northeast area face a significant lack of accessibility to public transport, as their residences are situated at distances ranging from 20.0 to 30.0 km away from any public transport station.

3.4 Multiple regression relationship between transport mode to the workplace and factor of choosing the transport mode used

To conduct a comprehensive examination, the study employed multiple regression analyses to ascertain the determinants influencing the selection of transport modes for commuting to work among those low-income groups. According to the data shown in Table 10, the results of the multiple regression analysis revealed a correlation coefficient (R) of 0.230 between the dependent and independent variables. This indicates that the independent factors account for just 23.0% of the variance in the dependent variable. Hence, the remaining 77.0% of the variance cannot be accounted for by the independent variables examined in this study, since it necessitates an explanation based on other components that were not considered in the present analysis. Furthermore, the resulting value of Adjusted R^2 indicates the extent to which the constructed model can be effectively generalised to the population. Ideally, a smaller gap between the R^2 and Adjusted R^2 values is considered more favorable. Hence, in order to ascertain this, the discrepancy between the R^2 and Adjusted R^2 values amounts to 0.013 or 1.3%. Hence, the slight disparity demonstrated the formation of a more robust generalisation. Furthermore, it is worth noting that the Standard Error of the Estimate (SEE) is a mere 0.547, which suggests that the constructed model is highly precise in estimation of the dependent variable. Additionally, an F test was conducted to assess the significance level in the relationship between the independent factors and the dependent variable, as shown in Table 11. This test aimed to identify whether there are significant and relevant influences present. According to the data presented in Table 11, the F test value of 107.783 suggests the presence of a strong regression equation, as it is above the threshold of 100.00. The F significant value of 0.042 indicates that the observed relationship between variables is statistically significant. In conclusion, the ANOVA analysis yielded a significant p-value of less than 0.05 (F test), suggesting the presence of a statistically significant difference between the independent factors and the dependent variable. Following that, the regression coefficient underwent testing and was then displayed in Table 12. The purpose of this analysis was to determine the correlation between the dominant mode of transportation used for commuting to the workplace and the component that influences

Table 10 Summary model of multiple regression for relationship between transport mode to the workplace and factor of choosing the transport mode used

R	R square	Adjusted R square	Std. error of the estimate
0.479	0.230	0.217	0.547

Predictors: (Constant), AMC, DHP, DHW, OS, MCC
Dependent Variable: DTM

Table 11 Data variance analysis (ANOVA) for the relationship between transport mode to the workplace and the factor F choosing the transport mode used

Model	Sum of squares	df	Mean square	F	Sig.
Regression	26.582	5	5.316	107.783	0.000
Residual	89.089	298	0.299		
Total	115.671	303			

Dependent Variable: DTM
Predictors: (Constant), MCC, DHP, DHW, OS, MCC

Table 12 Coefficients of relationship between transport mode to the workplace and factor of choosing the transport mode used

Model	Unstandardised coefficients	Standardised coefficients		*t*	Sig.
	B	Std. error	Beta		
(Constant)	1.013	0.166		6.085	0.000
DHW	–0.005	0.002	–0.100	–1.918	0.056
DHP	0.151	0.055	0.141	2.729	0.007
OS	0.344	0.045	0.405	7.590	0.000
MCC	0.001	0.001	0.110	2.052	0.041
AMC	0.024	0.022	0.060	1.106	0.270

Dependent Variable: DTM

the choice of vehicle. Based on the results of the analysis, it can be inferred that three variables, specifically DHP (distance from house to the closest public transportation station), OS (ownership status of the vehicle utilised as the dominant transport mode for commuting to work), and MCC (monthly commuting costs), demonstrate statistical significance, as indicated by a p-value below 0.05.

Furthermore, to ascertain the most influential independent variables on the dependent variable, the selection of the primary mode of transportation for commuting to the workplace, the standardised coefficients values presented in Table 12 are consulted. Evidently, the standardised coefficients, β, exhibit varying magnitudes. The coefficient βOS holds the highest value at 0.344, followed by βDHP at 0.151, and βMCC at 0.001.

Based on the obtained results, it can be inferred that the variable of interest, namely the ownership status (OS) of the vehicle used as the primary mode of transportation for commuting to the workplace, exerts the most significant influence on the transportation mode choice of the low-income groups. In summary, the outcomes derived from the multiple regression analysis encapsulate the primary and robust factors that significantly impact the decision-making process regarding the choice of transportation for daily commuting to the office. These findings are succinctly presented in Eq. (1). Regression equation:

$$\begin{aligned} Y &= \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 \\ Y &= \beta_0 + \beta_{\mathrm{OS}} X_{\mathrm{OS}} + \beta_{\mathrm{DHP}} X_{\mathrm{DHP}} + \beta_{\mathrm{MCC}} X_{\mathrm{MCC}} \\ Y &= 1.013 + 0.344 X_{\mathrm{OS}} + 0.151 X_{\mathrm{DHP}} + 0.001 X_{\mathrm{MCC}} \end{aligned} \quad (1)$$

In this study, the outcomes of multiple regression analysis indicated that the vehicle's ownership status utilised as the major transport method to travel to the workplace is the strongest determinant. This issue substantially encourages the low-income groups to choose the vehicle that they use to get to the workplace daily. The results of this study align with the circumstances observed in the urban area of Klang Valley, Malaysia, where persons possess automobiles and demonstrate a tendency to rely on their personal vehicles for transportation, influenced by several causes. Several factors contribute to the challenges faced by individuals in accessing public transportation. These factors encompass the significant geographical distance separating their dwellings from the nearest public transportation station, the absence of secure pedestrian paths, inadequate protection from precipitation at bus stops, insufficient lighting, and the lack of visible bus schedules (Tan, 2022). This scenario suggests that individuals choose to possess their own personal vehicles and select them for transportation purposes due to the advantages they offer in terms of proximity, security, well-being, and more efficient commute arrangements. According to the findings of this study, a significant majority of the low-income groups opted for motorcycles as their dominant transport mode for their daily commute to work. According to Bowler (2023), motorcycles are comparatively smaller than cars, resulting in reduced influence on traffic infrastructure and congestion. This is attributed to their smaller spatial footprint, ease of manoeuvrability, and lesser environmental consequences. However, motorcycles can be considered an unsustainable mode of transportation due to their inherent risks that expose riders to a significantly higher likelihood of being involved in road accidents. The incidence of motorbike road accidents poses a significant threat to individuals, as it exposes them to severe and perhaps life-threatening injuries. This pressing public health issue is rising (Delamou et al., 2020). Nevertheless, motorcycles serve as a means of transportation that might potentially offer cost-saving benefits in terms of fuel expenditure for individuals belonging to low-income demographics. Additionally, motorcycles can be time-efficient alternatives, particularly when individuals are confronted with traffic congestion. A significant number of automobiles on Penang Island has resulted in a notable rise in traffic congestion (Focus Malaysia, 2022). The current situation is deteriorating, resulting in frequent delays in employees' commutes due to highway congestion. One of the factors contributing to this phenomenon is the compact nature of Penang Island, as reported by Penang Global Tourism (2019). Additionally, the island exhibits a comparatively high population density of 2031.74 inhabitants per square kilometre, as documented by Kenworthy (2006). Therefore, it appears that acquiring and utilising motorcycles serve as a potential remedy for reducing transportation expenses and travel duration within the low-income demographic. Based on the aforementioned

discourse surrounding the study's findings, it is evident that a significant portion of the low-income demographic residing in Penang Island is engaging in unsustainable practices when it comes to getting job opportunities. The possession of private automobiles and the reliance on them might indicate the inadequacy and inefficiency of public transit systems. To address the issue at hand, the Penang State Government is presently engaged in formulating and implementing strategies to enhance the public transport infrastructure and road network within the region. This endeavor is being carried out through the Penang Transport Master Plan, as outlined by the Penang State Government in 2019. It is anticipated that individuals belonging to the low-income urban workforce residing in Penang Island will benefit from adopting sustainable mobility practices, contributing to long-term sustainability.

4 Conclusion

The excessive reliance on privately owned vehicles has a significant impact on the unsustainable nature of mobility, hence exacerbating urban mobility issues. The present study reveals that a significant proportion of low-income groups primarily depend on personal vehicles as their dominant mode of transportation for commuting to their workplaces. The majority of these low-income groups employ motorcycles as their primary means of transportation for commuting purposes. This preference is mostly attributed to the comparatively lower costs associated with motorcycle ownership than car ownership, the shortened commuting time, space-efficient vehicle, minimal fuel consumption, and cheaper maintenance expenses that motorcycles offer. The determinant of ownership is crucial in determining the preferred dominant form of transportation. At the same time, the characteristics of the selected vehicle types reflect the preference of low-income groups for the most efficient and cost-effective method of transportation. Therefore, when devising plans for the promotion of sustainable transport and mobility, policymakers may consider the variables of affordability and punctuality inorder to establish a transportation system that is both cost-effective and efficient, thereby catering to the mobility needs of low-income populations. Nevertheless, the mere provision of a comprehensive and enduring transportation system, encompassing an extensive network that facilitates convenient access for individuals from low-income backgrounds to their residences and places of employment, does not inherently ensure the adoption of said sustainable transportation system as the primary mode of travel. This study does not investigate the determinants that may influence individuals from low-income backgrounds to opt for other modes of transportation rather than utilising their personal vehicles for their daily commute to work. Future studies should be directed towards examining these features to devise more efficient strategies to promote sustainable mobility through sustainable transport alternatives among low-income groups.

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