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Public perceptions: an important determinant of transport users' travel behaviour

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The public perception towards the existing public transport in Malaysia has constantly been declining over the years. Perceptions are instruments to indicate existing service quality and expected quality from the passenger's point of view. The primary objectives of this study were to assess the needs and perceptions of passengers towards effective public transport and to evaluate the passenger and travel characteristics of public transport in the city of Johor Bahru in Malaysia. The main results formed clear consensuses that Lower Income Group (LIG) are largely captive bus users. Despite being captive bus users, the bus service is highly marginalised in quality terms for their travel, and there is a vast potential for improvement. Similarly, Higher Income Group (HIG) reflected car dominance not only due to poor service quality of buses but also due to other socioeconomic factors. The present research provides many clues for the policymakers to understand public perceptions towards promoting sustainable transport modes, and that can support the implementation of the ambitious Malaysian National Transport Policy (2019-2030).

Key Words: ***passenger characteristics, public perceptions, travel behaviour, trip characteristics, Johar Bahru, Malaysia***

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Introduction

In the 21st century, most developed countries and their citizens appear to be reassessing the use of automobiles and their perceptions regarding the expected role of public transport systems. Passenger perceptions must be regarded as vital elements in providing feedback for improving standardised levels of quality in public transport services. The strategies to improve the existing standards concerning public transport services can be viewed as a cycle of two parts: the first part deals with the service provision provided by public transport operators as against available standards (Cascetta & Cartenì, 2014; Fellesson & Friman, 2012) and the second part deals with perceptions of the public transport users' toward transport services offered (dell'Olio et al., 2011). Therefore, users' perceptions are not only vital for transport managers to assist in the better operation of, but in guiding the designing of the type, capacity, and structure of the public transport systems so that it conforms to their expected quality (Boltze et al., 2003; Himanen et al., 1992). There are definitive gaps between quality standards set by transport policymakers and what public transport operators offer. Understanding users' perception is necessary for policymakers to introduce policies that can change negative perceptions and attitudes towards public transport and reduce car dominance (Horak et al., 2014; Burian et al., 2018). Similarly, a disparity exists between the transport services offered by operators and transport services perceived by public users. Perceived quality of services raises further expectations of its users.

Johor is the fifth largest Malaysian state, located in southernmost peninsular Malaysia, with a total population of 3,233,434 (second largest in Malaysia as of 2010). The state of Johor is divided into ten districts, Johor Bahru has the largest population of 1,386,569. It also has the second-largest federal roads of 2,343.87 km after Pahang (3,760 km). Similarly, Johor State also has the second-largest state roads of 11,214 km after Selangor, which also contains Kuala Lumpur (13,582.68 km) (Abdul-Aziz, 2002) (Almselati et al., 2011). The ethnicity of the population of Johor Bahru consists of 47.5% Malay, 34.2% Chinese, 9.0% Indian, 0.6% other minorities, and 8.7% non-citizens. It is an important industrial, logistical, and commercial centre (Department of Statistics Malaysia, 2010).

Malaysia is aiming to be a developed nation by the year 2020 (Prime Minister's office of Malaysia, 2012; Sarji, 1993; Kassim, 1993). However, this ambitious goal requires that the public transport system should be given greater consideration in making it competitive and becoming the prime transport mode. Conceivably, the proliferation of private car ownership in recent years in conjunction with transport developments and policies favouring a high volume of private vehicles are poised to cause a setback. Previous studies validate that the number of registered private cars increased by 41% from 2005 to 2010 (Borhan et al., 2014; Minhans et al., 2013; Minhans et al., 2014). Furthermore, this situation has been supported by rampant highway developments, and the trend shows no signs of decline. Public transport modes, especially buses, have been severely compromised. While public transport modes suffer from high subsidies, poor

patronage, poor brand image, and down-graded service quality, private transport is being encouraged through soft-loans for purchasing cars, low fuel costs, low maintenance costs, and low taxes. Furthermore, transport and other urban development are mainly focused on the car as the preferred mode of transport (Minhans & Moghaddasi, 2013).

The countries with developed economies have begun to discourage their citizens' dependence on private vehicles and investing heavily to promote public transport systems (Pourbaix, 2011; European Environmental Agency, 2013). Alongside this, it is now a well-proven fact that the harmful emissions coming from all gasoline-powered vehicles present an alarming risk to humankind due to air-pollution and perilous rise in greenhouse gas emissions. The ever-increasing rise in greenhouse gas emissions (GHGs) has pointed out that transport and burning of fossil fuels are the primary culprits in causing global warming (Shahid et al., 2014). Many European cities like Barcelona, Berlin, London are aiming to promote a more efficient and environmentally friendly modes of public transport (Ramos et al., 2019) and lowering the trips made by private car (Land Transport Authority, 2011). Therefore, there is an increasing need to promote sustainable modes of transport in the Malaysian context.

Enhancing public transport is being considered as part of a national solution for future sustainable transport by many countries (Kenworthy & Laube, 2001). Malaysian transport policies and transport departments have not sufficiently addressed the issues and challenges that public transport faces at present, making it a low priority. According to the 9th Malaysia Plan Period (2006-2010), the Malaysian Government spent RM 17.3 billion (1 Malaysian Ringgit equals 0.311 United States Dollar, average exchange rate in 2010) for road development programs, increasing its road length manifold times. This financial allocation indicates the major milestones for road development and its priority in Malaysia (Economic Planning Unit, 2006). Gasoline prices, annual road tax, registration charges, and annual vehicle insurance in Malaysia are among the lowest in the Association of Southeast Asian Nations (ASEAN) member countries (Minhans et al., 2013; MITI, 2015; ASEAN, 2019). Unlike in many developed countries such as Germany, France, UK, Japan, Singapore, public transport in Malaysia barely meets its development as a priority and competitive mode, and a social welfare model. Underlying ambiguous policies and lack of a clear framework to integrate public transport at the regional and urban levels pose impediments to the projected modal shift, as suggested in the Master Plan developed by the Land Public Transport Commission (Hussein & Yaacob, 2012). Moreover, several agencies that oversee various public transport sectors lack coordination, and this made public transport mostly unorganised, and its benefits have been insufficiently exploited (Azmi & Fanim, 2012; Almselati et al., 2011). Another essential drawback in Malaysia is the lack of service quality standards in public transport, which has led people to use private cars. Currently, only 20% of the people in Malaysia are using public transport (Ministry of Transport, 2019). However, in order to keep and attract more people to use public transport, it must satisfy and fulfil the broader range of different customers' needs (Almselati

et al., 2011). To reduce excessive reliance on private cars and promote public transport, Malaysia requires robust initiatives to ensure that the national public transportation mode would be the prime choice of the people. Policies that aim at substantial modal shift and increasing public transport usage can be viewed as mutually supportive of its pursuit of a developed nations' image. It requires significant improvements in service quality, which can only be implemented by a comprehensive assessment of travel behaviour about passengers' needs and expectations (Anable, 2005). If public transport amelioration is based on users' needs and perceptions, it can lead to a significant percentage of car users switching to public transport modes. Thus, it seems essential to assess user perceptions, in order to recognise the probable strengths and weaknesses of public transport systems (Anwar, 2009; Gatersleben & Uzzell, 2007; O'farrell & Markham, 1974).

This paper intends to understand the reasons behind bus usage among different socioeconomic and demographic groups in six different precincts in the city of Johor Bahru, Malaysia. Therefore, the primary objectives of this study are to reveal the difference in the use of public transport by (i) the surveyed areas based on the varied socioeconomic profile (ii) the public transport users and non-users (iii) the low income and high-income people (iv) the car owners and non-car owners and (v) to extend few suggestions based on the bus users' perspective for improving public transport service quality in Malaysia.

Public Perceptions

Significance of Public Perceptions

Public perceptions are an integral part of transport planning processes. In contemporary transport planning practices, public consultation is essential to obtain valuable information, a more comprehensive set of alternatives, cooperation, and ease of implementation. Senses of ownership with more responsibility and commitment are seen when the public is consulted. Consultations eliminate several conflicts in different stages of planning, design, construction, and implementation of large projects (Bickerstaff et al., 2002). Transport users' suffer the consequences of low service quality, and their judgment of service quality is therefore crucial.

Furthermore, it strengthens the democratic fabric and acts as a vehicle for community empowerment (Lowndes et al., 2001). However, in traditional planning approaches, public participation was relatively ignored (Abdul-Aziz, 2002). This ignorance led to decisions often taken through internal consultation without the cooperation of the public. Transport users' suffer the daily consequences of low service quality, and their judgment of service quality is, therefore, crucial for policymaking (Ramos et al., 2019). Public perceptions are valuable sources of more reliable information about the quality of public transport systems. Such information, when combined with socioeconomic status, demographics, and trip behaviour of users, can suggest a substantive improvement. Analyses based on market research can influence decisions dealing with customer

service, advertising, strategic planning, public relations, fare policy, demand for responsive services, vehicle purchasing, facilities planning, among many other critical decisions involved in the planning and operation of the bus services (Elmore-Yalch, 1998).

Instruments of Public Perceptions

Understanding the trip behaviour of users and the characteristics of travel demand are essential for public transport operators. By defining the attributes of transport services, performance monitoring, and evaluation of public transport modes are possible (Lai & Chen, 2011). Such analyses may also trigger testing and refining (or modifying) of previously set alternatives of operations (Borhan et al., 2014). The user perception about the quality of services can be assessed from both qualitative and quantitative parameters (Das & Pandit, 2013). Market research techniques to obtain public perceptions involve several methods: these are on-board passenger surveys, random telephonic interviews, interviews in person, focus group surveys, random mails, or non-random telephone surveys (Eboli & Mazzulla, 2012). Both disguised and non-disguised questionnaires can be formulated to gather information from user groups (Gupta, 1995). Similarly, the questionnaire may adopt a structured style of questions or a non-structured style to maximise the response from the focus groups (Strauss, 1987). Researchers have pointed out the benefits of working with the survey-based sampling approach (DeWitte et al. 2008; Belwal & Belwal 2010; Guirao et al. 2015) to understand the transit users' perception about service quality.

Materials and Methods

Sample Selection

This study investigates the relationship between typical trips and users' income, trips and car ownership levels, and finally, socioeconomic and demographic characteristics with public transport patronage groups. A total of 264 samples were collected from March 5th to March 31st, 2016, for this study from six different precinct, which are distinctive geographic areas within a larger urban area with a diversity of urban form and character and vitality. In this research, the precinct has been selected based on mean distance from CBD, income groups, the prevalence of similar public transport services, and data availability. The samples were collected at the bus stops to get right responses from each passenger. Of the 264 respondents, 124 questionnaires (47%) were filled by respondents who had previous experience of using public bus transport, and 140 questionnaires (53%) were filled by respondents who travel by car and never used public transport. Attention was made to ensure the non-parametric equivalent for each parametric general type of test. The convenience sampling technique was employed, which means subjects were selected based on the convenient accessibility and proximity to the researcher. In 2010 the city of Johor Bahru had an area of 220 km^2 and a population of 497,067 (Department of Statistics Malaysia, 2010). The current modal share of national public transport is meagre (20%). For a city size of Johor

Bahru, it is required to have a considerable number of samples for such types of studies. This is both time and resource-intensive. In situations where the appropriate sample size collection is not possible (in present case less than 1% of the city population), statisticians try to overcome this drawback by using non-parametric methods, which can be employed for smaller sample sizes, compromised data quality, unknown distribution, among many other constraints. Therefore, it can be expected that non-parametric analyses of this convenient sample would generate as close as possible results valid for the entire population. Selective surveys, biased and disguised survey methods were adopted for better results. Also, a sample size of 264 samples ascertained the estimation of differences between independent and dependent groups as well as chosen variables.

Precinct Selection and Survey Design

The rationale for precinct selection was the relative distance of precinct from the Central Business District (CBD), the income groups, availability of sufficient data, and prevalence of similar public transport services in the selected precincts (Figure 1).

One of the most important reasons why the precincts mentioned above were chosen for this research was the distance from CBD. This attribute could determine travel behaviour in different modes, and it influences relative travel costs, time, and comfort (Beirão & Cabral, 2007; Majid & McCaffer, 1997; Nor, 2004). The second reason was to evaluate how the socioeconomic status of respondents from different areas can be explained (Table 1). Based on the locally available economic indicators, the residents in Setia Tropika and Taman Nong Chik were higher-income residents and a higher standard of living. Those residents had more options available regarding mobility than those who lived at Taman Perling and Bukit Indah. Furthermore, travel behaviour is very much influenced by people's socioeconomic status. Thirdly, the availability of data on background information with regards to the socioeconomic status of the residents, road network, and current traffic levels was also taken into account during precinct selection. This secondary information was obtained from the office of the Majlis Perbandaran Johor Bahru Tengah (MPJBT), a municipal authority of Johor Bahru. Finally, it was also deemed necessary that similar public transport modes serviced all precincts.

The characteristics of the public transport system were studied in the chosen catchment areas, and the government-operated City Bus was used as a typical mode. It was assumed that the respondents had some knowledge about the general service quality of City Buses. Also, people's judgment dealing with the relative attractiveness of those services was entirely based on perceptions or experience.

The survey was conducted in six different precincts with four levels of household income zoning, which were Setia Tropika (A), Taman Nong Chik (B), Bukit Indah (C), Taman Perling (D), Taman Daya (E), and Majidee (F).

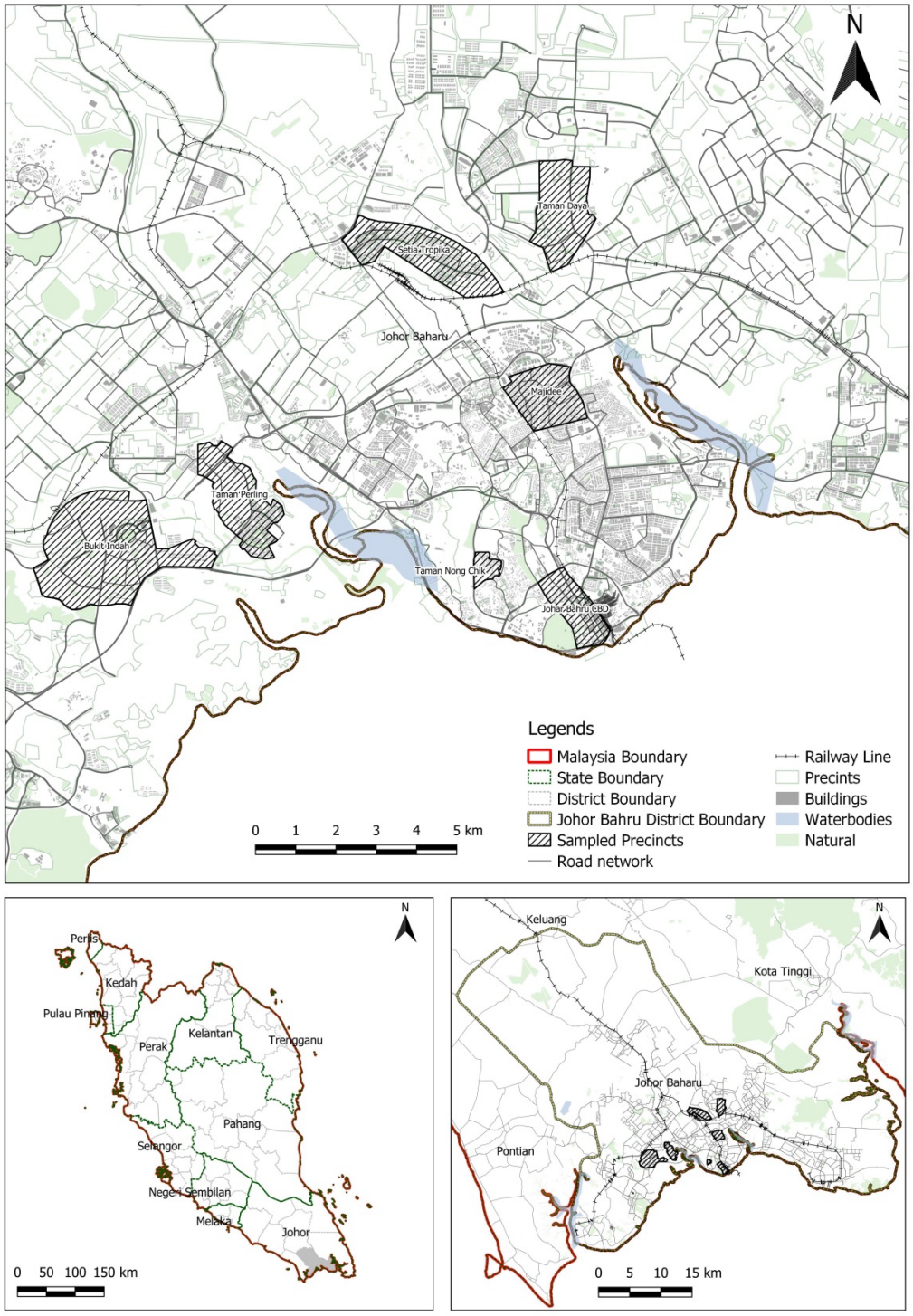

Figure 1. Location of Study Precincts on Johor Bahru

Table1. Details of precincts for sample surveys

Zone	Income	Precinct	Sample Size	Mean distance from CBD
A	High Income	Setia Tropika	24	13 km
B	High Income	Taman Nong Chik	30	6 km
C	Above Average	Bukit Indah	70	17km
D	Middle Income	Taman Perling	50	16 km
E	Low Income	Taman Daya	40	15 km
F	Low Income	Majidee	50	7.5 km

Note: In this study, Mean Distance from CBD was calculated through conducting a field trip in a Car (on arterial and sub-arterial roads) from City Centre to respective locations. Socio-economic status was determined by considering the average income in those areas collected through household surveys in this study.

Selected variables and Analysis Tools

For this study, the Likert scale on five ordinal measures of the agreement was adopted. In the survey, the respondents specified their level of agreement or disagreement for each question. There were three sections in the survey to meet the objectives of the study. The first section (part A) dealt with user characteristics in terms of socioeconomic data. Socioeconomic and demographic characteristics were defined by 19 attributes which include personal income, education, gender, age, family size, ethnicity, occupation, distance from home to workplace or school, the distance between home and CBD, vehicle ownership, number of vehicles owned, number of drivers, marital status, child (<6year old), primary, secondary, and higher school, number of employed and number of unemployed to identify captive users of buses. The second section (part B) was focused on travel behaviour data defined by 15 attributes. In this part, variables reflect reasons for travel like the purpose of travelling, trip time, trip distance, and trip frequency. Other attributes in this group endeavour to describe the availability and quality of public transport include in terms of buses' quality, time spent to access bus stations, or transfer time to identify transport users' mobility level to conduct their daily activities. Finally, the last section of the survey (part C) gathered transport system data by identifying passenger's perceptions about the City Bus services. Seven main attributes were formulated, which include safety, accessibility and mobility, reliability, quality of vehicle environment, transit fare, staff conduct, and information. Sub-attributes were subsequently formed, concurring to precinct-specific transport problems. To develop the inter-relationships between the socioeconomic variables and their trip behaviour, part A and B of the survey questionnaire were used.

Furthermore, the quality-related variables were obtained from natural and built-up environment conditions and the prevailing quality of public transport in the city of Johor Bahru, Malaysia. The attributes were collected based on preliminary discussion and observation of representative users. Perception statements were formulated based on people's opinions and beliefs. The importance of each attribute was obtained by the Analytical Hierarchy Process (AHP) technique. The attribute with the highest score was considered to be salient

according to passenger perception. This analysis provided necessary information about the relative suitability of the attributes underlying the choice of bus travel among individuals, type of trips, and consistency of service.

Many statistical methods were used to analyse the information obtained. Where the ordinal and nominal data were involved, tests included significant difference tests and variability tests, mainly using Chi-square and Cramers' V tests. Focusing on the ratio scale data, the analysis of variances was obtained mainly from F-values and Eta coefficients statistics. Arithmetic Mean, Frequency Distribution, and Standard Deviation were also used. AHP was only adopted to provide the importance of selected attributes and sub-attributes from the public transport users' point of view. The importance of public transport attributes obtained from AHP provided (assisted) the focus groups and steered the focus questions in getting relevant information.

Result and Discussion

Relative Importance and Satisfaction of Attributes

A total of 264 questionnaires was carefully analysed in this study. Table 2 illustrates the basic statistics involving mean responses and standard deviation from all respondents for each sub-attribute.

Table 2. Ranking of attributes

Main attributes (Local Weights)	Sub-Attributes	Local Weight	Global weight	Meana	Std. Deviation	Rank
Safety (0.24)	Weather protection at bus stop	0.46	0.11	3.34	2.84	1
	Pedestrian footpath	0.31	0.07	3.40	1.10	3
	Lateral distance from road	0.23	0.06	3.45	1.09	6
Accessibility and mobility (0.24)	Location of bus stop	0.39	0.06	3.39	1.31	4
	Travel time to the bus stop	0.15	0.06	2.88	1.27	13
	Bus service availability	0.36	0.08	2.84	1.44	9
	Bus network coverage	0.10	0.04	2.89	1.35	17
Reliability (0.17)	Punctuality	0.44	0.11	2.87	3.88	5
	Frequency	0.34	0.04	3.13	1.00	8
	Directness of travel	0.22	0.02	3.12	0.95	15
Quality of vehicle environment (0.12)	Seating	0.30	0.04	3.26	3.62	14
	Air conditioner provision	0.30	0.04	3.53	5.22	11
	Entertainment	0.25	0.01	2.70	1.99	20
	Cleanliness	0.15	0.01	2.78	1.96	22
Transit fare (0.12)	Trip cost	0.42	0.06	3.17	0.80	7
	Fare collection method	0.33	0.04	3.23	2.83	10
	Service quality	0.25	0.02	3.13	1.07	16
Conduct (0.09)	Driver conduct	0.67	0.06	4.42	3.52	2
	Co-passenger conduct	0.33	0.03	4.05	1.28	12
Information (0.04)	Trip timetable	0.31	0.01	3.06	1.17	18
	Other trip schedule	0.30	0.01	2.80	1.16	19
	Bus route coverage	0.22	0.01	2.70	0.97	21
	Fare information	0.17	0.01	2.84	3.79	23

Note. The mean was calculated according to 5-point Likert scale

The importance of the attributes was measured using mean responses measured on a Likert scale of 1 to 5, in increasing order of their importance. According to respondent's perception, drivers' conduct stood out as the most important attribute among 23 attributes securing mean rating scores of 4.4. The second most important attribute was co-passengers' conduct depicting mean rating scores of 4.05 followed by air conditioner provision (3.53), lateral distance from road (3.45), pedestrian footpath (3.40), location of bus stop (3.39), weather protection at bus stop (3.34), seating (capacity) (3.26), fare collection method (3.23), trip cost (3.17), frequency of buses (3.13), service quality (with respect to appropriation of travel cost) (3.13), directness of travel (3.12), trip timetable (3.06). All the above-explained 14 attributes that were used to indicate significance in public bus travel were agreed on a moderate level among different user groups.

Entertainment provision inside the bus turned out to be the least essential sub-attribute with rating mean rating scores of 2.70. Other less important sub-attributes were bus route coverage information, cleanliness of the bus, trip scheduling information (in cases of breakdowns), fare information, bus service availability, travel time to bus stops, and bus punctuality with a mean rating score of less than 3.0. The results showed that none of the attributes presented to the respondents obtained a rating score of less than 2.5, which showed that all of the attributes were relevant and of reasonable significance to respondents.

People with different personal backgrounds were expected to come up with different responses related to the importance of each attribute. As a result, the standard deviation of mean rating scores is used to show if the level of difference is high, which means the attribute is disputed (Ackoff, 1965; Bhat & Lockwood, 2004; Cao & Mokhtarian, 2005). For the five-point Likert rating scale adopted, the standard deviation (S) was found to be 1.41. The standard deviation result shows that respondents did not share similar perceptions about the importance of many public transport service attributes. A closer analysis of the sub-attributes revealed that the provision for air conditioner and its operation (standard deviation of 5.22) was found to be the most contradictory sub-attribute among all 23 sub-attributes. Following the air conditioner sub-attribute, the second refuting sub-attribute was 'punctuality' of bus arrival (standard deviation of 3.880), closely followed by 'fare information' (standard deviation of 3.79). Since nearly 50% of sub-attributes were contentious, the mean alone cannot be considered a reliable method to rank the importance of the sub-attributes. Consequently, AHP was utilised to weigh and rank attributes (Saaty, 1990; 1994). The AHP is used to determine the importance of the pre-selected attributes and sub-attributes defining passenger's perception of the City Bus services of Johor Bahru. Based on this method, the scores are obtained, which provide decision-makers with information about the relative importance of the chosen attributes and sub-attributes. This information substantiates the ranking of chosen attributes presented in Table 2.

The respondents seemed most satisfied with the 'weather protection at bus stops' with the highest score of 0.37. The bus driver's conduct was the second sub-attribute with a score of 0.27 followed by 'pedestrian footpath', and the 'location

of bus stops' revealing scores of 0.25 and 0.21 respectively. On the other hand, the respondents showed the least amount of satisfaction regarding the cost of bus fares. According to the results, people were not satisfied with the travel information provided for bus users. Since it was quite challenging to find needed travel information in Johor Bahru, the only way to obtain such information was by inquiring the driver or commuter passengers. Therefore, the lack of available travel information was seen as an inherent weakness in the existing bus transport system.

Also, people were seemingly dissatisfied with the 'air conditioner provision' (rank 11) and 'cleanliness' (rank 22) in vehicles, which were both sub-attributes in the quality of the vehicle environment. Any plans to rectify and reorganise the public transport system by the concerned authorities must take into account the issues addressed by this research study. Johor Bahru city has already become prone to traffic congestion, increasing the likelihood of drivers' frustration, accidents, and the further derailment of traffic flow.

Income and travel behaviour

Trip characteristics differences were analysed against income level and the number of cars owned and also socioeconomic, demographic data were analysed against bus patronage. Several studies have demonstrated that socio-economic parameters (mainly car ownership & high-income level) including demographic parameters (age, gender & ethnicity) have direct association with Bus patronage. Household and personal income does significantly relate travel either in the usage of Car or patronage towards public transport modes. Therefore, statistical study conducted in this paper tries to examine the strength of this relationship. Respondents trip characteristics were analysed for the different income levels of Johor Bahru (low-income group, (<1500 RM per month), middle-income group (1500-5000 RM per month), and high-income group (>5000 RM per month). Due to inadequate information available from the High-Income Group (HIG), the trip characteristics of HIG were excluded from this study. Therefore, trip characteristics were examined for Low-Income Group (LIG) and Middle-Income Group (MIG) only. Table 3 illustrates the mean and standard deviation of trip characteristics of the respondents according to the income level of the respondents. The data on the ratio scale was analysed by F-Value and Eta coefficient, and the remaining data, which were in nominal scale and ordinal scale, were investigated by Chi-Square and Cramers' V value.

Between ratio scale data, the attribute 'travel time' with an Eta coefficient of 0.53, and the significance of 0.00 has the highest significance difference in different income groups. On a second level 'access time' and 'dwell time' had the most significant difference between attributes. Among ordinal, nominal, and ratio scale data, all attributes except 'transfer time' showed a significant difference concerning income level. The attribute connected to service quality, such as 'transport service' coverage, had the highest significance difference to Cramers' V value of 0.58 and the significance of 0.00. It is followed by attributes such as 'transfer mode' and 'access time' respectively with Cramers' V value of 0.57 and

0.53 and significance of 0.00. Data analysis shows that people with higher income levels live farther from work and recreation places. Although lower-income groups live farther from bus stops, they use public bus services more than higher-income groups. Also, it is observed that lower-income groups are more likely to use taxis as transfer mode than higher-income groups.

Table 3. Income and travel behaviour statistics

Attributes	Income Level (RM)						ANOVA/ Chi-Square/ Cramers V			
	<1500		1500-5000		>5000					
	Mean	S.D.	Mean	S.D.	Mean	S.D.	F-value/ x2	Sig.	Eta/Cramers' V	Sig. of Cramer V
Time for work trips	12.66	12.56	15.11	18.71			7.21	0.00	0.32	
Time for educational trips	2.47	8.78	4.91	9.51	5.28	12.18	1.14	0.32	0.13	
Time for social trips	7.12	12.15	7.23	13.58			2.78	0.07	0.20	
Time for recreational trips	7.60	12.70	10.77	17.95			3.81	0.02	0.24	
Access to bus	0.44	0.40	0.21	0.27			15.26	0.00	0.44	
Travel time	17.16	12.57	6.91	9.11			25.07	0.00	0.53	
Dwell time	7.36	4.93	4.98	6.54			13.06	0.00	0.41	
No. of buses used per trip	0.38	0.56	0.30	0.50			4.06	0.02	0.24	
Transfer mode	0.81	0.40	0.39	0.49			42.73	0.00	0.57	0.00
Trip requency	1.03	0.77	0.45	0.60			47.53	0.00	0.42	0.00
Access time	7.31	6.33	4.46	6.24			74.69	0.00	0.53	0.00
Single vehicle	0.86	0.44	0.41	0.53			45.15	0.00	0.41	0.00
Transfer time	0.17	0.92					2.59	0.27	0.14	0.27
Transport service	0.83	0.38	0.39	0.49			45.15	0.00	0.58	0.00
Bus patronage	1.40	0.82	0.59	0.80			47.15	0.00	0.42	0.00

Note: i) Number of participants (n) = 264, ii) Shaded attributes indicate a significance difference (sig. <0.05) between different attributes

Car ownership and travel behaviour

Trip characteristics in the chosen area were analysed against car ownership per household. According to this classification, respondents were divided into 4 categories (0, 1, 2, and more than 2 cars per household). It is assumed that 0 car households (captive bus users) group are more likely to use public transport as they do not have any private mode availability. The attributes which had a significance difference (sig. <0.05) between different categories were highlighted by dark colour in Table-4. As Table-4 presents, most attributes except four showed significance differences among chosen groups. The attributes which did not have significance differences in different groups are 'time for educational trips', '-social trips', '-recreational trips', and 'transfer time' with significance more than 0.05. In ratio scale data, attributes such as 'travel time' and 'dwell time' represent maximum Eta coefficient of 0.68 and significance of 0.00. Between nominal and ordinal scale based attributes, 'transport service' coverage for the desirable destination has a maximum Cramers' V value of 0.81 and significance of 0.00 followed by attribute 'transfer mode' with Cramers' V of 0.80 and significance of 0.00.

Table 4. Car ownership and travel behaviour statistics

Attributes	Number of car ownership								ANOVA/ Chi-Square / Cramers V			
	0		1		2		>2					
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	F-value/ x2	Sig.	Eta/Cramers' V	Sig. of Cramer V
Time for work trips	21.42	16.23	2.26	6.54	4.74	9.61			17.32	0.00	0.59	
Time for educational trips	1.69	7.94	7.70	10.04	4.43	11.03	6.43	11.07	2.13	0.08	0.25	
Time for social trips	13.19	14.95							13.33	0.00	0.54	
Time for recreational trips	10.50	14.09	2.22	8.47	6.51	16.00	15.00	25.98	2.11	0.08	0.25	
Access to bus	0.47	0.29	0.08	0.24	0.14	0.38			12.90	0.00	0.54	
Travel time	18.98	10.44	2.78	8.36	3.43	7.25			26.62	0.00	0.68	
Dwell time	9.44	4.63	0.93	2.79	2.46	5.17			27.27	0.00	0.68	
No. of buses used per trip	0.60	0.59	0.04	0.19	0.03	0.17			14.76	0.00	0.56	
Transfer mode	0.94	0.25	0.11	0.32	0.20	0.41			83.87	0.00	0.80	0.00
Trip frequency	1.05	0.49	0.33	0.96	0.29	0.62			89.36	0.00	0.48	0.00
Access time	8.60	5.64	0.96	3.17	2.83	6.18			235.23	0.00	0.67	0.00
Single vehicle	1.00	0.31	0.11	0.32	0.20	0.41			87.75	0.00	0.58	0.00
Transfer time	0.16	0.89							2.29	0.68	0.13	0.68
Transport service	0.95	0.22	0.11	0.32	0.20	0.41			87.35	0.00	0.81	0.00
Bus patronage	1.53	0.62	0.22	0.70	0.31	0.68						91.48

Note: i) Number of participants (n) = 264, ii) Shaded attributes indicate a significance difference (sig. <0.05) between different attributes

Statistics show that people who do not have a personal car spent more time in work trips. Moreover, people who have more personal cars live farther from their workplaces. Public bus users are mostly people who do not have a personal car, and they mostly use the taxi as a transfer mode. People who do not have a personal car spend more time to access to the bus station. Such people have significantly longer total 'door-to-door' travel time. 'Door-to-door' travel time is accepted as a good indicator for comparative modal-shift analyses.

Socioeconomic and demographic variables and bus patronage

Socioeconomic and demographic characteristics were analysed according to bus patronage of respondents in years. For this reason, respondents were classified into four groups. The first group contained persons who did not use bus services at all, followed by respondents who used buses less than 2 years, then those who used them between 2 to 5 years and the fourth group those that used busses for more than 5 years. Results indicated significant differences between attributes such as age, distance between home and CBD, number of vehicles owned, number of drivers (per household), personal income, educational status, ethnicity, occupation, vehicle ownership, and marital status. However, attributes such as family size and bus patronage in years failed to establish any relationships. Similarly, the distance between home and workplace/CBD varied among all

income groups and bus patronage. Education status and the number of employed in the household did not show any relationship (Table 5).

Table 5. Socioeconomic and demographic variables and bus patronage

Attributes	Bus Patronage (years)								ANOVA/ Chi-Square/ Cramers' V			
	0 (Non-User)		< 2		2-5		5 <					
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	F-value / x2	Sig.	Eta/Cramers' V	Sig. of Cramer V
Age	36.77	7.36	26.75	8.46	28.45	7.85	41.00	14.14	15.49	0.00	0.52	
Family size	3.84	1.52	3.64	1.81	3.08	2.10	4.50	0.71	1.71	0.17	0.20	
Distance (to work/school)	12.97	7.46	9.07	7.33	11.40	5.09	11.00	8.49	2.14	0.10	0.22	
Distance to CBD	19.50	5.71	22.14	3.65	19.00	2.50	18.50	4.50	3.07	0.03	0.26	
Number of vehicles owned	1.65	0.79	0.21	0.57	0.28	0.68	0.50	0.71	41.46	0.00	0.70	
No. of drivers	1.92	0.77	1.43	1.14	1.10	1.13			6.19	0.00	0.36	
Child (<6 year old)	0.15	0.36	0.18	0.39	0.18	0.38			0.20	0.89	0.07	
Primary school	0.42	0.76	0.50	0.84	0.33	0.62			0.53	0.67	0.11	
Secondary school	0.65	0.94	0.36	0.56	0.45	0.81	1.00	1.41	1.11	0.35	0.16	
Higher school	0.58	1.14	0.57	0.69	0.18	0.50	0.50	0.71	1.88	0.14	0.21	
No. of employed per family	1.79	0.45	1.57	0.88	1.85	1.55			1.49	0.22	0.18	
No. of unemployed per family	0.26	0.48	0.43	0.50	0.15	0.43			2.17	0.09	0.22	
Income	3955	1962	1469	840	1391.25	550.98			95.48	0.00	0.49	0.00
Education	3.55	0.97	2.96	0.92	2.13	0.56	1.50	0.71	64.05	0.00	0.40	0.00
Gender	1.39	0.49	1.50	0.51	1.60	0.50	1.50	0.71	4.50	0.21	0.18	0.21
Ethnicity	1.85	0.67	1.79	0.99	1.73	1.01	3.50	0.71	42.24	0.00	0.33	0.00
Occupation	1.13	0.50	1.93	1.02	1.15	0.53			27.14	0.00	0.45	0.00
Vehicle ownership	1.06	0.25	1.89	0.31	1.73	0.64	1.50	0.71	98.91	0.00	0.61	0.00
Marital status	1.77	0.42	1.29	0.46	1.38	0.49	1.50	0.71	25.41	0.00	0.44	0.00

Note: i) Number of participants (n) = 264, ii) Shaded attributes indicate a significance difference (sig. <0.05) between different attributes

Findings

The main findings from this study can be summarised as follows:

- Bus stop location and its environment were rated highly essential attributes by users of public transport. Even the service quality attributes relating to the cost of fares, the frequency of bus-service, and the availability of seats on the buses were considered attributes that were of great importance.

- Weather protection at the bus stops, the conduct of drivers, punctuality of bus arrival, a method of fare collection, and passenger information was rated high to moderately-important by most bus users. However, satisfaction scores were very low for all bus-related information attributes. Therefore, public transport service operators must improve in the provision and quality of passenger information available by putting it on a website and at bus stops.
- Cleanliness and entertainment in buses, bus network coverage did not appear to be of much concern for bus users' in the study. Such ratings may indicate that bus users' were satisfied with cleanliness in buses, entertainment provided by the bus operators, and the total network coverage of the buses. However, that does not necessarily mean that those attributes showed high or reasonable standards maintained by transport operators. One could argue that the low socioeconomic group people who are the most regular bus users' did not consider the above attributes as an essential requirement than HIG users. Hence, the alternative hypothesis must be tested to substantiate the results.
- Times involved in realising trips for work were maximum among non-car users (captive bus users'). Since low-income groups resided in relatively remote areas, bus routes were not found to cover those areas sufficiently. Despite the fact that low-income people used buses and taxis a lot more frequently, they were found heavily marginalised as they had to travel long distances to reach bus stops. It resulted in needlessly prolonged travel time to work and shopping-related activities.
- Non-car owners (low socioeconomic groups) tend to live in the city area or close to it, where bus transport service is quite frequent as compared to upscale neighbourhoods where multiple car owners (higher income groups) reside. Even though adequate departures per hour are offered in economically impoverished areas, significant deficiencies were reported regarding longer access distances, and time is taken to get to the bus stops by non-car owners, signifying inadequacies in last-mile connectivity. Non-car owners were found to make most trips on average during the week, obviously for work-related travel, which indicated maximum mobility among selected groups.
- The mean age of non-bus users was 39 years. Yet, the routine users were mostly young people (mean age 29 years). Moreover, a very high number of bus ridership were observed to be middle-age people (mean age, 41 years).
- Non-bus users not only had more drivers per household, but they were also more educated corroborating to their standard of living. It needs to be pointed out that non-bus users were found evenly distributed among all ethnic groups in Malaysia.
- Non-bus users constituted mostly of self-employed personnel than regular bus users, who were employed by private and public employers.
- Non-bus users mainly were married, signifying the use of a car as their primary means of travel, whereas bus users were primarily non-married people.
- High ridership of buses was noted amongst people residing in precincts closer to the Central Business District.

The available service quality of public transport buses was found to be highly compromised for lower-income groups, non-car owners, and most frequent bus users, despite being captive users of buses in the city of Johor Bahru. This study showed huge potential for the enhancement and modification of the existing service quality presently offered to such bus users. Higher-income groups indicated their preference for car usage over the bus. One could understandably argue that poor service quality of buses must be a deterrent, but socioeconomic attributes are also responsible. Even though personally driven vehicles provide a certain amount of luxury, convenience, and added mobility benefits to the HIG, but there are definitive merits for them to be encouraged to use bus transit.

Conclusions

The present research on passengers' perception towards effective public transport and evaluating the passenger and travel characteristics of public transport, including attitude towards perception transformation, would be impossible unless the Malaysian Government takes decisive steps in overhauling the bus system. Expanding the new road network in cities is tacitly conducive to more marketing of personally owned automobiles. The National Government policies until the recent past are biased towards promoting personally owned automobiles by economic incentives of cheaper fuel through subsidies, inexpensive road tax, vehicle registration, and insurance, etc. Disincentives such as high parking costs, strict enforcement of parking rules, and road pricing are still not in full maturity stages, rendering people to choose private over the public mode of transport.

Malaysia's transport sector represents a critical driver for socioeconomic development. The growth of convenient and safe public transport will strengthen Malaysia's position as a transport hub for the Southeast Asia region in the future. For that, the Malaysian Government recently launched an ambitious National Transport Policy (2019-2030) aiming to achieve substantial increase in public transport modal share, including doubling of current public transport usage, by the end of 2030 (Ministry of Transport, Malaysia 2019). The new policy has set an objective to improve the consumer experience towards public transport, and for that, the perception of passengers towards public transport is necessary to frame the right set of interventions. Adopting cleaner fuel solutions – such as biodiesel and electric public transport, can achieve the reduction of GHG emission and supports the objective of sustainable transport in Malaysia. The current research on understanding public perception towards the existing public transport, including travel behavior and characteristics, can act as an input for the policymakers to suggest suitable programs for promoting behavioral change.

The world has been witnessing a population surge in cities, and existing transport systems must be improved to reduce the looming threat of climate change, which is omnipresent due to spiking GHG emissions. Such a pressing need to make cities more liveable and sustainable in (ASEAN) countries striving

to become developed nations in the near future necessitates further research to understand the socioeconomic reasons for not choosing public transport.

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