

Factors Affecting Satisfaction and Loyalty in Public Transport using Partial Least Squares Structural Equation Modeling (PLS-SEM)

Shiaw-Tong Ha, Wan Hashim Wan Ibrahim, May-Chiun Lo, Yau-Seng Mah

Abstract: With an increasing number of privately own vehicles in Malaysia, the popularity of public transports is increasingly challenged by ride-hailing services such as Grab, MyCar, JomRides and MULA. To develop effective strategies aimed at retaining users, it is necessary to understand the factors that affect users' satisfaction and loyalty in public transport. In this study, we propose that satisfaction and loyalty in public transport are associated with five key factors: accessibility, reliability, perceived value, comfort, and safety and security. Data collected from a survey of 179 public transport users in Kuching city was used to test the research model. Partial least squares structural equation modeling (PLS-SEM) was used to analyse the data. The main findings were that safety and security, and reliability significantly affected the users' satisfaction and loyalty in public transport, while no statistically significant relationship was found among accessibility, satisfaction and loyalty. These findings not only contribute to the theory development of transportation research but also help practitioners to develop novel strategies aimed at increasing public transport usage.

Keywords : Accessibility, Reliability, Perceived Value, Comfort, Safety and Security, Satisfaction, Loyalty, PLS-SEM.

I. INTRODUCTION

Public transport is an important element to the economic and social development of the nation. Shifting from privately own vehicles to public transport such as buses, rails, taxis, and boats comes with many benefits which include improved air quality, less traffic congestion and lower noise pollution. Nevertheless, the increasing number of privately own vehicles has not encouraged people to use public transport as the main mode of transport [6]. Moreover, with the increasing ownership of vehicles, ride-hailing services such as Grab, MyCar, JomRides and MULA have rapidly increased. These ride-hailing services have been widely used by people in Malaysia because they come with benefits such as easy booking, flat and cheaper rate fees, and shorter wait times.

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One way to increase public transport usage is to retain current users while at the same time attracting new ones. Improving customer satisfaction and loyalty have long been recognised as the key to business success in today's challenging business environments. Not surprisingly, much of the recent studies on transportation research have raised a concern about the study of customer satisfaction and loyalty. In this study, the concept of satisfaction refers to a customer's positive feelings with a service compared to his or her expectations [3], and the concept of loyalty is defined as a customer's intended future usage and willingness to recommend a service based on his or her previous experiences [35], [59], [60].

In order to develop comprehensive strategies that can increase public transport usage, it is necessary to identify the key factors affecting users' satisfaction and loyalty. Although there has been an increasing amount of literature on factors influencing passengers' satisfaction and loyalty, these studies usually measure the factor by using a single item [35]. This study aims to fill the gaps by examining and providing empirical evidence on the relationships between multiple factors and users' satisfaction and loyalty in public transport.

The rest of the paper is organised as follows. Section 2 shows the theoretical context, the proposed research model and hypotheses. Section 3 presents the research methodology of the study which includes research design, measures, data collection procedure and data analysis. Section 4 contains the findings of the study. Section 5 provides a discussion on the findings. Section 6 is the last section of the study and this section presents implications and limitations of the study and recommendations for future research.

II. LITERATURE REVIEW

A. Accessibility

Accessibility refers to the ease in which a passenger can boards and alights the vehicle [15], [60]. Many researchers argue that accessibility is an essential factor affecting the intention of individuals to use public transport and revisit same destination [13], [46], [56]. Indeed, accessibility was found to be a crucial factor in retaining and attracting passengers to experience public transport service in the study of Lai and Chen [41]. Furthermore, other studies have also examined and provided empirical evidence of a positive relationship between accessibility and satisfaction as well as loyalty in public transport [10], [38], [60].

B. Reliability

Reliability is regarded as one of the most important service factors in the public transportation system [8], [49]. It refers to the consistency of public transport's punctuality and on-time performance according to scheduled time [60]. Previous studies suggest reliability should be the focus of service provider as the passengers who are satisfied with the reliability of the vehicles are more likely to satisfy with overall public transportation service [24], [47], [62]. Intrinsically, reliability is directly influencing the intention of users for usage of public transport. For example, Mugjon et al. [48] propounded that reliability is a key component in enhancing the satisfaction and loyalty of bus users. Overall, passengers are likely to be satisfied and loyal if the vehicle consistently operates according to its scheduled departures and arrivals [9], [17], [60].

C. Perceived Value

The concept of perceived value originated in theories of consumer behaviour and reflects the feelings and attitudes of consumers in order to comprehend their tendency to be attracted toward the purchase of certain products [34]. Perceived value is important as it anticipates not only the price of a product but the various factors of psychology that influence a consumer's decision to purchase a product [67]. Conventionally, the perceived value was thought to be a function of a product's price, but a growing number of recent studies have highlighted the importance of 'value for money' as the primary indicator of perceived value [22], [51]. Numerous studies have examined the effects of perceived value on different aspects of users' behaviours such as satisfaction [4], [23], [43]. These findings are also supported by Jen et al. [36] who found that perceived value is the most important predictor of passengers' satisfaction and behavioural intention. Similarly, several studies have also highlighted that there is a positive relationship between perceived value and customers' satisfaction as well as their loyalty [11], [54], [56], [58].

D. Comfort

Public transport comfort is governed primarily by quality accepted globally. Ride comfort is described as facilities usability, comfort for riding, ambient environments, supplementary equipment and ergonomics [32]. In other words, the most fundamental transportation service which, in terms of hedonic characteristics, may refer to the accessory elements of the system that passengers may favourably perceive, such as the perception of the number of seats available, the room available in cars and certain extra facilities such as wireless and air conditioning [2]. Similarly, Le-Klahn et al. [42] clarified that comfort and cleanliness are the most prevalent factors in quality description and user preferences orientation. In addition, in-vehicle crowding is also a significant factor in affecting the public transport experience of passengers, which is linked to overall comfort and safety [7], [16]; [31]. Past studies have found that comfort is strongly associated with perceived passenger satisfaction and loyalty [18], [47], [57]. Recent evidence suggests that comfort as one of the system-related characteristics is crucial in most cities by showing differences in how public transport

is perceived in different travel cultures [30]. According to their findings, the comfort of public transport has a significant impact on both passengers' satisfaction and loyalty, which, in turn, will establish a benchmark for public transport facilities and performance.

E. Safety and Security

The perception of safety and security by the user is linked to general passenger satisfaction and loyalty ([24], [40], [54]). Safety and security can be described as the feeling of safety and security against traffic accident and assaults when passengers waiting at the terminals or using the public transit service [19]. Previous studies identify three aspects of safety and security: safety from crime, safety from accidents and perceptions of security [37], [54], [55]. Recent studies have raised a concern about the importance of safety and security in public transport due to high risk of harassment which produced a more adverse crowding experience [5], [21], [66]. For example, Abenoza et al. [1] found users' perception of safety to be one of the key variables in influencing passengers' travel satisfaction and loyalty. Overall, safety and security appear to be an important factor in assessing the service quality of public transport services.

F. Proposed Research Model and Hypotheses

Based on the above theoretical assumptions, a research model on factors of satisfaction and loyalty in public transport is proposed as shown in Figure 1. In this model, it is expected that accessibility, reliability, perceived value, comfort, and safety and security will affect public transport users' satisfaction and loyalty. Accordingly, the following hypotheses are formulated:

- H1: Accessibility is positively related to public transport users' satisfaction.
- H2: Accessibility is positively related to public transport users' loyalty.
- H3: Reliability is positively related to public transport users' satisfaction.
- H4: Reliability is positively related to public transport users' loyalty.
- H5: Perceived value is positively related to public transport users' satisfaction.
- H6: Perceived value is positively related to public transport users' loyalty.
- H7: Comfort is positively related to public transport users' satisfaction.
- H8: Comfort is positively related to public transport users' loyalty.
- H9: Safety and Security is positively related to public transport users' satisfaction.
- H10: Safety and Security is positively related to public transport users' loyalty.

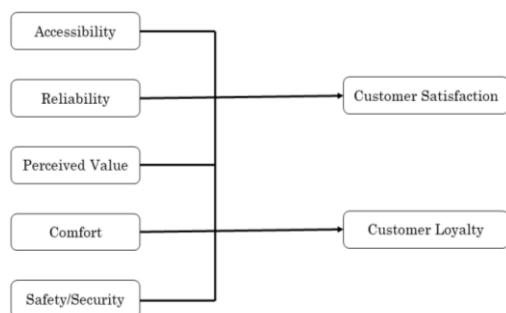


Fig. 1. Research model

III. METHODOLOGY

A quantitative study was conducted in the city of Kuching in Malaysia to investigate the public transport users' perceptions related to the factors affecting public transport use and their satisfaction and loyalty towards public transportation service, using a structured questionnaire. The questionnaire was composed of 41 questions and was structured into two parts. Part A included 8 profiling questions while Part B contained 33 items in regard to accessibility, reliability, perceived value, comfort, safety and security, satisfaction, and loyalty. All items were adapted from the previous studies and slightly adjusted after pre-test survey [8], [29], [33] [35], [36], [44], [62], [65]. These items were measured using a 7-point Likert scale ranging from 1 (Strongly Disagree) to 7 (Strongly Agree).

A survey was conducted on a convenience sample of 500 Kuching citizens. Data collection began on 1 January 2019 and ended on 28 June 2019, with 188 completed questionnaires being returned, giving a response rate of 37.6%. After preliminary data analysis, 179 responses were used for further analysis. Among the 179 respondents, 78.2% were women; the mean age was 30 years old and most of them had a degree or professional qualification. About 55.3% of the respondents had a valid driving license. About 38% of the respondents used public transport one to four times in a week and most of them used public transport for commuting purposes (74.3%). A G*power analysis was used to assess the sufficiency of sample size. The sample size was calculated with a priori analysis at a level of significance of 5% with a power of 80%, effect size of 0.15, and a maximum of 5 predictors. The results of the power analysis indicated that the required sample size if 92 respondents. Thus, it can be assured that the sample size used in this study is sufficient for testing the significance of the hypothesized relationships.

PLS-SEM was adopted in this study to test the proposed model as shown in Figure 1. PLS-SEM was selected for this study to test the relationships for the following reasons. Firstly, PLS-SEM is suitable when the objective of the study is prediction-oriented. Secondly, PLS-SEM is useful for testing a complex model with many constructs and items. Thirdly, the research model can be estimated by PLS-SEM without requiring a large sample size and multivariate normal distribution [27], [53]. SmartPLS 3.0 developed by Ringle et al. [52] was in this study. The research model was assessed following a two-stage procedure: first stage was to evaluate the reliability and validity of the constructs and items (known

as measurement model) and the second stage was to test the research hypotheses (known as structural model).

IV. FINDINGS

A. Assessment of the measurement model

Prior to hypothesis testing, the reliability and validity of the constructs were assessed. As can be seen in Table 1, all factor loadings exceeded 0.50, except for three items in accessibility (ACE_3, ACE_4, ACE_5) and one item in reliability (R_10). These items were tested and removed as the removal of these items improve the model's adequacy. Furthermore, the results show that both composite reliability and Cronbach's alpha values of all measures were above 0.70 and below 0.95, indicating that the measures used in this study were reliable [12], [26], [27]. Convergent validity was verified by Average Variance Extracted (AVE) values. As shown in Table 1, AVE of all constructs was above threshold of 0.5, indicating high convergent validity among constructs.

The discriminant validity of the constructs was first tested using Fornell-Larcker criterion [20]. The results (Table 2) show that the discriminant validity was established as all square root of the AVE (as represented by the bolded values on the diagonals) surpassed intercorrelations with other constructs. Further to that, a new discriminant validity test called heterotrait-monotrait ratio of correlations (HTMT) criterion was performed [28]. The results (Table 3) show that all HTMT values were below the threshold of 0.85 and 0.90 [25], [39]. Based on the results of the two discriminant validity test results, it can be concluded that discriminant validity was established. All these results indicated that the measurement model used in this study was reliable and valid.

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Table- I: Measurement model

Construct	Item	Loadings	Cronbach's Alpha	AVE	CR
Accessibility	ACE_1	0.906	0.750	0.799	0.888
	ACE_2	0.882			
Reliability	R_6	0.877	0.890	0.753	0.924
	R_7	0.744			
	R_8	0.929			
	R_9	0.908			
Perceived Value	PV_11	0.888	0.725	0.654	0.847
	PV_12	0.898			
	PV_13	0.607			
Comfort	C_14	0.563	0.842	0.565	0.885
	C_15	0.713			
	C_16	0.767			
	C_17	0.809			
	C_18	0.808			
	C_19	0.817			
Safety and Security	SCT_20	0.886	0.911	0.790	0.938
	SCT_21	0.914			
	SCT_22	0.889			
	SCT_23	0.866			
Satisfaction	CSAT_24	0.728	0.894	0.707	0.923
	CSAT_25	0.793			
	CSAT_26	0.907			
	CSAT_27	0.884			
	CSAT_28	0.877			
Loyalty	CL_29	0.873	0.895	0.707	0.923
	CL_30	0.862			
	CL_31	0.714			
	CL_32	0.885			
	CL_33	0.860			

Table- II: Discriminant validity

	1	2	3	4	5	6	7
1.Accessibility	0.894						
2.Comfort	0.467	0.752					
3.Loyalty	0.456	0.598	0.841				
4.Perceived Value	0.432	0.517	0.563	0.809			
5.Reliability	0.152	0.366	0.460	0.291	0.868		
6.Safety and Security	0.495	0.706	0.636	0.409	0.472	0.889	
7.Satisfaction	0.444	0.655	0.736	0.455	0.523	0.743	0.841

Table- III: Discriminant validity HTMT

	1	2	3	4	5	6	7
1.Accessibility	[REDACTED]						

2.Comfort	0.586	[REDACTED]					
3.Loyalty	0.552	0.685	[REDACTED]				
4.Perceived Value	0.575	0.671	0.692	[REDACTED]			
5.Reliability	0.197	0.405	0.492	0.353	[REDACTED]		
6.Safety and Security	0.598	0.795	0.699	0.493	0.512	[REDACTED]	
7.Satisfaction	0.539	0.746	0.814	0.549	0.572	0.817	[REDACTED]

B. Assessment of the structural model

A bias-corrected bootstrapping with 5000 resamples was performed using PLS-SEM analysis to test the significance of the relationships between the constructs. The results are shown in Table 4 and Figure 2.



The R² values in Figure 2 show that the five factors: accessibility, reliability, perceived value, comfort, safety and security together explained 63.1% of the variance in satisfaction (R² = 0.631) and 55.1% of the variance in loyalty (R² = 0.551). Referring to Hair et al.[27] categorisation of R², the explanatory power of these five factors on both satisfaction and loyalty can be described as moderate.

As can be seen in Table 4, the majority of the paths were significant at the level of p < 0.05 or higher. Safety and Security seems to be the key factor affecting satisfaction (β = 0.440, p < 0.01) and loyalty (β = 0.295, p < 0.01), therefore H9 and H10 were supported. The contribution of the reliability to satisfaction (β = 0.210, p < 0.01) and loyalty (β = 0.175, p < 0.01) were significant and positive, thus H3 and H4 were also supported. Surprisingly, accessibility does not translate into higher user satisfaction (β = 0.068, p > 0.05) and loyalty (β = 0.100, p > 0.05), therefore H1 and H2 were not supported. The path coefficient between perceived value and loyalty was statistically significant at the level of p < 0.01 (β = 0.278, p < 0.01), thus H6 was supported. However, path coefficient between perceived value and satisfaction (β = 0.085, p > 0.05) was not significant, therefore H5 was not supported. It is also worth noting that the path coefficient between comfort and satisfaction was statistically significant at the level of p < 0.05 (β = 0.192, p < 0.05), but not for the path from comfort to loyalty (β = 0.135, p > 0.05). Therefore, H7 was supported and H8 was not supported.

To provide a better understanding of the relationships between the constructs, effect size values (f²) were examined. The effect size values of 0.35, 0.15, and 0.02 can be considered as respectively large, medium, and small (Cohen, 1988; [27]). As shown in Table 4, majority of the paths had a small effect size (0.044 - 0.116) and only the path from safety/security to satisfaction had medium effect size (0.216).

Table- IV: Hypotheses testing

Hypothesis	Relationship	Std. Beta	Std. Error	t-value	Decision	f ²
H1	Accessibility -> Satisfaction	0.068	0.067	1.011	Not Supported	0.008
H2	Accessibility -> Loyalty	0.100	0.065	1.535	Not Supported	0.015
H3	Reliability -> Satisfaction	0.210	0.056	3.770**	Supported	0.090
H4	Reliability -> Loyalty	0.175	0.059	2.980**	Supported	0.051
H5	Perceived Value -> Satisfaction	0.085	0.064	1.338	Not Supported	0.013
H6	Perceived Value -> Loyalty	0.278	0.065	4.308**	Supported	0.116
H7	Comfort -> Satisfaction	0.192	0.086	2.243*	Supported	0.044
H8	Comfort -> Loyalty	0.135	0.092	1.473	Not Supported	0.018
H9	Safety and Security -> Satisfaction	0.440	0.066	6.701**	Supported	0.216
H10	Safety and Security -> Loyalty	0.295	0.087	3.399**	Supported	0.080

*p < 0.05, ** p < 0.01

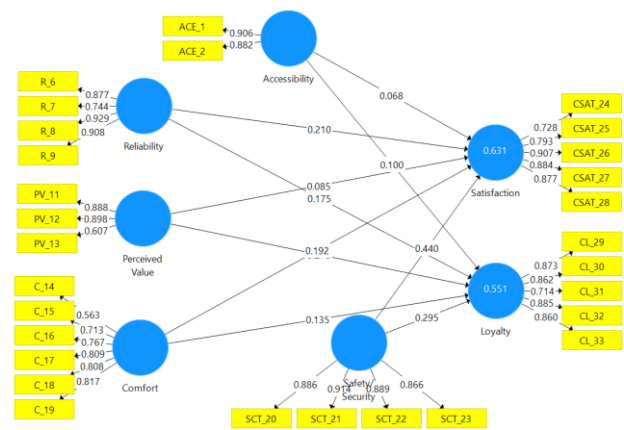


Fig. 2. Results of Path Analysis

V. DISCUSSION

To increase public transport usage, it is important to improve riders' satisfaction and loyalty. Therefore, the main objective of this study is to determine the key factors that affect public transport users' satisfaction and loyalty. The findings show that safety and security, reliability and comfort significantly affect the users' satisfaction towards public transport. In addition, it has been identified that perceived value, safety and security and reliability are the key factors affecting public transport users' loyalty.

Among all the factors, safety and security is the strongest predictor of public transport users' satisfaction. Moreover, it also had a significant positive impact on loyalty. These findings are consistent with previous studies which suggested that passengers' perception of safety and security have a significant positive relationship with satisfaction and loyalty in public transport [1], [5]. In addition, the findings suggested that reliability also had significant positive impacts on both satisfaction and loyalty. Therefore, policymakers of public transport management should make sure their vehicle consistently operates according to its scheduled departures and arrivals [9], [17]. Furthermore, the research findings suggested that perceived value and comfort are also the important factors affecting users' experiences in public transport and are related to satisfaction and loyalty. Perceived value was found to be the most significant predictor of loyalty [54] while comfort significantly affected satisfaction [30]. Surprisingly, accessibility was not found to have significant relationship with both satisfaction and loyalty. This contrasts with the findings of Lai and Chen [41] who found that accessibility is an important factor in retaining and attracting public transport users. A possible interpretation for this result would be due to the inconvenience of accessing the public transport. With limited stations at some parts of the city, it is not convenient for the people especially those who stay far to access to public transport.

The results of this study contribute to theory development by identifying the key factors affecting satisfaction and loyalty in public transport. This study finds strong support for the importance of safety and security and reliability as key factors affecting both satisfaction and loyalty of public transport users. Another notable result in this study is



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that neither satisfaction nor loyalty was significantly affected by accessibility. From a practical viewpoint, the results of this study provide a theoretical reference for practitioners and policymakers of public transport management to develop comprehensive strategies aimed at increasing public transport usage. The results suggest that policymakers should focus on safety and security, reliability and comfort to increase users' satisfaction. On the other hand, the policymakers should focus on perceived value, safety and security, and reliability to retain their customers.

VI. CONCLUSION, LIMITATION AND RECOMMENDATIONS FOR FUTURE RESEARCH

In this study, a model that includes several key factors to predict the users' satisfaction and loyalty in public transport. The results show that two factors: safety and security, and reliability significantly affected both satisfaction and loyalty in public transport. Another notable finding of this study is that accessibility was not significantly affected both satisfaction and loyalty. Furthermore, the results show that satisfaction not significantly affected by perceived value, and that loyalty not significantly affected by comfort.

Although the research objective was successfully achieved, this study is not without limitations. First, since our survey respondents were from Kuching city only, the population of public transport users in Malaysia may not be fully represented by this sample. Therefore, future studies could replicate the proposed model and extend the results by collecting data from more representative samples. Second, the findings of this study were based on cross-sectional survey. Future research could implement longitudinal studies or mixed methods research, to provide a better understanding of factors affecting the public transport users' satisfaction and loyalty. Furthermore, future studies considering other factors such as customer service and quality of transfers are necessary to enhance the model of this study to increase public transport usage.

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