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Transportation Research Procedia 55 (2021) 370–377

Transportation Research Procedia

www.elsevier.com/locate/procedia

14th International scientific conference on sustainable, modern and safe transport

Understanding the public rail quality of service towards commuters' loyalty behavior in Greater Kuala Lumpur

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Abstract

Sustainability in urban transport mechanisms is a matter of significance in developing economies. Assessing the commuters' behavior towards urban transport system facilitates the authorities to devise the policies for the safe and advanced choice of mobility. In the Klang Valley of Malaysia, the personal mobility practices have created the challenges of overcrowding the urban roads with automobile cars which resulted in economic, environmental, and infrastructure losses. The public rail transit system is deemed as the preferable choice of solution. To understand the perception of rail transit service attributes from commuters' viewpoint, a quantitative study was conducted by accumulating Service Quality (SQ) of rail network towards Behavioural Intention or Loyalty (BI) of commuter to use the public transport. Satisfaction (SAT) was added as mediation between SQ and BI. An online survey was conducted that resulted in 141 commuters' responses. The data were analyzed through Structural Equation Modelling (SEM) and it was found that SQ has a positive and significant impact on SAT and BI. The partial mediation was developed from the path analysis of the trio. The study strengthened the vitality of service quality features for enhancing the loyalty of denizens towards public transport mechanism. The research provided the attributes of transport services to focus on more for commuter integration.

Peer-review under responsibility of the scientific committee of the TRANSCOM 2021: 14th International scientific conference on sustainable, modern and safe transport

Keywords: Urban Mobility; Service Quality, Satisfaction,

1. Introduction

Personal mobility arrangements were counted as a status symbol from ancient times. Owning a certain breed of horse or camel was the sense of prestigious significance in society. Similarly, the chariots and horse wagons were introduced for rapid mobility practices, had also crafted classification between the social groups. However, in the last

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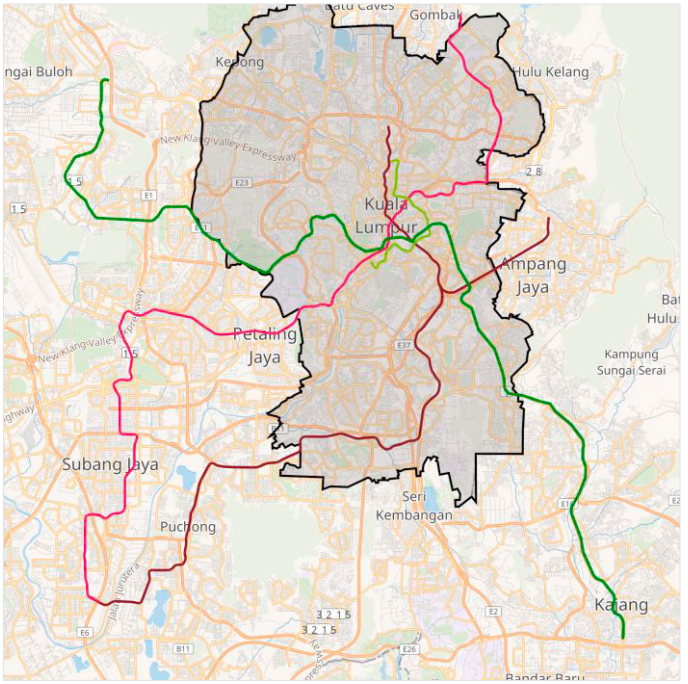
Peer-review under responsibility of the scientific committee of the TRANSCOM 2021: 14th International scientific conference on sustainable, modern and safe transport
10.1016/j.trpro.2021.06.043

century, after the second industrial revolution, the gasoline-powered engines were modeled for personal mobility in the shape of automobile cars. Ford motor company initiated the mass production of affordable cars with attractive taglines such as "put the world on wheels" and "father, mother, child and car" (Kapsch. 2016). This propounding of car purchase behavior appeared in the state of economic development around the globe. As urbanization trended post the third industrial revolution, the lacking in the planning of cities and crowding of cars on the roads generated mobility, environmental, and infrastructure challenges in the cities. Relatedly in Malaysia, the registered personal mobility conveyances (i.e., motorcars and motorbikes) are numbered around 90% of the total population (Lee 2017). The issues of congestion, road infrastructure damages, fuel waste, environmental harms, and psychological aspects of road travelers are the main challenges faced by the authorities in Greater Kuala Lumpur or Klang Valley (i.e., the Kuala Lumpur city and its surrounding districts). Klang Valley is the largest metropolitan terrain with 25% (7.6 Million) of country's population including expats (United Nations 2018). The outnumbered automobiles on roads in Klang valley cost a negative impact on the economy by wasting the citizens' productive time on roads in congestions. It also dwindled the average speed of cars on the main roads which resulted in road impairments and more fuel consumption (Ahmed et al. 2020). To solve these issues, the public transport system (i.e., bus or rail network) needs to integrate into citizen behavior towards regular commute in urban localities.

To manage the urban mobility through rail, "Klang Valley Integrated Transit System" operates multiple services such as LRT (Light Rapid Train), MRT (Mass Rapid Transit), KL Monorail, KTM and airport transit services (i.e., KLIA Ekpress and KLIA Transit) (MOT 2020b). This rail network is connected through each district i.e., Kuala Lumpur, Selangor, Cheras etc. with daily travelers count of 865,713 (MOT 2020a). KTM network covers terrain outside the Klang valley also. The major rail network inside the Klang Valley is operated by Rapid Rail which controls 75% of commuting through 04 services, as portrayed in Fig. 1 (a), i.e., LRT Kelana Jaya, LRT AMPANG, MRT SBK (Sungai Buloh-Kajang) and KL Monorail (MOT 2020c). The classification of commuter ridership in the integrated transit system of Klang Valley is shown in Fig 1 (b) where LRT & MRT has 91% ridership. However, number of public rail commuters among 7.6 million population are lower which necessitates growing towards sustainable urban mobility (Isai et al. 2020; Oña et al. 2016; Ngah et al. 2020). By viewing the personal cars crowding in the context of urban mobility challenges, the crafting of citizen loyalty behavior towards using such public transport services (de Oña 2021) would help to control the personal mobility practices. The studies on public transport assessment towards commuters' satisfaction in Klang valley are limited. Recently a study on moderating the impact of service quality between travel behavior and travel intention was iterated (Ngah et al. 2020) for public transport, however satisfaction level was not considered in the behavioral intention. Another study on KTM service quality was conducted to assess the customer satisfaction(Isai et al. 2020), although loyalty factor was not included, and study was constrained to only KTM train service which operates across the peninsula Malaysia and has less impact on urban mobility practices.

As service quality is profoundly used in public transport assessment around the world with numerous parameters (de Oña 2021; Nguyen-Phuoc et al. 2020; de Oña, Estévez, and de Oña 2020; Esmailpour et al. 2020; Vicente, Sampaio, and Reis 2020; Quddus et al. 2019; Hadiuzzman et al. 2017; Oña et al. 2016; De Oña et al. 2013; Eboli and Mazzulla 2011) towards crafting the public transport satisfaction level (Hadiuzzman et al. 2017; Isai et al. 2020; Zhang et al. 2019) that eventually enhances the behavioral intention to use the public transport or loyalty towards continuous public transport use (Vicente, Sampaio, and Reis 2020; de Oña 2021; Nguyen-Phuoc et al. 2020; Twum et al. 2020; Chen and Shen 2020; de Oña, Estévez, and de Oña 2020). Comprehending the satisfaction level against the rail transit service quality towards the loyalty behavior among the citizen would fortify the efforts to build the sustainable urban mobility practices, however, there is a dearth of research on assessing service quality for commuter satisfaction towards behavioral intention to keep using or attracting towards public rail transport in Klang valley. Therefore, this study aimed to assess the service quality (SQ) of rail transport in Klang Valley (i.e., LRT Kelana Jaya, LRT AMPANG, MRT SBK and KL Monorail) towards the loyalty behavior (BI) of using the services. The intervening role of satisfaction (SAT) was also infused between SQ and BI as highly validated in multi-city public transport analysis(de Oña 2021). The study used primary data to test variables relationship through Structural Equation Modeling analysis.



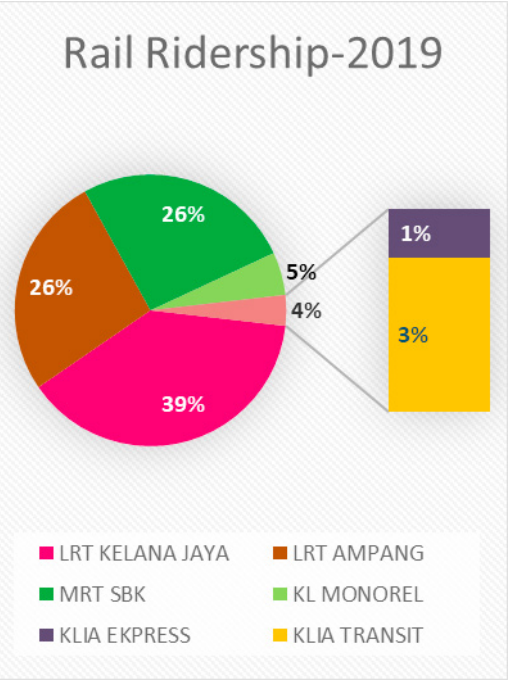


Fig.1 (a). Klang Valley Rapid Rail Network (b). Rail ridership in Klang Valley 2019

By doing so, we proposed the concept of service quality assessment tool towards solving the mobility challenges by creating the statistical association between satisfaction and loyalty.

2. Literature Review

Service quality (SQ) is one of the key concerns in public transport modes including rapid transit (LRT, MRT, Metro etc.), and many reference disciplines steered the status in the present scenario of this phenomenon (Oña, Oña, Eboli, Forciniti, & Mazzulla, 2016; Zhang, Liu, Lu, & Xiao, 2019; Vicente, Sampaio, & Reis, 2020; Oña, Estévez, & Oña, 2020; Oña, 2021). Definitions in enlightening of SQ have usually come from outcomes of service delivery systems. According to Parasuraman, Zeithaml, and Berry (1985), SQ is the difference between service expectations and service perceptions. To more clarify the service quality, the authors categorized the services into three groups, namely intangibility (the inability of assessing the value of services), variability or heterogeneity (the distinctiveness of service offerings), and inseparability (services are undistinguishable by the users). Moreover, the term "SQ" is the direction on the gaps between service-level expectations and the actual services offered (Guo and Bouwman 2016). The wider gaps, the smaller SQ, and the fewer gaps, the higher levels of SQ (Chen and Shen 2020). In line with the emphasis on the SQ assessment in public transport, we included 14 SQ of rapid transit, including safety, security, temperature, cleanliness, information (known as service intangibility); intermodality, proximity, frequency, service hours, punctuality, speed, cost (classified as service variability); and accessibility, individual space (categorized into service inseparability) (de Oña 2021).

The SQ has been widely studied as an influential predictor of both satisfaction (SAT) and behavioral intention (BI) (also known as loyalty). In the last two decades, various studies have carried out integrating these three paradigms in the same frame in terms of the public transit context (de Oña 2021). Looking into public transit commuters, two recent studies confirmed SQ is positively associated with travellers' SAT and BI (Oña et al., 2016, 2020). Using 3211 responses to metro services, Dell'Olio, Ibeas, Oña, & Oña (2018) found that SQ positively and significantly affects both SAT and BI. Analysing the data of 2579 respondents from Europe consisting of five European cities, namely Madrid, London, Rome, Lisbon, and Berlin, Oña (2021) proved that SQ of public transport is a much better forecaster of travellers' SAT and BI or loyalty. In the structural equation modelling (SEM) approach, Shankar and Jebarajakirthy

(2019) and Chen and Shen (2020) showed that SQ enhances the effect of BI or loyalty. After assessing the responses of 349 Ghanaian participants, Twum, Adams, Budu, and Budu (2020) concluded that the perceptions of high service quality provide higher levels of SAT. From this point onward the following hypotheses have been proposed:

Hypothesis 1 (H1): The SQ of public transport has a direct positive effect on commuters' SAT.

Hypothesis 2 (H2): The SQ of public transport has a direct positive effect on commuters' BI or loyalty.

Satisfaction (SAT) is mainly defined as a positive response towards any desire-fulfilment. The most widely accepted concept of SAT is interrelated to post-consumers' experiential values of precise services and, is originated from a comparison of outcomes between the fulfilment or non-fulfilment of the service-expectations (Vicente, Sampaio, and Reis 2020). The commuters' SAT is a term originally used in the public transport system. In our research, the SAT is documented as the level of fulfilment with commuters' desires in terms of travel mode's service. On the other hand, the notion of loyalty and BI has been merged in the field of public transit(de Oña 2021). The author more clarified that no particular distinction exists between these two terms. Therefore, we consider commuters' loyalty and BI as the same construct in this research.

SQ of public transport, commuters' SAT, and BI or loyalty are closely connected as all these constructs embroil with an assessment of service expectations and actual service offerings in public transport modes. However, several studies confirmed the direct positive effect of SAT on BI or loyalty, and at the same time the mediating role of SAT on the relationship between SQ and BI or loyalty. For example, through analysis of large sets of data (i.e., usable data sets of 3211, 1166, 2579 valid responses, respectively), recent researches in public transport found a significant positive effect of SAT on passengers' BI or loyalty, as well as a mediating effect of SAT on the connection between SQ and BI or loyalty (Oña et al., 2016; Vicente et al., 2020; Oña, 2021). In PLS-SEM using 4702 responses of public transport users in urban China, Zhang, Liu, Lu, and Xiao (2019) found a high correlation (0.95) between traveler satisfaction and their loyalty, whereas the full mediation effect of SAT is established on the entire relationship between SQ and traveler loyalty. Based on the path analysis results, the highest effect of SAT on passengers' loyalty is achieved in Nguyen-Phuoc, Su, Tran, Le, and Johnson's (2020) research work in Vietnam, and SAT partially mediates the link between SQ and loyalty. Thus, the subsequent statements are hypothesized in this research:

Hypothesis 3 (H3): The commuters' satisfaction towards public transport has a direct positive effect on their BI.

Hypothesis 4 (H4): Commuters' SAT mediates the relationship between the SQ of public transport and their BI or loyalty.

3. Methods.

Assessing the impact of contextual elements leads to conduct the causal analysis. This study methodology was adopted from Sounders' Research Onion by accommodating the philosophy of research as positivism (i.e., quantitative), approach as deductive, strategy to conduct the research as survey and time horizon as cross sectional (Saunders, Lewis, and Thornhill 2015). An online survey was conducted to collect the random responses from commuters through the close-ended questionnaire. The questionnaire was based on two sections as demographic particulars and variables questions. The questions of variables i.e., service quality (SQ), satisfaction (SAT) and behavioral intention/ loyalty (BI) were adopted from the comprehensive study of Oña (2021) on commuters' satisfaction survey of public transport. The questionnaire items were assessed by the commuters' response through 5 point-Likert scale (as for 14 questions of SQ: "1=very low quality" to "5=very high quality", for 04 questions of SAT: "1=completely disagree" to "5=completely agree", and for 04 questions of BI: "1=completely disagree" to "5=completely agree"). We used the recommended sample size as five to ten times the questionnaire items, proposed by Hair, Black, and Babin (2010). The survey was resulted in 141 responses that were appropriate for Structure Equation Modeling (SEM) analysis. Data were then classified on the basis of demographic features, and analyzed the reliability, validity, factor loadings, model fit indices and path analysis through IBM-SPSS Statistics v25 and IBM-AMOS v24.

4. Results

The demographic features of surveyed respondents depicted that the higher participation induces are as male (58%), 26-35 age group (36%), Bachelor qualified (48%), employees (51%), daily LRT usage (67%) and no possession of

car (70%) as illustrated in Table 01. For SEM analysis, measurement model (i.e., data reliability, validity, outer loadings, correlation, and model fit indices) and structural model (i.e., path analysis or hypothesis testing) were conducted. All the questionnaire items description and their respective means and standard deviation (SD) are presented in Table 2. Towards the reliability and validity of data for SEM analysis, the Cronbach's alpha ($\alpha > 0.70$), Composite Reliability (CR > 0.70), and Average Variance Extracted (AVE > 0.40) were assessed (Awang 2015; Kline 2011; Hair, Black, and Babin 2010) and results showed the data values are reliable and valid by fulfilling the minimum criteria as explored in Table 2.The outer loadings of each item was analyzed against the threshold value higher than 0.50(Awang 2015) and it was revealed that all items lie in the acceptance range as illustrated in Table 2. The correlation among the model variables is limited to the value of 0.90 and in our analysis, as in Table 2, correlation values among the variables are enough to show the positive relationship with each other. The good-model-fit indices are the preceding step towards path analysis. In Table 3, CMIN/DF(1.731), CFI (0.905), SRMR (0.069) and RMSEA(0.072) concluded the satisfactory level of absolute fit, incremental and parsimonious fit indices (Awang 2015). By fit indices, the measurement model is proved valid, reliable, and fit for further analysis.

Table 1. Demographic results

Gender %	Age (years) %	Education %	Profession %	LRT Use %	Car Possession %
Male = 58	15-25 = 33	Diploma = 12	Student = 37	Daily = 67	0 = 70
Female = 42	26-35 = 36	Bachelors = 48	Employee = 51	Weekly = 24	1 = 26
	36-45 = 20	Masters = 29	Businessman = 12	Monthly = 9	2 = 4
	45 & Above = 11	Doctorate & Above = 11			

Table 2. Items description, Means, Standard Deviation, Outer loadings, Reliability, Validity and Correlation

Variable	Item	Description	Means	S.D.	Outer Loadings	α	C.R	AVE	(SQ)	(SAT)	(BI)
Service Quality (SQ)	SQ1	(Service hours)	3.752	0.719	0.584	0.886	0.904	0.404	1	-	-
	SQ2	(Proximity)	3.752	0.656	0.674						
	SQ3	(Frequency)	3.766	0.651	0.602						
	SQ4	(Punctuality)	3.865	0.749	0.573						
	SQ5	(Speed)	3.766	0.723	0.558						
	SQ6	(Cost)	3.752	0.688	0.628						
	SQ7	(Accessibility)	3.731	0.631	0.626						
	SQ8	(Intermodality)	3.801	0.678	0.649						
	SQ9	(Individual space)	3.809	0.696	0.605						
	SQ10	(Temperature)	3.787	0.725	0.502						
	SQ11	(Cleanliness)	3.695	0.585	0.509						
	SQ12	(Safety)	3.660	0.695	0.596						
	SQ13	(Security)	3.801	0.624	0.648						
	SQ14	(Information)	3.809	0.696	0.618						
Satisfaction (SAT)	SAT1	(General satisfaction)	3.688	0.698	0.731	0.855	0.902	0.699	0.522	1	-
	SAT2	(Expectations)	3.801	0.749	0.851						
	SAT3	(Needs)	3.780	0.728	0.876						
	SAT4	(Global experience)	3.738	0.693	0.659						
Behavioural Intention / Loyalty (BI)	BI1	(travel one-off trips)	4.050	0.730	0.847	0.939	0.957	0.846	0.527	0.636	1
	BI2	(Travel regular trips)	4.128	0.716	0.915						
	BI3	(increase commuting)	4.121	0.722	0.884						
	BI4	(recommending others)	4.128	0.735	0.923						

In the structural model, the path analysis is explained by hypothesis testing. Here in Table 4, all the hypotheses are supporting the criteria of critical ratio (C.R>1.96) and significance value (P-value<0.05). The indirect impact of SQ on BI through SAT is analyzed through PROCESS function in SPSSv25 which showed 36% indirect impact on BI. As values of BootLLCI and BootULCI were not equal to zero with 95% confidence interval and 5000 samples of bootstraps, the indirect impact is resulted as significance (Hayes 2017). The beta estimate values described the strength of regression relationship in the respective hypothesis as described in Table 4. The overall impact of both variables (SQ and SAT) on behavioral intention or Loyalty (BI) is positive and 46% as illustrated in the structural model (see Figure 2) and Table 4.

Table 3. Model fit indices

Model Fit Parameter	CMIN	DF	CMIN/DF	CFI	SRMR	RMSEA
Resulted Values	356.55	206	1.731	0.905	0.069	0.072
Standards	--	--	Between 1 and 3	>0.95	<0.08	<0.06
Status	--	--	Excellent	Acceptable	Excellent	Acceptable

Table 4. Path analysis

	Hypotheses	Estimate	S.E.	C.R.	P	Status	R-squared
H1	SQ→SAT	0.568	0.13	4.367	0.000	Accepted	0.27
H2	SQ→BI	0.395	0.14	2.829	0.005	Accepted	0.46
H3	SAT→BI	0.672	0.139	4.827	0.000	Accepted	
	Indirect Effect	**Effect**	**BootSE**	**BootLLCI**	**BootULCI**	**Partial Mediation**	
H4	SQ→SAT→BI	0.3659	0.1072	0.1424	0.5591	Accepted	

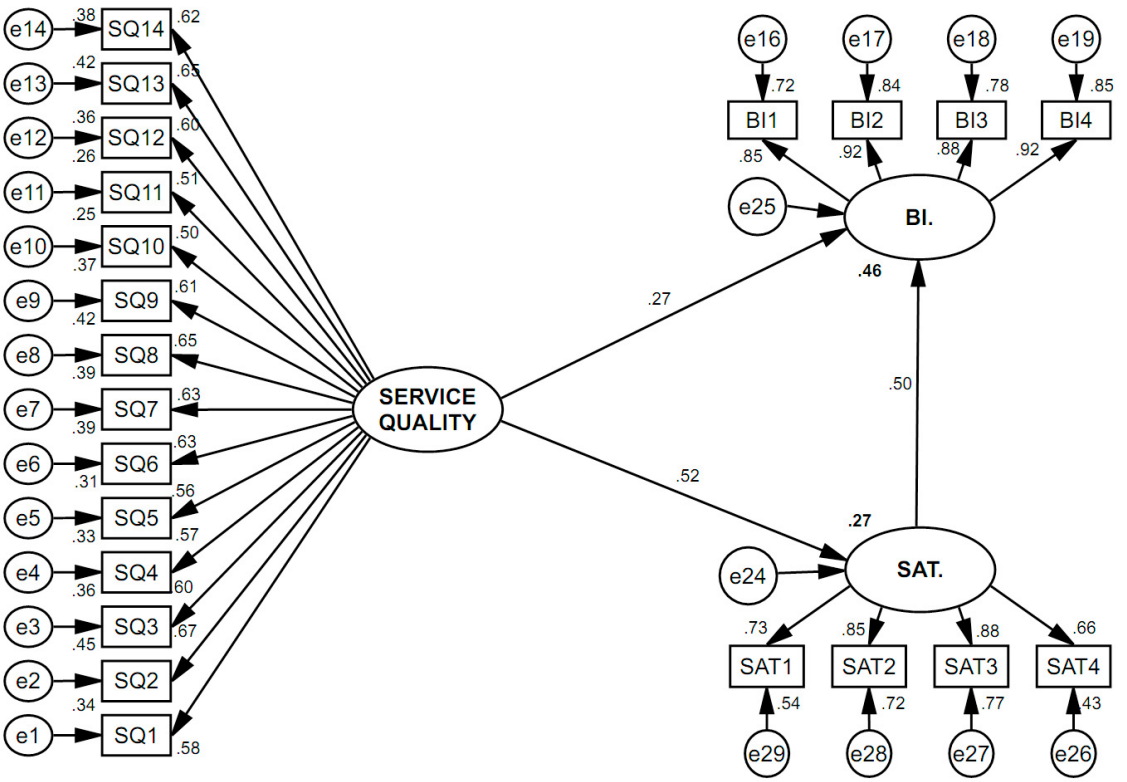


Fig.2. Structural Model

5. Discussion

The SEM analysis portrayed that SQ and SAT can shape the loyalty behavior towards the rail transit system with 46% positive intentions (i.e., R-squared=0.46). It also represents that rail transit in Klang valley is quite useful in terms of commuters' satisfaction level. The beta estimate of hypothesis 3 (H3=SAT→BI) showed that SAT happened to be the most vital and significant predictor towards behavioural intention with the value of 0.672 and a higher critical ratio. The reason for such a higher satisfaction level lies in the quality of services being rendered to commuters. In such services, citizens responded with the positive perception values for ample individual space, timely and punctual schedule, information dissemination, and security levels. The main service of the rail network that was positively assessed by commuters was intermodality that describes the combination of numerous modes of mobility in a convenient form. However, as per the given responses through the 5 point-Likert scale, the means showed the quality level for each service, the safety services should be more improved. The research is the initial step towards commuters' satisfaction studies in Malaysian metropolitan. The connection of loyalty of public transport utility will support the safe and sustainable urban environment. The study will enhance the body of knowledge towards mobility and urban user behaviour. As per the quality preference, the higher 18% of respondents considered the punctuality as "very high quality" while only 4% of respondents marked cleanliness as "very high quality". As the survey was conducted during the COVID-19 era, the level of cleanliness might differ from normal times. It will support the authorities to look over the services and service delivery. As the safer level of onboard the train services enhance the valuable endeavours during traveling, it can boost the loyalty of commuters eventually (Ahmed et al. 2021). The hypothesis 4 result depicted the partial mediation between SQ and BI through SAT which is a variant from the previous study(de Oña 2021). As full mediation was resulted in 05 cities of European countries, while our different inference might have based on the disparity of geographical proposition, level of awareness, service structure, and personal experience, etc.

This research highlights several limitations in which further studies may involve. Firstly, this research was confined to public transport in Greater Kuala Lumpur. However, commuters' perceived SQ in public transport is an explicit form of a social phenomenon (Nguyen-Phuoc et al. 2020; Dell'Olio et al. 2018; de Oña, Estévez, and de Oña 2020). Hence, further research is needed to replicate with commuters' evaluation towards SQ of public transport in different cities for comparative analysis (i.e., Jakarta, Manila, Singapore, Bangkok, and Hanoi etc.) contexts to improve the generalizability of the results, as well as for a cross-country analysis. Secondly, we generalized our research findings based on a small data set. Therefore, analysing larger data sets from the target population would deliver useful insights into public transport providers' actions designing SQ management practices to attract particular public transport users (Oña et al., 2016; Zhang et al., 2019; Vicente et al., 2020; Oña, 2021). Moreover, we gathered the data at a single point in time, rather than over a while. Due to technological innovation, travellers' perceptions of SQ in public transport are likely to be changed over time. This directs that repeating this research with longitudinal data might lead to more robust findings.

6. Conclusion

The study aimed to understand the behavior of Klang Valley's netizens towards the rail transport system through the quality of service. Inferences signalled constructive behaviour towards the LRT and MRT service features. Service attributes that perceived better were named as security, individual space, intermodality, and information. The study will support transportation and behavioral science literature with theme of urban mobility. The 30% of respondents were owning the cars who showed loyalty towards public transport use. Further studies on private car owners would enhance the body of knowledge and can encapsulate the numerous factors such as involvement, income level, social influence, social responsibilities, and citizen behavior, etc. towards netizens engagement for public transportation.

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