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Service Quality Performance of E-Hailing Services in Sarawak, Malaysia

Anita Rosli *

*Corresponding author, Ph.D., Department of Social Science and Management, Faculty of Humanities, Management and Science, Universiti Putra Malaysia Sarawak, Nyabau Road, 97008 Bintulu, Sarawak, Malaysia. E-mail: anitarosli@upm.edu.my

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Abstract

With the advancement of communication technology, e-hailing services are becoming more widespread in Malaysia. Even though e-hailing services offer relative advantages compared to other types of public transport, research on the service quality aspects and customer satisfaction is essential to ensure customers receive worthwhile service with the money they spend on the services. Therefore, the growth of the e-hailing sector in Malaysia has drawn attention from the government, service providers, passengers, and even academics to the issues of service quality and customer satisfaction. Much research on service quality has been conducted in Malaysia; however, limited research has yet to be done on e-hailing services specifically for the state of Sarawak (East Malaysia) compared to peninsular areas. Thus, this research aims to measure the service quality performance of e-hailing in Sarawak and investigate the factors influencing passenger satisfaction. Three hundred ninety-two e-hailing users voluntarily participated in the survey, which was conducted in 2023. The partial least squares structural equation modeling (PLS-SEM) was performed to assess the measurement and structural model. The analysis revealed that vehicle condition, customer service, and reliability have a significant one-percent relationship with passenger satisfaction. To ensure e-hailing vehicles are always in good condition, e-hailing companies and government agencies must make it mandatory for e-hailing cars to be maintained periodically. Next, the driver should improve communication skills and show a good attitude to provide excellent customer service. Besides, prompt response to customer orders is a must to ensure e-hailing services are reliable public transportation.

Keywords: Public transportation, E-hailing industry, PLS-SEM, Sarawak

Introduction

The phenomenon of the "sharing economy," also known as "property sharing," marked the introduction and rapid growth of a new generation of sharing services based on digital multi-sided platform economies, partially made possible by the spread of smartphones (Bergh, Funcke, & Wernberg, 2021). A sharing economy is a process of reciprocal exchange where different individuals share their goods with others for use through digital platforms (Andreotti et al., 2017). The concept has been applied in various industries, including the transportation sector. "Shared mobility" is one subclassification of the "sharing economy" that emerged within the transportation industry. The concept of shared mobility is distinguished from the conventional methods of public transportation, whereby e-hailing, ride-sourcing, ridesharing, and carpooling services are provided to complement the needs of designated customers (Shaheen et al., 2015; Ahmad & Azizan, 2020). In Malaysia, those public services are known as "E-Hailing," while in North America and Europe, these services are known as "Ride-Sourcing" or "Ride-Hailing" (Shaheen et al., 2015).

The emergence of the Internet of Things (IoT) and mobile applications has changed the pattern of public transportation services. E-hailing services are private vehicles that provide public transport to passengers who utilize the internet and mobile apps for their services. E-hailing services have been a significant disrupter in the transportation industry since the introduction of Uber in 2009 and have rapidly gained popularity among the public as mobile internet users have grown tremendously recently (Abdul et al., 2022). Besides, e-hailing services are also known as on-demand vehicle acquisition that rely on network dependency and a specific digital application through the Internet (Ahmad & Azizan, 2020). With the advancement of technology such as the Global Positioning System (GPS) and software applications, E-hailing services are becoming more widespread in Malaysia.

Seven e-hailing companies have been operating in Malaysia, including Grab, Uber and Mycar, Maxim, Buddy Driver, Indriver Malaysia, and Kumpool. Statista (2024) reported that the number of e-hailing users has been increasing from 8.12 million in 2017 to 8.82 million by 2023 and is expected to amount to 9.95 million users by 2028. Next, according to Transport Minister Anthony Loke, the number of trips recorded by e-hailing companies has increased from six million trips in 2016 to 18 million trips in 2020, generating a total of RM2.8 billion (USD0.58 billion) revenue in 2020. Thus, this growth has hugely benefited consumers looking for convenient and affordable options for getting around (Ezdom, 2020).

Malaysians' preferences for private vehicles, shorter travel distances, and convenience are satisfied by e-hailing (Marlisa et al., 2023). E-hailing services are easy to access, flexible compared to scheduled buses, and cheaper than a taxi and rental cars or vans. E-hailing services are initiated due to the inefficiency and gaps found in the traditional transportation systems within the first and last-mile connectivity, as well as alternative transportation solutions that are convenient and affordable (Rajendran & Wahab, 2022). The availability of

e-hailing services also helps reduce the grievances of passengers towards the conventional taxi providers, which, most of the time, are inefficient, indiscipline, rude drivers, stinky cabs, and have been known to overcharge (Abdul et al., 2021). Besides, the e-hailing industry provides flexible employment opportunities for working persons, students, and even housewives to have a side income source as e-hailing drivers. The Star in 2019 reported that the total number of drivers in Malaysia alone reached the number of 200,000, with three-quarters of them being part-timers (Lai & Hendawy, 2019).

Problem statement

Even though e-hailing services gain relative advantages compared to other types of public transport, research on service quality is essential to ensure customers receive worthwhile service with the money they spend on the services. There are numerous studies about service quality and customer satisfaction in the e-hailing industry in Peninsular Malaysia. However, more research on e-hailing services has yet to be done in Sarawak state (East Malaysia). Recent research focusing on e-hailing services in Sarawak was conducted by Nur et al. (2019). The study investigated the intention of undergraduate students to use the Grab e-hailing services at Universiti Malaysia Sarawak (UNIMAS), Malaysia.

Since then, there has been yet to be an extension or generalization of research on e-hailing service to a broad community in Sarawak state. Besides, this research is also an extension of the previous research by Anita et al. (2024), as their study just focused on general service quality dimensions for all types of public land transportation. Thus, this research fills the gap of the previous research with a new conceptual framework and research findings. The continuous monitoring of e-hailing services is critical, but the lack of data might hinder growth, especially in customer acceptance and satisfaction with Malaysia's E-hailing services (Yee & Mad, 2022; Abdul et al., 2022).

Therefore, the main objective of this research is to investigate the service quality performance of e-hailing in Sarawak that influences passenger satisfaction. The research findings will provide valuable insights to policymakers, e-hailing service providers, and relevant parties to identify service quality dimensions affecting user satisfaction. The emergence of the e-hailing industry and its significant contribution to the economic, social development, and transportation sector motivates this research to investigate further the service quality dimensions of e-hailing in Sarawak.

Literature Review

Customer satisfaction and service quality

Customer satisfaction and service quality attributes are closely related. The success of a business relies on how good product or service quality delivery meets customer expectations and satisfaction. Customer satisfaction is the degree of experience with the product that determines customer happiness (Athirah et al., 2020). Meanwhile, service quality is a

relationship between the expectations and perceptions of the service when the service quality exceeds or meets the customers' expectations (Parasuraman, Zeithaml, & Berry, 1985).

In the service sector, service quality is vital for customer satisfaction and a key indicator of business performance. Improving services to meet customer satisfaction and performing their promise is essential to customer perception (Nur' et al., 2019). When customers are happy and satisfied with the services provided, they will return, and they are more likely to become loyal customers and promote the business's products or services to everyone else (Marlisa et al., 2023). However, service quality is subjective as it is based on customer perception of specific characteristics as service quality that will fulfill their needs and expectations. According to Kang and James (2004) and Wu and Ko (2013), service quality is subjective, illusive, and abstract due to its intangible nature, making it challenging to offer a comprehensive and uniform measurement. In conclusion, customer or passenger satisfaction is about their expectation, experience, perception, and assessment of the consumption of public transport services.

Service quality dimensions of e-hailing

As numerous studies on service quality and customer satisfaction with e-hailing services have been conducted, various dimensions or attributes of service quality have been used. Table 1 shows previous studies on service quality and customer satisfaction with e-hailing services. The SERVQUAL dimension introduced by Parasuraman and Zethami (1985) has been widely utilized to conduct e-hailing research. However, much previous research used other service quality dimensions to measure customer satisfaction. The selection of service quality dimensions is subject to service quality criteria that they want to measure and based on the environment of the research location. For this research, the selection of service quality dimensions or attributes is determined based on indicators or attributes of the previous research. The details about service quality dimensions used for this research will be explained in the next section.

Table 1. Service Quality Dimensions of E-Hailing Services

Author (year) and Country	Service quality dimension
Norizzati, Mariati, & Gobu (2018) Country: Ipoh, Perak (Malaysia)	SERVQUAL Parasuraman and Zethami (1985) (tangibility, responsiveness, empathy, reliability, assurance)
Chia et. al. (2019) Country: Kuala Lumpur, Malaysia	
Aryo, Haryadi & Andika (2018) Country: Jakarta	
Rachbini, Anggraeni, & Febrina, (2020). Country: Indonesia	
Surya & Surtiningsih (2019) Country: Indonesia	SERVQUAL Parasuraman and Zethami (1985) (tangibility, responsiveness, empathy, reliability, assurance), price
Sharmila, Md & Mohammad (2021) Country: Bangladesh	
Yee & Mad (2022) Country: Malaysia	SERVQUAL Parasuraman and Zethami (1985) (tangibility, responsiveness, empathy, reliability, assurance), waiting time, valence

Author (year) and Country	Service quality dimension
Azlia et. al. (2018) Country: Klang Valley, Malaysia	mobile app, punctuality, safety, comfort, price
Nur, Menudin & Nooraneda (2019) Country: Malaysia	perception measurement: service quality, customer satisfaction, brand image
Nur et. al. (2019) Country: Sarawak, Malaysia	social marketing, price. reliability, customer satisfaction
Wan et. al. (2020) Country: Klang Valley, Malaysia	service quality, price, comfort
Nur, Hazura & Ruzzakiah (2020) Country: Malaysia	DART model (dialogue/ communication, accessibility, risk assessment, transparency)
Ruzzakiah et. al. (2021) Country: Malaysia	
Mohamad, Sabiroh & Najiah (2021) Country: Perlis, Malaysia	safety and security, price, convenience, accessibility
Atheria, Michele & Jugindar (2021) Country: Malaysia	economic, social, environmental
Wan et. al. (2021) Country: Malaysia	service quality, price, comfort
Abdul & et. al. (2021) Country: Malaysia	price, reliability, safety, app's function, timeless
Salman et. al. (2021) Country: Malaysia	relative advantage, ease of use, trialability, social influence, safety
Lima & Fernandez (2022) Country: Malaysia	vehicle condition, polite attitude, safety, waiting time, cost
Daphine & Muhammad (2022) Country: Malaysia	mobile payment, price, perceived convenience, perceived ease of use
Felina et. al. (2022) Country: Malaysia	perceived ease of use, security, perceived value
Marlisa et. al (2023) Country: Malaysia	promotion, safety, reliability
Nguyen & Tran (2018) Country: Vietnam	service quality, system quality, information quality, content adequacy, content usefulness
Hau & Nguyen (2020) Country: Vietnam	reliability, information, responsiveness, dignity, tangibles, price
Nguyen & Hoang (2022) Country: Vietnam	perceive service quality: functional quality, technical quality, information quality

Framework and hypothesis of research

Figure 1 shows the conceptual framework of this research. There are five service quality dimensions, i.e., vehicle condition, convenience, customer service, reliability, and safety. Vehicle condition refers to the physical appearance of the private vehicle for E-hailing services. The physical appearance of the vehicles is often categorized as a tangibility dimension that focuses on the physical quality of the tangible assets and equipment (Chica-Olmo, Gachs-Sánchez, & Lizárraga, 2018; Parasuraman & Zeithaml, 1985). For this research, indicators for the vehicle's physical condition are the vehicle's cleanliness (inside and outside), comfortable seat, ample legroom, air conditioning, luggage space, and vehicle maintenance based on passenger perception. Passengers value the interior vehicle's cleanliness, lifespan, and equipment when evaluating E-hailing services (Yee & Mad, 2022). Passengers need public transportation with proper luggage space, comfort, ample leg room, good air conditioning, and well-maintained (Anita et al., 2024). Besides, several policies that

require all e-hailing vehicles to undergo authorized inspection within a shorter interval can boost user satisfaction (Azlia et al., 2018). For instance, in Malaysia, vehicle inspections have been undertaken by Puspakom Sdn Bhd for public transport such as taxis and e-hailings.

Availability, frequency of services, flexible waiting places, and payment methods represent the convenience dimension. E-hailing services have high availability and frequency because they are on-demand and flexible compared to other types of public transport, such as buses, which must follow the schedule. E-hailing services are available 24 hours a day, seven days a week, and late-night public transit is difficult to get by, and most public transportation stops running after a specific time (Daphne & Shafi, 2022). Next, e-hailing is a door-to-door trip, and waiting places are flexible as long as the e-hailing mobile apps can detect the passenger's location. Unlike public bus services, where passengers must stay at the bus stop to get the service, the bus stop may be far from the passengers' houses. Next, e-hailing gained popularity because they are cashless and adopted the innovation of a mobile payment method where the passenger could pay the fare through a mobile application (Daphne & Shafi, 2022; Rayle et al., 2014). Consumers who own smartphones will likely have easy access to e-hailing services and may be more likely to adopt e-hailing (Teo, Mustaffa, & Mohd, 2018).

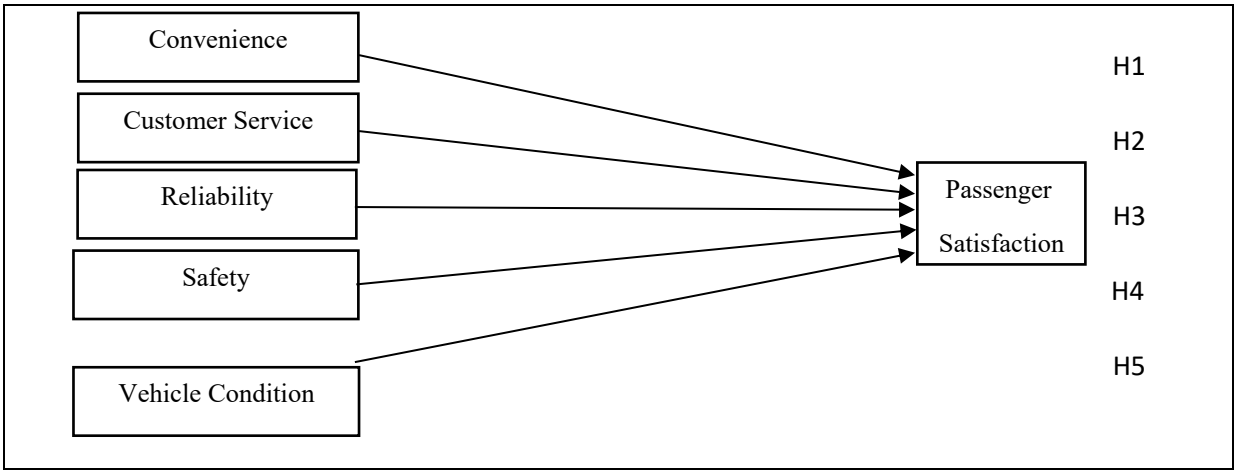

Figure 1. Conceptual Framework

Favorable customer service experiences are crucial for the success of a company's offering (Azlia et al., 2018). The customer service dimension includes driver attitudes, readiness to serve, responsibility, and courtesy. To improve service quality and increase customer satisfaction, the drivers must display sincerity and responsiveness in their services, possess a trustworthy attitude towards the passengers, communicate with passengers to understand their needs, and respond to their inquiries or even complaints (Yee & Mad, 2022; Olawole, 2021). Showing their responsibility during the service process may help customer satisfaction (Fatima, Malik, & Shabbir, 2018).

Reliability refers to an organization's ability to perform the service accurately and dependably (Chia et al., 2019). In transportation service, reliability involves the ability to deliver a service regularly and punctually. For the ridesharing service quality dimensions,

factors including destination arrival, communications, scheduled routes, and journey length are vital components (Abdul et al., 2022). For this research, punctuality, waiting time, and vehicle breakdown are reliability indicators. In the public transport industry, providing promised services to consumers, such as conveying consumers to a particular place within the defined time range and being on time, can improve the reliability aspect of public transport service (Hamzah et al., 2023). Excessive waiting time can lead to negative consequences for passengers, such as being late to attend meetings or missing out on an opportunity, and they are unsatisfied or frustrated (Yee & Mad, 2022; Brown & LaValle, 2021). Next, one element that passengers worry about is when the vehicle suddenly breaks down during the service. Previous research found that the best age limit for cars for e-hailing services should be at most five years (Mohamad, Sobiroh, & Najiah, 2021; Salleh et al., 2021). Therefore, it is essential to maintain vehicle conditions among e-hailing drivers to ensure the vehicles are safe for passengers and they are experiencing a smooth trip.

Functioning seat belts, driving attitudes, speed, and feeling secure during the journey with e-hailings are indicators of the safety dimension. Security inspection is an essential factor that can attract customers to take up e-hailing services where rules and legislation are ready to ensure that e-hailing service is assured of security (Mohamad, Sobiroh, & Najiah, 2021). Travel speed and personnel/driver behavior are the most critical factors driving public transport (PT) satisfaction (Mouwen, 2014). Then, according to Choy & Mad (2022), the driver's skills will instill a sense of security in the passengers, allowing them to feel safe and confident that the e-hailing services will deliver them to their requested destination on time.

In the public transportation industry, passenger satisfaction is achieved when the service meets the needs and expectations of the passengers (Olawale, 2021). When service is conveyed timely and fulfills clients' needs, consumers perceive that the service quality is of a high standard (Fattah, 2015). Overall satisfaction, the efficiency of the journey, and vehicle condition are indicators for this dependent variable.

Hypotheses of research

Five research hypotheses are constructed to achieve the second objective of the research, which is to investigate service quality factors that significantly determine passenger satisfaction. The hypotheses are:

H1: There is a significant relationship between convenience and passenger satisfaction.

H2: There is a significant relationship between customer service and passenger satisfaction.

H3: There is a significant relationship between reliability and passenger satisfaction.

H4: There is a significant relationship between safety and passenger satisfaction.

H5: There is a significant relationship between vehicle condition and passenger satisfaction.

Methodology

Data collection and analysis method

Survey research was conducted in 2023 to collect e-hailing users' opinions about the service quality of e-hailing services in Sarawak using questionnaires. The questionnaire consists of two main sections: passenger profile and perception of service quality. Five Likert scales are used to measure users' perceptions of the service quality attributes: very dissatisfied (1), dissatisfied (2), neither dissatisfied nor satisfied (3), satisfied (4), very satisfied (5). The 10 main divisions in Sarawak were involved in this study: Kuching, Samarahan, Serian, Sri Aman, Sarikei, Sibu, Mukah, Bintulu, Miri, and Limbang (refer to Figure 2). A convenience sampling method was applied to this study. The questionnaire was distributed to e-hailing users who were voluntarily involved in this survey through Google Forms. A total of 261 respondents voluntarily participated in the survey, and the sample size is sufficient to conduct the research (refer to Table 2). Most of the time, a sample size between 160 and 300 is well-suited for statistical analysis, such as CB-SEM and PLS-SEM (Memon et al., 2020).

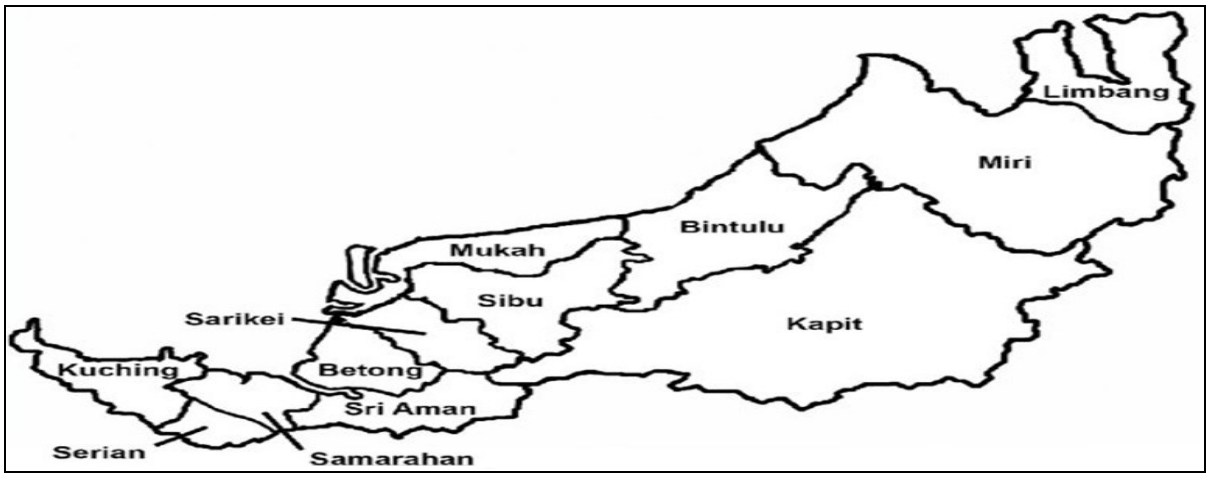

Figure 2. Sarawak State Map

Source: Dow (2021)

Table 2. Number of Respondents

Sarawak State Division	No. of respondents	%
Betong	6	2.3
Bintulu	32	12.3
Kuching	105	40.2
Limbang	5	1.9
Miri	38	14.6
Mukah	7	2.7
Samarahan	23	8.8
Sarikei	5	1.9
Serian	8	3.1
Sibu	26	10.0
Sri Aman	6	2.3
Total	261	100.0

Two main analysis methods were used to achieve the research objectives: descriptive analysis and structural equation modeling (SEM). IBM SPSS Statistics version 27 was used for descriptive analysis, and Smart-PLS 4.1.0 was used to run the SEM. Descriptive analysis summarizes respondents' profiles and the frequency of responses to service quality attributes. In contrast, SEM is used to analyze measurements and structural models. The assessment of the measurement model is focused on reliability and validity, including consistency reliability, convergent reliability (outer loadings and average variance extracted [AVE]), and discriminant validity. For SEM in Smart-PLS, two stages of analysis begin with a measurement model test, followed by a structural model (Hair et al., 2014). A bootstrapping approach with a re-sample of 5000 was applied to assess the path significance coefficients and loadings (Hair et al., 2014). The evaluation of the measurement model is also known as confirmatory factor analysis, whereas the selection of appropriate indicators with construct variables is based on outer loading values. Structural models, also known as inner models, involve the evaluation of the constructs that are connected. Therefore, this evaluation aims to obtain information about the relationship between the constructs in the path coefficient model, to determine whether the relationship is significant or not.

Results

Respondents' profile

The respondents' profile is shown in Table 3. 261 e-hailing users were involved in this survey, whereas 58.24% are female and 41.76% are male. Most (92.33%) e-hailing users are 40 years old and below. E-hailing services are appropriate among Generation Y (millennials) and above, as this generation has good exposure to digital communication technology, especially smartphones. All e-hailing transactions, such as bookings and payments, use mobile applications. The use of e-hailing services was also among respondents with proper educational backgrounds, as most attended high secondary school and above (97.32%). The use of e-hailing services needs knowledge and skills in digital communication, such as smartphones and mobile applications. Besides, e-hailing services are popular among higher education students (49.04%) and private and government workers (35.25%). Then, as expected, e-hailing services are always used by low-income groups (68.97%), especially by those who do not have transportation. Next, the distribution of frequency using e-hailing services is relatively fair among respondents. About 30% of respondents use e-hailing services 1 to 3 per year, 4 to 6 times per year, and more than six times per year, respectively. Then, about 60% of respondents have experienced using Maxim, 54.79% have used Grab, 22.99% have used Mycar, and 22.22% have used other types of e-hailing.

Perception towards service quality of e-hailing in Sarawak

The results of perception towards service quality of e-hailing are shown in Table 4. The mean value for five service quality dimensions, i.e., vehicle condition, safety, convenience, reliability, customer services, and overall satisfaction, is around 4.00 (satisfied). The results

show that respondents were 'satisfied' (4.00) with the service quality attributes of e-hailings in Sarawak. It indicates that e-hailing services in Sarawak provide good service quality to customers.

Table 3. Respondents' Profile

Respondents' Background	Frequency	%
Gender		
Male	109	41.76
Female	152	58.24
Age		
20 and below	83	31.80
21 – 30	97	37.16
31 – 40	61	23.37
41 – 50	15	5.75
51 and above	5	1.92
Education Level		
Primary school	1	0.38
Lower secondary school	6	2.30
High secondary school	26	9.96
Upper six	13	4.98
Diploma	116	44.44
Bachelor	77	29.50
Master	16	6.13
Doctor of philosophy	5	1.92
Occupation		
No occupation/No permanent job	25	9.58
School students	4	1.53
High education student	128	49.04
Housewife	2	0.77
Retiree	1	0.38
Private worker	49	18.77
Government worker	43	16.48
Self-employed	8	3.07
Household Income (RM)		
B40 (3719 and below)	180	68.97
M40 (3720 - 8649)	63	24.14
T20 (more 8649)	18	6.90
Frequency Using E-hailing (per year)		
1 to 3 times	90	34.48
4 to 6 times	82	31.42
More than 6 times	89	34.10
Type E-hailing Service Used		
Maxim	157	60.15
Grab	143	54.79
Mycar	60	22.99
Other	58	22.22

Table 4. Perception towards Service Quality of e-hailing Among Respondents

Service Quality Dimension	Attributes	1	2	3	4	5	Mean
Convenience (CV)	Accessibility	0	0	61	109	91	4.18
	Frequency	0	0	58	119	84	
	Flexible waiting place	0	0	52	118	91	
	Easy payment method	0	0	31	105	125	
Customer Service (CS)	Driver attitudes	0	0	56	111	94	4.15
	Courtesy	0	0	44	124	93	
	Readiness to serve	0	0	57	115	89	
	Responsibility	0	0	47	121	93	
Reliability (RL)	Punctuality	0	5	67	117	72	4.01
	Waiting time	0	10	83	111	57	
	Vehicle breakdown	0	0	46	104	111	
Safety (SF)	Seatbelt	0	0	27	107	127	4.20
	Driving attitudes	0	0	58	110	93	
	Speed	0	0	54	120	87	
	Security	0	0	48	120	93	
Vehicle Condition (VC)	Vehicle Maintenance	0	5	69	113	74	4.14
	Cleanliness	0	0	60	125	76	
	Car seat	0	0	41	121	99	
	Ample Legroom	0	0	49	124	88	
	Air Conditioning	0	0	47	104	110	
	Luggage Space	0	0	41	122	98	
Overall Passenger Satisfaction (PS)	Satisfaction towards services	0	0	48	120	93	4.19
	Service Efficiency	0	0	43	104	114	
	Vehicle Condition for e-hailing	0	0	48	127	86	

Measurement model assessment

There are three criteria in measurement model assessment, i.e., internal consistency reliability, convergent reliability (outer loadings and AVE), and discriminant validity. The results of measurement model assessment are shown in Table 5. In PLS-SEM, internal consistency reliability is valued by composite reliability (CR) values. The CR threshold value of more than 0.7 or within 0.7 to 0.9 is satisfied, achieves construct reliability, and is accepted in research (Hair et al., 2014; Hair et al., 2019). The CR value in this research is from 0.862 to 0.933. Thus, the indicators for service quality dimensions are acceptable, and construct reliability is achieved in this research. Next, for convergent validity, the outer loading values are more than 0.708 for all indicators, which means that the indicators for each construct show high variance with each other. Hair et al. (2017) have set that the outer loading value needs to achieve at least 0.708 because the square power value of outer loading will generate indicator reliability that will produce a variance of at least 0.50 after the square power. Besides, the AVE should be at least 0.5 based on the average value of variances obtained from the square power value of the outer loading indicator; thus, AVE should be equal to or higher than 0.5.

Table 5. Measurement Model Assessment

	Convergent Validity			Internal Consistency Reliability
Indicator/ Attribute	Outer Loadings (> 0.708)	AVE (> 0.5)	Indicator Reliability	Composite Reliability (CR) (> 0.708)
CV1	0.86	0.684	0.74	0.896
CV2	0.842		0.708	
CV3	0.833		0.693	
CV4	0.772		0.596	
CS1	0.904	0.777	0.817	0.933
CS2	0.846		0.716	
CS3	0.885		0.782	
CS4	0.89		0.792	
RL1	0.798	0.689	0.637	0.869
RL2	0.877		0.768	
RL3	0.813		0.661	
SF1	0.861	0.729	0.742	0.915
SF2	0.769		0.592	
SF3	0.896		0.803	
SF4	0.883		0.779	
VC1	0.789	0.657	0.622	0.92
VC2	0.847		0.717	
VC3	0.803		0.644	
VC4	0.795		0.632	
VC5	0.73		0.534	
VC6	0.889		0.79	
PS1	0.825	0.676	0.681	0.862
PS2	0.875		0.765	
PS3	0.761		0.58	

Then, the discriminant validity is based on the Fornell-Larcker Criterion. Based on the criteria, when the correlation value is higher than the correlation value in the same column, discriminant validity is achieved. The results in Table 6 show that the correlation value for all the construct variables is higher than that in the same column. Thus, all the construct variables are valid in this research.

Table 6. Discriminant Validity (Fornell-Larcker Criterion)

Construct Variable	Convenience	Customer Service	Passenger Satisfaction	Reliability	Safety	Vehicle Condition
Convenience	0.827					
Customer Service	0.678	0.881				
Passenger Satisfaction	0.724	0.795	0.822			
Reliability	0.722	0.729	0.778	0.830		
Safety	0.746	0.716	0.736	0.684	0.854	
Vehicle Condition	0.728	0.690	0.796	0.719	0.780	0.810

Structural model assessment

The structural model measures the relationship between construct variables and tests the hypotheses of this research. However, a collinearity test should be conducted first to check collinearity issues in the model. The variance inflation factor (VIF) value should be more than

0.2 but less than 5.0 to ensure collinearity issues do not exist (Hair et al., 2017). The VIF for all the construct variables are higher than 0.2 and less than 5.0, showing no collinearity issues in this model (refer to Table 7).

Table 7. Collinearity (0.2 < VIF < 5.0)

Construct Variable	Passenger Satisfaction
Convenience	2.946
Customer Service	2.713
Reliability	2.909
Safety	3.361
Vehicle Condition	3.238

Next, the model is run with the bootstrapping with 5000 subsamples in PLS-SEM, as Hair et al. (2019) suggested, to measure the relationship and test the hypothesis. The results of the structural model are shown in Table 8. Three (H2, H3, H5) out of five hypotheses proposed are supported. It shows the significant relationship between vehicle condition (t-value=4.886, p<0.001), customer service (t-value=5.059, p<0.001), and reliability (t-value=3.901, p<0.001) and passenger satisfaction towards e-hailing services in Sarawak are significant with less 1% probability of error. Figure 3 reported the proposed model's path coefficient, p-value, and t-value.

Then, two criteria were used to assess the model fitness. The coefficient determination R2 is 0.779, which means the constructed independent variables can explain 77% of passenger satisfaction. Hair et al. (2019) recommended that the explanatory power in R2 above 0.75 is large. Besides, the predictive relevance of the model can be read through the analysis of the Q2 value, and the value of Q2 greater than zero indicates that the path model can predict the observed initial value (Hair et al., 2019). The Q2 value is 0.508, which means convenience, customer service, reliability, safety, and vehicle condition have significant predictive relevance to passenger satisfaction.

Table 8. Structural Model Analysis

Hypothesis	Relationship	β	P	t	Decision	R^2	Q^2
H1	Convenience_ -> Passenger Satisfaction_	0.072	0.232	1.196	Rejected	0.779	0.508
H2	Customer Service -> Passenger Satisfaction_	0.331	0.000	5.059	Supported		
H3	Reliability_ -> Passenger Satisfaction_	0.227	0.000	3.901	Supported		
H4	Safety -> Passenger Satisfaction_	0.041	0.548	0.601	Rejected		
H5	Vehicle Condition -> Passenger Satisfaction_	0.320	0.000	4.886	Supported		

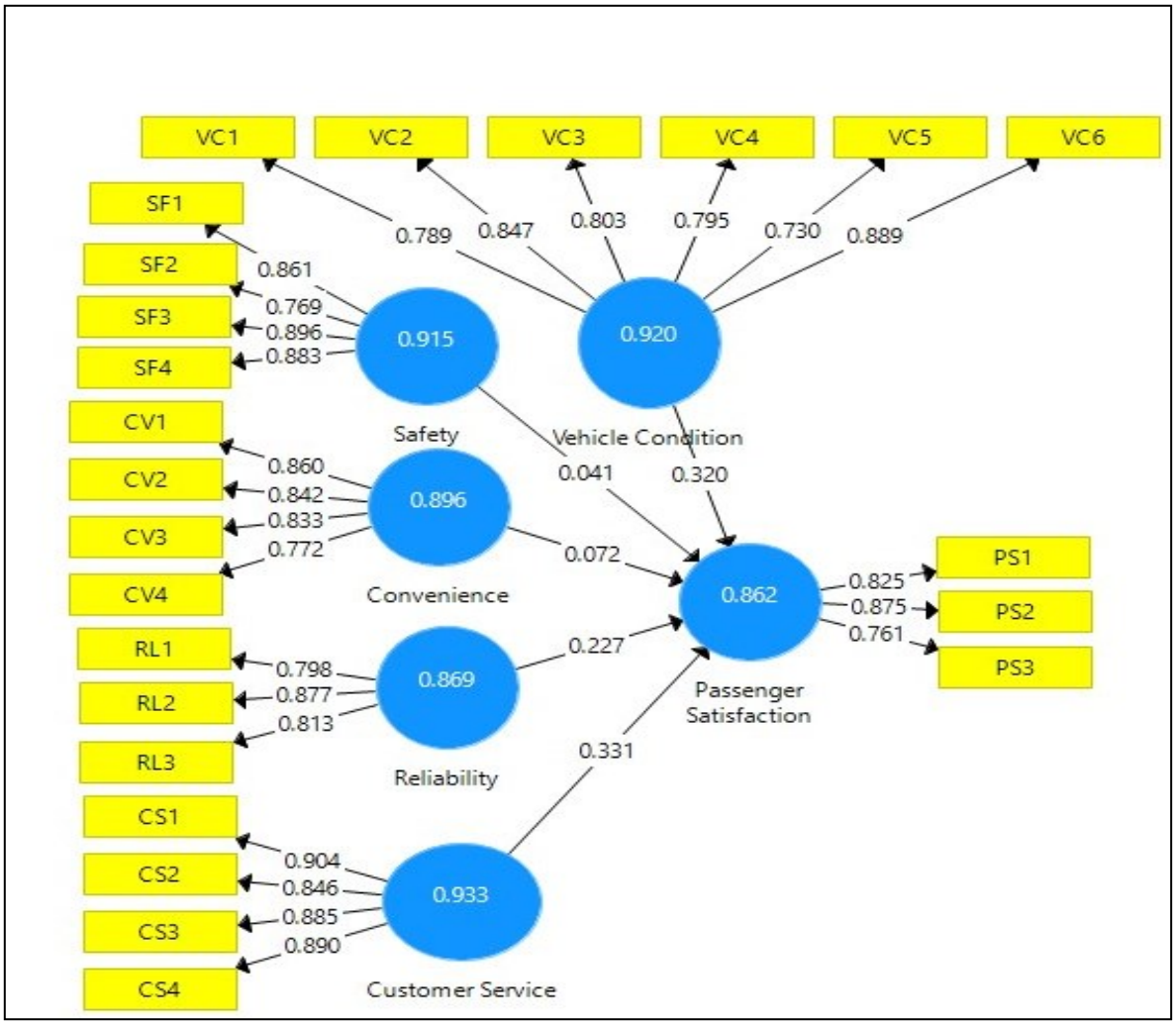

Figure 3. Structural Model

Discussion

The results show three service quality dimensions influencing and increasing passenger satisfaction towards e-hailing services in Sarawak state: customer service, vehicle condition, and reliability. The first dimension is customer service (β = 0.331). The attitude of the e-hailing driver plays a significant factor in passenger satisfaction. As public transport drivers, they need to show good attitudes and courtesy towards passengers. Besides, the driver should be responsible for any matter during the service and always ready to serve if passengers need it. Second, vehicle condition (β = 0.320) or the physical appearance of e-hailing vehicles plays a significant factor in passenger satisfaction. The cleanliness outside or inside the car, space for luggage, air ventilation, and maintenance of the vehicle increase passenger comfort and contribute to their satisfaction. Then the third is the reliability (β = 0.227) of the e-hailing service. In this dimension, punctuality and waiting time become their concern in using e-hailing services. Unlike public buses, which are tied to the operation schedule, e-hailing service is flexible, whereas the driver needs to fetch the customer once they receive the order. Due to the flexibility of e-hailing service, customers hope the service is punctual and reduces

the waiting period. Besides, the maintenance of vehicles is also related to the reliability dimension. Vehicle maintenance must be done periodically to avoid technical problems during service delivery.

In the context of research on the public transportation sector of Sarawak state, the significant dimensions in this research, i.e. customer service, vehicle condition, and reliability, are consistent with the significant dimensions in the previous studies. For instance, Nur et al. (2019) found that customer satisfaction among undergraduate students of UNIMAS Sarawak towards Grab e-hailing services was significantly determined by reliability. Then, in the research by Anita et al., (2024), vehicle conditions and customer service dimensions also have significantly influenced passenger satisfaction towards public land transportation in Sarawak.

Conclusion

Theoretical and Managerial Implication

This study has expanded the service quality dimensions for public transportation research in Sarawak state, specifically focusing on e-hailing service quality performance and passenger satisfaction. Service quality dimensions are subjective to the research subject. The selection of service quality dimensions or attributes is not only based on previous research but also depends on the aspects or attributes that researchers are willing to measure based on their observation and experience. The service quality dimensions need to be expanded to match the subject of studies and adapt to new environments. For instance, the vehicle condition dimension describes the physical appearance and condition of personal vehicles used as public transportation.

In contrast, much research categorizes it as the tangibility dimension originally proposed by Parasuraman and Zeithaml (1985). Theoretically, the tangibility dimension includes the vehicle's physical appearance and the staff or driver. However, this research focused only on the physical appearance of the cars, and the vehicle condition dimension is suitable for researching public transportation such as buses, taxis, and e-hailing.

Next, other than waiting time and punctuality elements, vehicle problems during service delivery are a new attribute of the reliability dimension. This element must be included in public transportation research because when public transport always has technical problems or breakdowns during the service, it will affect the reliability and satisfaction of the e-hailing service. Additionally, it is also related to how essential vehicle maintenance is to avoid service delivery interruption. To ensure e-hailing vehicles are always in good condition, e-hailing companies and government agencies must make it mandatory for e-hailing cars to be maintained periodically. Furthermore, the vehicle owner must ensure that their vehicle is kept clean.

Then, for e-hailing, the driver is the only staff member responsible for the service, and the driver's attitude towards passengers measures the customer service dimension. To provide excellent customer service, he or she should learn and improve communication skills and show a good attitude towards customers. A prompt response to customer orders is a must to ensure e-hailing services are reliable public transportation.

Limitations and Future Research Recommendations

This research generally investigates overall e-hailing services in Sarawak, regardless of the company or service provider. Several e-hailing services have been operating in Sarawak, such as Maxim, Grab, MyCar, AirAsia Ride, and Indriver Malaysia. Thus, this research should be extended to investigate service quality and customer satisfaction in specific e-hailing companies. For instance, Atheria, Michele, and Jugindar (2021), Choy and Mad (2022), Nur et al. (2019), and Nur et al. (2019) focused on Grab services. E-hailing companies must study user satisfaction through various aspects to make e-hailing services the best and continuously innovate (Ruzzakiah et al., 2021).

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Conflict of interest

The authors declare no potential conflict of interest regarding the publication of this work. In addition, the ethical issues including plagiarism, informed consent, misconduct, data fabrication and, or falsification, double publication and, or submission, and redundancy have been completely witnessed by the authors.

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