Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

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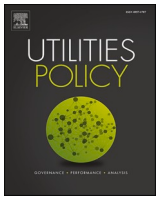

Public utility vehicle service quality and customer satisfaction in the Philippines during the COVID-19 pandemic

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ABSTRACT

The implementation of lockdown due to the COVID-19 pandemic has affected most businesses worldwide. The transportation business, specifically in the Philippines, has been heavily affected since only the healthcare and essential workers were allowed to leave their homes during the early stage of the pandemic. This paper aimed to explore the service quality of Public Utility Vehicles (PUV) in the Philippines during the COVID-19 pandemic utilizing the SERVQUAL dimensions. A total of 564 participants answered an online questionnaire using the convenience sampling approach, consisting of 58 questions. Structural equation modelling (SEM) was applied to derive the causal relationships between SERVQUAL dimensions, COVID-19 safety protocol, and customer satisfaction simultaneously. Out of the six dimensions, the SEM indicated that COVID-19 protocols, tangibility, and assurance variables were found to significantly affect PUV service quality and thus, customer satisfaction. This study is one of the first complete studies that analyzed the PUV service quality during the COVID-19 pandemic. The findings could provide the government with an evaluation of the compliance of PUVs to the imposed COVID-19 protocols. Furthermore, the framework of this study could also be applied and extended in evaluating PUV worldwide.

1. Introduction

Public Utility Vehicles (PUV) are road-based motor vehicles (mostly with four wheels) that provide conveyance to the general public. These vehicles have dedicated routes and standard fares regulated by the government. Academicians, engineers, and even the government sector are involved continuously in PUV related studies (Kim et al., 2020), aiming to maximize satisfaction while minimizing the perceived negative quality. One of the countries heavily congested by PUV is the Philippines (Mateo-Babiano et al., 2020; Tiglao et al., 2020).

In the Philippines, PUV is considered to be the primary transportation system. Table 1 represents the trip composition by mode in the Philippines from JICA in 2014, indicating that most respondents travel using public methods (48.8%). Compared with other modes, PUV provides a more affordable conveyance, so the general public prefers it. Moreover, PUV offers accessibility as it covers several routes in the country.

On March 16, 2020, the Philippine government placed the whole country under community quarantine because of the local transmission of COVID-19 or widely known as lockdown. This community quarantine restricts individuals' movement, large groups of people or communities in an area to reduce the risk of transmission of COVID-19 (Prasetyo et al., 2020). During this period, all residents in the country are advised to stay at home. Subsequently, this condition resulted in the suspension of several non-essential businesses in the country, including all PUV operations. The restriction of PUV operations played a significant role in making the country's residents stay at home. Ultimately, all of the government's restrictions have helped limit the spread of COVID-19.

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Table 1
Trip composition by mode (JICA, 2014).

Mode	No. of Trips (000)	% of Public or Private	% to Total
Public Mode	17,337	100.0	48.8
Train	1485	8.6	4.2
Bus	2352	13.6	6.6
Jeepney	6763	39.0	19.1
Tricycle	5687	32.8	16.0
UV/HOV	261	1.5	0.7
Pedicab	631	3.6	1.8
Others	156	0.9	0.4
Private Mode	7263	100.0	20.4
Motorcycle	2948	40.6	8.3
Car	2894	39.9	8.2
Taxi	315	4.3	0.9
Truck	270	3.7	0.8
Others	826	11.4	30.7
Walking	10,913	–	30.7
Total	35,503	–	100.0

Then, on June 1, 2020, the government decided to ease its restrictions by allowing PUV operations. Thru this period, PUV operations were minimal and different from what the commuters have accustomed to (Table 2). Since the threat of COVID-19 was still present, the government-imposed protocols on the PUV, including the physical distancing inside the PUV's. As shown in Table 2, only 50% is the allowable capacity inside the PUV's. Additional restrictions like face masks and face shields are also required to ride the PUV to ensure the passengers, drivers, and conductors' safety from COVID-19.

Service quality for other transportation modes has been evaluated in different areas of the world. Liou et al. (2014) explained how service quality relates to the positive effect on passenger behavioral intention. It is utilized to evaluate the willingness of customers to choose a specific transportation system. Yilmaz et al. (2021) evaluated service quality of light rail public transportation in Turkey utilizing the American Customer Satisfaction Index. They showed that perceived quality would lead to customer satisfaction, eventually leading to customer loyalty. Their study highlighted that customer expectation acted as a full mediator leading to image and loyalty. Deveci et al. (2019) evaluated the service quality of public buses utilizing fuzzy QFD. However, their study focused on developing a quantitative assessment framework. Guirao et al. (2016) explained how customer satisfaction surveys have been widely utilized to measure service quality among public transportations. They explained how narrowing the questionnaire would be best to evaluate service quality. Research has focused on utilizing a different method to evaluate service quality using different constructs (Liou et al., 2014).

Several methods to measure service quality have been explored. In South Korea, Kim et al. (2018) explored the service quality of transfer facilities in the rail system using five dimensions: 'Information,' 'Mobility,' 'Comfort,' 'Convenience,' and 'Safety'. Utilizing Rasch analysis, their result presented that the developed framework and constructs were easily understood and evaluated by the respondents. In Turkey, Tumsekcali et al. (2021) considered extending the SERVQUAL model to evaluate customer satisfaction. Their proposed SERVQUAL 4.0 model was acceptable and could present as a developed framework for service quality evaluation. Moreover, it was seen that the basic SERVQUAL model to evaluate the service quality is still highly reliable, especially in a new environment or situation such as the COVID-19 pandemic. There is always a debate regarding the best method to measure service quality.

Table 2
Passenger limits in PUV (DOTR, 2020).

Mode	Max. Allowable Capacity	Additional Restrictions
Public Utility Buses (PUBs)	50% of vehicle's capacity (excluding driver and conductor)	Passengers seated one seat apart; No standing passengers
Public Utility Jeepneys (PUJs)	50% of vehicle's capacity (excluding driver and conductor)	Passengers seated one seat apart; No standing passengers; Only one passenger on the driver's row (if no conductor)
UV Express	Max. 2 passengers per row	Only one passenger allowed on the driver's row
Taxis and TNVS	Max. 2 passengers per row	Only one passenger allowed on the driver's row
Shuttle Service	50% of the vehicle's capacity (excluding driver and conductor)	Only one passenger allowed on the driver's row (if no conductor)
Tricycles	Max. 1 passenger in the side-car	No passenger shall be seated right beside/behind the driver

Previously, there were several studies related to PUV in some countries. In Bangladesh, Rahman et al. (2016) investigated the service quality of paratransit in their country. Their research revealed that 'Punctuality,' 'Reliability,' 'Fitness of Vehicle,' and 'Cost' have the most significant effects on service quality. On the other hand, Grujičić et al. (2014) investigated the passenger's perception of public transportation quality in Serbia. Their study showed that 'Ventilation, 'Cleanliness' and 'Ticket price' are the most critical in evaluating service quality. In Norway, Munim and Noor (2020) studied young people's perceived service quality of bus service. They found that 'Tangible Features', 'Empathy' and 'Environmental Performance' positively affect customer satisfaction. Moreover, In Russia, Mikhaylov et al. (2015) identified that the tangible dimension has the most significant effect on public transportation service quality. Based on these different studies dealing with PUVs from different countries, it was seen that the SERVQUAL model could be utilized as a baseline for service quality evaluation.

SERVQUAL is a model usually utilized in businesses and marketing evaluation of service quality. Marco-Laraja et al. (2021) reiterated that this model is considered an essential tool for evaluating customer satisfaction. During the COVID-19 pandemic, the SERVQUAL model had been widely utilized to evaluate service quality in several different, fields such as e-learning (Swani et al., 2021; Shahzad et al., 2020; Camilleri, 2021), health and healthcare (Babroudi et al., 2021), and even marketing (Yang et al., 2020; Özden and Celik, 2021; Ong et al., 2021a; Nilashi et al., 2021; Rumiyati and Syafarudin, 2021). Since the core of SERVQUAL is to evaluate the quality of service by businesses to enhance customer satisfaction (Balinado et al., 2021), the need to consider the new normal living condition should be explored to create a baseline on how businesses should be run during the COVID-19 pandemic.

Despite the availability of many studies in different countries, there was no local study in the Philippines during the COVID-19 pandemic regarding PUVs. While a study by Tiglao et al. (2020) on the service quality of paratransit users in Metro Manila, the study only focused on passengers of public utility jeepneys traversing inside a specific university. Further studies on the service quality of several PUV's in the country could help improve the current public transportation system, especially during the COVID-19 pandemic.

This study aimed to investigate the service quality of public utility vehicles (PUV) in the Philippines during the COVID-19 pandemic. To better explore the service quality dimensions of PUV, the SERVQUAL model was utilized. This study is one of the first complete studies that analyzed the PUV service quality during the COVID-19 pandemic. The findings could provide the government with an evaluation of the compliance of PUVs to the imposed COVID-19 protocols. Furthermore, the framework of this study could also be applied and extended in evaluating PUV worldwide.

2. Conceptual framework

Fig. 1 shows the framework of the current study, constructed based on the SERVQUAL model: Tangibility, Responsiveness, Reliability, Assurance, and Empathy. In addition, the COVID-19 protocol was added as an additional latent for evaluating service quality and customer

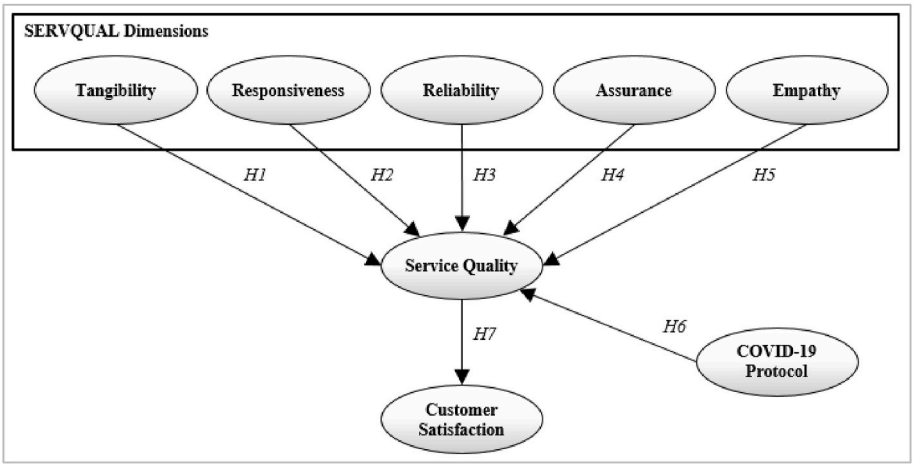

Fig. 1. The conceptual framework of the study.

satisfaction. Supported by several different studies, several hypotheses were proposed based on these dimensions.

Alam and Mondal (2019) considered the SERVQUAL model in evaluating the service quality of railway slums in Khulna. They highlighted that customers should have the sanitation service and visual appearance to enable high customer satisfaction. Mikhaylov et al. (2015)presented that users' perception of public transportation's tangible dimension significantly affects service quality. In addition, respondents of airline service quality highlight the tangible dimension for the SERVQUAL model (Basfirinci and Mitra, 2015). Thus, it was hypothesized that:

H1. Tangibility has a significant direct effect on Service Quality.

In the Philippines, Tiglao et al. (2020) showed that responsiveness positively affects the service quality perception of paratransit users. Chou et al. (2011) highlighted the significance of responsiveness to service quality. The more responsive the service provider is towards their customer, the more likely customer will be satisfied with the catered service. Therefore, it was hypothesized that:

H2. Responsiveness has a significant direct effect on Service Quality.

Reliability in this study considers the ability of PUV to perform the promised services accurately. Sam et al. (2018) explained how bus transportation in Ghana achieved high results leading to customer satisfaction. They highlighted reliability as having a high Cronbach's alpha value towards service quality. Tiglao et al. (2020) and Rahman et al. (2016) also showed the effect of reliability on service quality among transit users. Thus, it was hypothesized that:

H3. Reliability has a significant direct effect on Service Quality.

Assurance was presented as one of the highest dimensions during the COVID-19 pandemic in the study of Tumsekcali et al. (2021). In addition, the study of Chuah and Hilmi (2011) showed how assurance had a positive effect on service quality. Moreover, Sam et al. (2018) presented how assurance is highlighted as one of the significant factors in the service quality of bus transportation in Ghana. It considers the knowledge and courtesy of the operators and the ability to convey trust and confidence to the customers, in turn leading to high customer satisfaction (Sam et al., 2018). Thus, it was hypothesized that:

H4. Assurance has a significant direct effect on Service Quality.

Concerning assurance, Chuah and Hilmi (2011) showed how empathy leads to a significant direct effect on customer satisfaction. The care and personalized attention given to customers would affect their satisfaction (Sam et al., 2018). In the study of Alam and Mondal (2019), empathy showed the highest significant effect on customer satisfaction in railway evaluation. Thus, it was hypothesized that:

H5. Empathy has a significant direct effect on Service Quality.

The COVID-19 protocols (Prasetyo et al. 2020, 2021a, 2021b) directly affect service quality. With the change of lifestyle during the COVID-19 pandemic, the service provided by different sectors changed. The re-evaluation of the different service sectors was deemed relevant due to the implemented protocols for the new normal (Tumsekcali et al., 2021).

H6. COVID-19 protocol has a significant direct effect on Service Quality.

Different studies such as de Oña et al. (2013), de Oña et al. (2016), and Wang et al. (2020) have noted that perceived service quality directly affects customer satisfaction. The five dimensions covering the SERVQUAL model would evaluate service quality and lead to customer satisfaction (Kouthouris and Alexandris, 2005). Therefore, it was hypothesized that:

H7. Service Quality has a significant direct effect on Customer Satisfaction.

3. Research methodology

3.1. Data collection and participants

The study targeted all residents in the Philippines who have experienced riding PUV in this pandemic or specifically starting from March 16, 2020. The questionnaire was only distributed to different online platforms using Google forms. Kline (2015) suggested that the data sample size should be greater than 200 to generate a dependable SEM result (Hadiuzzman et al., 2017; Munim and Noor, 2020). Moreover, Kline (2015) identified that the model's intricacy, the estimation model used, and the variables' characteristics should be considered in classifying the model's required sample size (Hair, 2010; Ong et al., 2021a; Hadiuzzman et al., 2017).

The questionnaire was distributed through online platforms from August to October 2020 and gathered up to 605 respondents. Out of the 605 respondents, only 564 were valid participants and considered in the study. Table 3 represents the descriptive statistics of the respondents. In the PUV usage, the respondents were asked to select all the PUV they had used during the pandemic. The results showed that most of the respondents had used tricycle (78%) followed by jeepney (55%), bus (44%), taxi (22%), and UV express (13%). Perhaps the reason for this was that more tricycles were allowed to operate in the community quarantine, unlike the remaining PUV's (jeepneys, buses, taxis, and UV

Table 3
Descriptive statistics of respondents (N = 564).

Variable	Characteristics	Total	Public Utility Vehicles				
			Tricycle	Jeepney	Bus	Taxi	UV Express
Gender (%)	Male	252	47.99	58.39	45.71	70.59	85.19
	Female	312	52.01	41.61	54.29	29.41	14.81
Age (%)	15–24	32	2.564	10.56	5.72	5.882	7.407
	25–34	329	50.92	66.46	65.71	64.71	59.26
	35–44	166	34.07	22.36	28.57	27.94	29.63
	45–54	14	4.029	0.621	0	1.471	3.704
	>64	22	8.425	0	0	0	0
Frequency (%)	once/week	91	12.22	18.62	18.75	35.94	7.7
	2 - 3/week	111	26.3	17.3	0	15.63	19.23
	4 - 5/week	278	49.26	54.48	81.25	39.06	57.69
	6 - 7/week	57	12.22	9.655	0	9.375	15.38
Occupation (%)	Private employee	394	73.99	57.14	77.14	76.47	77.78
	Student	55	4.399	17.39	8.571	11.76	14.82
	Government Employee	57	13.55	10.56	8.575	0	0
	Businessman	11	0	1.25	2.857	10.29	3.704
	Others	47	8.061	13.66	2.857	1.48	3.704

express), which were assessed and selected first by DOTR before allowing them to operate.

Based on the descriptive statistics majority of the respondents were from 25 to 44 years old. All ride different types of PUVs at least 2–3 times a week or more. In the Philippines, the majority lives in the province and works in the city, which explains why 81.25% of the respondents ride the buses four to five times a week. It could also be seen that employees from private companies ride almost all types of PUVs. In the Philippines, the lifestyle is cost-effective and peaceful in the province, which is why citizens try to move to provinces while still working in the capital to earn more (Clausen, 2010). It is evident why the demographic statistics present a high number of commuters utilizing PUVs. Filipinos have been accustomed to traveling from the residing areas of the province to their workplace in the capital (Christ, 2020).

3.2. Questionnaire design

The questionnaire was developed in English and classified into two parts. Part I is about the respondent's profile, designed to gather information about the respondents, such as age, sex, and occupation. Part II contains the indicators of the study's variables: SERVQUAL five dimensions, COVID-19 transport protocols, service quality, and customer satisfaction. The SERVQUAL five dimensions were designed to measure the service quality of PUV. It contains tangibility (14 questions), responsiveness (7 questions), reliability (6 questions), Assurance (11 questions), and Empathy (4 questions). The COVID-19 transport protocol (7 questions) measures were designed to assess the ability of the PUV to follow the government-mandated protocols against COVID-19. Service Quality (4 questions) measures were designed to determine the customer's evaluation of the services provided by the PUV (Shah et al., 2020). Lastly, customer satisfaction with their PUV experience was measured with four questions. All indicators used in the questionnaire were adopted based on a comprehensive literature review. Moreover, all indicators are measured by a seven-point Likert scale, where seven represents a strong agreement, and 1 illustrates strong disagreement. Details of the Part II questionnaire are indicated in Table 4.

3.3. Statistical analysis

(Silva et al., 2014) described SEM as a multivariate statistical method used to estimate parameters for a system of linear equations. Furthermore, SEM is used to test how fit is the theoretical model by evaluating a system of linear equations (Silva et al., 2014). Statistical Package for Social Science (SPSS, version 25) and Analysis of a Moment Structure (AMOS, version 20) with Maximum Likelihood estimation approach were utilized to generate the model.

The goodness of fit of the model is evaluated using: full model test, incremental fit indices, the goodness of fit index, and badness of fit index (Ong et al., 2021b; Lin et al., 2019; Lin et al., 2019; Stein et al., 2011). The normed chi-square was measured to apply the full model test. The result of the normed chi-square must be lower than acceptable limits of below 5.0 (Diamantidis and Chatzoglou, 2019) to indicate a good model fit, which means no substantial variance between the SEM model and the sample data (Hair, 2010; Lin et al., 2019). For the incremental fit indices: Normed Fit Index (NFI), Tucker Lewis Index (TLI), and Comparative Fit Index (CFI) were measured. The results must be higher by 0.90 (Diamantidis and Chatzoglou, 2019; Hair, 2010;Cheng et al., 2018) or closer to be considered a good model fit for the data collected (Ong et al., 2021c; de Oña et al., 2013). Moreover, the goodness of fit index was measured by Goodness of Fit Index (GFI) and Adjusted Goodness of Fit Index (AGFI) with greater than 0.90 thresholds to indicate a good model fit (Diamantidis and Chatzoglou, 2019; Lin et al., 2019). Lastly, the badness of the fit index was measured using the Root Mean Square Error of Approximation (RMSEA). The value should be less than 0.070 to indicate a fitting model (Lin et al., 2019), values between 0.08 and 0.10 were also considered a good fit (de Oña et al., 2013).

4. Results

SEM was utilized to derive more insight regarding the causal relationships between the SERVUQAL dimensions, COVID-19 safety protocol, service quality, and customer satisfaction. The initial SEM Model for the service quality of PUV is presented in Fig. 2. Based on this figure, three dimensions were found insignificant. Therefore, another model was created without the insignificant paths: RS-SQ (Hypothesis 3), RL-SQ (Hypothesis 2), and E-SQ (Hypothesis 5) to enhance the results. The final model is presented in Fig. 3.

To compare the results from the initial model against the final model, goodness of fit measures were used. The initial model was developed with the inclusion of the five latent variables of the study: Tangibility (T), Responsiveness (RS), Reliability (RL), Empathy (E), Assurance (A), and COVID-19 Protocol (C). Furthermore, the values of IFI, TLI, CFI, GFI, AGFI, and RMSEA from the initial model were not within the specified limit, as shown in Table 5.

For the final model, all possible modification indices were exhausted to improve the results. The IFI, TLI, CFI, GFI, AGFI, and RMSEA of the final model resulted in better values compared with the initial model. Moreover, RMSEA result was within the acceptable levels of 0.08–0.010 (de Oña et al., 2013). Finally, the factor loadings from the initial and final models are presented in Table 6. The factor loadings with a minimum reliability cut–off of 0.05 were considered satisfactory.

Furthermore, data reliability measurement was performed. The

Table 4
List of constructs.

Factor		Questions	Reference
Tangibility: the appearance of physical facilities, equipment, and personnel	T1	There is enough space inside the PUV	Grujičić et al., 2014
	T2	There are ample legroom and foot space inside the PUV	OJO et al., 2014
	T3	The seats are clean	Eboli and Mazzulla (2015)
	T4	The seats are comfortable	Barabino et al. (2012)
	T5	The PUV is ergonomically friendly	OJO et al., 2014
	T6	The floor of the vehicle is clean	Grujičić et al., 2014
	T7	Ventilation inside the PUV is satisfactory	Grujičić et al., 2014
	T8	The temperature inside the vehicle is satisfactory (not too hot and not too cold)	Mikhaylov et al. (2015)
	T9	There is no bad smell inside the PUV	Grujičić et al., 2014
	T10	There are no disturbing vibrations inside the PUV	Eboli and Mazzulla (2015)
	T11	There are no disturbing noises from the engine	Munim and Noor (2020)
	T12	I can see the signboard of the vehicle clearly	Cheng et al. (2018)
	T13	The appearance of the driver/conductor is neat and clean	Munim and Noor (2020)
	T14	The PUV is modern looking	Grujičić et al., 2014
Responsiveness: the willingness to help customers and to provide prompt service	RS1	PUV are easily accessible in my area	de Oña et al. (2013)
	RS2	I don't have to wait to be able to ride a PUV	de Oña et al. (2013)
	RS3	I can easily ride PUV even in rush hours	Grujičić et al., 2014
	RS4	I always arrive at my destination on time when riding PUV	Barabino et al. (2012)
	RS5	My travel time when riding PUV is satisfactory	Grujičić et al., 2014
	RS6	The passengers are always informed by the driver/conductor when it's okay to exit the vehicle	OJO et al., 2014
	RS7	The driver/conductor is very responsive and ready to stop at the desired location of the passenger	OJO et al., 2014
Reliability: the ability to perform promised service dependably and accurately	RL1	It is easy to find the loading and unloading areas of PUV	Liou et al. (2014)
	RL2	There are loading and unloading areas near my home	Eboli and Mazzulla (2015)
	RL3	There are available benches and shelter at loading and unloading areas	Munim and Noor (2020)
	RL4	PUV never breaks down or experienced mechanical failure on the road	OJO et al., 2014
	RL5	The price fee for the ride is affordable	de Oña et al. (2013)
	RL6	Driver/conductor always return the correct change to the passengers	(Mikhaylov et al., 2015)
Assurance: the knowledge and courtesy of driver and conductor and their ability to convey trust and confidence	A1	The driver unloads and loads the passengers in the appropriate area	Liou et al. (2014)
	A2	The driver adheres to a careful driving style	(Mikhaylov et al., 2015)
	A3	The driver drives smoothly (no sudden breaks)	Liou et al. (2014)
	A4	The driver drives with appropriate speed	Grujičić et al., 2014
	A5	Driver follows the road signs and signals	Munim and Noor (2020)
	A6	The driver knows the route very well and avoids traffic jams	Grujičić et al., 2014
	A7	The driver makes sure that the passenger has safely exited/entered the vehicle before moving	Munim and Noor (2020)
	A8	The driver has good driving skills	Munim and Noor (2020)
	A9	I feel secure against crimes inside the PUV	Barabino et al. (2012)
	A10	I feel secure against crimes while waiting at the loading and unloading area	Barabino et al. (2012)
	A11	I feel safe riding PUV	Grujičić et al., 2014
Empathy - the provision of caring, individualized attention to customers	E1	The driver/conductor is polite and friendly when communicating with passengers	Liou et al. (2014)
	E2	The driver/conductor assist disabled passengers and senior citizens	Mikhaylov et al. (2015)
	E3	The drivers never fail to stop for passengers who want to ride	Liou et al. (2014)
	E4	PUV routes are designed perfectly (no additional routes needed)	Mikhaylov et al. (2015)
COVID-19 Transport Protocol - the ability of the PUV to follow the mandated protocol of the government against Covid 19	C1	The driver and conductor are both wearing a face mask	Department of Transportation, 2020
	C2	The driver and conductor are both wearing gloves	
	C3	Only passengers with a face mask and face shield are allowed inside the PUV	
	C4	The driver area is sealed with a plastic barrier for protection	
	C5	To maintain social distancing, only 50% of the total capacity of the PUV are utilized	
	C6	The plate number and contact number of the PUV are visible to all passengers for contact tracing	
	C7	PUV follows the curfew time	
Service quality	SQ1	Overall service of the PUV is good	Amponsah and Adams, 2017;
	SQ2	Overall service of the PUV is safe and secure	Morton et al., (2016); Ojha (2020)
	SQ3		

(continued on next page)

Table 4 (*continued*)

Factor		Questions	Reference
		Overall, the service of the PUV is worth its price	
	SQ4	I have a positive attitude towards the quality of the service of this PUV	
	SQ5	I have fewer complaints about the service of the PUV	
Customer Satisfaction	CS1	Overall, I am happy with the service of the PUV	Sam et al. (2018)
	CS2	Overall, I am satisfied with the service of the PUV	
	CS3	I am likely to use PUV again	
	CS4	I am likely to recommend riding PUV to my friends and family	

Cronbach α and composite reliability (CR) were used to ensure that a degree of reliability exists in the data, that the instrument measures what it should. Alongside reliability, to measure the validity of the research instrument, two scales most used for this purpose were utilized: factor loading and average variance extracted (AVE). Table 7 represents the value of the reliability and validity measures.

5. Discussion

PUV is an integral part of the daily lives of every Filipino commuter. This study was created to investigate commuters' perceived satisfaction towards the service quality PUV in this pandemic using a modified SERVQUAL model. The dimensions that were used in the study were tangibility, responsiveness, reliability, assurance, empathy, COVID-19 protocols, perceived service quality, and perceived customer

Table 5
Goodness of fit measures.

Goodness of fit measures of the SEM	Final Model	Minimum cut-off	Suggested by
Incremental Fit Index (IFI)	.956	>0.90	Hair (2010)
Tucker Lewis Index (TLI)	.931	>0.90	Hu and Bentler (1999)
Comparative Fit Index (CFI)	.955	>0.90	Hair (2010)
Goodness of Fit Index (GFI)	.886	>0.80	Gefen et al. (2000)
Adjusted Goodness of Fit Index (AGFI)	.836	>0.80	Gefen et al. (2000)
Root Mean Square Error of Approximation (RMSEA)	.089	0.08–0.010	de Oña et al. (2013)

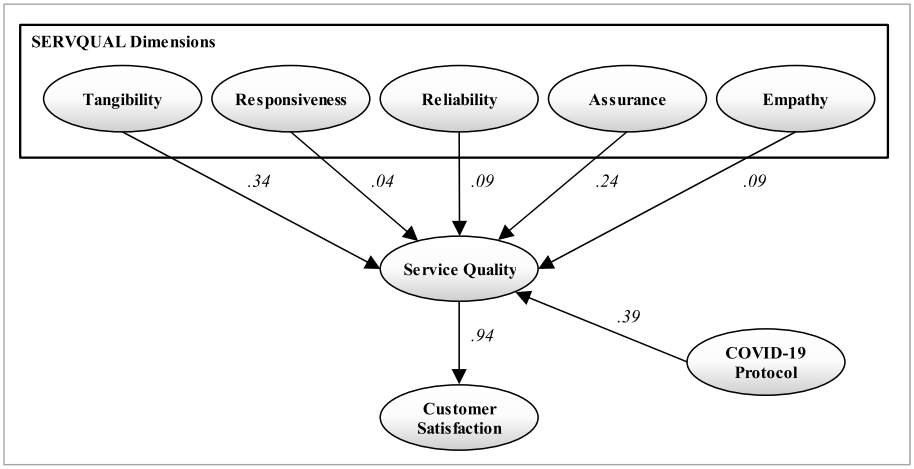

Fig. 2. The initial SEM model.

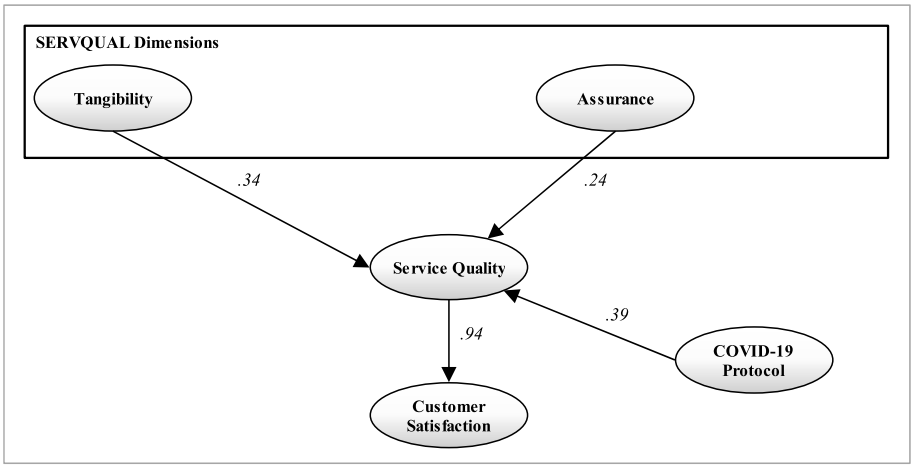

Fig. 3. The final SEM for exploring PUV service quality and customer satisfaction during the COVID-19 pandemic.

Table 6
List of factor loading.

Factor	Item	Mean	StDev	Variance	Factor Loading	
					Initial Model	Final Model
Tangible	T1	5.7624	1.08286	1.173	.63	.58
	T2	5.6188	1.15959	1.345	.73	.70
	T3	4.8475	1.19567	1.430	.66	.60
	T4	4.8209	1.23227	1.518	.67	.64
	T5	3.0621	1.61302	2.602	.16	–
	T6	4.3901	1.40551	1.975	.41	–
	T7	5.0887	1.08073	1.168	.64	–
	T8	5.0319	1.08553	1.178	.78	.80
	T9	5.0957	1.02094	1.042	.81	.82
	T10	4.8688	1.18778	1.411	.81	.80
	T11	4.9592	1.14806	1.318	.77	.76
	T12	5.5426	1.05276	1.108	.81	.61
	T13	4.9167	1.07208	1.149	.69	.69
	T14	4.9184	1.04622	1.095	.68	.67
Responsiveness	RS1	6.2287	1.10826	1.228	.74	–
	RS2	5.8333	1.39927	1.958	.82	–
	RS3	4.8918	1.41698	2.008	.67	–
	RS4	5.2766	1.05012	1.103	.77	–
	RS5	5.3369	.97207	.945	.77	–
	RS6	5.7057	1.04698	1.096	.73	–
	RS7	5.8635	1.02931	1.059	.75	–
Reliability	RL1	5.9450	1.20780	1.459	.84	.84
	RL2	5.9468	1.27999	1.638	.85	.85
	RL3	2.8830	1.55667	2.423	.00	–
	RL4	5.3262	.93099	.867	.45	–
	RL5	5.5532	1.17206	1.374	.46	–
	RL6	5.6720	.84323	.711	.27	–
Assurance	A1	5.7199	.88979	.792	.67	.72
	A2	5.2695	.93200	.869	.69	.62
	A3	5.1294	.89358	.798	.74	.65
	A4	5.1507	.99035	.981	.68	.61
	A5	5.5372	.80210	.643	.74	.75
	A6	5.8387	.79777	.636	.57	.58
	A7	5.5780	.84875	.720	.99	.98
	A8	5.7482	.82398	.679	.77	.86
	A9	3.2465	1.42594	2.033	.31	–
	A10	3.0089	1.49775	2.243	.21	–
	A11	5.1472	.89679	.804	.87	.67
Empathy	E1	5.6933	.73956	.547	.77	–
	E2	5.5745	.90771	.824	.75	–
	E3	5.8085	1.00206	1.004	.69	–
	E4	5.2110	.93282	.870	.61	–
COVID-19 Protocol	C1	6.7110	.73711	.543	.73	.71
	C2	2.4840	2.05987	4.243	-.08	–
	C3	6.4734	.93729	.879	.72	.73
	C4	6.6082	.84332	.711	.80	.76
	C5	6.3989	.97685	.954	.80	.72
	C6	5.8174	1.16810	1.364	.61	.72
	C7	6.6277	.90764	.824	.74	.75
Service Quality	SQ1	5.8794	.95158	.906	.81	.81
	SQ2	5.1383	.98408	.968	.75	.73
	SQ3	5.8387	.95393	.910	.77	.79
	SQ4	5.6649	.92303	.852	.90	.88
	SQ5	5.4060	.88003	.774	.81	.79
Customer Satisfaction	CS1	5.6596	.91430	.836	.91	.91
	CS2	5.5550	.88132	.777	.89	.89
	CS3	5.8067	.94044	.884	.80	.79
	CS4	5.5089	.94705	.897	.81	.80

satisfaction. Finally, the gathered data from the questionnaires were analyzed using SEM to identify the dimensions' interrelationship.

The direct, indirect, and total effects of each path are presented in Table 8. Interestingly, COVID-19 Protocols latent variable was found to have the most significant direct impact on the service quality of PUV. Likewise, it had the highest indirect effect on customer satisfaction of PUV users as well. Several indicators such as wearing a face mask and shield, plastic barriers, social distancing, contact tracing, and curfew time were regarded as significant to COVID-19 protocols. These results indicate that PUV users consider their health and safety from COVID-19 as the most important factor in their commuting experience.

Table 7
Reliability and validity.

Latent Variable	Cronbach's α	Average Variance Extracted (AVE)	Composite Reliability (CR)
Tangible	0.918	0.493	0.913
Responsiveness	0.894	0.564	0.900
Reliability	0.857	0.714	0.833
Assurance	0.897	0.527	0.907
Empathy	0.789	0.501	0.799
COVID-19 Protocol	0.865	0.536	0.874
Service Quality	0.901	0.642	0.899
Customer Satisfaction	0.917	0.721	0.912

Table 8
Direct Effect, Indirect Effect and, Total Effect.

Path	Direct effect	P-value	Indirect effect	P-value	Total effect	P-value
C → SQ	0.387	.001	No Path	–	.387	.001
T → SQ	.322	.001	No Path	–	.322	.001
A → SQ	.263	.001	No Path	–	.263	.001
SQ → CS	.955	.001	No Path	–	.955	.001
C → CS	No Path	–	.369	.0003	.369	.001
T → CS	No Path	–	.307	.001	.307	.001
A → CS	No Path	–	.251	.001	.251	.001

Based on the review done by Gkiotsalitis and Cats (2020), the new normal post-shutdown of PUV should be evaluated. Due to the crowding protocol implementation, the design and process were seen to be a setback among PUVs because operators and the government adhered to the COVID-19 protocols (Gkiotsalitis and Cats, 2020). Zhang et al. (2021) supported these findings. They explained how people are now cautious with utilizing PUVS due to crowding and virus transmission. The limitation of passengers, wearing of personal protective equipment (PPE), and following safety protocol was also evident in air transportation (Sun et al., 2021).

Second, tangibles showed to have a significant total effect on service quality. Significant indicators include space inside the vehicle, cleanliness, comfort, temperature, smell, vibrations, noises, visibility of signboard, the appearance of the driver, conductor, and PUV. This result is identical to the findings of Grujičić et al. (2014) and Chuah and Hilmi (2011), in which they identified tangibility as one of the significant dimensions in determining the service quality of a public transportation system. Apart from its significant effect on service quality, tangibility appeared to have the second-highest indirect effect on customer satisfaction. These findings are consistent with Kim and Rilett (2005) and Munim and Noor (2020), which revealed that a transportation system's tangible features significantly connect to customer satisfaction.

The physical appearance, facilities, and personnel caused a significance in the service quality of PUVs in the Philippines. During the COVID-19 pandemic, the study of Özden and Celik (2021) showed how transportation utilized for household means has a highly significant impact. The personnel's politeness reflects positive service quality. Thus, the need to emphasize tangibility among PUVs should be done during the COVID-19 pandemic (Özden and Celik, 2021). Moreover, Tumsekcali et al. (2021) also found that tangibles showed the highest dimension for the SERVQUAL model during the COVID-19 pandemic. Since people are cautious not to get infected, the need for cleanliness and comfort brings high service quality, leading to high customer satisfaction.

Third, assurance was identified to have a significant total effect on service quality and customer satisfaction. Several indicators were found to significantly impact on assurance, such as unloading and loading in the appropriate area, following road signs and signals, making sure that

passengers have safely exited or boarded the vehicle, and having good driving skills. These results matched the findings from Chuah and Hilmi (2011) and Kim and Rilett (2005), in which they found assurance as one of the critical factors affecting user satisfaction and service quality. The trust and safety of passengers should be taken into consideration by PUV operators during the COVID-19 pandemic (Tumsekcali et al., 2021). Tumsekcali et al. (2021) explained how assurance is travel safety. With the impact of the COVID-19 virus, commuters are highly cautious on safety and therefore considers the assurance of travel safety.

Surprisingly, responsiveness, reliability, and empathy were found insignificant towards service quality and customer satisfaction. These results contradict findings from Tiglao et al. (2020), Rahman et al. (2016) and, Chuah and Hilmi (2011), respectively. The studies were conducted before the COVID-19 pandemic, which explains the different results. The new normal led to how people would rely more on health-related services being provided by PUVs. Following the implemented health-safety protocols would satisfy the perception of service quality and lead to customer satisfaction (Zhang et al., 2021).

Overall, service quality was seen to have the highest significant direct effect. The indicators for a positive service quality were good, safe, and secure service provided by PUVs in the Philippines during the COVID-19 pandemic. It could thus be deduced that PUVs in the Philippines adhered to the COVID-19 safety protocols, leading to customer satisfaction. In addition, several studies showed how the different dimensions have significant and positive effects on customer satisfaction, an antecedent of service quality from the 5 SERVQUAL dimensions (de Oña et al., 2016; Wang et al., 2020; Shen et al., 2016). Therefore, when PUVs assure safety, cleanliness, and apply the health protocol during the COVID-19 pandemic, a positive impact on service quality will be evident, leading to high customer satisfaction.

5.1. Theoretical contributions

This study utilized the SERVQUAL model to identify the dimensions that significantly affect PUV service quality. SERVQUAL model was utilized because it is widely used in public transportation and other industries (Buttle, 1996; Patel and Bhatt, 2017). In addition, Banahene et al. (2017) indicated that the SERVQUAL model is prominent for service quality evaluation.

The theoretical implication of this study indicated that not all SERVQUAL dimensions significantly affect the service quality of PUV. The findings from this study suggest that only tangibles and assurance directly affected the service quality of PUV. These results were not uncommon. Based on Table 9, several studies using the SERVQUAL method have resulted in insignificant dimensions. Based on this table, we can perceive that assurance is the most significant dimension based on the results of each study, followed by tangibles. Furthermore, the significance of the SERVQUAL dimensions depends on the object that is being measured.

Table 9
Related Literature using SERVQUAL.

Research Study	Object	T	RS	RL	A	E
This study	Public Utility Vehicle	Sig	Not	Not	Sig	Not
Barabino et al. (2012)	Bus	Not	Not	Sig	Sig	NI
Shah et al. (2020)	Airline	Sig	Sig	Sig	Sig	Sig
Basfirinci and Mitra (2015)	Airline	Sig	Sig	Sig	Sig	Sig
OJO et al. (2014)	Public transportation	Not	Sig	Not	Sig	Sig
Mikhaylov et al. (2015)	Public transportation	Sig	Not	Not	Not	Not

Legend: Sig = significant, Not = Insignificant, NI = Not included in the identified research study.

5.2. Practical implications

COVID-19 pandemic has dramatically impacted the world. In the Philippines, the COVID-19 pandemic was found to have a significant impact on the PUV system. This study investigated the service quality of PUV during the COVID-19 pandemic. The results indicate that commuters have higher satisfaction with PUV service quality when COVID-19 protocols are followed. Furthermore, most protocols were observed inside the PUV except for the required wearing of gloves for the driver and conductor. This finding can inform the government about compliance and guide the strengthening of COVID-19 protocols, especially the wearing of gloves.

Following the COVID-19 protocols, commuters also recognize tangibles as a key dimension. Based on the factor loadings of the final model, the commuters were satisfied with several tangible indicators such as legroom and foot space, temperature, and smell. On the contrary, commuters perceived the ergonomics, cleanliness, and ventilation inside the PUV as the most unsatisfactory. With this outcome, it is suggested that PUV operators should always maintain cleanliness by placing trash bins inside their vehicles or by having a strict cleaning routine at the end of every trip.

This research also studied the perception of commuters with assurance. Overall, the commuters are satisfied when the driver follows the road signs and signals and unloads/loads the passengers in the appropriate area. In contrast, the commuters do not feel safe and secure against crimes inside the PUV and in the loading/unloading areas. Moreover, commuters were dissatisfied with the driver's driving style (speed and smoothness). These insights seem to capture the lack of security and formal waiting area for PUV's in the Philippines. This study has several suggestions to improve the safeness and security of commuters:

a. To enhance the safeness and security in the loading and unloading area, it may be a good idea to install closed-circuit television or CCTV, install additional lighting fixtures, and the presence of police or security guards. Further, the location of loading/unloading areas may be most secured if situated near police stations or crowded areas.
b. To enhance the safeness of commuters and also the driver inside the PUV, the government should strictly enforce the standard rules and regulations for public transport and educate both the driver and commuters about road safety. In addition, the government should cover the accident cost incurred by PUV.
c. To enhance the security of commuters and the driver inside the PUV, the government should add more law enforcers or police in areas with high crime rates.

In addition, the insights from this study can be useful to the government's Public Utility Vehicle Modernization Program, which has the goal to provide commuters with a safe, reliable, convenient, affordable, and environmentally-sustainable public transportation system in the country (Land Transportation Franchising and Regulatory Board, 2020).

Meanwhile, the respondents' dissatisfaction with the three variables: responsiveness, reliability, and empathy, reflects the lack of customer care in the Philippines' PUV system. The three factors mentioned above are considered to be associated with the customer care dimensions of the PUV system. The customer care dimensions indicate the driver's satisfactory performance and the care they provide to the commuters (Tiglao et al., 2020). Thus, the government and PUV operators should focus on improving these customer related dimensions.

5.3. Limitations and future research

The findings from this study yielded exciting insights into the service quality of PUV in the Philippines. However, some limitations should be taken into consideration. First, the study measured the service quality of

PUV, consisting of tricycles, jeepneys, buses, taxis, and UV express'. Further research needs to be done in measuring the service quality of each PUV. Second, the study only utilized the customer's perception of PUV. The study could generate insightful results if the customer's perception and expectations were measured. This study could also utilize machine learning algorithms such as data mining and analytics for further evaluation of human behaviour such as customer satisfaction. Finally, the study used dimensions from a modified SERVQUAL method (Šarac et al., 2017). Other relevant dimensions can also be incorporated in future research.

6. Conclusion

Recently, PUV studies are progressively focusing more on service quality (de Oña et al., 2013; Rahman et al., 2016). This study conducted Structural Equation Modelling (SEM) to investigate the service quality of PUV during this pandemic. A total of six dimensions that best represent the characteristic of PUV were identified and used. The results showed that three dimensions significantly influence PUV service quality and customer satisfaction. The three significant dimensions are COVID-19 protocols, tangibility, and assurance. Among the three significant dimensions, COVID-19 protocols showed to be the most significant. The positive reaction of commuters from the COVID-19 protocols indicates the PUV operator's compliance with the government.

On the other hand, the remaining three dimensions: reliability, responsiveness, and empathy, proved insignificant towards PUV service quality and customer satisfaction. The dissatisfaction of commuters with these three variables reflects the lack of customer care attributes of the Philippines' PUV system.

The findings from this study serve as an evaluation of the service quality of PUV during this pandemic. Determining the significant and insignificant dimensions offers several practical implications to different stakeholders, i.e., government and PUV operators. These practical implications can be a core strategy in improving the service quality of PUV in the Philippines.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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