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Measuring the city bus service quality based on users' perceptions: City bus service in Phnom Penh, Cambodia

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Abstract

The public transportation service quality continues to be one of the challenges for authorities and transportation stakeholders around the world. In this study, the researchers confront this challenge by identifying key attributes that affect the users' perceptions on bus service quality in Phnom Penh City. Questionnaire surveys were collected from bus users to measure their perceptions of the bus service quality. After that, data were analyzed using Factor analysis. Twenty-four quality attributes were analyzed utilizing exploratory factor analysis (EFA). This has led to the conclusion that five main factors affecting the perceptions of users regarding the quality of bus services. They are Bus Stop Facilities, Bus Services, Driver Attitude, Bus Capacity, as well as Vehicle Condition. To check whether factor structure is acceptable, confirmatory factor analysis (CFA) was applied. In this context, the high factor loading of CFA means those attributes had forceful beneficial effectiveness on city bus service quality. The results of this study will help the authorities and involved stakeholders gain a depth of understanding of the underlying problems of city bus service and consequently will enhance the city bus service quality.

Keywords: Service quality, City bus, Exploratory factor analysis, Confirmatory factor analysis, Cambodia

1. Introduction

Phnom Penh is the capital city of Cambodia as well as the largest city in the country in terms of population. In 2018, around 12.15% of Cambodia's population lived here. This will probably rise to 15.25% by 2030. Annually, the population of the city grows by 3.92% [1]. Generally, the population movement is into urban areas, mostly into Phnom Penh capital. Per capita growth of the GDP causes the main challenges to urban transport in Cambodia. For this reason, traffic congestion and accidents have become serious issues in the city. In 2015, the mean volume rate of recorded vehicles in Phnom Penh was about 20%, and the population has reached almost 1,500,000. Plus, the largest share of the registered vehicles was one of the effects due to the increase of motorcycles (accounting for about 84% of all registrations) [2].

Steg and Gifford [3] stated that the increase in cars on roads provides negative impact. Also, the low performance of public transport in part results from the growing numbers of private vehicles [4]. Indeed, Shamsuddin et al. [5] and Bunting [6] observed that the demand of car owners will continue to grow if people regard private vehicles as their first transportation choice. Many problems such as traffic bottlenecks, the poor air quality and noise, dissociable communities and pedestrian issues will occur. For these reasons, a mass transit network is required to prevent these problems. Improving the mass transit network service quality is an urgent priority. Public transport is a significant key to minimize the amount of personal transport inside a city. Additionally, it may help people who have financial limitations in paying the regularly changing paratransit mode or taxi fares when they do not own vehicles [7]. Public transport not only decreases the amount of personal transport and other means of transportation, but it also assists to minimize difficulties such as traffic bottlenecks, poor air quality and noise, driveway issues and power use [8].

Many techniques have been proposed in the literature for measuring service quality. However, a large concern with those techniques is that they are not often based on user evaluations [9]. The author further suggests that the best methods for quality evaluation are either user interviews to learn their viewpoints on the quality of service, or, by asking/enquiring about customer expectations or both.

According to Rietveld [10], public transport owners and suppliers may exaggerate the service quality provided by comparing to the evaluations of users. Instead of thinking about user viewpoints on service quality, they tend to only

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care about manager perspectives of service. According to Parkan [11], attributes regarded as important by suppliers are different from the key factors considered by users. Therefore, measuring service quality should be done by asking the users to rate or rank some specifically selected service attributes. This will ensure that an overall satisfaction measure is achieved. Moreover, previous studies have demonstrated several other measures for determining the quality of the mass transit service. These include comfort, reliability, accessibility, information, and safety [12].

In the current market of great competition, service providers make an effort to offer a customer-centered quality of service. It is therefore indispensable to analyze the service quality regarding users' opinion since it is only customers who either endure a poor/inadequate service quality or feel delighted with the best service. In this study, a user thought survey is an appropriate method of gathering these viewpoints and perceptions to plan strategic policy for solutions. This study aims at first at assessing user perceptions of the quality of city buses in Phnom Penh. Second, it highlights the important factors that affect the quality of service and how those factors vary based on different user groups. These results will further aid the authorities and involved stakeholders with necessary information that they might use to improve the transportation system in Cambodia.

2. Literature review

The importance of evaluating the quality of service provided from user perspectives cannot be overemphasized. On the basis of Ettema et al. [13] as well as Hayes [14], users are considered a soft index that can be utilized as a principal key for measuring service quality. This is they are the direct users of the service provided. Furthermore, Iseki and Taylor [15] stated that the ultimate judges of the quality of service are the customers and their satisfaction can be studied using the customer satisfaction surveys. This will further aid the authorities and involved stakeholders to strengthen the quality of service provided and will further ensure growth in the number of people to use the service.

In the previous researches, there have been discussions about identifying whether a built environment or a better transit service can influence the development of sustainable cities [16]. These discussions about the quality of public transport have attracted much attention and research. This has led to the proposal of several indicators to evaluate the quality of mass transit services. These indicators include general transport network features such as vehicles, terminals and stops, interchange locations, and tangible services including equipment, the comfort of service and controlling operation support [17].

Other researchers have worked intensively in identifying the factors and contributors to the effectiveness of public transport. Their findings rely on and strengthen the value of service quality surveys from the customers' perspective. The result of Deb and Ahmed [18] showed that safety, comfort, timely performance, and accessibility were significant factors which affect the level of service on the basis of perceived and expected quality. Ratanavaraha et al. [19] considered buses, drivers and staff, and administration to be significant components contributing to the quality of tour bus service using Hierarchical CFA. Additionally, Verbich and El-Geneidy [20] used logistic regressions to assess different types of riders' satisfaction, resulting in identification of three main factors, bus services, vehicles, and bus capacity. Hu et al. [21] applied EFA, CFA, Structural Equation Modeling (SEM), and multinomial logit modeling to determine transit service performance based on passengers' perspectives. It has been found that bus services, availability, and safety were significant elements. Moreover, Mouwen [22] did multiple regression to assess customer satisfaction with public transport by services, driver attitudes, and vehicles. Nwachukwu [7] did a quality measurement of public bus transport services considering buses, bus stop facilities, and bus capacity. Furthermore, Shaaban and Khalil [23] stated that buses, stations, and drivers are the three important contributors to customer satisfaction with a bus service by applying SEM. Veliou et al. [24] suggested that the number of passengers using public transport increases by enhancing the transit system's efficiency. Plus, Iseki and Taylor [15] suggested two key elements to measure mass transit quality, the terminals, and stops along the transportation routes, followed by security. Abreha [25] found through his research that the critical components that support the effectiveness of mass transit are reliability and accessibility. Finally, Lau and Chiu [26] found accessibility and mobility to be the major characteristics of satisfaction by people concerned about mass transit. Based on the literature, the researchers decided to measure the city bus service quality regarding users' perceptions employing a user survey. This is because it is considered by many authors as the best method for evaluation of satisfaction.

3. Methodology

Figure 1 illustrates the methodological procedure employed of the current study. It is comprised of four main tasks:

1) Primary work: First, the statement of problems was determined and then, study objectives were formulated.

2) Questionnaire design: The questionnaire was adapted from a previous case study in Mauritius [27]. The structure of the questionnaire and data collection processes are described in Section 3.2.

3) Data collection and modeling: There are four initial activities in this part. First, data were gathered through the questionnaire. Second, the data were recorded and screened after collecting. Third, descriptive statistics were used to determine means, standard deviations, skewness, and kurtosis. Last, the data were used in factor analysis.

4) Final work: The findings of the study, discussion, and conclusion are outlined in this section.

3.1 Study area and participants

The city bus service in Phnom Penh was used in quality measurement in this research. Data were collected partly from the users at the terminals and stops along the city bus routes in Phnom Penh. For other parts, users were directly interviewed while they were on board the buses. As a result, 500 respondents were interviewed along all eight bus routes throughout the city.

3.2 Questionnaire design and data collection

To perceive the users' perceptions of city bus service, data were gathered using a questionnaire survey. According to Kline [28], the minimum sample size when using

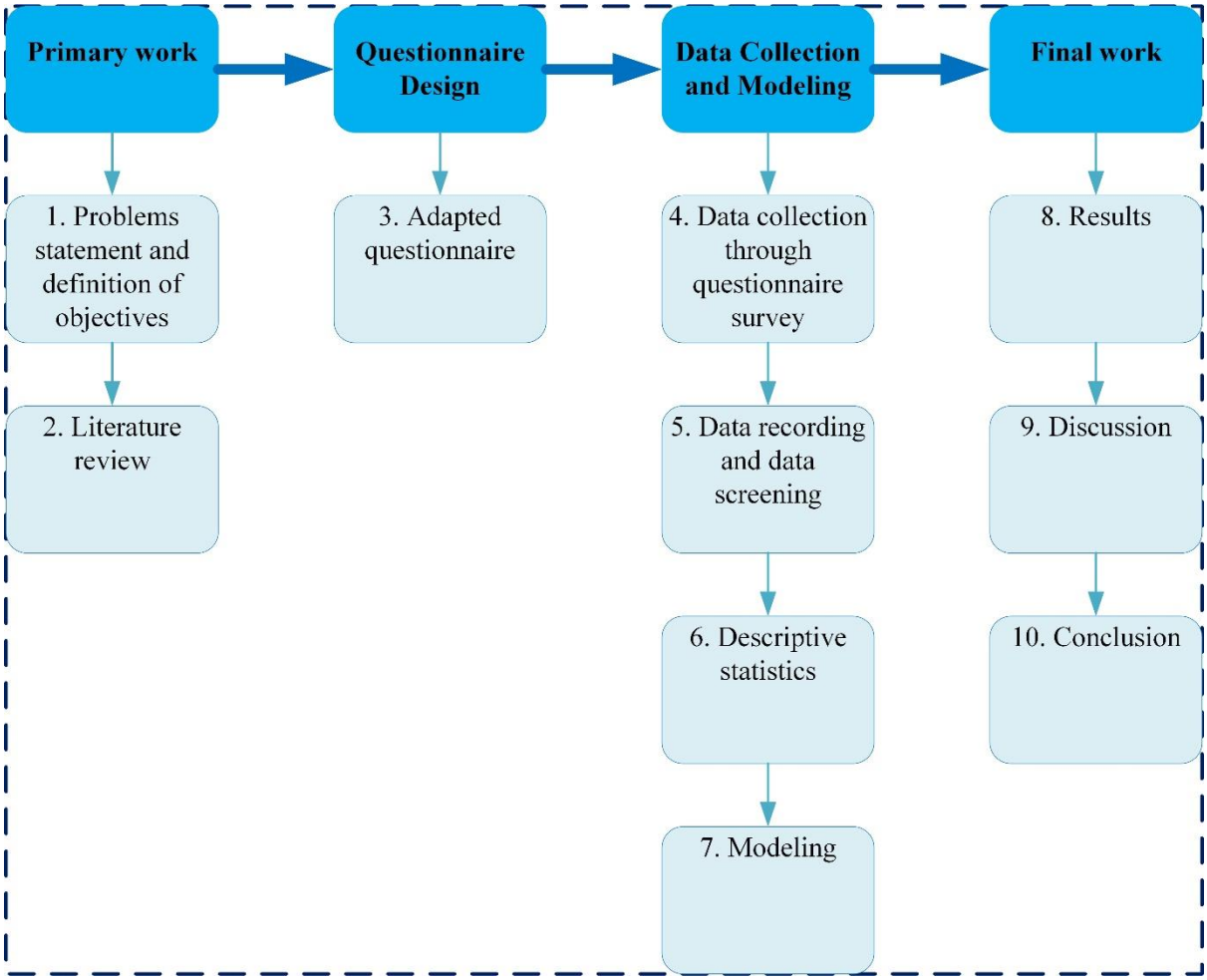

Figure 1 Research methodological procedure

CFA is 20 time the number of variables. As a result, the sample size needed to be at least 20 x 24 = 480 samples for these 24 variables.

In developing the questionnaire, the questions were divided into two sections. The first part included users' demographic information such as their age, school level, gender, and medium earnings. For the second one, respondents were asked to answer twenty-four questions to evaluate the city bus service quality based on their perceptions of satisfaction with a five-point Likert scale, from 1 meaning "strongly disagree" to 5 referring to "strongly agree" [29].

3.3 Factor analysis

Factor analysis, one of the multivariate data analysis techniques, was utilized to analyze the basic factors which affect a group of correlated observed parameters [30]. Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA) are the two principal types of factor analysis. Exploratory factor analysis was applied to determine latent (hidden) variables or constructs. Factor analysis plays an important role in reducing numerous particular elements into a smaller number of proportions [31]. So, instead of many issues in the study, these questions can be reduced to fewer number which still contains the information that was present in the initial group. EFA is appropriately used when a researcher does not have a specific number of unobserved/underlying factors [32]. CFA is applied to check the relationships of common factors and observed parameters [18, 32]. It is very necessary for the researcher to clearly understand the overall number of factors plus the connections between the common/latent factors and observed variables before attempting CFA modeling [18, 21, 32]. To streamline data by reducing the number of parameters in the regression model, factor analysis is applied. These final components are utilized as the measures of user perceptions of bus service quality. Therefore, EFA was used in this study to group variables into the dimension of bus service and do in-depth interpretation based on the questionnaire items. More importantly, the results of EFA were further evaluated by CFA for the purpose of addressing the weaknesses of EFA, leading to accurate results.

4. Results

4.1 Sample description

In 2018, the population of Phnom Penh city was 1,501,725. Based on the rule using CFA, the minimum size of the sample is 480. For this reason, data were collected through a questionnaire survey of 500 customers, including 164 male (32.80%) and 336 female respondents (67.20%). Among the 500 respondents, 149 participants (29.80%) were under the age of 20, 343 (68.60%) were between 20 to 65 years old, and only 8 people (1.60%) were older than 65 years. With regard to educational level, 245 participants

Table 1 Sample profile

		Frequency	Percentages
Gender	Men	164	32.80
	Women	336	67.20
Age	10 - 19	149	29.80
	20 - 29	212	42.40
	30 - 39	79	15.80
	40 - 49	26	5.20
	50 - 59	22	4.40
	60 - 65	4	0.80
	65+	8	1.60
Education level	Upper Secondary	201	40.20
	Diploma	44	8.80
	Bachelor	248	49.60
	Master	5	1.00
	Doctor	2	0.40
Average income	None	268	53.60
	<= 100$	17	3.40
	101$ - 200$	84	16.80
	201$ - 300$	79	15.80
	301$ - 400$	27	5.40
	401$ - 500$	13	2.60
	500$ +	12	2.40
Citizenship	Cambodian	500	100
	Tourist	0	0
Travel Experience	Yes	90	18.00
	No	410	82.00

(49.00%) had less than a bachelor's degree, while 248 respondents held bachelor's degree. Additionally, 7 (1.4%) had advanced education. In terms of average income, it was observed that 268 respondents did not have a salary or they were studying, 17 (3.4%) earned less than 100$, 203 participants (40.6%) earned from 100$ to 500$, and 12 (2.4%) reported that they earned more than 500$ per month. Furthermore, all 500 participants were Cambodian. Relating to the travel experience, ninety respondents (18.00%) said that they had encountered a broken-down bus, while 410 (82.00%) of passengers have never had this experience, as shown in Table 1.

4.2 Descriptive statistics

Table 2 shows 24 attributes arranged from the maximum to the minimum favorable experience in accordance with the results of participants' perceptions on city bus service quality. On the basis of these results, the mean score of the respondents' perceptions ranged from the highest value of 4.194 to the lowest value of 2.942. This indicates that interviewees had a variety of viewpoints of the city bus service. Moreover, the lowest value had a standard deviation of 0.632 and the highest value standard deviation was 0.976. In this table, it can be observed that V14, which represents "Bus routes cover every area", has the minimum mean value. Table 2 is also shown the results for skewness and kurtosis. According to Kline [28], the acceptable range of skewness of each variable should be in the range of -3 to +3, and the value of kurtosis should be less than 10. Considering skewness and kurtosis, the data had a normal distribution with 24 observed variables.

4.3 Exploratory factor analysis (EFA)

The values of factor loadings, Eigenvalue, percentage of variance explained, and Cronbach's alpha were determined using SPSS and these results are indicated in Table 3.

Principal component analysis and varimax rotation were utilized in factor analysis. These aim at testing the structure of the underlying factors of the data. Therefore, items which have a factor loading lower than 0.30 were removed, which further led to a lack of cross-loaded items. Maskey et al. [33] used a recent study on EFA that demonstrated that the cut-off value should be less than 0.3 or 0.4. The restricted value of Eigenvalues must be above 1.00 for the purpose of establishing the number of selected components.

Researchers estimated the internal consistency of the scores using the Cronbach alpha reliability test. Items in the questionnaire were tested in accordance with the five extracted factors. The reliability coefficient gives the consistency of the questionnaire. The readings of Cronbach's alpha for factors 1-4 ranged from 0.736 to 0.837. These results are good because if there are more than 10 items, then the Cronbach alpha value needs to be higher than 0.70. For factor 5, the Cronbach's alpha was equal to 0.612, which is an acceptable value. According to Hinton et al. [34], the accepted Cronbach's alpha ranges between 0.5 and 0.75 indicate a moderately reliable scale. Also, reliability was analyzed using Kaiser-Meyer-Olkin (KMO) = 0.888. This value is not far from 1 and more than 0.5. For Bartlett's Test of Sphericity: $\chi^2 = 45722.654$ ($p < 0.001$).

Table 3 shows the results of exploratory factor analysis. It has been observed that *Bus Stop Facilities* is the latent factor that most dominates the quality of bus service from a user perspective. It accounts for 16.130% of the total 57.068% variance, with an Eigenvalue of 3.871. Moreover, this factor consists of eight quality measures of bus service. These results indicate that the users' perceptions of the quality of bus service are highly dependent on bus stop facilities, to a much greater degree than any other factors. Therefore, any future improvements in the city bus service quality should take these items seriously to improve bus

Table 2 Descriptive statistics of bus service quality attributes

Code	Attributes	Mean	SD	Skewness	Kurtosis
V24	The temperature inside buses is cool.	4.194	0.821	-1.158	1.796
V22	Vehicle appearances look decent.	4.106	0.632	-0.518	1.137
V17	Driver and crew had good personality.	4.100	0.698	-0.814	1.808
V15	Ease of buying tickets.	4.066	0.846	-1.004	1.350
V19	Bus driven safely.	4.058	0.795	-1.186	2.383
V13	Bus schedule/maps are shown at bus stops.	3.936	0.773	-1.093	2.241
V18	Driver and crew are friendly, helpful and polite.	3.906	0.843	-0.788	0.79
V16	Timetable is clear and easy to understand.	3.872	0.849	-1.153	1.932
V23	Buses are clean.	3.632	0.864	-0.806	0.919
V11	Buses operated punctually according to schedule.	3.628	0.878	-0.573	0.236
V1	Bus stops have roofs that protect from sun and rain.	3.608	0.955	-0.449	-0.124
V4	Bus stops are durable and strong without any damage.	3.430	0.878	-0.312	0.252
V2	There are seats at bus stops.	3.414	0.906	-0.246	-0.251
V10	There are enough bus services outside rush hours.	3.412	0.925	-0.388	-0.154
V8	Bus stops are located in safe areas.	3.378	0.881	-0.287	0.048
V12	Bus schedules are online as Internet/application.	3.376	0.923	-0.338	0.266
V6	Bus stops are located near residences.	3.362	0.936	-0.353	-0.33
V5	Bus stops are sufficiently available at main buildings.	3.228	0.933	-0.260	-0.479
V20	Buses are crowded in rush hours.	3.168	0.895	-0.134	0.071
V9	There are enough bus services in rush hours.	3.152	0.942	-0.090	-0.244
V3	Bus stops are clean.	3.136	0.925	-0.090	-0.357
V7	Bus stops are lighted at night.	3.132	0.974	-0.019	-0.491
V21	Buses are crowded outside rush hours.	3.118	0.900	-0.185	-0.083
V14	Bus routes cover every area.	2.942	0.976	0.142	-0.652

Table 3 Exploratory factor analysis results

Factor	Code	EFA (N = 500)			
		Loadings [a]	Eigenvalue	Variance explained (%)	Cronbach's (α)
Factor 1: Bus Stop Facilities			**3.871**	**16.130**	**0.821**
	V1	0.714			
	V2	0.760			
	V3	0.576			
	V4	0.601			
	V5	0.607			
	V6	0.511			
	V7	0.559			
	V8	0.543			
Factor 2: Bus Services			**3.746**	**15.609**	**0.818**
	V9	0.339			
	V10	0.410			
	V11	0.602			
	V12	0.669			
	V13	0.665			
	V14	0.449			
	V15	0.601			
	V16	0.657			
Factor 3: Driver Attitude			**2.228**	**9.282**	**0.736**
	V17	0.755			
	V18	0.685			
	V19	0.600			
Factor 4: Bus Capacity			**2.211**	**9.212**	**0.837**
	V20	0.855			
	V21	0.868			
Factor 5: Vehicle Condition			**1.640**	**6.835**	**0.612**
	V22	0.674			
	V23	0.418			
	V24	0.820			

KMO = 0.888, Bartlett's Test of Sphericity: $\chi^2 = 45722.654$, df = 276, $p < 0.001$

[a] all factor loadings are significant at $\alpha \leq 0.05$

stop facilities. The second latent factor is the *Bus Services*. It accounts for 15.609% of the total 57.068% variance with an Eigenvalue of 3.746. This factor also consists of eight service quality measures. The results show that *Bus Services* is a very important factor from customer. Furthermore, the third latent factor is the *Driver Attitude*. It accounts for 9.282% of the total 57.068% variance with an Eigenvalue of 2.228. This factor consists of three service quality measures. Moreover, *Bus Capacity* is another latent factor that accounts for 9.212% of the total 57.068% variance with an Eigenvalue of 2.211. It is comprised of three service quality measures. The last latent factor is the *Vehicle Condition*, which accounts for 6.835% of the total 57.068% variance with an Eigenvalue of 1.640. There are three important bus service quality measures for this factor.

4.4 Confirmatory factor analysis (CFA)

4.4.1 Standardized factor loadings

This method begins by looking at the standardized loadings. According to Figure 2, factor loadings of V2-V24 are in the range of 0.402 – 0.883, which are over the cut-off values. Only the loading of V1 falls below 0.3. Most of the cut-off values of factor loadings in CFA are 0.5 [18, 32]. Hair et al. [35] stated that for the sample sizes of 350 or greater, a factor loading of 0.3 is significant. Thus, it is evident that V1 needed to be dropped.

4.4.2 Model fit indices

Figure 2 illustrates the findings of CFA. With Mplus7, the results of second-ordered CFA, the goodness-of-fit statistics are as follows: $\chi^2 = 492.309$, df = 207, $p < 0.001$, RMSEA = 0.053, CFI = 0.931, TLI = 0.916, and SRMR = 0.051. In comparison with the proposed criterion in Table 4, the model fits the data very well. In reference to these fit indices, the structures of the model have been accomplished with some amendments, which lead to good fitting models of this data. The best fit models and the standardized coefficients are shown in Figure 2.

4.4.3 Convergent validity

Convergent validity was the indicator of the individual constructs that should share a great percentage of variance.

Table 4 Model fit indices

Abbreviations	Stand for	Criterion / References
χ^2	Chi-square	χ^2/df ≤ 5 [18]
df	Degrees of Freedom	
RMSEA	Root Mean Square Error of Approximation	≤ 0.08 [18, 21]
CFI	Comparative Fit Index	> 0.9 [18, 21]
TLI	Tucker Lewis Index	> 0.8 [36]
SRMR	Standardized Root Mean Residual	≤ 0.08 [37]

Table 5 Results of standardized factor loadings, composite reliability, and average variance extracted of the model

Factor	Code	CFA (N = 500)			
		Loadings	Error Variances	CR	AVE
Factor 1: Bus Stop Facilities				**0.987**	**0.602**
	V2	0.495	0.038		
	V3	0.720	0.027		
	V4	0.500	0.039		
	V5	0.699	0.029		
	V6	0.650	0.031		
	V7	0.522	0.038		
	V8	0.631	0.032		
Factor 2: Bus Services				**0.989**	**0.597**
	V9	0.706	0.029		
	V10	0.633	0.031		
	V11	0.700	0.028		
	V12	0.681	0.029		
	V13	0.474	0.039		
	V14	0.460	0.039		
	V15	0.490	0.038		
	V16	0.629	0.031		
Factor 3: Driver Attitude				**0.971**	**0.651**
	V17	0.538	0.043		
	V18	0.708	0.036		
	V19	0.708	0.035		
Factor 4: Bus Capacity				**0.977**	**0.849**
	V20	0.883	0.034		
	V21	0.814	0.034		
Factor 5: Vehicle Condition				**0.954**	**0.556**
	V22	0.433	0.045		
	V23	0.834	0.044		
	V24	0.402	0.044		

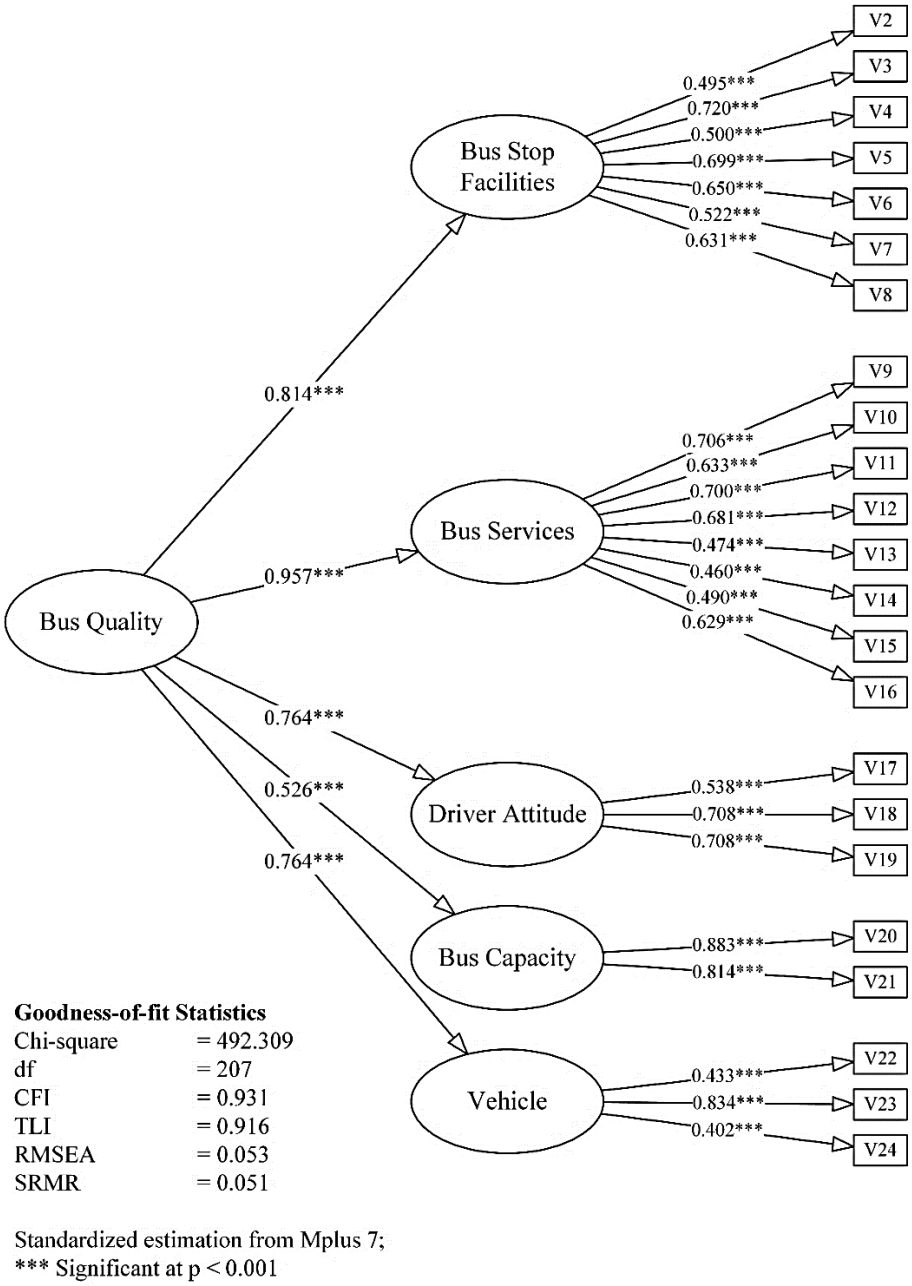

Figure 2 Confirmatory factor analysis results

To estimate the convergent validity among item measures, there are several approaches such as Standardized Factor Loadings, Composite Reliability (CR), and Average Variance Extracted [35, 38]. Hair et al. [35] suggested that if the CR is equal or higher than 0.70 and the value of AVE is equal or higher than 0.50, good reliability and adequate convergence will result. Moreover, all factor loadings are required to be statistically significant (> 0.3 in the case where the sample sizes are 350 or greater).

Table 5 illustrates the findings of Standardized Factor Loadings, Composite Reliability, and Average Variance Extracted. It was observed that the values of all measures are consistent with the criteria. All standardized factor loadings are greater than 0.4. The values of CR are in the range of 0.954 – 0.989 and the AVE values range from 0.556 to 0.849. Therefore, there is adequate confirmation of the convergent validity of the measures.

5. Discussion

The results of this study give an in-depth understanding of bus service quality from users' perceptions. These results also suggest that all the items were retained and were categorized under five different categories, *Bus Stop Facilities, Bus Services, Driver Attitude, Bus Capacity, as well as Vehicle Condition*.

Based on the structural model, it was observed that Bus Services is the most crucial factor, followed by Bus Stop Facilities, Driver Attitude, Vehicle Condition, and Bus Capacity, respectively.

Bus Services

The most important factor is the Bus Services. Regarding the measurement model, it was observed that users have

much interest in bus services, punctuality, and bus schedules. Additionally, there are inadequate bus routes. Therefore, for improving the bus quality, it would be best to take these three important elements in consideration by adding more bus routes to cover all the areas in Phnom Penh and provide more buses as well. This finding is in agreement with the study of De Oña et al. [39] which identified Bus Services as the main factor of service quality.

Bus Stop Facilities

It is the second main factor that effects on users' perceptions of bus service quality involves the cleanliness, convenience, and location of the bus stops. It has been revealed that "V3" having the highest regression weight, can be interpreted to mean that cleanliness of bus stops is very important to users. It is followed by the location and convenience of bus stops. This result is similar to [7] who indicated that inadequacy of bus stop facilities makes the public bus customers dissatisfied with the service.

Driver Attitude

Driver Attitude is the third most vital bus service quality measure. From the measurement model, it has been perceived that "V18" and "V19" have the highest regression weight, which means that on-board staff attitudes and safety are very significant to users. Public bus users require that drivers operate at safe speeds, respecting traffic rules. This result is in line with the findings of Deb and Ahmed [18] who showed that safety has a great impact on passenger satisfaction. Additionally, it is consistent with the studies of Cafiso and Graziano [40] and Eboli and Mazzulla [41].

Vehicle Condition

Vehicles are also a significant factor of bus service quality. The measurement model has shown that "V23" has the highest regression weight. This means that cleanliness of bus is most essential to user perceptions. This indicator is in agreement with the study of Tyrinopoulos and Antoniou [42] who indicated that vehicle cleanness plays a critical role in satisfying customers. Moreover, in further support of this finding, Jomnonkwao and Ratanavaraha [32] found that cleanliness is important to perceived vehicle service quality. The indicators of this dimension are presented previous research such as that of Deb and Ahmed [18], Güner [43], Goh et al. [44], and Hensher et al. [45].

Bus Capacity

Last, Bus Capacity is also an essential factor in bus service quality. In this instance, the users have the most concern about the availability of seats during rush hours rather than in normal hours. This dimension is supported by the study of Nwachukwu [7] who stated that bus capacity plays an important role to serve passenger needs. Insufficient numbers of buses (particularly high-capacity buses) caused many problems such as the long queues and long waiting periods, conflict to catch buses at the moment of arrival at most stops, and insufficient seating on many buses [7].

6. Conclusions

This study aims at measuring the city bus service quality in regard to users' perceptions in Phnom Penh. To fulfill the research's objectives, a questionnaire survey was used as a tool to gather research data. In analyzing this data, factor analysis was performed. First, EFA was used for the purpose of classifying 24 parameters into five different categories, *Bus Stop Facilities, Bus Services, Driver Attitude, Bus Capacity, as well as Vehicle Condition.* The first factor (Bus Stop Facilities) is comprised of eight items and other eight items were categorized under Factor 2 (Bus Services). Factor 3 (Driver Attitude) consisted of three items and the other two items were classified into Factor 4 (Bus Capacity). The last three items were grouped under Factor 5 (Vehicle Condition). According to the results, it may be specified that these 24 variables are powerful indices that can be used to evaluate bus quality of these five factors at the 0.001 significance level. Next, the results of EFA were further evaluated using CFA. CFA analysis provides an in-depth understanding of which attributes of the bus service needed to be addressed on the basis of a particular perceptions. Based on the highest CFA loading score in the second-order model, the authorities and involved stakeholders can prioritize the most important factors and can make improvements sequentially. For example, "Bus Services" is the most important factor for improving service quality, followed by Bus Stop Facilities, Driver Attitude, Vehicle Condition, and Bus Capacity. This means that the authorities and involved stakeholders should consider "Bus Services" first. By looking at the first-order model, "*There are enough bus services in rush hours.*" had the highest loading score, which indicated that the users/customers were most concerned about bus services in the peak hours. Concerning the second-highest factor loading score "Bus Stop Facilities", the attribute that gives the most significant improvement is "The cleanliness of the bus stops".

In the future, if these findings are taken into account, the performance of city bus services in Phnom Penh will be improved. Furthermore, the findings in this study are beneficial for Cambodian authorities and involved stakeholders who have the intention of providing a model to be used to solve problems/complains from the bus users regarding transportation policy.

7. References

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