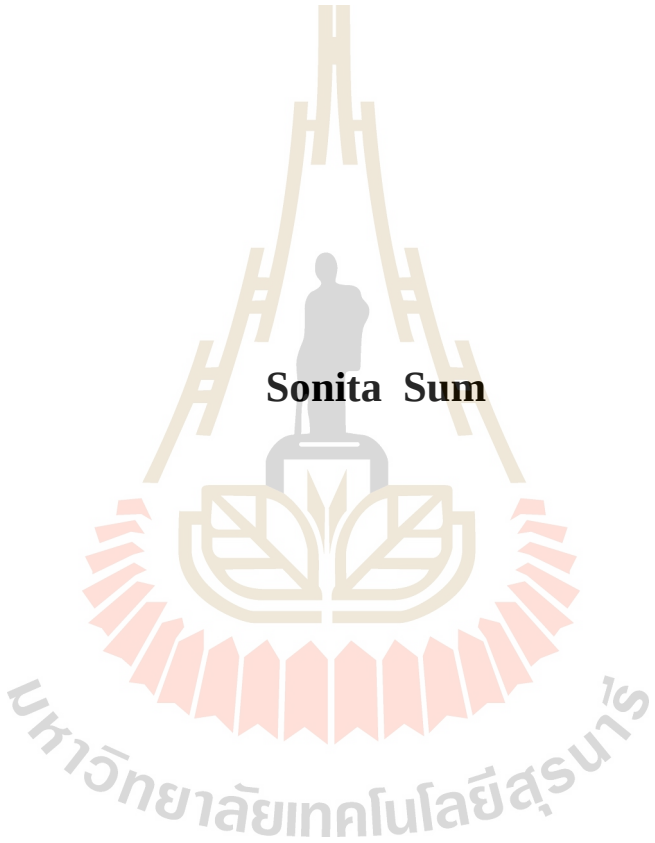
INVESTIGATING THE CITY BUS SERVICE QUALITY BASED ON USERS' PERCEPTIONS AND USERS' EXPECTATIONS

Sonita Sum



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การศึกษาการรับรู้และความคาดหวังของผู้ใช้บริการต่อคุณภาพการให้บริการของรถโดยสารประจำทาง

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วิทยานิพนธ์นี้เป็นส่วนหนึ่งของการศึกษาตามหลักสูตรปริญญาวิศวกรรมศาสตรมหาบัณฑิต
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INVESTIGATING THE CITY BUS SERVICE QUALITY BASED ON USERS' PERCEPTIONS AND USERS' EXPECTATIONS

Suranaree University of Technology has approved this thesis submitted in partial fulfillment of the requirements for a Master's Degree.

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วัตถุประสงค์ของงานวิจัยนี้ เพื่อศึกษาคุณภาพการให้บริการของรถโดยสารประจำทางในเมืองพนมเปญ บนพื้นฐานของการรับรู้และความคาดหวังของผู้ใช้บริการ เพื่อที่จะสามารถเป็นแนวทางสำหรับการจัดทำกลยุทธ์หรือนโยบายต่างๆ สำหรับรัฐบาลกัมพูชา หรือหน่วยงานที่เกี่ยวข้องในภาคการขนส่ง ทั้งนี้เพื่อยกระดับคุณภาพในการให้บริการของรถโดยสารประจำทาง โดยในงานวิจัยนี้จะแบ่งออกเป็น 3 ส่วนดังนี้

สำหรับการศึกษาส่วนที่ 1 ซึ่งเป็นการศึกษาถึงตัวชี้วัดที่สำคัญที่เกี่ยวข้องกับคุณภาพการให้บริการของรถโดยสารประจำทางในเมืองพนมเปญ โดยการสอบถามระดับการรับรู้ถึงคุณภาพการให้บริการของรถโดยสารประจำทางจากผู้ใช้บริการ 500 คน จากผลการวิเคราะห์องค์ประกอบเชิงสำรวจ (Exploratory Factor Analysis) สามารถแบ่งตัวชี้วัดคุณภาพทั้งหมด 24 ตัวชี้วัดได้เป็น 5 กลุ่มคือ ป้ายหยุดรถ การให้บริการ พนักงานขับรถ ความจุของรถ และตัวยานพาหนะ จากวิเคราะห์องค์ประกอบเชิงยืนยันลำดับที่สอง (Second-ordered Confirmatory Factor Analysis) สามารถยืนยันความเป็นองค์ประกอบของปัจจัยคุณภาพด้วย 5 กลุ่มตัวแปรดังกล่าว

ในการศึกษาส่วนที่ 2 ได้ทำการศึกษาถึงปัจจัยที่มีอิทธิพลต่อการรับรู้และความคาดหวังของผู้ใช้บริการต่อการให้บริการของรถโดยสารประจำทาง และศึกษาถึงความสัมพันธ์ระหว่างการรับรู้ ความคาดหวังของผู้ใช้บริการ และ ความพึงพอใจต่อการให้บริการ โดยการประยุกต์ใช้การวิเคราะห์โมเดลสมการโครงสร้าง (Structural Equation Modeling; SEM) ทั้งนี้การรับรู้และความคาดหวังของผู้ใช้บริการจะทำการวิเคราะห์แยกกันโดยวิธีการวิเคราะห์องค์ประกอบ (Factor analysis) และจากการวิเคราะห์องค์ประกอบเชิงสำรวจซึ่งแบ่งตัวชี้วัดได้เป็นตัวแปรแฝง 5 ตัวแปร คือ ป้ายหยุดรถ การให้บริการ พนักงงานขับรถ ความจุของรถ และตัวยานพาหนะ และตัวแปรดังกล่าวสามารถยืนยันความเป็นองค์ประกอบได้จากการวิเคราะห์องค์ประกอบเชิงยืนยันลำดับที่สอง (Second-ordered Confirmatory Factor Analysis) ดังที่กล่าวมาในข้างต้น เมื่อพิจารณาผลจากการวิเคราะห์ด้วยโมเดลสมการโครงสร้าง (Structural Equation Modeling; SEM) พบว่า การรับรู้ถึงคุณภาพการให้บริการมีความสัมพันธ์เชิงบวกอย่างมีนัยสำคัญทางสถิติต่อความพึงพอใจ ในขณะที่ความคาดหวังมีความสัมพันธ์โดยตรงต่อการรับรู้ถึงคุณภาพการให้บริการ แต่มีความสัมพันธ์ทางอ้อมต่อ ความพึงพอใจ อย่างมีนัยสำคัญทางสถิติ

สำหรับส่วนสุดท้ายนี้ ได้ทำการศึกษาการประยุกต์ใช้ Importance-Performance Analysis (IPA) เพื่อทราบถึง จุดแข็ง และจุดอ่อนของการให้บริการของรถโดยสารประจำทางในเมืองพนมเปญ โดยผลการวิเคราะห์พบว่า รัฐบาลหรือหน่วยงานที่เกี่ยวข้องควรยกระดับหรือรักษาระดับการให้บริการในตัวชี้วัดที่สำคัญซึ่งจะตกอยู่ในจตุภาค “Concentrate here” และ “Keep up the good work” ตามลำดับ ซึ่งตัวชี้วัดดังกล่าวคือ ความครอบคลุมพื้นที่ของเส้นทางรถโดยสารประจำทาง

งานวิจัยนี้จะเป็นประโยชน์สำหรับรัฐบาลกัมพูชาหรือหน่วยงานที่เกี่ยวของในภาคการขนส่ง ด้วยความตั้งใจที่จะพัฒนาแบบจำลองซึ่งจะสามารถใช้เป็นเครื่องมือหรือแนวทางสำหรับการกำหนดกลยุทธ์ต่างๆ เพื่อแก้ไขปัญหา ข้อร้องเรียนด้านคุณภาพการให้บริการของรถโดยสารประจำทางจากผู้ใช้บริการ

สาขาวิชา วิศวกรรมขนส่ง ลายมือชื่อนักศึกษา _____

ปีการศึกษา 2562 ลายมือชื่ออาจารย์ที่ปรึกษา _____

SONITA SUM : INVESTIGATING THE CITY BUS SERVICE QUALITY BASED ON USERS' PERCEPTIONS AND USERS' EXPECTATIONS. THESIS ADVISOR : PROF. VATANAVONGS RATANAVARAHA, Ph.D., 112 PP.

CITY BUS/SERVICE QUALITY/USERS' PERCEPTIONS/ USERS' EXPECTATIONS/STRUCTURAL EQUATION MODELING

This research aims at investigating the service quality of city bus in Phnom Penh on the basis of users' perceptions and users' expectations in order to be the strategical policies/ guidelines for Cambodia government authorities/ transportation stakeholders to enhance the city bus performance by categorizing into three sections.

The first section figured out the important indicators relating to the city bus service quality in Phnom Penh context by inquiring the users' perceptions of the bus service quality, resulting from 500 participants. According to Exploratory Factor Analysis (EFA), twenty-four quality indicators were divided into five main groups consisting of Bus Stop Facilities, Bus Services, Driver Attitude, Bus Capacity, as well as Vehicle. These five groups of variables were then confirmed by the Second-ordered Confirmatory Factor Analysis (CFA).

Regarding the second section, the potential factors influencing the users' perceptions and users' expectations of the city bus service were examined and the study of relationship between users' perceptions, users' expectations, and overall satisfaction of the service was conducted by Structural Equation Modeling (SEM). Users' perceptions and users' expectations were separately analyzed by Factor analysis. As a consequence, the big picture of EFA revealed that both data sets have extracted five

latent factors including Bus Stop Facilities, Bus Services, Driver Attitude, Bus Capacity, as well as Vehicle. The Second-ordered Confirmatory Factor Analysis (CFA) confirmed the structures of these mentioned factors. When considering the result of SEM, it was found that "perceptions" has the positive significant relationship to "overall satisfaction", while "expectations" has the direct significant relationship with "perceptions" but has the indirect relation to "overall satisfaction".

For the last section, this study applied Importance-Performance Analysis (IPA) to discover the strengths and weaknesses of the city bus services in Phnom Penh. Based on the graphical result, the government authorities should enhance or maintain the important indicators which located in quadrants "Concentrate here" and "Keep up the good work", particularly the critical indicator "*Bus routes cover every area*".

This research will be helpful for Cambodia government authorities/ transportation stakeholders with the intention of providing a model to be used as a strategical yardstick to solve problems/complain from the bus users regarding transport policy.

School of Transportation Engineering Student's Signature _____

Academic Year 2019 Advisor's Signature _____

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SYMBOLS AND ABBREVIATIONS

α	=	Statistically significant level
β	=	Structural coefficient
χ^2	=	Chi-square
df	=	Degree of freedom
AVE	=	Average Variance Extracted
CFA	=	Confirmatory Factor Analysis
CFI	=	Comparative Fit Index
CR	=	Composite Reliability
EFA	=	Exploratory Factor Analysis
IPA	=	Importance–Performance Analysis
KMO	=	Kaiser–Meyer–Olkin
RMSEA	=	Root Mean Square Error of Approximation
SEM	=	Structural Equation Modeling
SRMR	=	Standardized Root Mean Residual
TLI	=	Tucker Lewis Index

CHAPTER I

INTRODUCTION

1.1 Rationale of the research

1.1.1 General background

Phnom Penh is the capital city of Cambodia which is also the largest in terms of population. According to UN World Urbanization Prospects (United Nations, 2018), around 23.4% population (2018) is residing in urban areas and this will probably increase to 29% and 41.2% by 2030 and 2050 respectively as shown in Figure 1.1. This population increase moving into the urban area, mainly in Phnom Penh capital for pursuing their education and seeking employment to improve their standard of living. It is noticed that the increase of GDP per capita creates the main challenge of urban transport in Cambodia resulting in traffic congestion, air and noise pollution, unsociable society, exposing pedestrians and cyclists, and traffic accidents have become the most serious issues in the capital. Moreover, the traffic situation in Phnom Penh city has been deteriorated in recent years due to the rapid increase of vehicles caused by the concentration of population in the capital. The traffic problem in Phnom Penh occurs because of the population growth and non-improvement of transport system (Neth, Hirobata, &Lim, 2005). Other sources of traffic problems are due to the deteriorated road condition and inappropriate road facilities, inefficient traffic control devices, illegal usage of sidewalks, lack of discipline of drivers and pedestrians, and lack of public transport services in the city. In addition, inadequate regulations, poor use of

traffic management measures, and low levels of enforcement also aggravate the problem (JICA, 2001).

In addition, the number of registered vehicles grew by over 11.7% per year, more than tripling the number of registrations over the decade. As reported by Phnom Penh City Hall and JICA Cambodia, the trend of registered vehicles from 2000 to 2011 is shown in Figure 1.2. The number of registered light and heavy vehicles in Phnom Penh Capital City has rapidly increased, from 62,000 in 2000 to 235,000 in 2011. And during the same period, the number of motorcycles has increased from 267,000 to 828,000 (JICA, 2014). The rapid expansion of the ownership and the use of private transport in the city has resulted in increasing traffic volumes and increased congestion as infrastructure development and traffic management measures have been outpaced (NCSD, 2016). Moreover, this augmenting numbers of vehicles in the city is also caused some harmful effects on the environment by producing CO_2 and NO_x.

The traffic issues in Phnom Penh have become a common social problem, which has decelerated the economic activities, intensified the travel cost and time, and degraded the quality of life. To deal with these traffic issues and environmental problems, the government authorities have thus initiated a plan for public transportation system by considering the formal public transport modes such as intra−city public bus and urban rail systems including Bus Rapid Transit (BRT), Light Rail Transit (LRT), Sky rail, and Tramway (JETRO, 2009; JICA, 2001; SYSTRA, 2012). Among these modes, only the public bus service was actually put into operation in Phnom Penh.

Moreover, JICA (2001) attempted to implement public transit through the Bus Rapid Transit system inside the city, but the city bus service failed. In terms of

bus service attributes, high bus fare, and lack of comfort were found to be the most important considerations for passengers in Phnom Penh. Despite the first and fail attempt of the public bus service in 2001, Phnom Penh Capital Hall and Japan for International Cooperation Agency (JICA) brought back the public bus service in early 2014. After a one−month long experiment, the bus service was extended and service routes were expanded. However, the sustainability of the public bus service in the city is still uncertain, mainly due to an unstable passenger demand (Phun, Pheng, &Yai, 2015).

From these reasons, it is therefore very significant to measure the service quality provided by recent public bus.

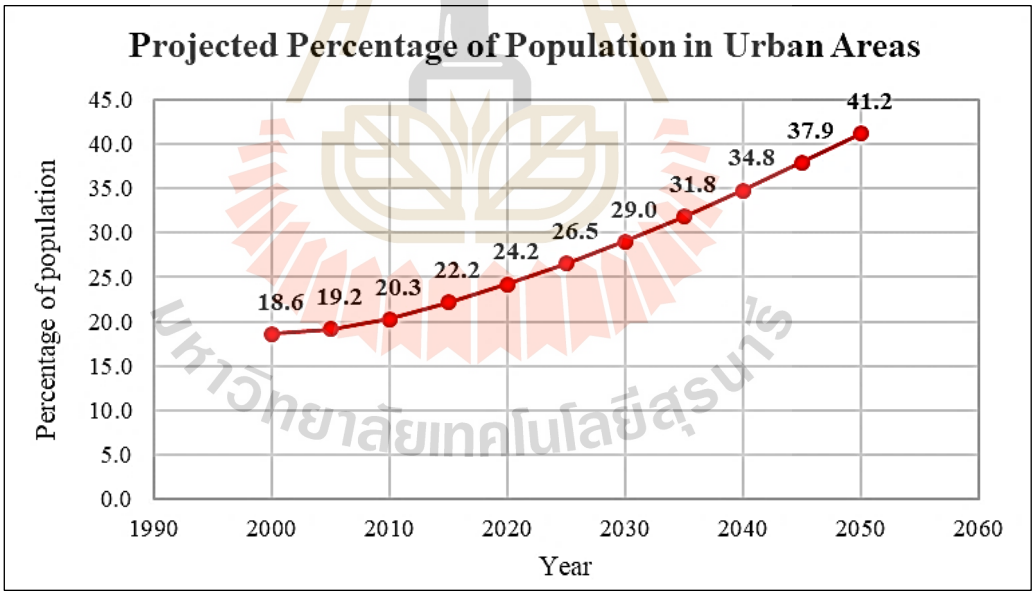

Figure 1.1 Trend of population in urban areas (2000 – 2050)

Source: United Nations, Department of Economic and Social Affairs, Population Division (2018). World Urbanization Prospects: The 2018 Revision.

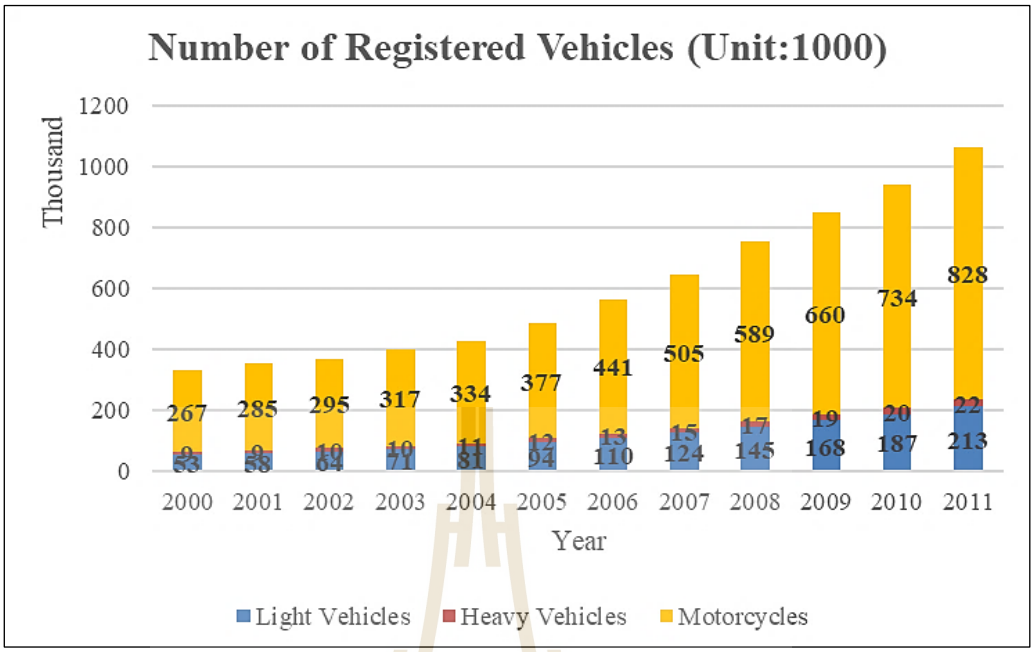

Figure 1.2 Number of registered vehicles in urban areas (2000 – 2011)

Source: Phnom Penh City Hall, JICA Cambodia

1.1.2 City bus service quality

As mentioned above, the traffic situation in Phnom Penh is still worse because of the lack of effective public transportation system. This is one of the key issues for transit engineers, planners, and operators to enhance the service quality. Up till now, there are only several studies focusing on the planning issues of the public transport system in Phnom Penh.

Phun, Lim, and Yai (2015) explored the characteristics of paratransit operation and fare in Phnom Penh, particularly the motorized paratransit modes with flexible transport service (i.e., Motordop and Remork). The result shows that the paratransit fare was influenced by several factors including trip attributes and driver working conditions.

Phun, Pheng, and Yai (2015) conducted Ordered Probit Modeling to investigate the factors affecting passengers' perceived bus performance in Phnom Penh. The results show that the perceived public bus performance is likely to be improved by enhancing the bus attributes (speed and comfort) and by addressing the bus passengers' concerns (requests for bus service expansion).

Virakvichetra, HIGASHI, and PHENG (2013) examined the preferential choices among private vehicles (motorcycle and car) and public transport (BRT and LRT). Analytic Hierarchy Process (AHP) was utilized to investigate the feasibility, assign priority criteria, and evaluate alternatives on the basis of potential demand in different areas and for various demographics of the city population. There are two types of factor in this study: Internal Factor (Travel Cost, Waiting Time, Travel Time, Comfort, and Safety) and External Factor/ Demography (Age, Gender, Job, Location, and Vehicle Ownership).

Long, Choocharukul, and Nakatsuji (2011) extended the Theory of Planned Behavior (TPB) model to explore the psychological factors influencing on commuters' behavioral intention toward the usage of future sky train in Phnom Penh. By conducting Structural Equation Modeling (SEM), it is found that the extension of TPB constructs, i.e. attitudinal aspect, subjective norm, perceived behavioral control, moral obligation, awareness of consequences, socioeconomic and travel characteristic significantly influence the behavioral intention towards future sky train usage.

Choocharukul and Ung (2011) conducted a stated preference study with general commuters to understand the potential mode change, from private vehicles and paratransit modes to a public bus. Based on several levels of bus service attributes including bus fare and headway, it was found that the potential demand for public bus

service was remarkably high.

However, there has never been research on the service quality of the city bus on the basis of the users' perceptions and users' expectations in Phnom Penh context.

1.2 Purpose of the research

The objectives of this research are:

1.2.1 To find out the indicators relating to the city bus service on the basis of users' perceptions,

1.2.2 To identify the potential factors which influence the users' perceptions and expectations of the city bus service and examine the relationship between users' perceptions, users' expectations, and overall satisfaction of the service,

1.2.3 To explore the gap between users' perceptions and users' expectations by identifying the strengths and weaknesses of the city bus service quality.

1.3 Scope of the research

The scopes of this research are as follows;

1.3.1 The city bus service of Phnom Penh has been considered for the quality assessment in this research (8 bus routes) as shown in Figure 1.3.

1.3.2 This research mainly focuses on the city bus's users.

1.3.3 Primary data were collected through questionnaire survey to know the users' perceptions and expectations of the city bus service.

1.3.4 Factor analysis was performed to identify the factors influencing the users' perceptions and users' expectations and Structural Equation Modeling was applied to know the relationship of users' perceptions, expectations, and satisfaction. Moreover, the strengths and weaknesses of the city bus service quality were investigated by conducting Importance−Performance Analysis.

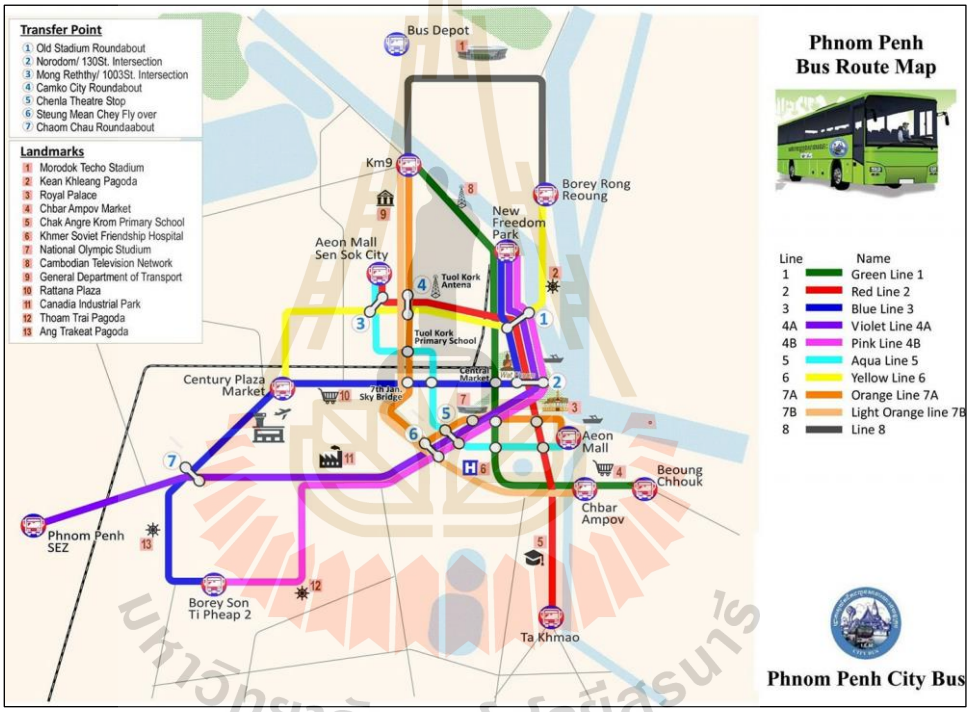

Figure 1.3 Bus route map of city bus in Phnom Penh (2018)

Source: Phnom Penh City Bus Authority

1.4 Research questions

This research has the following research questions;

1.4.1 What are the potential indicators suitable to be studied in the context of city bus in Phnom Penh?

1.4.2 What are the involved factors in the study which relate to the users' perceptions and users' expectations?

1.4.3 How do the users' perceptions and users' expectations affect to the overall satisfaction?

1.4.4 What are the strengths and weaknesses of the city bus service quality?

1.5 Contribution of the research

The contributions of this research are as follows;

1.5.1 Acknowledge the powerful indicators and factors which are suitable for the city bus quality in Phnom Penh context

1.5.2 Investigate the relationship between the users' perceptions, users' expectations, and overall satisfaction

1.5.3 Determine the strengths and weaknesses of the city bus service quality

These mentioned above contributions of this research would be beneficial for Cambodia authorities and transportation stakeholders with the intention of providing a model to be used as a benchmark to solve problems from the city bus users regarding transport policy.

1.6 Organization of the research

This research is divided into 5 chapters as follows;

Chapter I: Introduction section mentions the rationale and the importance of the problem objectives, purpose of the research, scope of the research, research questions, and expected contributions of the research.

Chapter II: Measuring the city bus service quality based on users' perceptions: City bus service in Phnom Penh, Cambodia. This chapter is the development of the key significant indicators which influence the users' perceptions on the bus service quality in Phnom Penh city.

Chapter III: City bus services in Phnom Penh: Users' perceptions, expectations, and satisfaction using Structural Equation Modeling (SEM). This chapter identifies the key significant attributors and potential factors influencing the users' perceptions and users' expectations on the bus service quality and discovers the relationship between users' perceptions, users' expectations, and overall satisfaction.

Chapter IV: An application of Importance–Performance Analysis (IPA) for evaluating city bus service quality in Cambodia. This chapter investigates the strengths and weaknesses of the city bus service in Cambodia.

Chapter V: Conclusion and recommendations. This section concludes the results from chapter II–chapter IV and gives the suggestions from the findings.

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CHAPTER II

MEASURING THE CITY BUS SERVICE QUALITY BASED ON USERS' PERCEPTIONS: CITY BUS SERVICE IN PHNOM PENH, CAMBODIA

2.1 Abstract

The public transportation services quality continues to be one of the challenges for authorities and transportation stakeholders throughout the entire globe. In this study, the researchers try to confront the challenge by identifying key important attributes that affect the users' perceptions on the bus service quality in Phnom Penh City. The questionnaire surveys were collected from bus users to measure their perceptions of the bus service quality. After that, data were analyzed by using Factor analysis. Twenty-four quality attributes were analyzed by utilizing Exploratory Factor Analysis (EFA), this has led to a conclusion that the five main factors affecting the perceptions of users regarding the quality of bus services are, Bus Stop Facilities, Bus Services, Driver Attitude, Bus Capacity, as well as Vehicle. 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 or involved stakeholders with a depth understanding of the underlying problem in city bus service and consequently will enhance the city bus service quality.

2.2 Introduction

In 2018, around 12.15% population inhabited in Phnom Penh, capital city of Cambodia, and this will probably be risen to 15.25% by 2030. Annually, the population in the city grows by 3.92% (United Nations, 2018). The movement of population increases into the urban area, mostly in Phnom Penh capital. This can be seen that the growth of GDP per capita causes the main challenge of urban transport in Cambodia. For this reason, there will be traffic congestion and traffic accidents that become the most serious issues in the city. In 2015, the mean volume rate of recorded vehicles in Phnom Penh was about 20%, and it had already reached almost 1,500,000. Plus, the largest share of the registered vehicles was one of the effects due to the increase of motorcycles (accounted about 84% of all registrations) ("Country report on sustainable urban transport (Cambodia)," 2016).

Steg and Gifford (2005) have mentioned that the increase in cars on roads provides a negative impact. Also, the low performance of public transport which is accessible in the cities due to these growing private vehicles (Badami &Haider, 2007). Indeed, Shamsuddin, Hassan, and Bilyamin (2012) and Bunting (2004) observed that it will consequently extend the demand of car if people keep considering the private vehicle as their first choice. Many problems such as traffic bottleneck, the badness of air and noise, dissociable community and pedestrians' issues will occur. For these reasons, the mass transit network is required to be put in operation to prevent the above-mentioned problems. Improving the mass transit network service quality is an urgent must. Public transport is the significant key to minimize the amount of personal transport inside the city plus it may help people who have a financial limit in paying the regularly changing paratransit mode or taxi fares and who do not own vehicles

(Nwachukwu, 2014). Public transport not only decreases the personal transports and other means of transportation but it also assists to minimize the difficulties like traffic bottleneck, the badness of air and noise, driveway issues and power use (Nocera, 2011).

Many techniques have been proposed in the literature for measuring service quality, but one thing of concern with those techniques is that they are not often based on users' evaluation (Figini, 2003). The author further suggests that the best methods for quality evaluation is either by interviewing users about their viewpoints on the quality of service, or, by asking/enquiring to know the customer expectation or both.

As stated by Rietveld (2005), public transport owners and suppliers may exaggerate the service quality provided by comparing to the evaluations of users. Instead of thinking about users' viewpoint on service quality, they tend to only care about managers' perspective of service. According to Parkan (2002), attributes regarded as important by suppliers are different from the key factors which are considered by users. Therefore, for measuring the service quality, this should be done by asking the users to rate or rank some specifically selected service attributes. This will ensure an overall satisfaction measure is achieved. Moreover, previous studies have demonstrated several other measures for determining the quality of the mass transit service such as comfort, reliability, accessibility, information, and safety (Noor &Foo, 2014).

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 only customers who either endure from the poor/ inadequate service quality or feel delighted with the best service. In this study, users' thought survey is the appropriate method of gathering these viewpoints and perceptions to plan the strategical policy for solutions. This study aims at firstly,

assessing the users' perceptions on the quality of city bus in Phnom Penh, and secondly, pointing out the important factors which affect to the quality of service and how those factors vary based on different groups of users. These results will further aid the authorities as well as involved stakeholders with the necessary information which they might use to improve the transportation system in Cambodia.

2.3 Literature review

The importance of evaluating the quality of service provided from the users' perspective cannot be overemphasized. On the basis of Ettema et al. (2011) as well as Hayes (1998), users are considered as a soft index which is utilized as a principal key for measuring the service quality since the fact is that they are the direct users of the service provided. Furthermore, Iseki and Taylor (2009) stated that the ultimate judges of the quality of service are the customers and their satisfaction can be studied by using the customers' satisfaction survey. This will further aid the authorities and involved stakeholders to strengthen the quality of service provided and will further ensure the growth amount of people to use the service.

In the previous researches, there have been discussions trying to identify whether a built environment or a better transit service can influence the development towards sustainable cities (Cervero, 2002). Based on these discussions about the quality of public transport has attracted much attention and research, which has led to the proposal of several indicators to evaluate the quality of mass transit service. These indicators include among others general transport network features, vehicles, terminations and stops of transportation, interchange locations and tangible services

including equipment, the comfort of service and controlling operation support (K. C. Hu &Jen, 2006).

Other researchers have worked intensively especially in identifying the factors and contributors to the effectiveness of public transport and their findings rely on and strengthen the idea of service quality survey from the customers' perspective. The result of Deb and Ahmed (2018) showed that Safety, comfort, timely performance, and accessibility were the significant factors which affect to level of service on the basis of perceived and expected quality, while Ratanavaraha, Jomnonkwao, Khampirat, Watthanaklang, and Iamtrakul (2016) considered buses, drivers and staffs, and administration to be the significant components contributing to the quality of tour bus service by using Hierarchical CFA. Additionally, Verbich and El-Geneidy (2016) used Logistic regressions to assess different types of riders' satisfaction, resulting in finding three main factors namely Bus Services, Vehicle, and Bus capacity, when X. Hu, Zhao, and Wang (2015) applied EFA, CFA, SEM, and Multinomial logit modeling to determine the transit service performance based on passengers' perspectives. It has been found that bus services, availability, and safety were the significant elements. Moreover, Mouwen (2015) conducted multiple regression to assess customer satisfaction of public transport by service, driver attitude, and vehicle, while Nwachukwu (2014) carried out the quality measurement of public bus transport services by buses, bus stop facilities, and bus capacity. Furthermore, Shaaban and Khalil (2013) stated that Bus, Station, and Driver are the three important contributors to investigate the customer satisfaction of the bus service by applying SEM, when Veliou, Kepaptsoglou, and Karlaftis (2010) suggested that the number of passengers using public transport increases by enhancing the transit system's efficiency. Plus, Iseki and Taylor (2009) suggests that the two key

elements to measure the potentiality of mass transit quality are, the terminations and stops of transportation services followed by the security factor, while Abreha (2007) found through his research that, the critical components which help to the effectiveness of mass transit are reliability and accessibility. Finally, Lau and Chiu (2003) found accessibility and mobility to be the major characteristics of satisfaction as the mass transit concerns. Based on the literature, the researchers decided to measure the city bus service quality regarding users' perceptions, by using the user survey, because it has been suggested by many authors as the best method for quality evaluation of satisfaction.

2.4 Methodology

Figure 2.1 illustrates the methodological procedure which composes of four main tasks as followings:

1) Primary work: Firstly, the statement of problems was determined and secondly, the study objectives were founded. **2) Questionnaire design:** The questionnaire was adapted from the previous case study in Mauritius (Champahom et al., 2018). The structure of the questionnaire and data collection processes were described in section 2.4.2. **3) Data collection and modeling:** There are four initial works in this part. Firstly, the data were gathered through the questionnaire. Secondly, the data were recorded and screened after collecting. Thirdly, descriptive statistics was used to test mean, standard deviation, skewness, and kurtosis. Lastly, the data were conducted by Factor analysis. **4) Final work:** The findings of the study, discussion, and conclusion were outlined in this section.

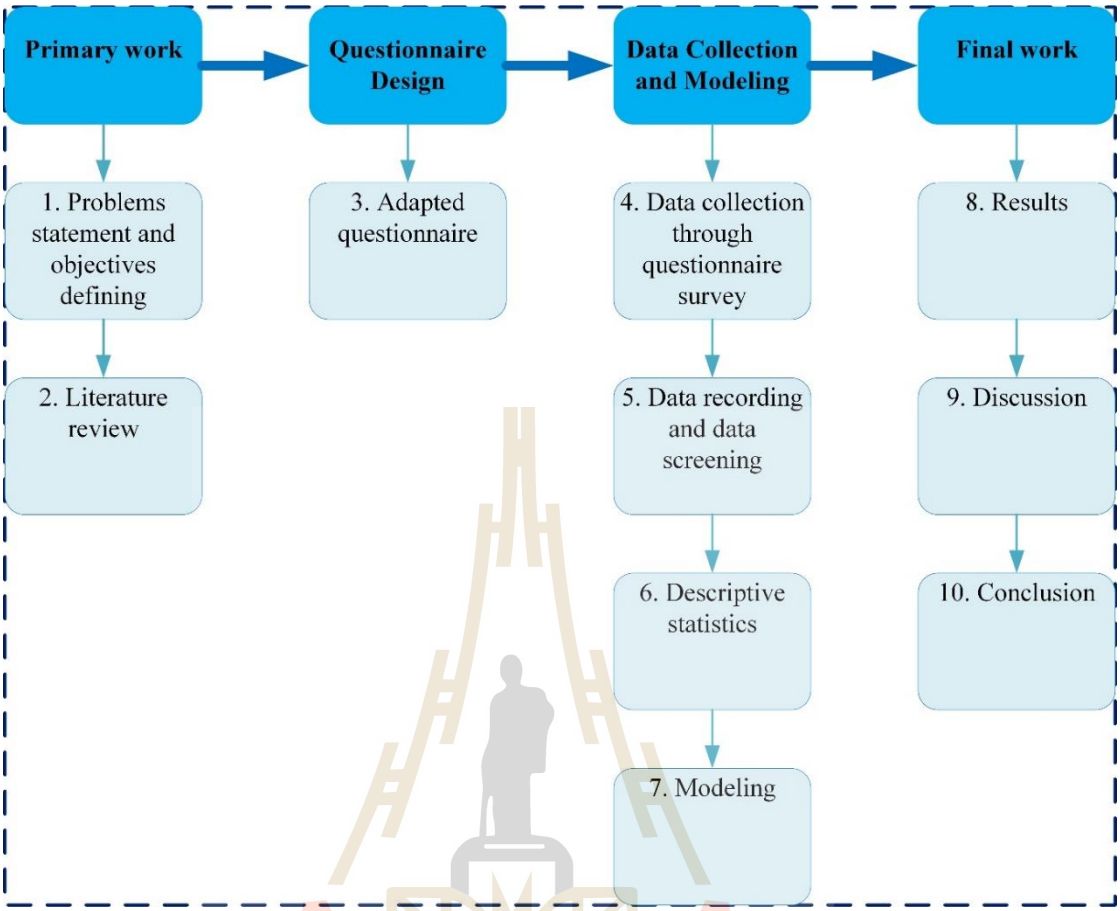

Figure 2.1 Research methodological procedure

2.4.1 Study area and participants

The city bus service in Phnom Penh has been found to be the quality measurement in this research. Data were collected partly from the users at the terminations and stops of a city bus in Phnom Penh and the other parts, the users were directly interviewed while they were on board. As a result, 500 respondents were interviewed for all 8 bus routes throughout the city.

2.4.2 Questionnaire design and data collection

To perceive the users' perceptions of city bus service, data were gathered by using a questionnaire survey. According to Kline (2011), the minimum sample size

of using CFA is 20 times of variable number. As a result, the sample size was 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' demographics such as age, school level, gender, medium earnings, etc. For the second one, respondents were requested to answer twenty-four questions in order to evaluate the city bus service quality based on their perceptions on the satisfaction level with a five-point Likert scale from 1 means "strongly disagree" to 5 refers to "strongly agree" (Lee, Yoon, &Lee, 2007). The detail of each question was described in Table 2.2.

2.4.3 Factor analysis

Factor analysis, one of the multivariate data analysis techniques, is utilized to analyze the basic factors which affect a group of correlated observed parameters (Joseph F Hair, Anderson, Babin, &Black, 2010). Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA) are the two principal groups of factor analysis. Exploratory Factor Analysis was applied, this term is utilized to determine latent (hidden) variables or constructs. Factor analysis plays an important role in diminishing numerous particular elements into a smaller amount of proportions (Seiler, 2004), instead of many questions that are involved in the study, these questions can be reduced to fewer questions which still contains the information that was present in the initial group. EFA is appropriately used when the researcher doesn't have a specific number of unobserved/ underlying factors (Jomnonkwao &Ratanavaraha, 2016). Whereas, to check the relation of common factors and observed parameters, CFA is applied (Deb &Ahmed, 2018; Jomnonkwao &Ratanavaraha, 2016). It is very significant for the researcher to understand clearly about the overall number of factors

plus the connection between the common/ latent factor and observed variables foregoing to CFA model (Deb &Ahmed, 2018; X. Hu et al., 2015; Jomnonkwao &Ratanavaraha, 2016). To streamline data like diminishing the number of parameters in the regression model, Factor analysis will be applied and these final components are utilized as the measure of users' perception on the bus service quality. Therefore, EFA was used in this study to group variables into the dimension of bus service and interpret in-depth based on the questionnaire items. More importantly, the results of EFA were further evaluated by CFA for the purpose of improving the weakness of EFA which leads to reasonable results.

2.5 Results

2.5.1 Sample description

In 2018, the population of Phnom Penh city is 1,501,725. Based on the rule of using CFA, the minimum size of the sample is equal to 480. For this reason, data were collected through the questionnaire survey from 500 customers, including 164 men respondents (32.80%) and 336 women 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%) who were older than 65 years old. With regard to education level, 245 participants (49.00%) were under the bachelor's degree, while 248 respondents got the bachelor's degree, and 7 (1.4%) had a school standard greater than a baccalaureate. In terms of average income, it has been observed that 268 respondents didn't have the salary or they were studying, 17 (3.4%) earned less than 100$, 203 participants (40.6%) could earn from 100$ to 500$, and 12 (2.4%) reported that they earned more than 500$ per month. Furthermore, 500 participants

(100%) were Cambodian. Relating to the travel experience, 90 respondents (18.00%) said that they had ever confronted with the bus breakdown problems, while 410 (82.00%) of passengers have never had this experience, as showed in Table 2.1.

Table 2.1 Sample profile

		Frequency	**Percentages**
Gender	Men	164	32.80
	Women	336	67.20
Age	15 – 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
Monthly 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
Citizen	Cambodian	500	100
Travel Experience toward bus usage	Yes	90	18.00
	No	410	82.00

2.5.2 Descriptive statistics

Table 2.2 shows 24 attributes arranging from the maximum to the minimum favorable experience in accordance with the results of participants'

perceptions on the city bus service quality. On the basis of the results, the mean score of the respondents' perceptions range from the highest value of 4.194 to the lowest value of 2.942, meaning that interviewees had a various viewpoint of the city bus service elements. Moreover, the lowest value of the standard deviation is 0.632 and the highest value is 0.976. By this table, it has been observed that V14, which represents "Bus routes are covered every area", has the minimum value of mean. Table 2.2 is also shown the results for skewness and kurtosis. According to Kline (2011), the acceptable range of skewness of each variable should be in the range of -3 to +3, and the value of kurtosis should be least than 10. By looking at the result of skewness and kurtosis, it has been observed that the data had normal distribution with 24 observed variables.

Table 2.2 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 are 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 driver driving 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

Table 2.2 Descriptive statistics of bus service quality attributes (Continued)

Code	Attributes	Mean	SD	Skewness	Kurtosis
V1	Bus stops have roofs that protect 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 in 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 in the 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 lighting 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 are covered every area.	2.942	0.976	0.142	-0.652

2.5.3 Exploratory Factor Analysis (EFA)

The values of factor loadings, eigenvalue, percentage of variance explained and Cronbach's alpha were determined by using SPSS and their results are indicated in Table 2.3. Principal Component Analysis and varimax rotation were utilized in Factor analysis, these aim at testing the structure of the underlying factor of the data. Therefore, items which have a factor loading lower than 0.30 were cut-off, which further led to lack of cross-loaded items. Maskey, Fei, and Nguyen (2018) had

the recent study on EFA which demonstrated that the cut-off value should be less than 0.3 and 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 (Cronbach alpha reliability test). Items in the questionnaire were tested in accordance with the extracted five factors. The reliability coefficient tells the consistency of the questionnaire. The readings of Cronbach's alpha for factor 1 – 4 range from 0.736 to 0.837, these results are good because if the items are more than 10, then the Cronbach alpha value needs to be higher than 0.70. For factor 5, Cronbach's alpha is equal to 0.612 which is the acceptable value. According to Hinton, McMurray, and Brownlow (2004), it has been observed that the accepted Cronbach's alpha ranges between 0.5 and 0.75, which are considered as indicating a moderately reliable scale. Also, Reliability was analyzed by Kaiser–Meyer–Olkin (KMO) = 0.888 which has the value not far from 1 and more than 0.5. For Bartlett's Test of Sphericity: $\chi^2 = 45722.654$ ($p < 0.001$).

Table 2.3 shows the results of Exploratory Factor Analysis. It has been observed that "Bus Stop Facilities" is the latent factor that mostly dominates the quality of bus service from users' perspective. It accounts for 16.130% of the total 57.068% variance, with an eigen value of 3.871. Moreover, this factor consists of 8 items for bus service quality measure. These results indicate that the users' perceptions of the quality of bus service highly relies on "Bus Stop Facilities" than any other factors. Therefore, any future improvements on the city bus service quality should take seriously in term of Bus Stop Facilities. The second latent factor is the "Bus Services", it accounts for 15.609% of the total 57.068% variance with an eigen value of 3.746. This factor also consists of 8 items for bus service quality measure. The results show that the next very

important factor from customers' viewpoints concerning the bus quality service is the "Bus Services". Furthermore, the third latent factor is the "Driver Attitude", it accounts for 9.282% of the total 57.068% variance with an eigen value of 2.228. This factor consists of 3 items for bus service quality measurement. Moreover, "Bus Capacity" is the fourth latent factor which accounts for 9.212% of the total 57.068% variance with an eigen value of 2.211. It is composed of 3 items for bus service quality measurement. The last latent factor is the "Vehicle" which accounts for 6.835% of the total 57.068% variance with an eigen value of 1.640. There are 3 important items of bus service quality measure in this factor.

Table 2.3 Exploratory Factor Analysis result

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			

Table 2.3 Exploratory Factor Analysis result (Continued)

Factor	Code	EFA (N = 500)			
		Loadings[a]	Eigenvalue	Variance explained (%)	Cronbach's (α)
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			**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 $\alpha \leq 0.05$

2.5.4 Confirmatory Factor Analysis (CFA)

2.5.4.1 Standardized factor loadings

It begins by looking at the standardized loadings. According to Figure 2.2, factor loadings of V2 – V24 are in the range of 0.402 – 0.883 which are over the cut-off value. Only the loading of V1 falls below 0.3. Even though most of the cut-off values of factor loadings in CFA are 0.5 (Deb &Ahmed, 2018; Jomnonkwao &Ratanavaraha, 2016). J.F. Hair, Black, and Babin (2010) 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.

2.5.4.2 Model fit indices

Figure 2.2 illustrates the findings of CFA. With Mplus7, the results of second-ordered CFA received the goodness−of−fit statistics as follows:

χ^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 2.4, the model fits the data very well. In reference to these fit indices, the structures of the model have accomplished with some amendments which lead to the great fit models of this data. The best fit models and the standardized coefficients are depicted in Figure 2.2.

Table 2.4 Model fit indices

Abbreviations	Stand for	Criterion / References
χ^2	Chi-square	χ^2/**df** ≤ **5** (Deb &Ahmed, 2018)
df	Degrees of freedom	
RMSEA	Root Mean Square Error of Approximation	≤ **0.08** (Deb &Ahmed, 2018; X. Hu et al., 2015)
CFI	Comparative Fit Index	> **0.9** (Deb &Ahmed, 2018; X. Hu et al., 2015)
TLI	Tucker Lewis Index	> **0.8** (Hooper, Coughlan, &Mullen, 2008)
SRMR	Standardized Root Mean Residual	≤ **0.08** (Schreiber, Nora, Stage, Barlow, &King, 2006)

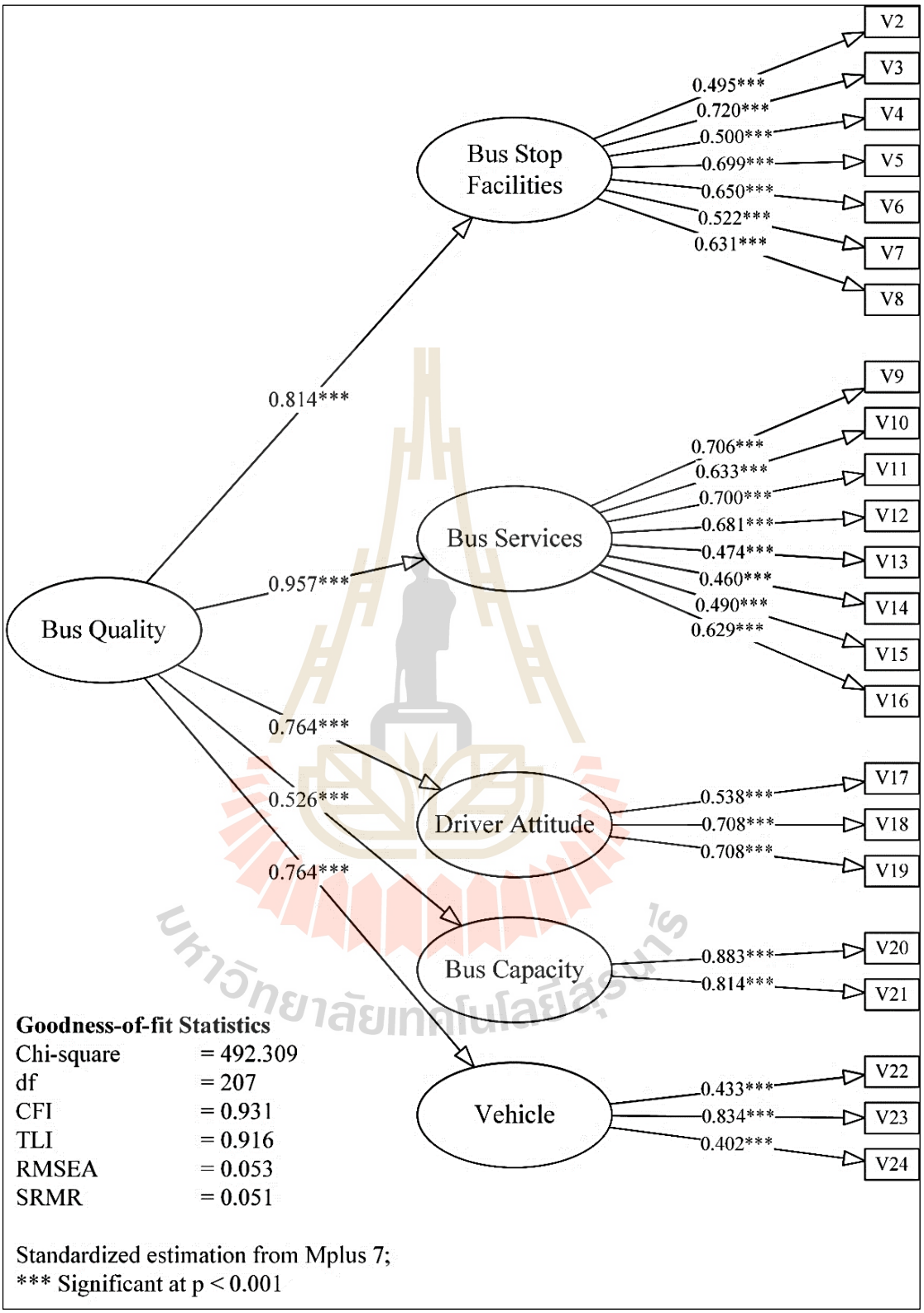

Figure 2.2 Confirmatory factor analysis result

2.5.4.3 Convergent validity

Convergent validity was the indicators of the individual construct which should share a great percentage of variance. To estimate the convergent validity among item measures, there are several ways such as standardized factor loadings, Composite Reliability (CR), and Average Variance Extracted (Filipović, Tica, Živanović, &Milovanović, 2009; J.F. Hair et al., 2010). J.F. Hair et al. (2010) suggested that the CR is equal or higher than 0.70 and the value of AVE is equal or higher than 0.50 provide good reliability and adequate convergence. Moreover, all factor loadings are required to be statistically significant (> 0.3 in case the sample sizes of 350 or greater).

Table 2.5 illustrates the findings of standardized factor loadings, Composite Reliability, and Average Variance Extracted. It has been observed that the values of all measures are consistent with the criteria, with 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, it is adequate confirmation of the convergent validity of the measures.

Table 2.5 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		

Table 2.5 Results of standardized factor loadings, Composite Reliability, and Average Variance Extracted of the model (Continued)

Factor	Code	CFA (N = 500)			
		Loadings	**Error Variances**	**CR**	**AVE**
	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				**0.954**	**0.556**
	V22	0.433	0.045		
	V23	0.834	0.044		
	V24	0.402	0.044		

2.6 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 which are, Bus Stop Facilities, Bus Services, Driver Attitude, Bus Capacity, as well as Vehicle.

Based on the structural model, it has been observed that "Bus Services" is the

most crucial factor, succeeded by Bus Stop Facilities, Driver Attitude, Vehicle, and Bus Capacity respectively.

Bus Services

The most important factor is the “Bus Services”. Regarding the measurement model, it has been observed that users have much interest in bus services, punctuality, and bus schedule. In addition, there are inadequate bus routes as mentioned above. Therefore, for improving the bus quality, it would be better to take these 3 important elements in consideration, add more bus routes in order to cover all the areas in Phnom Penh city, and provide more buses as well. This finding is in relation to the study of De Oña, de Oña, Eboli, and Mazzulla (2013) which identified that “Bus Services” is the main factor of service quality.

Bus Stop Facilities

It is the second main factor that effects on users’ perceptions on bus service quality which consists of the cleanliness, convenience and the location of the bus stop. It has been revealed that the “V3” having the highest regression weight which can interpret that cleanliness of bus stops is very important to users’ thoughts. It is followed by the location and convenience of bus stops respectively. It is similar to (Nwachukwu, 2014) which indicated that inadequacy of bus stop facilities makes the public bus customers dissatisfied with the service.

Driver Attitude

“Driver Attitude” is also the third most vital bus service quality measures. From the measurement model, it has been perceived that “V18” and “V19” have the highest regression weight which means that on-board staff’s attitude and safety are very significant to users’ opinions. The basic public bus users require drivers to drive at the

safe speed with respecting the traffic rules. This result is in line with the findings of Deb and Ahmed (2018) which proved that safety has a great impact on passenger satisfaction. In addition, it is consistent with the studies of Cafiso, Di Graziano, and Pappalardo (2013) and Eboli and Mazzulla (2007).

Vehicle

"Vehicle" is also the significant factor of bus service quality. The measurement model has shown that "V23" has the highest regression weight. It means cleanliness of bus is the most essential to users' perceptions. This indicator is relevant to Tyrinopoulos and Antoniou (2008) study which indicated that vehicle cleanness plays a critical role in satisfying the customers. Moreover, in order to support this finding, Jomnonkwao and Ratanavaraha (2016) found that cleanliness is the main importance of perceived vehicle service. The indicators of this dimension were also mentioned in other previous researches such as Deb and Ahmed (2018), Güner (2018), Goh, Currie, Sarvi, and Logan (2014), and Hensher, Stopher, and Bullock (2003).

Bus Capacity

Lastly, "Bus Capacity" is also an essential factor in bus service quality. In this instance, the users have the most concern about the available seats in the rush hours more than outside rush hours. This dimension is relevant to the study of Nwachukwu (2014) which stated that bus capacity plays an important role to serve passengers' needs. Insufficient many buses (particularly high-capacity buses) caused many problems such as the long queues and long waiting periods, the conflict to catch a bus at the moment of its arrival at most stop locations, and the insufficient many seats in the buses (Nwachukwu, 2014).

2.7 Conclusion

This study aims at measuring the city bus service quality in regard to users' perceptions. To fulfill the research's objectives, a questionnaire survey was the tool to gather the research data. In analyzing this data, factor analysis has been performed. First, EFA was used for the purpose of classifying 24 parameters into five different categories which are Bus Stop Facilities, Bus Services, Driver Attitude, Bus Capacity, as well as Vehicle. The first factor (Bus Stop Facilities) comprised of eight items and other eight items were categorized under factor 2 (Bus Services). For factor 3 (Driver Attitude), it consists 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). According to the results, it may be specified that the 24 variables are the forceful indices to evaluate the bus quality of five factors at the 0.001 significance level. Next, the results of EFA are further evaluated by CFA. By considering the results of the CFA analysis, it provides the depth understanding which attributes of the bus service is needed to be ameliorated on the basis of a particular perception factor. Based on the highest CFA loading score in the second-order model, the authorities / involved stakeholders can prioritize the most important factor and can make the improvement eventually. For example, "Bus Services" is the most important factor for improving service quality, succeeded by Bus Stop Facilities, Driver Attitude, Vehicle, and Bus Capacity respectively. Meaning that the authorities/ involved stakeholders should consider "Bus Services" to improve 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 concern about the bus services in the peak hours the most. Concerning the second-highest factor loading score "Bus Stop Facilities", the attribute that gives the most significant for improvement

is “The cleanliness of the bus stops”.

In the future, if these findings are taken into account, it will increase the performance of city bus services in Phnom Penh. Furthermore, the findings in this study are strongly beneficial for Cambodia authorities and involved stakeholders with the intention of providing a model to be used as a yardstick to solve problems/complain from the bus users regarding transport policy.

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CHAPTER III

CITY BUS SERVICES IN PHNOM PENH: USERS' PERCEPTIONS, EXPECTATIONS, AND SATISFACTION USING STRUCTURAL EQUATION MODELING (SEM)

3.1 Abstract

This research aims at figuring out the city bus service quality from users' perspectives by identifying their perceptions and expectations through the questionnaire survey. The data were then analyzed using suitable statistical methods which included Factor analysis and Structural Equation Modeling. Based on these analyses, five latent factors including Bus Stop Facilities, Bus Services, Driver Attitude, Bus Capacity, and Vehicle were extracted from both the perceptions and expectations data sets. Moreover, the relationship between perceptions, expectations, and satisfaction was discovered by conducting Structural Equation Modeling. The results of this research could be beneficial for government authorities and other transportation stakeholders when regulating city bus services and designing policies to solve the underlying transportation problems.

3.2 Introduction

Quality of Life (QOL) turned to one of the global concerns and a worldwide term for the quality of the different dimensions of human life. In term of happiness and health, it has been considered that QOL depends on the general well−being of

individuals and societies. Felce and Perry (1995) observed that it is a multidimensional concept which consists of five categories that are emotional, social, physical, material, and developmental. QOL can be defined as the fulfilment of individuals' expectations of their lives, which are influenced by the culture, values, goals, and standards and concerns about the context in which people live (Schneider, 2013).

Transportation is therefore an entire attribute of one's QOL. In the absence of adequate transportation, people cannot connect to society, go to school/work, or move around at their convenience. Moreover, an eco-friendlier and more environmental understanding of the 21st century citizens' needs throughout the world indicates more convenient transportation systems, cleaner air, and safer roads, are required. Public transportation should be a sustainable system which is crucial to for the population's health and safety (Bunting, 2004).

Greene and Wegener (1997) stated that the speedy increase in individual vehicle use in urban areas have caused many issues. It affects the environment negatively and also contributes to an anti−social society, a lack of good health, traffic bottlenecks, and exposes pedestrians and cyclists to danger. In addition, Batterbury (2003) claimed that the use of individual vehicles within urban areas disables sustainable economic achievements, eco−friendly adaptations, and residents' health and safety. In order to meet sustainability goals, it is essential to minimize the demand for personal vehicles in urban areas.

Furthermore, Badami and Haider (2007) stated that the disability of transit systems lead to the expanding use of individual cars in urban areas. For this reason, a high quality of transit system has to be developed. Public transport is key to minimizing the number of individual cars in the city and may help people with financial limitations

who struggle to pay for the regularly changing paratransit modes or taxi fares and who do not own vehicles (Nwachukwu, 2014).

Public transport not only decreases personal vehicles and various transport modes but also minimizes many other concerns including traffic bottlenecks, the badness of noise and air, parking control and the use of energy (Nocera, 2011). For these reasons, a transit system is required that operates in a way that prevents the above-mentioned problems. Hence, enhancing the quality of the transit system is an urgent must.

Phnom Penh is the capital city of Cambodia which is also the largest in terms of population. The government initiated a plan to provide formal public transportation modes, namely Bus Rapid Transit, Sky Rail, Light Rail Transit, and Tramway to manage traffic and environmental problems (JETRO, 2009; JICA, 2001; SYSTRA, 2012). In reality, only the city bus service was put into operation in Phnom Penh. However, it was a failure due to its inability to attract the number of passengers or users of private vehicles. Thus, an enhanced level of service is required to ensure higher user satisfaction and the expansion of public transportation use. A higher quality city bus service is required to reduce personal vehicle usage (Deb &Ahmed, 2018).

Figini (2003) noted that service quality has been measured by many techniques, but the main challenge is the lack of user evaluation. Furthermore, the author proposes that questioning users about their perceptions/satisfaction on the quality of service, or, enquiring about users' expectations, or both, is the most effective approach to service quality evaluation.

Determining the quality of service regarding the users' perceptions has been the focus of most previous transportation studies. However, several previous research

studies (Deb &Ali Ahmed, 2018; dell'Olio, Ibeas, &Cecin, 2011; Sam, Hamidu, &Daniels, 2018; Verma, Verma, Ajith, &Sindhe, 2014) have investigated the expected or desired service quality. In addition, dell'Olio et al. (2011) stated that the researches on perceived quality provided information about the authorities' or operating companies' customers, while research on expected quality provides comprehensive knowledge about their customers and what they really want from the service. Therefore, more satisfactory policies must be developed. Finally, it would be better for local authorities/ transit operators worked on closing the small gap between perceived and expected quality as soon as possible.

In this study, a survey of users' perceptions and expectations collected and processed users' viewpoints of the service to help design adequate interventions and strategies for improvement. This study therefore aimed at (1) identifying the potential factors influencing the users' perceptions and expectations of the city bus service, (2) investigating the relationship between users' perceptions, expectations, and satisfaction level.

3.3 Literature Review

In the publications, numerous research studies have measured users' perceptions of service quality; whereas few have focused on service quality in term of expected or desired service quality.

Some examples of the prior researches focusing on the level of service and identifying the factors and contributors to the effectiveness of public transport are described briefly in Table 3.1 below. Both qualitative and quantitative analyses were applied in these research studies as well as various types of statistical techniques.

3.3.1 Factors influencing service quality

Researchers have worked intensively to identify the factors and contributors to the effectiveness of public transport and their findings strengthen the importance of service user quality surveys. Previous relevant researches have focused on different types of transport, namely urban buses, intercity buses, sightseeing buses, intra-city buses, and public transport.

The literature has highlighted various contributors and factors which influence quality of transport system. These can be categorized into five main groups including Bus Services, Vehicle, Driver Attitude, Bus Stop Facilities, and Bus Capacity. This literature indicates that Vehicle was the most frequently cited influence, followed by Bus Services, Driver Attitude, Bus Stop Facilities, and Bus Capacity respectively. However, no previous study has considered these five factors simultaneously.

Vehicle: Vehicle was identified as one of the most powerful factors affecting the quality of service in many research studies (Bordagaray, dell'Olio, Ibeas, &Cecín, 2014; Cafiso, Di Graziano, &Pappalardo, 2013a, 2013b; Carreira, Patrício, Jorge, &Magee, 2014; De Oña, De Oña, Eboli, &Mazzulla, 2013; Deb &Ahmed, 2018; dell'Olio et al., 2011; Eboli &Mazzulla, 2011; Freitas, 2013; González-Díaz &Montoro-Sánchez, 2011; Hu, Zhao, &Wang, 2015; Sajjakaj Jomnonkwao &Ratanavaraha, 2016; S Jomnonkwao, Siridhara, &Ratanavaraha, 2015; Mouwen, 2015; Nwachukwu, 2014; Ratanavaraha, Jomnonkwao, Khampirat, Watthanaklang, &Iamtrakul, 2016; Rojo Arce, Gonzalo Orden, Dell'Olio, &Ibeas Portilla, 2011; Rojo, dell'Olio, Gonzalo-Orden, &Ibeas, 2013; Shaaban &Khalil, 2013; Verbich &El-Geneidy, 2016; Vetrivel Sezhian, Muralidharan, Nambirajan, &Deshmukh, 2014).

Bus Services: Bus Services were also investigated in numerous previous research papers (Bordagaray et al., 2014; Carreira et al., 2014; De Oña et al., 2013; Deb &Ahmed, 2018; dell'Olio et al., 2011; Eboli &Mazzulla, 2011; Freitas, 2013; González-Díaz &Montoro-Sánchez, 2011; Hu et al., 2015; Sajjakaj Jomnonkwao &Ratanavaraha, 2016; S Jomnonkwao et al., 2015; Mouwen, 2015; Nwachukwu, 2014; Ratanavaraha et al., 2016; Rojo Arce et al., 2011; Rojo et al., 2013; Rojo, Gonzalo-Orden, dell'Olio, &Ibeas, 2012; Verbich &El-Geneidy, 2016; Vetrivel Sezhian et al., 2014).

Driver Attitude: Many research findings indicated that users' viewpoints of the friendliness, kindness, and ability of drivers really needed into consideration when evaluating the level of transport services (Bordagaray et al., 2014; Cafiso et al., 2013a, 2013b; Carreira et al., 2014; De Oña et al., 2013; Deb &Ahmed, 2018; dell'Olio et al., 2011; Eboli &Mazzulla, 2011; Freitas, 2013; Hu et al., 2015; Sajjakaj Jomnonkwao &Ratanavaraha, 2016; S Jomnonkwao et al., 2015; Mouwen, 2015; Ratanavaraha et al., 2016; Shaaban &Khalil, 2013; Vetrivel Sezhian et al., 2014).

Bus Stop Facilities: Bus stop facilities were a significant factor in the evaluation of service quality. This has been supported by many study findings (Carreira et al., 2014; Eboli &Mazzulla, 2011; Nwachukwu, 2014; Rojo Arce et al., 2011; Rojo et al., 2013; Rojo et al., 2012; Shaaban &Khalil, 2013; Vetrivel Sezhian et al., 2014).

Bus Capacity: Bus capacity also determined the service level of various modes of transportation and has been investigated by many researchers (De Oña et al., 2013; Hu et al., 2015; Mouwen, 2015; Nwachukwu, 2014; Rojo Arce et al., 2011; Verbich &El-Geneidy, 2016).

3.3.2 Analysis Methods

In previous studies, various multivariate data analysis techniques were applied to determine the significant factors influencing users' views of public transportation service quality, as well as users' satisfaction. Among the various types of statistical techniques used, Exploratory Factor Analysis (Deb &Ahmed, 2018; Hu et al., 2015; Sajjakaj Jomnonkwao &Ratanavaraha, 2016; Popuri, Proussaloglou, Ayvalik, Koppelman, &Lee, 2011; Vetrivel Sezhian et al., 2014), Confirmatory Factor Analysis (Deb &Ahmed, 2018; Hu et al., 2015; Sajjakaj Jomnonkwao &Ratanavaraha, 2016; Popuri et al., 2011; Ratanavaraha &Jomnonkwao, 2014), and Structural Equation Modeling (De Oña et al., 2013; Deb &Ahmed, 2018; Lai &Chen, 2011) have been broadly applied by various scholars to discover the significant factors influencing the various parameters of the level of transportation service. In addition to finding the latent factors, the relative weight values were estimated for all factors by conducting various methods including Multinomial Logit modeling (dell'Olio et al., 2011; Hu et al., 2015), Ordered probit model (Bordagaray et al., 2014; Dell'Olio, Ibeas, &Cecín, 2010; Rojo et al., 2013), Ordered logit model (Rojo et al., 2013), Binary Logistic regression (Popuri et al., 2011), and Linear Regression analysis (Deb &Ahmed, 2018; Nwachukwu, 2014; Verma et al., 2014).

Therefore, questionnaire surveys have been suggested as the best method of service quality evaluation based on users' satisfaction. Factor analysis and Structural Equation Modeling were identified as the most suitable methods in this study, since these techniques have been broadly applied to service evaluations of many modes of transport. Furthermore, most previous studies have described how users' perceptions could be utilized for determine existing service quality but only a few previous research

studies (Deb &Ali Ahmed, 2018; dell'Olio et al., 2011; Sam et al., 2018; Verma et al., 2014) have investigated users' expectations. However, there has been no previous study of the perceived and expected service quality in Cambodia context.

Table 3.1 Résumé of the relevant publications

Author(s) (Year)	Mode of Transport	Analysis Method	Factors				
			Bus Services	Bus Stop Facilities	Driver Attitude	Vehicle	Bus Capacity
Deb and Ahmed (2018)	Urban bus	FA, Linear regression analysis, and SEM	✓		✓	✓	
Sajjakaj Jomnonkwao and Ratanavaraha (2016)	Sightseeing bus	Hierarchical CFA	✓		✓	✓	
Verbich and El-Geneidy (2016)	Bus transit	Logistic modeling	✓			✓	✓
Ratanavaraha et al. (2016)	Tour bus	MSEM	✓		✓	✓	
Hu et al. (2015)	Bus, Train, and Private car	FA, SEM, and Multinomial logit modeling	✓		✓	✓	✓
Mouwen (2015)	Public Transport	Multiple regression	✓		✓	✓	✓
S Jomnonkwao et al. (2015)	Sightseeing bus	Cluster Analysis	✓		✓	✓	
Nwachukwu (2014)	Intra-city bus	PCA, Linear regression analysis	✓	✓		✓	✓
Vetrivel Sezhian et al. (2014)	Urban bus	Discriminant analysis	✓	✓	✓	✓	
Bordagaray et al. (2014)	Inter-urban bus	Ordered probit model	✓		✓	✓	
Carreira et al. (2014)	Bus transportation company	EFA, CFA, SEM	✓	✓	✓	✓	
Cafiso et al. (2013a)	Urban bus	Kendall's algorithm			✓	✓	
Cafiso et al. (2013b)	Urban bus	Delphi method			✓	✓	
Freitas (2013)	Intercity road transportation	ISA	✓		✓	✓	
Shaaban and Khalil (2013)	Public transport	SEM		✓	✓	✓	

Table 3.1 Résumé of the relevant publications (Continued)

Author(s) (Year)	Mode of Transport	Analysis Method	Factors				
			Bus Services	Bus Stop Facilities	Driver Attitude	Vehicle	Bus Capacity
Rojo et al. (2013)	Inter-urban	Ordered logit and probit models	✓	✓		✓	
De Oña et al. (2013)	Urban bus	SEM	✓		✓	✓	✓
Rojo et al. (2012)	Inter-urban	Discrete choice models	✓	✓			
Eboli and Mazzulla (2011)	Public transport	Logical and Mathematical	✓	✓	✓	✓	
Rojo Arce et al. (2011)	Inter-urban	Ordered logit and probit models	✓	✓		✓	✓
dell'Olio et al. (2011)	Urban bus	Multinomial discrete choice model	✓		✓	✓	
González-Díaz and Montoro-Sánchez (2011)	Urban bus	Qualitative research	✓			✓	

Note:
FA = Factor Analysis, SEM = Structural Equaltion Modeling, EFA = Exploratory Factor Analysis,
CFA = Confirmatory Factor Analysis, MSEM = Multilevel Structural Equaltion Modeling,
PCA = Principal Component Analysis, ISA = Importance-Satisfaction Analysis

3.4 Methods

3.4.1 Factor analysis

Factor analysis has been considered as a well−known technique of the multivariate data analysis techniques to identify the underlying factors which affect a variety of interrelated observed variables (Joseph F Hair, Anderson, Babin, &Black, 2010). Moreover, it comprises an Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA). Factor analysis has an essential role in minimizing the number of questions involved in a study by retaining the detail of the initial group (Seiler, 2004). The application of EFA determines latent (hidden) variables or constructs. When there

is no clear information on the specific number of unobserved/ underlying factors, it is best to apply EFA (Sajjakaj Jomnonkwao &Ratanavaraha, 2016). However, the effect of common factors by observed variables is confirmed by applying CFA (Deb &Ahmed, 2018; Sajjakaj Jomnonkwao &Ratanavaraha, 2016). Therefore, researchers should have sufficient information on the total number of factors and the effects of the common/ latent factors by observed variables before applying the CFA model (Deb &Ahmed, 2018; Hu et al., 2015; Sajjakaj Jomnonkwao &Ratanavaraha, 2016). In this study, data were simplified by applying Factor analysis. The variables were then reduced into smaller amount which led to the final factors. These were utilized as the measure of perceived and expected value on the quality of bus service.

3.4.2 Structural Equation Modeling (SEM)

The methodological procedure of SEM has been broadly applied in various fields of research. SEM is a powerful method used to describe the relationships among numerous variables (Joseph F Hair, Black, Babin, &Anderson, 2014). It was developed from theories that illustrate the links among latent variables and the correlation of latent variables which are measured by observed variables. This multivariate technique contains two models: a measurement model and a structural model. This measurement model presents the links among latent and observed variables, while a structural model represents the relationships of variables between constructs. In this research, the relationship between users' perceptions, users' expectations, and satisfaction was explored by deploying SEM.

3.5 Data Collection

To fulfil the aims of this study, a questionnaire survey was the tool to gather users' viewpoints (both perceived value and expected value) on the city bus service. The target respondents in this research were city bus users aged between 15 and 70 years old. Data were gathered while they were waiting at bus stops and on board. The participants who travelled along the study line were voluntarily recruited. A suitable sample size for SEM was applied with reference to the recommendations of researchers. Golob (2003) recommended that: the acceptable size of an SEM sample should be at least 200 (Kline, 2015), and the minimum size of the sample used to calculate Maximum Likelihood (ML) should be 15 times the number of observed variables (Pituch &Stevens, 2015). The model contained 11 observed variables. As a result, 500 respondents completed the questionnaire survey to meet these SEM requirements.

When developing the questionnaire, the questions were divided into two sections. Firstly, users' demographics were collected, namely; age, gender, school level, and average earning. Secondly, participants were asked 24 questions to evaluate the quality of city bus services according to their viewpoints and expectations on the level of satisfaction with a five–point Likert scale from 1 points to "strongly disagree" to 5 points to "strongly agree" (Lee, Yoon, &Lee, 2007).

3.6 Findings

3.6.1 Sample characteristics

Users' perceptions and expectations surveys were collected from 500 users. Table 3.2 indicates the sample characteristics included 32.80% male respondents and 67.20% female respondents. With regard to age, 29.80% of the group were under

the age of 20, 68.60% of the group (were 20 – 65 years old), and 1.60% were over 65 years old. Concerning to education level, the levels of education of respondents were in proportion to lower than an undergraduate degree (49.00%), an undergraduate degree (49.60%), and greater than an undergraduate degree (1.40%). Income data revealed that 53.60% of respondents had no income, while 3.40% reported that their income was less than 100$, 40.60% earned in the range of 100$ to 500$, and 2.40% earned more than 500$ per month. When asked about travel experiences, 82.00% of respondents stated they had never had a bus breakdown problem, while 18.00% had faced this experience. Furthermore, all respondents were Cambodian.

Table 3.2 Profile of survey bus users

Socio-demographic Characteristics		**Percentages**
Gender	Men	32.80
	Women	67.20
Age	15 – 19	29.80
	20 – 29	42.40
	30 – 39	15.80
	40 – 49	5.20
	50 – 59	4.40
	60 – 65	0.80
	65+	1.60
Education level	Upper Secondary	40.20
	Diploma	8.80
	Bachelor	49.60
	Master	1.00
	Doctor	0.40
Monthly average income	None	53.60
	<= 100$	3.40
	101$ – 200$	16.80
	201$ – 300$	15.80
	301$ – 400$	5.40
	401$ – 500$	2.60

Table 3.2 Profile of survey bus users (Continued)

Socio-demographic Characteristics		**Percentages**
	500$ +	2.40
Citizen	Cambodian	100
Travel Experience toward bus usage	Yes	18.00
	No	82.00

3.6.2 Descriptive statistics

Table 3.2 presents the samples' results of users' perceptions and expectations relying on the descriptive statistics, for example, the mean, standard deviation, skewness, and kurtosis, resulting from 24 question attributes. According to the results, the mean scores and standard deviations are varied, meaning that participants had different perspectives on the current service provided and the expected service. Moreover, data must be normally distributed because this study used ML estimation, for which SK and KU are the indices. According to Kline (2011), it has been suggested that the SK value should be in the range of -3.0 to +3.0 and the KU value should be under 10.0. As illustrated in Table 3.3, it has been observed that the SK and KU values of both perceptions and expectations worked with the acceptable range, meaning that the data had a normal distribution.

Table 3.3 Descriptive Statistics of bus service quality attributes

Attributes	Code set for Perceptions	Code set for Expectations	Perceptions data set				Expectations data set			
			Mean	SD	SK	KU	Mean	SD	SK	KU
Bus stops have roofs that protect sun and rain.	V1	V1e	3.608	0.955	-0.449	-0.124	3.984	0.710	-0.112	-0.643
There are seats at bus stops.	V2	V2e	3.414	0.906	-0.246	-0.251	3.870	0.643	0.126	-0.620
Bus stops are clean.	V3	V3e	3.136	0.925	-0.090	-0.357	3.762	0.659	0.298	-0.757
Bus stops are durable and strong without any damage.	V4	V4e	3.430	0.878	-0.312	0.252	3.784	0.665	0.274	-0.781
Bus stops are sufficiently available in the main buildings.	V5	V5e	3.228	0.933	-0.260	-0.479	3.790	0.635	0.207	-0.631
Bus stops are located near residences.	V6	V6e	3.362	0.936	-0.353	-0.330	3.882	0.633	0.100	-0.542
Bus stops are lighting at night.	V7	V7e	3.132	0.974	-0.019	-0.491	3.794	0.633	0.197	-0.618
Bus stops are located in safe areas.	V8	V8e	3.378	0.881	-0.287	0.048	3.834	0.651	0.179	-0.687
There are enough bus services in rush hours.	V9	V9e	3.152	0.942	-0.090	-0.244	3.766	0.648	0.270	-0.710
There are enough bus services outside rush hours.	V10	V10e	3.412	0.925	-0.388	-0.154	3.832	0.636	0.157	-0.603
Buses operated punctually according to schedule.	V11	V11e	3.628	0.878	-0.573	0.236	4.048	0.550	0.027	0.300
Bus schedules are online in internet/application.	V12	V12e	3.376	0.923	-0.338	0.266	3.740	0.691	0.394	-0.879
Bus schedule/maps are shown at bus stops.	V13	V13e	3.936	0.773	-1.093	2.241	4.144	0.548	0.072	0.090
Bus routes are covered every area.	V14	V14e	2.942	0.976	0.142	-0.652	4.060	0.685	-0.077	-0.865
Ease of buying tickets.	V15	V15e	4.066	0.846	-1.004	1.350	4.216	0.637	-0.221	-0.649
Timetable is clear and easy to understand.	V16	V16e	3.872	0.849	-1.153	1.932	4.130	0.557	-0.028	0.374
Driver and crew are good personality.	V17	V17e	4.100	0.698	-0.814	1.808	4.216	0.557	0.032	-0.247
Driver and crew are friendly, helpful and polite.	V18	V18e	3.906	0.843	-0.788	0.790	4.166	0.596	-0.072	-0.344
Bus driver driving safely.	V19	V19e	4.058	0.795	-1.186	2.383	4.278	0.563	-0.043	-0.504
Buses are crowded in rush hours.	V20	V20e	3.168	0.895	-0.134	0.071	3.634	0.630	0.474	-0.659
Buses are crowded outside rush hours.	V21	V21e	3.118	0.900	-0.185	-0.083	3.660	0.667	0.476	-0.698
Vehicle appearances look decent.	V22	V22e	4.106	0.632	-0.518	1.137	4.208	0.542	0.103	-0.136
Buses are clean.	V23	V23e	3.632	0.864	-0.806	0.919	3.898	0.651	-0.114	-0.121
The temperature inside buses is cool.	V24	V24e	4.194	0.821	-1.158	1.796	4.382	0.577	-0.285	-0.738

3.6.3 Exploratory Factor Analysis (EFA)

The results of factor loadings, eigenvalues, percentage of variance explained, and Cronbach's alpha values were established by using SPSS as described in Table 3.4 and Table 3.5. Moreover, factor structure of the data was checked by performing Principal Component Analysis and varimax rotation. Items which have a factor loading below 0.30 were dropped which further cause to lack of cross−loaded items. According to the recent study on EFA by Maskey, Fei, and Nguyen (2018), it has been found that 0.3 is the cut-off value of factor loading. Moreover, eigenvalues greater than 1.00 were considered to identify the number of selected components.

Cronbach's alpha reliability test was performed to check the scores' internal consistency. For both users' perceptions and expectations, five factors were extracted; namely Bus Stop Facilities, Bus Services, Driver Attitude, Bus Capacity, and Vehicle. The values of α were in the range of 0.518 to 0.853 which indicated that the data was reliable. Hinton, Brownlow, Mcmurray, Cozens, and SPSS (2004) stated that Cronbach's alpha values indicating a moderately reliable scale are in the range of 0.5 – 0.75. Furthermore, Kaiser–Meyer–Olkin (KMO) and Bartlett's Test of Sphericity were conducted to assess the samples' suitability for PCA (Maskey et al., 2018). In this study, KMO = 0.888 (Perceptions) and KMO = 0.890 (Expectations) were close to 1 and more than 0.5 and Bartlett's test of Sphericity were significant at p_value < 0.001.

Table 3.4 Exploratory Factor Analysis Result of Perceptions data

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			**1.640**	**6.835**	**0.612**
	V22	0.674			
	V23	0.418			
	V24	0.820			

[a] all factor loadings are significant at $\alpha \leq 0.05$
KMO = 0.888, Bartlett's Test of Sphericity: Chi-Square = 45722.654, df = 276, $p < 0.001$

Table 3.5 Exploratory Factor Analysis Result of Expectations data

Factor	Code	EFA (N = 500)			
		Loadings[a]	Eigenvalue	Variance explained (%)	Cronbach's (α)
Factor 1: Expected Bus Stop Facilities			**4.780**	**19.919**	**0.853**
	V1e	0.702			
	V2e	0.709			
	V3e	0.686			
	V4e	0.669			
	V5e	0.678			
	V6e	0.624			
	V7e	0.667			
	V8e	0.613			
Factor 2: Expected Bus Services			**2.749**	**11.456**	**0.773**
	V9e	0.307			
	V10e	0.312			
	V11e	0.741			
	V12e	0.625			
	V13e	0.663			
	V14e	0.330			
	V15e	0.626			
	V16e	0.633			
Factor 3: Expected Driver Attitude			**2.151**	**8.963**	**0.685**
	V17e	0.730			
	V18e	0.795			
	V19e	0.684			
Factor 4: Expected Bus Capacity			**1.679**	**6.995**	**0.707**
	V20e	0.810			
	V21e	0.826			
Factor 5: Expected Vehicle			**1.524**	**6.350**	**0.518**
	V22e	0.715			
	V23e	0.316			
	V24e	0.745			

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

KMO = 0.890, Bartletts's Test of Sphericity: Chi-Square = 3716.540, df = 276, $p < 0.001$

3.6.4 Confirmatory Factor Analysis (CFA)

3.6.4.1 Standardized factor loadings

We began by checking the standardized factor loadings of all items. Figure 3.1 and Figure 3.2 illustrate that factor loadings of V2 – V24 and V1e – V23e were over the cut-off value. Only the V1 and V24e loadings were discarded since they fell under the cut-off value. Although most of research studies consider 0.5 as the cut-off value of CFA factor loadings, J.F. Hair, Black, and Babin (2010) pointed out that a factor loading of 0.3 is significant for a sample size of 350. It was therefore evident that V1 and V24e had to be discarded. CFA standardized factor loadings assist the policy makers to identify the most critical attributes in need of improvement.

3.6.4.2 Model Fit Indices

Mplus version 7 was used to assess CFA of users' perceptions and expectations. Figure 3.1 illustrates the CFA model of perceptions data which had goodness-of-fit statistics as follows: $\chi^2 = 474.795$, df = 202, $\chi^2/df = 2.350$, $p < 0.001$, RMSEA = 0.052, CFI = 0.934, TLI = 0.917, and SRMR = 0.048. Figure 3.2 illustrates the CFA model of expectations data with the goodness-of-fit statistics: $\chi^2 = 392.316$, df = 208, $\chi^2/df = 1.886$, $p < 0.001$, RMSEA = 0.042, CFI = 0.946, TLI = 0.935, and SRMR = 0.043. When a comparison to the criteria illustrated in Table 3.6 was performed, the model fit indices were in accordance with acceptable limits. Therefore, the model could be utilized to interpret the results. According to these fit indices, there were some model modifications required to obtain the optimal fit for both data sets, as shown in Figure 3.1 and Figure 3.2.

Table 3.6 Criterion of model fit indices

Model Fit Indices	Abbreviations	Acceptable Limits	References
Chi-square Degrees of freedom	χ^2 df	$\chi^2/df \leq 5$	(Deb &Ahmed, 2018)
Root Mean Square Error of Approximation	RMSEA	≤ 0.08	(Deb &Ahmed, 2018; Hu et al., 2015)
Comparative Fit Index	CFI	> 0.9	(Deb &Ahmed, 2018; Hu et al., 2015)
Tucker Lewis Index	TLI	> 0.8	(Hooper, Coughlan, &Mullen, 2008)
Standardized Root Mean Residual	SRMR	≤ 0.08	(Schreiber, Nora, Stage, Barlow, &King, 2006)

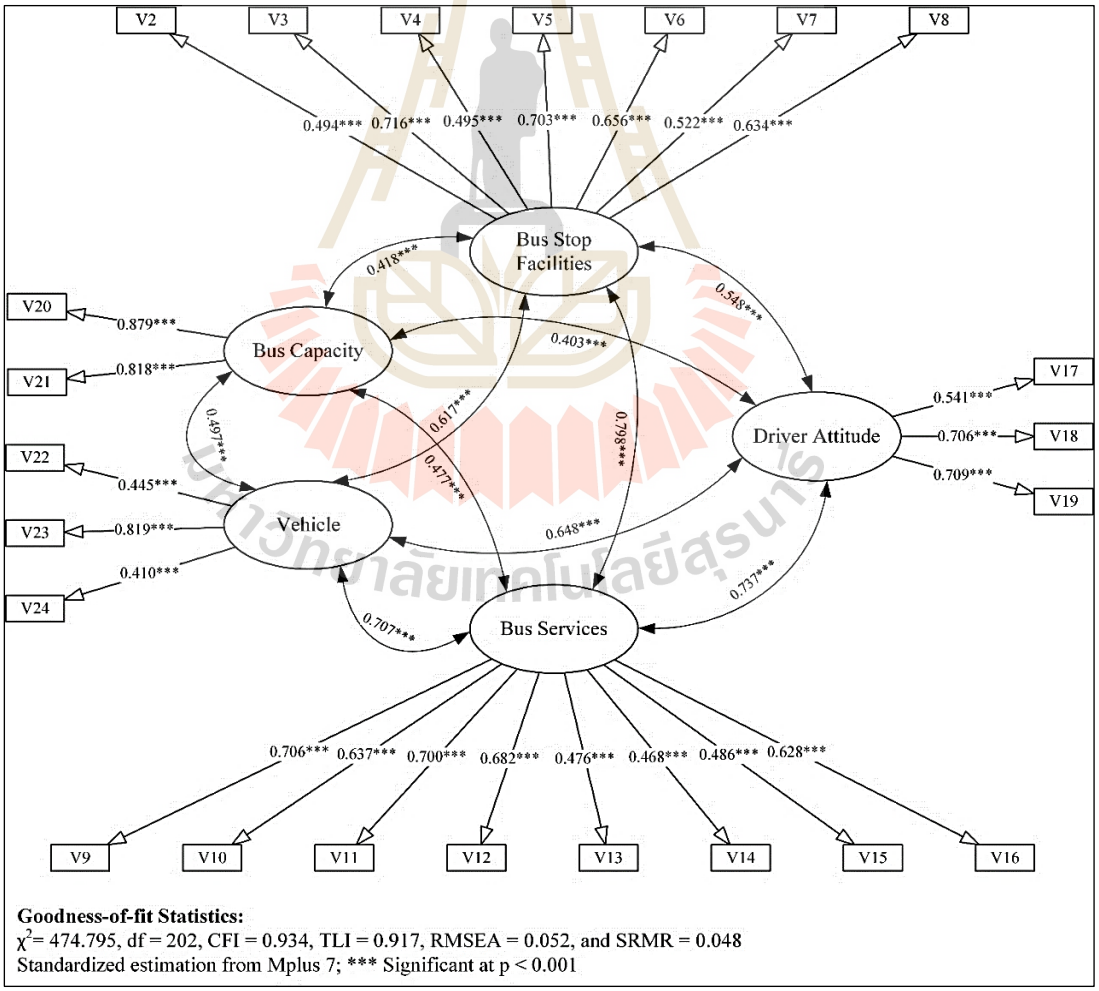

Figure 3.1 Confirmatory Factor Analysis Result of Perceptions Data

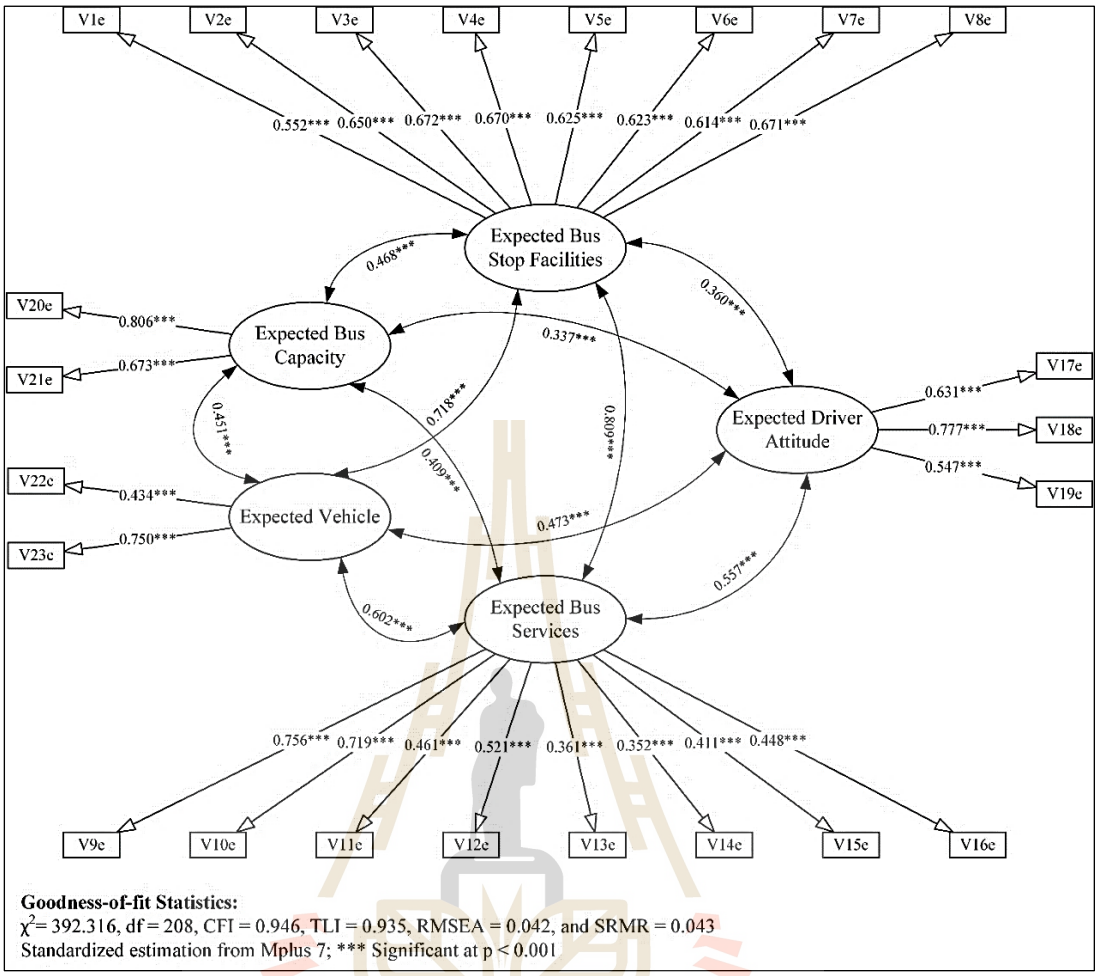

Figure 3.2 Confirmatory Factor Analysis Result of Expectations Data

3.6.4.3 Convergent Validity

After obtaining the CFA results, the convergent validity is required to test for all factors. Convergent validity indicates the individual construct shares a high percentage of common variance. Standardized factor loadings, Composite Reliability (CR), and Average Variance Extracted are the criteria used to estimate convergent validity across item measures (Filipović, Tica, Živanović, &Milovanović, 2009; J.F. Hair et al., 2010). Table 3.7 demonstrates the results of standardized factor loading, the CR, and AVE of the model on the basis of perceived and expected values.

For perceptions, all standardized factor loadings were greater than 0.4, the CR ranged from 0.956 – 0.989 and the AVE values were in the interval of 0.528 to 0.849. Meanwhile, for expectations data, the standardized factor loadings ranged from 0.352 – 0.806, the CR values were in the proportion of 0.933 – 0.991, and the AVE were in the interval of 0.504 – 0.740. All factor loadings should be statistically significant (> 0.3 in cases where the sample sizes of 350 or greater). When did a comparison to the criteria that the CR should be greater or equal to 0.70 and the AVE should be higher or equal 0.50 (J.F. Hair et al., 2010), all the values measured were within the acceptable limits, resulting in an adequate confirmation of convergent validity.

Table 3.7 Results of standardized factor loading, CR, and AVE of the model on the basis of perceived and expected values

Factor	Perceptions data set, CFA (N = 500)				Expectations data set, CFA (N = 500)			
	Code	Loadings	CR	AVE	Code	Loadings	CR	AVE
Factor 1			**0.987**	**0.528**			**0.991**	**0.635**
					V1e	0.552		
	V2	0.494			V2e	0.650		
	V3	0.716			V3e	0.672		
	V4	0.495			V4e	0.670		
	V5	0.703			V5e	0.625		
	V6	0.656			V6e	0.623		
	V7	0.522			V7e	0.614		
	V8	0.634			V8e	0.671		
Factor 2			**0.989**	**0.598**			**0.982**	**0.504**
	V9	0.706			V9e	0.756		
	V10	0.637			V10e	0.719		
	V11	0.700			V11e	0.461		
	V12	0.682			V12e	0.521		
	V13	0.476			V13e	0.361		
	V14	0.468			V14e	0.352		
	V15	0.486			V15e	0.411		
	V16	0.628			V16e	0.448		
Factor 3			**0.971**	**0.652**			**0.971**	**0.652**
	V17	0.541			V17e	0.631		
	V18	0.706			V18e	0.777		
	V19	0.709			V19e	0.547		
Factor 4			**0.978**	**0.849**			**0.958**	**0.740**
	V20	0.879			V20e	0.806		
	V21	0.818			V21e	0.673		

Table 3.7 Results of standardized factor loading, CR, and AVE of the model on the basis of perceived and expected values (Continued)

Factor	Perceptions data set, CFA (N = 500)				Expectations data set, CFA (N = 500)			
	Code	Loadings	CR	AVE	Code	Loadings	CR	AVE
Factor 5			**0.956**	**0.558**			**0.933**	**0.592**
	V22	0.445			V22e	0.434		
	V23	0.819			V23e	0.750		
	V24	0.410						

3.6.5 Relationship between Perceptions, Expectations, and Satisfaction

The effect of perceptions and expectations on satisfaction, as well as expectations on perceptions, were performed using SEM. The SEM result is illustrated in Figure 3.3 and Table 3.8. The model contains: $\chi^2 = 112.058$, df = 29, $\chi^2/df = 3.864$, p_value < 0.001, RMSEA = 0.076, CFI = 0.968, TLI = 0.938, and SRMR = 0.066 point to the fit with the acceptable criteria given in Table 3.6 of **section 3.6.4.2**, resulting in a good fit between the model and the empirical data. Moreover, the latent factors of perceptions and expectations contained the same CR values of 0.984 and AVE values of 0.628 and 0.624 respectively. When a comparison to the criteria given in **section 3.6.4.2** was performed, it is therefore the values measured indicated adequate confirmation of convergent validity. According to Figure 3.3 and Table 3.8, there was a positive significant relationship between perceptions and satisfaction, and statistically significant relationship between expectations and perceptions. Also, there was an indirect relationship between expectations and satisfaction.

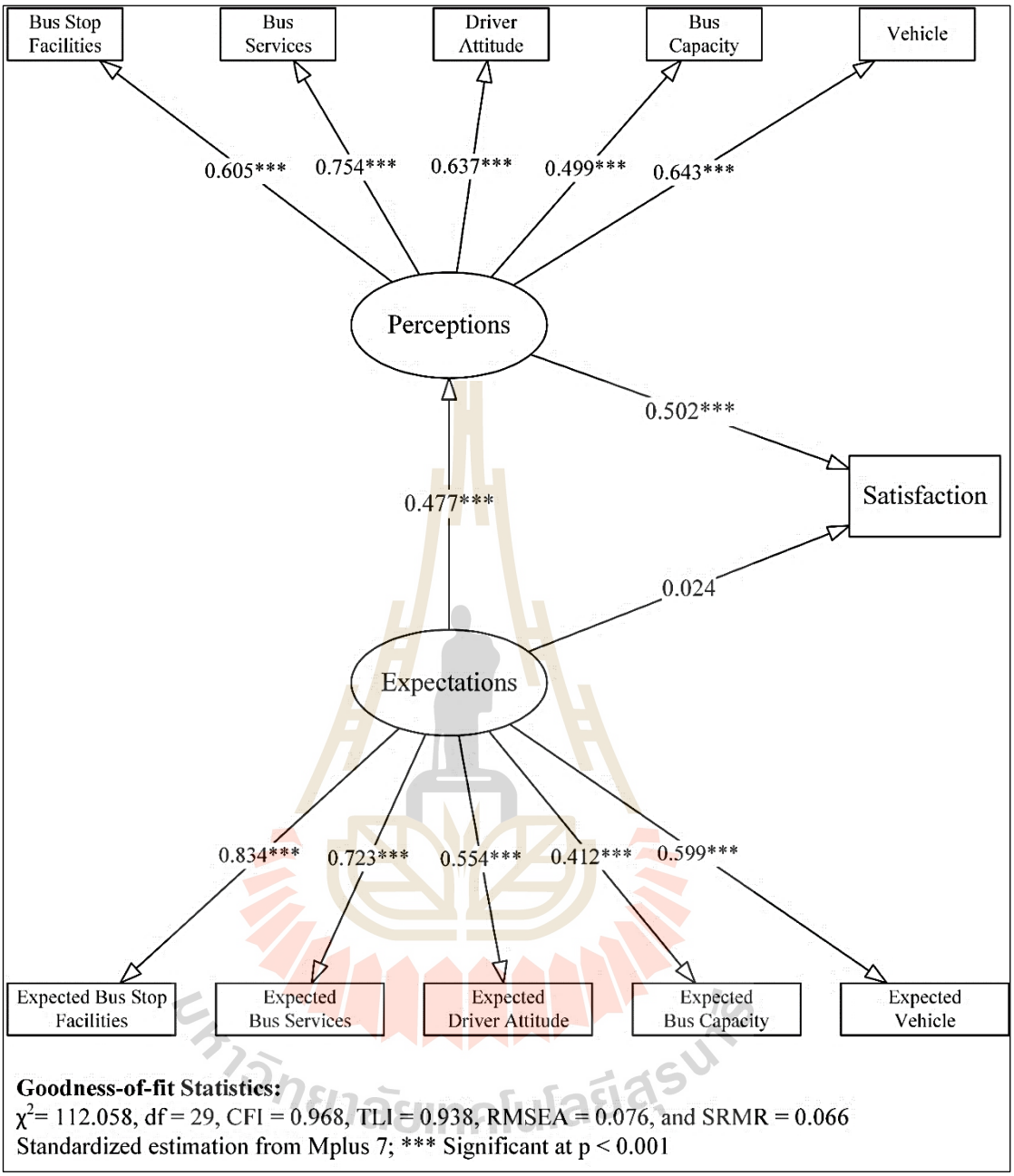

Figure 3.3 Relationship between Perceptions, Expectations, and Satisfaction

Table 3.8 Overall standardized factor loading of Structural Equation Modeling

Relationship	Standardized factor loading	p_values (<0.001)	Significance (Yes/No)
Perceptions –> Satisfaction	0.502	< 0.001	Yes
Expectations –> Satisfaction	0.024	0.637	No
Expectations –> Perceptions	0.477	< 0.001	Yes

3.7 Discussion

According to the analysis above, the overall EFA picture indicated that five different latent factors namely Bus Stop Facilities, Bus Services, Driver Attitude, Bus Capacity, as well as Vehicle were extracted from both data sets. CFA was then applied to evaluate the EFA results. By investigating the results of the CFA analysis, it has been noted that there are differences between perceptions and expectations in factor 1 and factor 5. When measuring perceptions, "Bus Stop Facilities" consisted of 7 parameters (V2 – V8) and "Vehicle" consisted of 3 items (V22 – V24). However, "Expected Bus Stop Facilities" comprised of 8 parameters (V1e – V8e) and "Expected Vehicle" included only 2 items (V22e – V23e). It is noteworthy that "V1" was eliminated from the perceptions CFA model and "V24e" was also dropped from the expectations CFA model due to their low factor loadings. This reflects the fact that there are insufficient bus stops along the route, especially near the residential areas and main buildings. Passengers/ users might therefore think that just providing extra bus stops stand would fulfil their current demand. When considering the temperature inside the bus, Murakoshi, Namagami, Xuan, Takayama, and Takaguchi (2017) studied the residential energy consumption in Southeast Asia, and pointed out that Hanoi has the highest adoption rate of air conditioners (91 %), followed by Ho Chi Minh City, Kuala Lumpur, and Bangkok (approximately 50 %). However, air conditioning is used by only (15 %) of households in Phnom Penh city. Furthermore, the electricity supply framework has not highly developed yet in Cambodia. It can be said that the citizens of Phnom Penh city are unlikely to expect the temperature/ an air conditioner inside a city bus. When considering the relationship between perceptions, expectation, and satisfaction, the effects of "perceptions" and "expectations" on "satisfaction", as well as the effect of

“expectations” on “perceptions” were measured using SEM. Based on Figure 3.3 and Table 3.8, it can be concluded that the “expectations” data did not have a direct significant relationship with “satisfaction”, which is consistent with studies by Kamaruddin, Osman, and Pei (2012); (Wu &Ding, 2007). In addition, Oliver (1999) stated that the customers still commit to re-purchase/re-support a service or preferable goods continuously in the future if current goods/services satisfy them. However, the result indicated that the “expectations” has a direct significant relationship with “perceptions”, and an indirect relation to “satisfaction”. Moreover, the positive statistically significant effect between “perceptions” and “satisfaction”, which supports a study by Eboli and Mazzulla (2007), demonstrated that users’ perceptions were significant indicators of customer satisfaction. This means that users’ perceptions have to be improved to enhance their satisfaction.

By looking at the model of perceptions data depicted in Figure 3.3 and Figure 3.1, it has been observed that “Bus Services” plays a significant factor, succeeded by Vehicle, Driver Attitude, Bus Stop Facilities, and Bus Capacity respectively.

When considering the “Bus Services” factor, the variable with the highest factor loading was V9 (There are enough bus services in rush hours.), followed by V11 (Buses operated punctually according to schedule.) and V12 (Bus schedules are online in internet/application.). These 3 attributes should be taken into consideration for improving the level of service. This finding is in relation to the finding of De Oña et al. (2013) which discovered that the major factor for measuring service quality was Bus Services.

Meanwhile, the second-most important factor “Vehicle”, revealed that V23 (Buses are clean.) obtained the highest factor loading, followed by V22 and V24

respectively. Bus cleanliness is very important for users' evaluations of service quality. This finding supports a study by Tyrinopoulos and Antoniou (2008) which stated that the most important indicator of user satisfaction is vehicle cleanness. Moreover, Sajjakaj Jomnonkwao and Ratanavaraha (2016) added that cleanliness is vital for the perceived vehicle service. In addition, prior studies also mentioned this attribute (Deb &Ahmed, 2018; Goh, Currie, Sarvi, &Logan, 2014; Güner, 2018; Hensher, Stopher, &Bullock, 2003).

The third most important factor "Driver Attitude", had the highest factor loadings for V18 and V19, which means that users are concerned with on-board staff attitudes and safety when evaluating service quality. It was also relevant in a study by Deb and Ahmed (2018) which stated that safety played a crucial role in customer satisfaction. Moreover, this attribute was mentioned in previous studies (Cafiso et al., 2013b; Eboli &Mazzulla, 2007).

Fourthly, V3 was the most important attribute of "Bus Stop Facilities", followed by V5 and V6. Therefore, users concern about the cleanliness, location, and convenience of bus stops must be addressed to improve service quality. This finding echoes a study by Nwachukwu (2014) which stated that customers' dissatisfactions with the services arise from the insufficiency of bus stop facilities.

Finally, when considering the "Bus Capacity" factor, users were more concerned about the availability of seats during rush hours than outside rush hours. This supports a study by Nwachukwu (2014), which found that bus capacity must be considered to meet users' needs. For instance, if buses are inadequate, users spend a long time waiting, have to navigate conflict when boarding buses when they do arrive, and encounter insufficient seats on buses.

3.8 Conclusions and Recommendations

This research aims at measuring users' views of the city bus service quality in the capital of Cambodia, Phnom Penh. To fulfill the study aims, a questionnaire survey was chosen to gather data which were examined using Factor analysis and Structural Equation Modeling. In this research, it can be found out that twenty-four parameters are the powerful indicators of city bus service quality. These parameters were categorized into five factors; namely Bus Stop Facilities, Bus Services, Driver Attitude, Bus Capacity, and Vehicle. However, these parameters cannot be improved simultaneously. Policymakers must prioritize these items and make the required improvements. For instance, the model found that "Bus Services" was the most significant factor, succeeded by Vehicle, Driver Attitude, Bus Stop Facilities, and Bus Capacity respectively. Thus, these indicators suggest "Bus Services" should be improved first.

Based on these results, appropriate policy and regulations could be established by focusing on the influential standardized coefficients as follows:

1) **Bus Services:**

- More buses in operation during the rush hours since there are not enough buses to serve users' needs.
- Bus schedules should be revised in accordance with users' needs and should be accurate.
- Moreover, bus schedules should be more available online or on an application, since it is the 21st century, people have a lot of technological skills, and want to get information rapidly and easily.

2) **Vehicle:**

- Buses have to be cleaned and provide a comfortable environment to

ensure users feel convenient while taking the buses.

- Moreover, operators should perform maintenance activities on every bus.

3) Driver Attitude:

- Drivers should be trained in term of the safety aspect.
- Moreover, drivers and cabin crew members should maintain friendly and helpful behavior towards users.

4) Bus Stop Facilities:

- Bus stops have to be cleaned.
- More bus stops should be installed near main buildings or residences since currently, users must make a long journey to arrive at a bus stop.

5) Bus Capacity:

- Currently, there are no seats available during rush hours. Thus, more buses should be provided to meet users' demands.

In the future, if these recommendations are put into operation, the performance of city bus services in Phnom Penh will improve. Furthermore, the study findings will benefit the Cambodia authorities and service suppliers by informing regulations and policy strategies that aim to resolve bus users' complaints.

This research was conducted according to the Cambodia context. However, the study findings could be initially applied to different contexts because various countries have identified the same factors and attributes. These research attributes could be considered as prototype indicators for re-analysis.

Furthermore, this research focused on service users only to identify indicators of service quality. In further research, it would be appropriate to study the gap between

demand and operator side by taking operators' assessments into account. Moreover, there should be further study of the relationship between indicators, satisfaction, and loyalty, since this research considered the relationship between indicators and satisfaction only.

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CHAPTER IV

AN APPLICATION OF IMPORTANCE-PERFORMANCE ANALYSIS (IPA) FOR EVALUATING CITY BUS SERVICE QUALITY IN CAMBODIA

4.1 Abstract

The purpose of this study is to evaluate the service quality of city bus in Cambodia. In this research, Importance-Performance Analysis (IPA) was applied with the focus on assessing the city bus service quality from the users' viewpoints. In order to evaluate the service quality, the twenty-four items were grouped into five different factors concerning Bus Services, Bus Stop Facilities, Driver Attitude, Vehicle, and Bus Capacity with the use of five-point Likert scale. On a five-point Likert scale, face to face survey was performed to grasp the users' expectations and perceptions on the service quality, resulting from 500 respondents. The IPA, a strategic tool, is composed of four quadrants namely: (1) Concentrate Here; (2) Keep up the Good Work; (3) Low Priority: and (4) Possible Overkill, resulting to identify the attributes of service which need to be improved immediately and the ones which are not essential currently, the ones which are overestimated, and the criterions that are satisfactory. Finally, the graphical results play a critical role for the government authorities/agencies to find out the focus areas for improvement of city bus service quality.

4.2 Introduction

To pursue the education and seek for job, people keep moving to Phnom Penh where is the capital city of Cambodia. In 2018, around 12.15% population resided in the city and this will probably increase to 15.25% by 2030. The city's population growth rate is 3.92% annually (United Nations, 2018). This population increase moving into the urban area, mainly in Phnom Penh capital. It is noticed that the increase of GDP per capita creates the main challenge of urban transport in Cambodia resulting in traffic congestion and traffic accidents that become the most serious issues in the city. To confront this problem, many various modes of public transport have been considered by the government namely Bus Rapid Transit (BRT), Light Rail Transit (LRT), Sky rail, and Tramway (Phun, Pheng, &Yai, 2015). Recently, only the public bus service was introduced firstly in Phnom Penh city.

Public buses were introduced in the capital Phnom Penh in 2001. About two months later, they were scrapped due to their poor performance, lack of interest from the public, and lack of cultural familiarity with the concept. Until 2014, the air-conditioned buses were launched which have run from 5:30 am to 20:30 pm along three main bus routes throughout the city. They are managed by the Phnom Penh Municipal Government and formerly sponsored by the Japanese International Cooperation Agency. The system opened to the public in September 2014 with three main lines, other lines have been gradually added over the next several years, as of 2018, 8 city bus lines run across the city (JICA, 2014).

The ability to attract and retain the number of passengers takes a leading role in the public transport system's success and destiny. From this perspective, the quality of

service turns into the key significance for improving the level of service quality, resulting in higher satisfaction of the passengers and an increase in the use of the system.

Service quality and customer satisfaction have been concerned by companies progressively in recent decades. It might be helpful for both customers and companies, notably for passengers and transit authorities/agencies. It would therefore be beneficial to attract more users by improving service quality and user satisfaction. In addition, this process also assists to minimize the problems like traffic congestion, air, and noise pollution, parking problems and energy consumptions due to the use of private vehicles would be decreased gradually (Nocera, 2011). In this regard, it is very significant to enhance service quality and user satisfaction.

The enhancement in service quality doesn't mean to focus on only cost-effectiveness, but also to rank which attributes/indicators affecting the quality of service based on the customer viewpoints, resulting in getting better services to attract users/customers. Therefore, one of the major ways to strengthen customer loyalty is keeping the customer delighted/ satisfied with the service (Dabestani, Shahin, Saljoughian, &Shirouyehzad, 2016).

According to Davidson (2003), customer satisfaction plays a critical role in business destiny and success. It stems from the fact that customers are approved to be the "judges" of the service, it would logically evaluate service on the basis of customers' expectations and standard that they need. The researchers suggest that in measuring the service quality, it would be useful to take everything that might affect customer satisfaction into consideration (Chou, Liu, Huang, Yih, &Han, 2011). Recently, in order to evaluate the service quality, it is mainstream to quantify the gap between customers' expectation and perception of the service they obtained (Wang, Wang, &Zhao, 2007).

Based on the literature, many techniques have been conducted to measure service quality, one thing of concern with many techniques is that they are not often based on customer evaluation as suggested by (Figini, 2003). This author further suggests that the best methods for quality evaluation is either by asking customers their perception/satisfaction on the quality of service or, by asking and inquiring to know the customer expectation or both.

This research explores the gap between users' expectation and perception by identifying the strengths and weaknesses of the city bus service in Cambodia. The data was collected from the city bus users to rate the satisfaction levels of various aspects namely: Bus Stop Facilities, Bus Services, Driver Attitude, Bus Capacity, and Vehicle (Cafiso, Di Graziano, &Pappalardo, 2013b; De Oña, De Oña, Eboli, &Mazzulla, 2013; Deb &Ahmed, 2018; Goh, Currie, Sarvi, &Logan, 2014; Güner, 2018; Sajjakaj Jomnonkwao &Ratanavaraha, 2016; Nwachukwu, 2014). In addition, IPA technique is used in this research since many of transport company managers suggested (Figler, Sriraj, Welch, &Yavuz, 2011; Foote &Stuart, 1998; Group, 2013; Machado-León, de Oña, Baouni, &de Oña, 2017). This is due to the fact that IPA, the simplified and graphical tool, can provide the perceptive hints for the managers/ authorities to pay attention to the vital attributes of service.

The aim of this research is to recognize the strengths and weaknesses of the city bus service in Cambodia. It is worth noting that there has never been such research before in Cambodia context. The result will further give hint to the authorities/service providers about those aspects of service they must address urgently and the ones which are not very concerned.

4.3 Literature review

4.3.1 Satisfaction

Satisfaction is the output of purchasing act/using the service, arising from the comparison between customers' expectations and perceptions of the actual performance they received. Based on the Disconfirmation Model of Customer Satisfaction, it can be seen that the customer satisfaction is extremely affiliated to confirmation/disconfirmation of pre-purchase expectations. In other words, customers have their own mainstream in consideration before purchasing/using the service (expectations). After perceiving the actual performance of service, the satisfaction evaluations are made by comparing between their perceptions and what they need/want. According to Freitas (2013), the satisfaction evaluation is marked unfavorable disconfirmation if the expectation is better than actual service, favorable disconfirmation if the expectation is worse than actual service, and ordinary confirmation if the actual service meets the expectation. It is therefore significant to take a level of satisfaction into consideration due to it can point out the strengths, the weakness, and productivity of that service.

4.3.2 Factors influencing public transit service quality

In recent decades, the quality of transit service has become an interesting topic among scholars. According to the literature, numerous previous studies have been involved thoroughly in determining the factors and contributors to the efficiency of public transport, resulting from the users' point of view on the service quality. The prior related studies which have involved in the measurement of service quality with many various multivariate data analysis techniques are outlined concisely in Table 4.1 (Bordagaray, dell'Olio, Ibeas, &Cecín, 2014; Cafiso, Di Graziano, &Pappalardo, 2013a;

Cafiso et al., 2013b; Carreira, Patrício, Jorge, &Magee, 2014; De Oña et al., 2013; Deb &Ahmed, 2018; Eboli &Mazzulla, 2011; Freitas, 2013; Hu, Zhao, &Wang, 2015; Joewono, Tarigan, &Susilo, 2016; Sajjakaj Jomnonkwao &Ratanavaraha, 2016; S Jomnonkwao, Siridhara, &Ratanavaraha, 2015; Mouwen, 2015; Nwachukwu, 2014; Ratanavaraha, Jomnonkwao, Khampirat, Watthanaklang, &Iamtrakul, 2016; Shaaban &Khalil, 2013; Verbich &El-Geneidy, 2016; Vetrivel Sezhian, Muralidharan, Nambirajan, &Deshmukh, 2014). Based on these aforementioned studies, it has been highlighted that by applying different statistical analysis approaches, there were homogeneous and heterogeneous factors influencing the quality of public transit service. This is related to the fact that customers have the different expectations and perceptions of the service quality because of their society, individuality, and mainstream toward similar service.

As a result, it can be concluded that there are five main factors influencing public transit service quality consisting to Bus Services, Vehicle, Driver Attitude, Bus Stop Facilities, and Bus Capacity. Moreover, Table 4.1 reveals that "Bus Services" and "Vehicle" had the most significant frequency, "Driver Attitude" was the second highest factors, "Bus Stop Facilities" and "Bus Capacity" also related to the service quality.

Table 4.1 Summary of Factors influencing public transit service quality

Author(s) (Year)	Analysis Method	Factors				
		Bus Services	**Bus Stop Facilities**	**Driver Attitude**	**Vehicle**	**Bus Capacity**
Deb and Ahmed (2018)	Factor analysis, Linear regression analysis, and SEM	✓		✓	✓	
Sajjakaj Jomnonkwao and Ratanavaraha (2016)	Hierarchical CFA	✓		✓	✓	

Table 4.1 Summary of Factors influencing public transit service quality (Continued)

Author(s) (Year)	Analysis Method	Factors				
		Bus Services	Bus Stop Facilities	Driver Attitude	Vehicle	Bus Capacity
Joewono et al. (2016)	SEM	✓	✓	✓	✓	
Verbich and El-Geneidy (2016)	Logistic modeling	✓	✓	✓	✓	
Ratanavaraha et al. (2016)	MSEM	✓		✓	✓	
Hu et al. (2015)	Factor analysis, SEM, and Multinomial logit modeling	✓		✓	✓	✓
Mouwen (2015)	Multiple regression	✓	✓	✓	✓	
S Jomnonkwao et al. (2015)	Cluster Analysis	✓		✓	✓	
Nwachukwu (2014)	PCA, Linear regression analysis	✓	✓		✓	✓
Vetrivel Sezhian et al. (2014)	Discriminant analysis	✓	✓	✓	✓	
Bordagaray et al. (2014)	Ordered probit model	✓		✓	✓	
Carreira et al. (2014)	SEM	✓	✓	✓	✓	
Cafiso et al. (2013a)	Kendall's algorithm			✓	✓	
Cafiso et al. (2013b)	Delphi method			✓	✓	
Freitas (2013)	IPA	✓	✓	✓	✓	
Shaaban and Khalil (2013)	SEM	✓	✓	✓	✓	
De Oña et al. (2013)	SEM	✓		✓	✓	✓
Eboli and Mazzulla (2011)	Logical and Mathematical	✓	✓	✓	✓	

4.3.3 Importance-Performance Analysis (IPA)

IPA is a graphical tool used for better understanding about customer satisfaction and identifying the most critical attributes/ items for improvement (Martilla &James, 1977). Based on Frauman and Banks (2011), IPA is composed by two-dimensional graph that the vertical axis represents Customers Satisfaction or Performance and the horizontal axis represents Importance of service, which is broken into four quadrants as shown in Figure 4.1:

"Concentrate Here" represents the area where items are highly important and where the performance levels are low. It would get the maximum result if the items in this area are improved immediately.

"Keep up the Good Work" denotes the area where items are highly important and where the performance levels are high. The entrepreneurs should maintain recent activities.

"Low Priority" represents the area where items are low important and where the performance levels are low. It means that it is not necessary to improve this area.

"Possible Overkill" denotes the area where performance levels are high, but the items are not defined as important. In this quadrant, the improvement to these items can be minimized.

According to the literature, IPA has been broadly applied in various fields such as Tourism (Azzopardi &Nash, 2013; Coghlan, 2012; Cohen, Coleman, &Kangethe, 2016; Dwyer, Cvelbar, Edwards, &Mihalic, 2012; Griffin &Edwards, 2012; H.-S. Lee, 2015; Pan, 2015; Rasoolimanesh, Dahalan, &Jaafar, 2016; Ziegler, Dearden, &Rollins, 2012), Public administration (Van Ryzin &Immerwahr, 2007), Food industry (Jang, Ha, &Silkes, 2009), Healthcare (Abalo, Varela, &Manzano, 2007; Mohebifar, Hasani, Barikani, &Rafiei, 2016), Restaurant (Chen &Chen, 2010), and more interestingly in Public transportation (Freitas, 2013; Shaaban &Khalil, 2013).

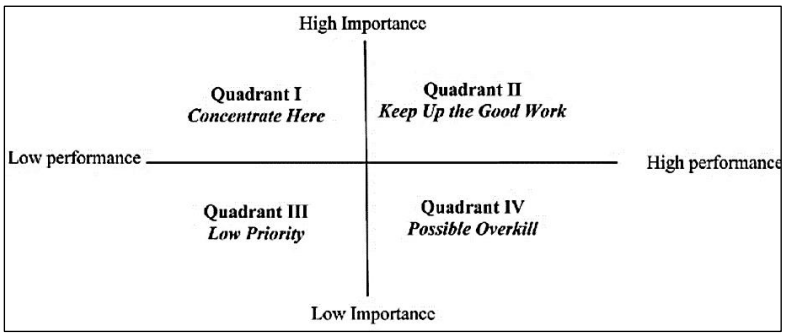

Figure 4.1 The original IPA framework. Source: (Martilla &James, 1977)

4.4 Methodology

The proposed methodological procedure was composed of two main parts namely (1) Questionnaire design and Data collection; (2) An application of Importance-Performance Analysis for identifying the attributes of service which need rapid attention and the ones which are not crucial at the moment, the ones which are overstated, and the dimensions that are sufficient.

4.4.1 Questionnaire design and Data collection

Data was collected through a questionnaire in order to firstly, assess the users' expectations of the service, which is made before getting the service, and secondly, evaluate the users' perceptions of the service, which is made after getting the service. The questionnaire was composed of two main sections consisting of i) Questions concerning users' demographics such as gender, age, education level, average income etc. ii) bus users were asked 24 questions/items to rate the service quality on the measurement of satisfaction by using a five-point Likert scale from 1 to 5, where 1 = strongly disagree, 2 = disagree, 3 = Neither Agree nor Disagree, 4 = Agree, and 5 = strongly agree (De Oña et al., 2013; Hernandez &Monzon, 2016; C.-K. Lee, Yoon, &Lee, 2007). In order to evaluate the service quality, the 24 items were grouped

into 5 different factors concerning Bus Services, Bus Stop Facilities, Driver Attitude, Vehicle, and Bus Capacity as indicated in Table 4.2. Data were gathered in Phnom Penh city by using questionnaire and oral interviews in July 2018. City bus users (both waiting at bus stops and being on board) were the target population in this study. They would be best able to provide their viewpoints for evaluating the existing city bus services and levels of satisfaction with those services in Phnom Penh. Simple Random Sampling Technique was used as the tool to collect data. Participants who use bus services in the city and were between the ages of 15 and 70 were selected, resulting from 500 respondents.

Table 4.2 Factors and Variables of service quality

Factor	Variable	Question
Bus Stop Facilities	V1	Bus stops have roofs that provide protection from sunlight and rain.
	V2	Bus stops have enough seats for waiting.
	V3	Bus stops are clean without any dust or garbage.
	V4	Bus stops are durable and strong without any damage.
	V5	Bus stops are sufficiently available in the main buildings.
	V6	The locations of bus stops are appropriate. They are not very far from residences.
	V7	Bus stops have sufficient lighting at night.
	V8	Bus stops are located in safe areas that are not lonely and fearful.
Bus Services	V9	There are enough bus services in rush hours.
	V10	There are enough bus services outside rush hours such as during daytime and evening.
	V11	The buses run punctually according to the bus schedule.
	V12	There are widespread public relationships of bus schedules on the internet/application.
	V13	There are available of schedule/maps at bus stops.
	V14	Bus routes cover every area.
	V15	Ease of purchasing tickets.
	V16	Timetable is clear and easy to understand.
Driver Attitude	V17	Good personality and appearance of driver and crew that is neat, clean, and meets uniform standards.

Table 4.2 Factors and Variables of service quality (Continued)

Factor	Variable	Question
	V18	Friendly, helpful and polite customer service of driver and crew.
	V19	Bus driver driving safely, i.e. at a safe speed, politely, with respect for traffic rules.
Bus Capacity	V20	In rush hours, the buses are crowded. There are no available seats.
	V21	Outside rush hours, the buses are crowded. There are no available seats.
Vehicle	V22	Decent appearance of vehicle body.
	V23	The bus floor is clean without any dust or garbage.
	V24	While sitting in the buses, the temperature inside is cool, and it is not stuffy.

4.4.2 Importance-Performance Analysis (IPA)

IPA in this research was used for the evaluation of the attributes to assess the quality of bus service which managed by Phnom Penh Municipal Government. In total, 24 items in the questionnaire were grouped into each of the four Quadrants which were constructed by the two-dimensional graph that on the vertical axis, Users Satisfaction or Performance calculated from the average of General Satisfaction of each attribute and on the horizontal axis, Importance of service calculated from the average of General Important Degree of each attribute as well. As a result, by using the importance and performance of each attribute, IPA can be plotted graphically.

4.5 Findings

4.5.1 Sample Characteristic

According to Table 4.3, it can be observed that most of the respondents were women 67.20% and 32.80% were men. In term of age, it was grouped into ten years interval and it has been found that 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%) who were older than 65 years old. Regarding to education level, it was found that the majority of the respondent was bachelor holders 49.60%, followed by under the bachelor's degree 49.00%, Upper Secondary 40.20%, Diploma 8.80%, Master 1.00%, and Doctor 0.40% respectively. In terms of average income, the sample of respondents was composed of 268 respondents who didn't have the salary or they were studying (53.60%), followed by 101$ – 200$, 201$ – 300$, 301$ – 400$, <= 100$, 401$ – 500$, and 500$ + were in the portion of 16.80%, 15.80%, 5.40%, 3.40%, 2.60%, and 2.40% respectively. Furthermore, there is no tourist to participate in this survey, so 100% of the sample were Cambodian. With regard to the travel experience, 82.00% of passengers has never had this experience, while 18.00% said that they had ever faced a problem of bus breakdown on the way.

Table 4.3 Socio-demographic Characteristics of bus users

Socio-demographic Characteristics		**Percentages**
Gender	Men	32.80
	Women	67.20
Age	15 – 19	29.80
	20 – 29	42.40
	30 – 39	15.80
	40 – 49	5.20
	50 – 59	4.40
	60 – 65	0.80
	65+	1.60
Education level	Upper Secondary	40.20
	Diploma	8.80
	Bachelor	49.60
	Master	1.00
	Doctor	0.40
Monthly average income	None	53.60
	<= 100$	3.40
	101$ – 200$	16.80

Table 4.3 Socio-demographic Characteristics of bus users (Continued)

Socio-demographic Characteristics		**Percentages**
	201$ – 300$	15.80
	301$ – 400$	5.40
	401$ – 500$	2.60
	500$ +	2.40
Citizen	Cambodian	100
Travel Experience toward bus usage	Yes	18.00
	No	82.00

4.5.2 Descriptive statistics

Table 4.4 illustrates the information about importance and performance of each variable. In regards to Importance, it has been observed that "Driver Attitude" had the highest mean of importance at 4.220, while the second most important factor was "Vehicle" at the mean value of 4.163. On top of that, "Bus Services" was the third most important factor at the mean value of 3.988 and the fourth most important one was "Bus Stop Facilities" at the mean value of 3.838. Moreover, the lowest mean of importance was "Bus Capacity" at the mean value of 3.647. In terms of Performance, it has been noted that "Driver Attitude" also had the highest mean of satisfaction at 4.021, followed by Vehicle, Bus Services, Bus Stop Facilities, and Bus Capacity were at the mean satisfaction of 3.977, 3.548, 3.336, 3.143, and 3.143 respectively. More interestingly, if we take a closer look at Table 4.4, it is worth highlighted that the users considered V24 (While sitting in the buses, the temperature inside is cool, and it is not stuffy), V19 (Bus driver driving safely, i.e. at a safe speed, politely, with respect for traffic rules), V15 (Ease of purchasing tickets), V17 (Good personality and appearance of driver and crew that is neat, clean, and meets uniform standards), and V22 (Decent appearance of vehicle body) as the most important variables/ items that lead them to use

the bus service and feel satisfied with it. In addition, V14 (Bus routes cover every area) was the only item that makes users dissatisfied with the current service. Furthermore, the mean average importance of all the 24 items was calculated at 3.960, while the average of mean satisfaction was at 3.556. Therefore, if the importance and performance were plotted on the IPA grid, it would be useful for authorities/ managers to quickly evaluate the areas which need urgent attention and the ones which do not need to focus on.

Table 4.4 Descriptive statistics of variables/ items

Factor	Variable	N	Importance			Performance		
			Mean	SD	Mean	Mean	SD	Mean
Bus Stop Facilities	V1	500	3.984	0.710	3.838	3.608	0.955	3.336
	V2	500	3.870	0.643		3.414	0.906	
	V3	500	3.762	0.659		3.136	0.925	
	V4	500	3.784	0.665		3.430	0.878	
	V5	500	3.790	0.635		3.228	0.933	
	V6	500	3.882	0.633		3.362	0.936	
	V7	500	3.794	0.633		3.132	0.974	
	V8	500	3.834	0.651		3.378	0.881	
Bus Services	V9	500	3.820	0.642	3.988	3.152	0.942	3.548
	V10	500	3.790	0.628		3.412	0.925	
	V11	500	4.048	0.550		3.628	0.878	
	V12	500	3.740	0.691		3.376	0.923	
	V13	500	4.144	0.548		3.936	0.773	
	V14	500	4.018	0.717		2.942	0.976	
	V15	500	4.216	0.637		4.066	0.846	
	V16	500	4.130	0.557		3.872	0.849	
Driver Attitude	V17	500	4.216	0.557	4.220	4.100	0.698	4.021
	V18	500	4.166	0.596		3.906	0.843	
	V19	500	4.278	0.563		4.058	0.795	
Bus Capacity	V20	500	3.634	0.630	3.647	3.168	0.895	3.143
	V21	500	3.660	0.667		3.118	0.900	
Vehicle	V22	500	4.208	0.542	4.163	4.106	0.632	3.977
	V23	500	3.898	0.651		3.632	0.864	
	V24	500	4.382	0.577		4.194	0.821	
Average			3.960			3.556		

4.5.2 Importance-Performance Analysis (IPA)

The intersection in this IPA grid is constructed by utilizing the mean average of importance at 3.960 and the mean average of performance at 3.556. The variables are plotted on the IPA grid by using their mean values; consequently, the graphical results were illustrated in Figure 4.2 and briefly summarized in Table 4.5.

From Figure 4.2 and Table 4.5, it has been observed that only one variable (V14) Bus routes cover every area which falls into quadrant 1, Concentrate Here, which means that the users considered this variable as very important, but the performance level is under an average. Government authorities should prioritize this critical variable for improving the service quality provided. Therefore, it needs an imperative concentration for improvement in this quadrant.

Variables such as (V24), (V19), (V17), (V15), (V22), (V18), (V13), (V16), (V11), and (V1) are positioned in quadrant 2, Keep up the Good Work, which classified by stating high importance and performance level is also high. In addition, the variable which has the highest importance and satisfaction is (V24) While sitting in the buses, the temperature inside is cool, and it is not stuffy. Even though these variables are the strength of the service, the government agencies should keep up the good work in order to make the users satisfied. On the contrary, these variables might take a chance to run into the quadrant 1, for instance, (V1) Bus stops have roofs that provide protection from sunlight and rain and (V11) The buses run punctually according to the bus schedule in this research.

Some of the variables are considered as Low Priority “Low important and the performance levels are also low” and fall directly into quadrant 3 namely: (V6) The locations of bus stops are appropriate. They are not very far from residences, (V2)

Bus stops have enough seats for waiting, (V8) Bus stops are located in safe areas that are not lonely and fearful, (V4) Bus stops are durable and strong without any damage, (V12) There are widespread public relationships of bus schedules on the internet/application, (V10) There are enough bus services outside rush hours such as during daytime and evening, (V9) There are enough bus services in rush hours, (V5) Bus stops are sufficiently available in the main buildings, (V7) Bus stops have sufficient lighting at night, (V3) Bus stops are clean without any dust or garbage, (V21) Outside rush hours, the buses are crowded. There are no available seats, and (V20) In rush hours, the buses are crowded. There are no available seats. It is not necessary to improve in this area.

In quadrant 4, Possible Overkill, there is only one variable (V23) The bus floor is clean without any dust or garbage which falls under. The users considered this variable as low importance and the performance levels are high. Thus, the improvement in this area would be ineffective since the users are satisfied with service already.

Furthermore, the strengths and weaknesses of service were investigated by the level of satisfaction. From Figure 4.2, it has been revealed that there is only one variable which is the weakness of service (V14) Bus routes cover every area. Moreover, the strengths of service consist of; **i) Vehicle:** (V24) While sitting in the buses, the temperature inside is cool, and it is not stuffy and (V22) Decent appearance of vehicle body, **ii) Driver Attitude:** (V17) Good personality and appearance of driver and crew that is neat, clean, and meets uniform standards and (V19) Bus driver driving safely, i.e. at a safe speed, politely, with respect for traffic rules **iii) Bus Services:** (V13) There are available of schedule/maps at bus stops, and **iv) Bus Stop Facilities:** (V1) Bus stops

have roofs that provide protection from sunlight and rain.

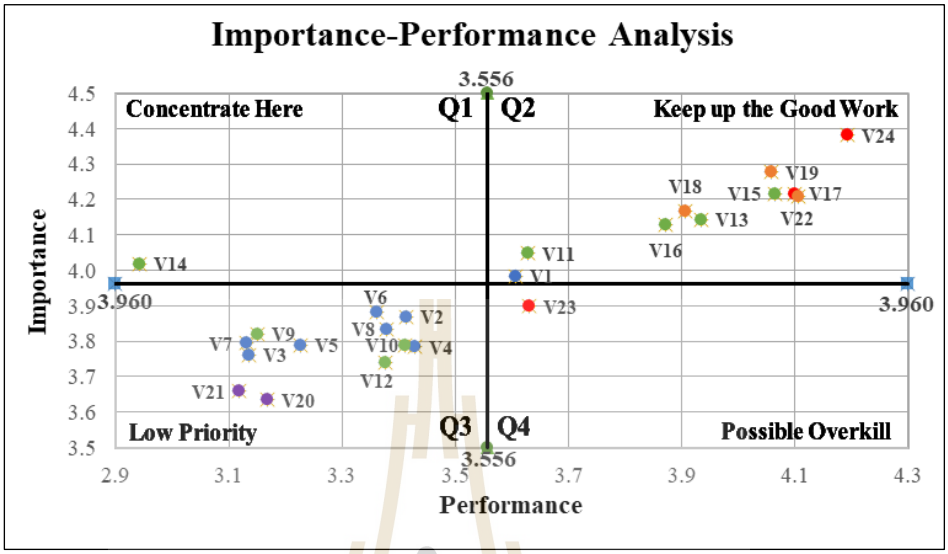

Figure 4.2 Importance-Performance Analysis Grid

Table 4.5 Summarized results of IPA

Concentrate Here (Q1)	Keep up the Good Work (Q2)	Low Priority (Q3)	Possible Overkill (Q4)
(V14) Bus routes cover every area.	(V24) While sitting in the buses, the temperature inside is cool, and it is not stuffy	(V6) The locations of bus stops are appropriate. They are not very far from residences	(V23) The bus floor is clean without any dust or garbage
	(V19) Bus driver driving safely, i.e. at a safe speed, politely, with respect for traffic rules	(V2) Bus stops have enough seats for waiting	
	(V17) Good personality and appearance of driver and crew that is neat, clean, and meets uniform standards	(V8) Bus stops are located in safe areas that are not lonely and fearful	
	(V15) Ease of purchasing tickets	(V4) Bus stops are durable and strong without any damage	
	(V22) Decent appearance of vehicle body	(V12) There are widespread public relationships of bus schedules on the internet/application	
	(V18) Friendly, helpful and polite customer service of driver and crew	(V10) There are enough bus services outside rush hours	

Table 4.5 Summarized results of IPA (Continued)

Concentrate Here (Q1)	Keep up the Good Work (Q2)	Low Priority (Q3)	Possible Overkill (Q4)
	(V13) There are available of schedule/maps at bus stops	(V9) There are enough bus services in rush hours	
	(V16) Timetable is clear and easy to understand	(V5) Bus stops are sufficiently available in the main buildings	
	(V11) The buses run punctually according to the bus schedule	(V7) Bus stops have sufficient lighting at night	
	(V1) Bus stops have roofs that provide protection from sunlight and rain	(V3) Bus stops are clean without any dust or garbage	
		(V21) Outside rush hours, the buses are crowded. There are no available seats	
		(V20) In rush hours, the buses are crowded. There are no available seats	

4.6 Discussion and Conclusions

Specifying the strengths and weaknesses of the city bus services has made an essential contribution to the government authorities. In this research, face to face survey was made in order to know the users' expectations and perceptions to strategically prioritize the area for improvement, resulting from 500 respondents. The IPA, a strategic tool, was applied and discussed in this research, resulting to provide the government authorities the guideline which rapidly empowers them to comprehend users' demands and desires and to evaluate user satisfaction instead of depending on only performance attributes. Logically, the variables in the Concentrate Here quadrant are considered as the urgent contributors which need urgent attention.

Based on the results of IPA, it has been observed that only one variable *"Bus routes cover every area"* which is located in the Concentrate Here quadrant. This is due

to the fact that all 8 city bus lines are located in the urban area and the lack of bus lines in the suburban area for fulfilling customers' demands. Actually, the population is centralized in the city and there is a lesser population in the suburban area. Running in long and less payable areas would cause to meet a budgetary shortfall in the bus business. Furthermore, there are very long routes in the suburban areas which require more than 200 bus vehicles to fulfill the service with 15-minute headway. There are inadequate city buses to cover the entire both urban and suburban area. In addition to the above mentioned, there are missing road links and poor road infrastructure in suburban areas – including low road density, the preponderance of unpaved roads and roads too narrow to allow traffic to pass safely. For the quadrant which is doing the good work, the variables that are positioned in this quadrant consisting of *"While sitting in the buses, the temperature inside is cool, and it is not stuffy"*. Moreover, it is also important to pay attention to the variables which are closed to Concentrate Here boundary like Bus Stop Facilities; *"Bus stops have roofs that provide protection from sunlight and rain"* and Bus Services; *"The buses run punctually according to the bus schedule"*. Variables which are placed in the "Low Priority" quadrant concerning Bus Stop Facilities, Bus Services, and Bus Capacity. However, the variables which are considered as the less important among all the variables are *"Outside rush hours, the buses are crowded. There are no available seats"* and *"In rush hours, the buses are crowded. There are no available seats"*. According to the users, the variable which is situated in Possible Overkill quadrant is *"The bus floor is clean without any dust or garbage"*. The users are not considered it as important, it is thus not necessary to make an improvement in this quadrant.

After investigating the results, it is worth highlighted that the critical issue concerning the lack of bus routes in every area. It would increase the level of users' satisfaction if the government authorities provide more bus routes even in suburban areas.

To conclude, this IPA is the strategic tool for the government authorities or researchers to evaluate the city bus services quality by providing the guideline to prioritize the focus area for improvement. Even though obtaining the good responses from 500 participants, it would be better for further research to make it more generalized to the entire population.

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CHAPTER V

CONCLUSION AND RECOMMENDATIONS

This research investigated the city bus service quality in Phnom Penh based on users' perceptions and users' expectations. Data were conducted through face–to–face questionnaire survey from the users who were waiting at bus stops and on board. The participants who traveled along the study line were voluntarily recruited, resulting from 500 respondents. The indicators and factors influencing the bus service quality were examined by using suitable statistical methods namely Exploratory Factor Analysis, Confirmatory Factor Analysis, and Structural Equation Modeling. Moreover, Importance–Performance Analysis was performed to explore the gap between users' expectations and users' perceptions.

The summary of this research is classified into three main research objectives as follows; (1) to find out the indicators relating to the city bus service on the basis of users' perceptions, (2) to identify the potential factors which influence the users' perceptions and users' expectations of the city bus service and examine the relationship between users' perceptions, users' expectations, and overall satisfaction of the service, and (3) to explore the gap between users' perceptions and users' expectations by identifying the strengths and weaknesses of the city bus service quality.

5.1 Indicators relating to the city bus service quality

On the basis of Exploratory Factor Analysis (EFA), twenty–four quality indicators of the city bus service quality were categorized into five main factors

affecting the users' perceptions namely Bus Stop Facilities, Bus Services, Driver Attitude, Bus Capacity, as well as Vehicle. Subsequently, the second-ordered Confirmatory Factor Analysis (CFA) was applied to check whether factor structure is acceptable. From CFA, the results showed that the model had construct validity with $\chi^2 = 492.309$, $df = 207$, $\chi^2/df = 2.378$, $p < 0.001$, Root Mean Square of Approximation (RMSEA) = 0.053, Comparative Fit Index (CFI) = 0.931, Tucker Lewis Index (TLI) = 0.916, Standardized Root Mean Residual (SRMR) = 0.051. These five factors of indictors were able to confirm the first composition of the city bus service quality. Furthermore, all 24 indicators were able to confirm the second composition of the city bus service quality at statistical significance level 0.001. Considering the second–ordered CFA loading, it was found that the latent variable with the most CFA loading value was "Bus Services" factor (β = 0.957), followed by "Bus Stop Facilities" (β = 0.814), "Driver Attitude" (β = 0.764), "Vehicle" (β = 0.764), and "Bus Capacity" (β = 0.526) respectively. Regarding the first-ordered CFA loading, it has been observed that the indicators of "Bus Services" had standardized factor loadings between 0.460 – 0.706 ("There are enough bus services in rush hours." revealed the maximum CFA loading score). The indicators' standardized factor loadings of "Bus Stop Facilities" were in the range of 0.495 – 0.720 ("Bus stops are clean." exhibited the highest CFA loadings). The indicators of "Driver Attitude" had standardized factor loadings between 0.538 – 0.708 ("Driver and crew are friendly, helpful and polite." and "Bus driver driving safely." had the highest CFA loading). The indicators of "Vehicle" had standardized factor loadings ranged from 0.402 – 0.834 ("Buses are clean." offered the highest CFA loading). The indicators' standardized factor loadings of "Bus

Capacity" were in the range of 0.814 – 0.883 ("Buses are crowded in rush hours." exposed the highest CFA loading).

According to the results of the analysis, it provides the depth understanding which indicators of the bus service are needed to be ameliorated on the basis of a particular perception factor. The authorities and transportation stakeholders potentially prioritize the most important factors and indicators based on the factor loading data and make the improvement eventually.

5.2 The potential factors influencing the users' perceptions and users' expectations of the city bus service and the study of the relationship between users' perceptions, users' expectations, and overall satisfaction of the service

5.2.1 Factors influencing the users' perceptions and users' expectations of the city bus service

Both perceptions and expectations data were separately analyzed by factor analysis. As the result, the overall picture of EFA indicated that five latent factors namely Bus Stop Facilities, Bus Services, Driver Attitude, Bus Capacity, as well as Vehicle were extracted from both data sets. CFA was then analyzed based on the results obtained from the EFA. The results of the model had construct validity with χ^2 = 474.795, df = 202, χ^2/df = 2.350, p < 0.001, Root Mean Square of Approximation (RMSEA) = 0.052, Comparative Fit Index (CFI) = 0.934, Tucker Lewis Index (TLI) = 0.917, Standardized Root Mean Residual (SRMR) = 0.043 for perceptions data set; χ^2 = 392.316, df = 208, χ^2/df = 1.886, p < 0.001, Root Mean Square of Approximation (RMSEA) = 0.042, Comparative Fit Index (CFI) = 0.946, Tucker Lewis

Index (TLI) = 0.935, Standardized Root Mean Residual (SRMR) = 0.043 for expectations data set. In addition, by investigating profoundly on the results of the CFA, it has been pointed out that all 24 indicators were not able to confirm the second composition of the city bus service quality. It is noteworthy that V1 was eliminated from the perceptions CFA model and V24e was also dropped from the expectations CFA model due to their low factor loadings. Thus, there are differences between perceptions and expectations in factor 1 and factor 5. When measuring perceptions, Bus Stop Facilities consisted of 7 parameters (V2 – V8) and Vehicle consisted of 3 items (V22 – V24). However, Expected Bus Stop Facilities comprised of 8 parameters (V1e – V8e) and Expected Vehicle included only 2 items (V22e – V23e). This reflects the fact that there are insufficient bus stops along the route, especially near the residential areas and main buildings. Passengers/ users might therefore think that just providing extra bus stops stand would fulfil their current demand. When considering the temperature inside the bus, Murakoshi, Namagami, Xuan, Takayama, and Takaguchi (2017) studied the residential energy consumption in Southeast Asia, and pointed out that Hanoi has the highest adoption rate of air conditioners (91 %), followed by Ho Chi Minh City, Kuala Lumpur, and Bangkok (approximately 50 %). However, air conditioning is used by only (15 %) of households in Phnom Penh city. Furthermore, the electricity supply framework has not highly developed yet in Cambodia. It can be said that the citizens of Phnom Penh city are unlikely to expect the temperature/ an air conditioner inside a city bus.

5.2.1 The relationship between the users' perceptions, users' expectations, and overall satisfaction of the service

From the results of SEM, it was found that the model had construct validity with the following good–of–fit statistic: χ^2 = 112.058, *df* = 29, χ^2/df = 3.864, $p < 0.001$, Root Mean Square of Approximation (RMSEA) = 0.076, Comparative Fit Index (CFI) = 0.968, Tucker Lewis Index (TLI) = 0.938, Standardized Root Mean Residual (SRMR) = 0.066. Regarding the parameter value, it has been highlighted that perceptions data have the positive effect on overall satisfaction ($\beta = 0.502$, $p < 0.001$). While, expectations data have the direct positive effect on perceptions ($\beta = 0.477$, $p < 0.001$) and have the indirect effect on overall satisfaction.

5.3 The gap between users' perceptions and users' expectations

This study applied Importance–Performance Analysis (IPA) to find out the strengths and weaknesses of the city bus services in Phnom Penh. According to the results of IPA, it has been revealed that there is only one variable which is the weakness of service *(V14) "Bus routes cover every area"*. Moreover, strengths of service consist of; **i) Vehicle** *(V24) "While sitting in the buses, the temperature inside is cool, and it is not stuffy"* and *(V22) "Decent appearance of vehicle body"*, **ii) Driver Attitude** *(V17) "Good personality and appearance of driver and crew that is neat, clean, and meets uniform standards"* and *(V19) "Bus driver driving safely, i.e. at a safe speed, politely, with respect for traffic rules"* **iii) Bus Services** *(V13) "There are available of schedule/maps at bus stops"*, and **iv) Bus Stop Facilities** *(V1) "Bus stops have roofs that provide protection from sunlight and rain"*.

This graphical result provides the government authorities the guideline which rapidly empowers them to comprehend users' demands and desires and to evaluate users' satisfaction instead of depending on only performance attributes. Logically, the variables in the "Concentrate Here quadrant" are considered as the urgent contributors which need the urgent attention. In this study, it is worth highlighted that the critical issue concerns to the lack of bus routes in every area. It would increase the level of users' satisfaction if the government authorities and transportation stakeholders provide more bus routes even in the sub-urban areas.

5.4 Recommendations

The investigation of the city bus service quality is primarily concluded. The recommendations can be drawn as follows;

1) In order to assess the city bus service quality, it should consider the users' expectations in addition to the users' perceptions about the service since there is the direct statistical relationship between users' perceptions and expectations.

2) For city bus service quality development, the government authorities and transportation stakeholders should consider five aspects comprising Bus Services, Vehicle, Driver Attitude, Bus Stop Facilities, and Bus Capacity. For setting up the strategical policy, the government authorities and transportation stakeholders should take the results of this study into consideration by prioritizing the importance of each indicator from standardized factor loading as the researchers mentioned in chapter 3.

3) Regarding the strengths and weaknesses of the city bus service quality, the government authorities and transportation stakeholders should prioritize the focus areas for improvement consequently as the researchers mentioned in chapter 4.

4) When considering the methods to predict the overall satisfaction, it can be concluded that the statistical methods like Regression analysis, SEM are more powerful than IPA since the traditional IPA can be misleading and needs to be reconsidered/ modified. Neslin (1981) stated that relative values derived from statistical methods have more predictive validity than self-stated absolute values. In addition, Taplin (2012) added that the modeling of relative values proved to be quite effective in predicting overall satisfaction and provides a strong empirical support for the Importance–Performance Analysis. Moreover, Matzler, Sauerwein, and Heischmidt (2003) indicated that self-stated absolute importance does not appropriately reflect the relationship between each service attribute and overall satisfaction.

5) For the further studies in the future, the gap between the demand side and operator side should be studied by taking operators' assessments into account. Moreover, there should be a study about the relationship between indicators, satisfaction, and loyalty since this research focused on the relationship between indicators and satisfaction only.

5.5 References

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APPENDIX I

LIST OF PUBLICATIONS

List of Publications

Sum, S., Champahom, T., Ratanavaraha, V., & Jomnonkwao, S. (2019). An Application of Importance-Performance Analysis (IPA) for Evaluating City Bus Service Quality in Cambodia. **International Journal of Building, Urban, Interior and Landscape Technology (BUILT), 13, 55-66**.

Sum, S., Jomnonkwao, S., Champahom, T., Roodheer, B., & Ratanavaraha, V. (2019). Measuring the city bus service quality based on users' perceptions: City bus service in Phnom Penh, Cambodia. **Engineering and Applied Science Research**. (In press)

BIOGRAPHY

Miss. Sonita Sum was born on the 22nd of June, 1994 at Kandal Province, Cambodia. She started her primary education at Bun Rany Hun Sen Primary School, secondary education at Preah Sihanoukreach Secondary School, and obtained her high school diploma at HUN SEN Khsach Kandal High School. Then, she received her B. Eng. degree in Civil Engineering (CE) from Institute of Technology of Cambodia (ITC), Cambodia in 2017. After her graduation, she pursued to Master degree in Transportation Engineering at Suranaree University of Technology (SUT), Thailand in 2017. Her field of interest is transportation planning and policy and many perspectives in transportation field.