Evaluation of Bus Service Performance Based on Women Commuters in Developing Countries: A Case Study on Major Cities in Bangladesh

(開発途上国の女性通勤者に基づくバス運行実績の評価:バングラデシュ主要都市を事例として)

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A dissertation submitted to the Saitama University in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

Supervised by

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Umme Ayesha

March, 2023

Saitama, Japan

Dedicated to my family

Abstract

Buses, specifically public buses, are considered the most accessible and widely used transportation mode, and this statement is so true for developing countries like Bangladesh. Yet, public bus service in Dhaka city as well as the urban cities of the country is experiencing poor service quality with a number of issues like overcrowding, insufficient number of buses, long-travel time, poor infrastructure, lack of observations and policies etc. However, the most concerning fact regarding public buses in the urban areas of Bangladesh is that nowadays, public buses have become a hotspot of women's harassment. In the era of rapid urbanization and women's emancipation, women's participation in economic activities outside the home is growing daily in Bangladesh. Many economically active women are working in Dhaka, and they use public buses as their main mode of transportation for daily trips.

Yet, women's needs and perceptions are always an afterthought while measuring or evaluating bus service performance in Bangladesh. Evaluating the service quality of public buses is to evaluate it based on the specific needs of both genders (male and female), but in the long run, with social, cultural, as well as religious aspects, women's perspectives have always been neglected in Bangladesh. The main objective of this study is to evaluate bus service performance based on female commuters in the major cities (Dhaka, Narayanganj, and Gazipur) in Bangladesh.

Keeping the main principle in mind and using the SERVQUAL model as a means of data analysis, this study attempts to analyze the gap between perceptions and expectations of both male and female commuters in major cities in Bangladesh. This helps to explore the real picture of service quality, especially based on female commuters, and helps to understand how there lies a great difference between the perceptions and expectations of female commuters regarding the bus service performance.

The Structural Equation Model (SEM) provided an appropriate way to measure the satisfaction of women commuters with the public bus service in Dhaka city. After disclosing the poor satisfactory level of women commuters with the public bus service in Dhaka city, SEM helps to

explore some recommendations that can help the bus service operators and administration to offer a better public bus service quality to their commuters.

One of the significant contributions of this study is that it attempts to find out commuters' willingness to pay by identifying a list of improved service facilities for which they are willing to pay. Two different models (Binary Logistic Model and Ordinal Logistic Model) were established to estimate and explore commuters' willingness to pay for improved service quality and the factors responsible for the amount for which commuters are willing to pay.

Finally, the findings of the study came up with several suggestions and facts that can help the transport planners and authorities not only in Bangladesh but also in developing countries like Bangladesh. Apart from the suggestions, this study can make a contribution in the field of service quality measurement, where women's needs, perceptions, and suggestions are a subject of neglect.

Keywords: *Bus Service Quality, Perception & Expectation, Gap Analysis,SERVQUAL, Women Commuters Satisfaction, SEM, Safety and Security, WTP, Regression Analysis.*

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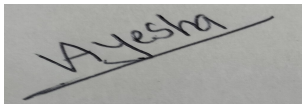
List of Abbreviations

AIC	Akaike's Information Criterion
BRTA	Bangladesh Road Transport Authority
BRTC	Bangladesh Road Transport Corporation
CFI	Comparative Fit Index
CNG	Compressed Natural Gas
CPTED	Crime Prevention through Environmental Design
CVM	Contingent Valuation Method
F-APH	Fuzzy Analytical Hierarchy Process
DCC	Dhaka City Corporation
DMC	Dhaka Metropolitan City
DMP	Dhaka Metropolitan Police
DTCA	Dhaka Transport Coordination Authority
DTCB	Dhaka Transport Coordination Board
IPT	Intermediate Public Transport
LF	Labor Force
LFP	Labor Force Participation
MNL	Multinomial Logit Model
OLR	Ordinal Logit Model
PT	Public Transport
RAJUK	Rajdhani Unnayan Kartipokkho
RHD	Roads and Highways Department

RMG	Ready-made Garments
RMSEA	Root Mean Squared Error of Approximation
RSTP	Revised Strategic Transport Plan
SDGs	Sustainable Development Goals
SEM	Structural Equation Model
SERVQUAL	Service Quality Model
SP	Stated Preference
SRMR	Standardized Root Mean Squared Residual
TLI	Tucker-Lewis Index
UNESCO	United Nations Educational, Scientific and Cultural Organization
WTP	Willingness to Pay

Declaration of Original Authorship

I hereby admit that the studies contained in this thesis book have not been previously published or submitted to meet the demands or requirements for an honor or equivalent award at any higher education institution or research farm. This thesis book, to the best of my knowledge and belief, doesn't even include any information, claims, or conclusions that have already been published or written by another author, unless appropriate citations are made.

Signature: 

Date: 09/02/2023

Chapter-1

General Introduction

Chapter 1 of this thesis introduces this study, which is about "the evaluation of bus service performance in major cities in Bangladesh based on the women commuters." The chapter opens with a brief account of the background and motivation of the study and the rationale behind the research, followed by a conceptual framework and significance of the research.

1.1 CONTEXT OF RESEARCH

This research attempts to evaluate bus service performance in major cities in Bangladesh, focusing on female commuters' needs and perceptions. To read and understand the research, it is necessary to be aware of why bus service in Bangladesh needs to be evaluated from a women's point of view. This section of the study presents a background of the Dhaka Metropolitan City (DMC) with its bus service conditions, especially for female commuters.

1.1.1 Overview of Dhaka Metropolitan City

Dhaka, the capital of Bangladesh, is frequently considered as the only city of its size that lacks a well-organized, regularly scheduled bus service or any type of mass rapid transit system (Satu & Shakil). With a population of 22.3 million in the urban area and 10.9 million in the city, this megacity is the fifth-most densely populated city (World Population, 2022) and the fourth least livable city in the world ("Global Livability Index 2021 Report | Economist Intelligence Unit," 2021). The city has a total area of 360 square kilometers and there are 24 thanas in total, including: Lalbagh, Kotwali, Hazaribagh, Sutrapur, Ramna, Motijheel, Paltan, Dhanmondi, Mohammadpur, Tejgaon, Gulshan, Mirpur, Pallabi, Shah Ali, Turaag, Sabujbagh, Dhaka Cantonment, Demra, Shyampur, Badda, Kafrul, Kamrangir char, Khilgaon and Uttara ("Dhaka-Geography"). This capital city is also growing at the second highest rate of the world's twenty most populated megacities (Katz and Rahman, 2010). There are almost 47,400 people living in this city per square kilometer (World Population, 2022), which is almost half of the total population living in the urban areas of Bangladesh. This city is growing at the second highest rate of the world's 20 most populated megacities (Katz and Rahman, 2010).

Every year, people from various nearer or distant parts of the country settle into these major cities like Dhaka, Narayanganj, Gazipur, etc., because compared to other cities, especially Dhaka, these cities offer their residents the advantages of employment, social opportunities, health, education, and modern facilities (Satu & Shakil, 2015). These opportunities of this city fascinated the country's population on a large scale, so that thousands of daily commuters from all over the country migrated to this city, which is considered as a city of dreams or city of opportunities to them. All of these factors contribute to the city's growing population. Nasrin (2015) illustrates the growth in the population of Dhaka city from 1950 to 2010 by taking information from the Bangladesh Bureau of Statistics (2010) and UN (2001). Figure 1.1 shows the illustration, i.e., the growth in the population of Dhaka from 1950 to 2010.

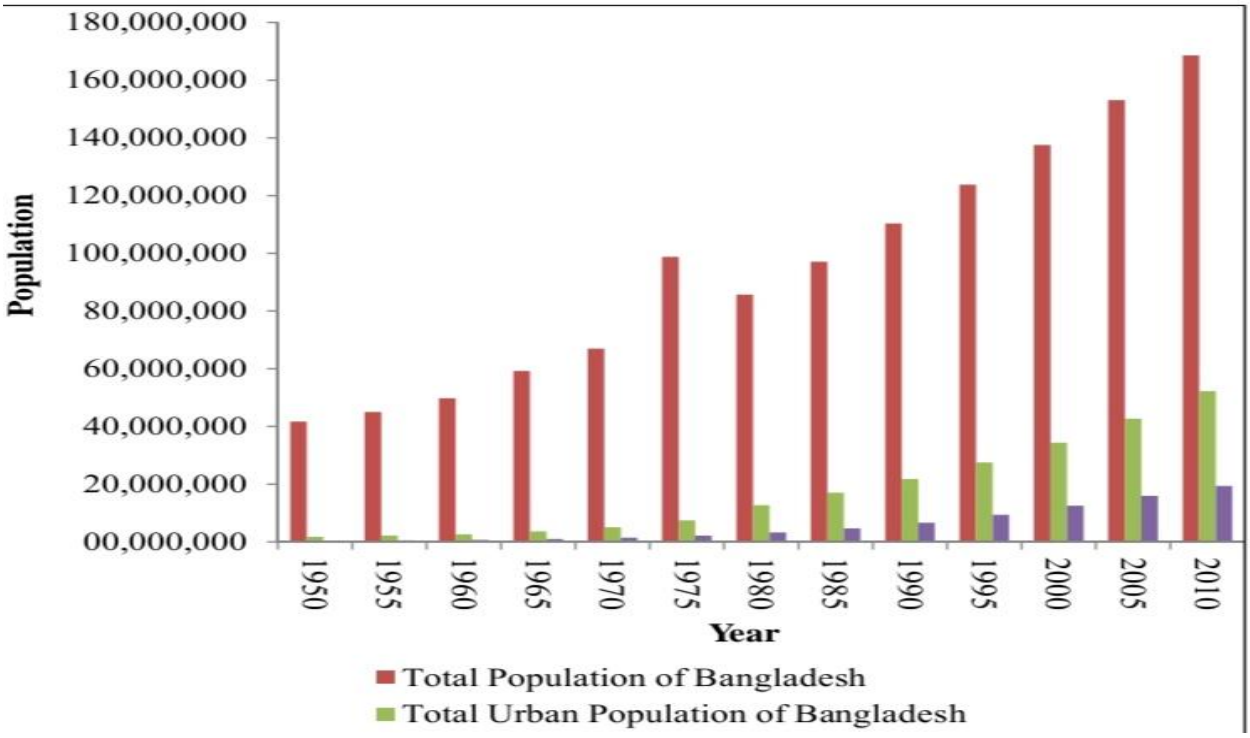
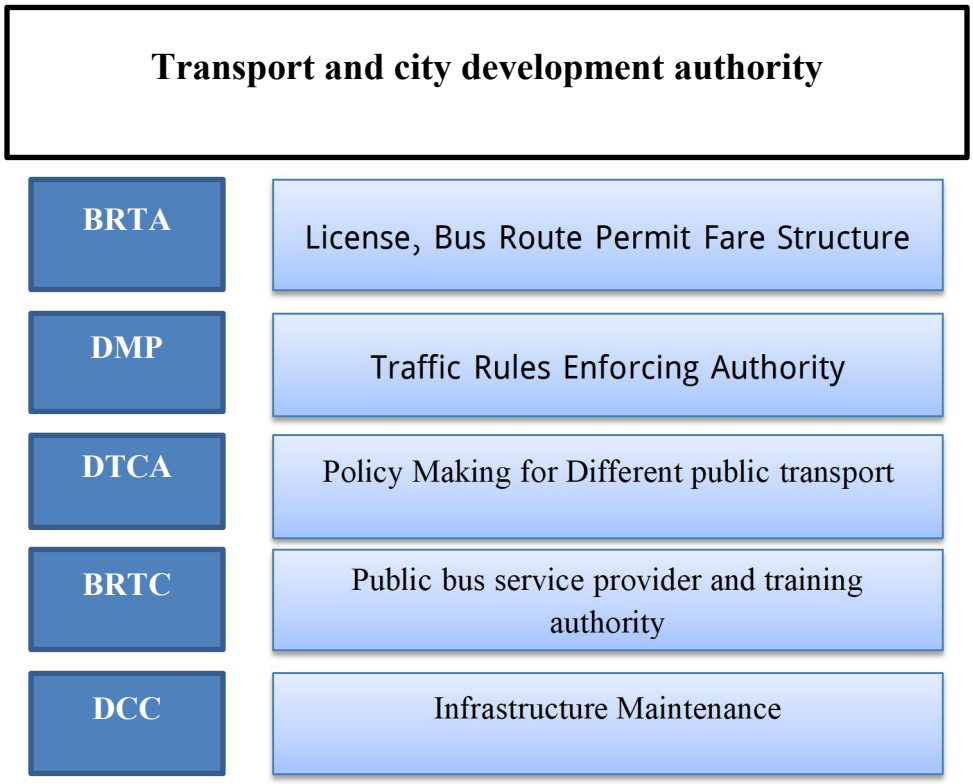


Figure 1. 1 Comparison of Dhaka's population with total population of Bangladesh and total urban population of Bangladesh (Source: Nasrin, 2015)

1.1.2 Transportation System of Dhaka Metropolitan City

The people in Dhaka city use a range of transportation for their day-to-day purposes. Some of the main modes of transportation in Dhaka city are buses, mini-buses, double-deck buses, CNG-autos (Compressed Natural Gas), auto-rickshaws, cars, motor-cycles, bi-cycles, etc. With a large population and number of activities, Dhaka is experiencing serious traffic congestion on a daily

basis and unauthorized and unplanned city's infrastructure emphasize this problem to its' worse. To authorized and maintain the country's as well as the city's transportation system and offer a safe and comfortable transport experience; there are numerous government and non-government organizations. In Bangladesh, road and transportation systems are primarily planned and implemented by the Ministry of Communication (Nasrin, 2015). Apart from that, the Bangladesh Road Transport Authority (BRTA), the Bangladesh Road Transport Corporation (BRTC), the Roads and Highways Department (RHD), the Dhaka Transport Coordination Authority (DTCA), the Dhaka Metropolitan Police (DMP), the Dhaka City Corporation (DCC), and the Rajdhani Unnayan Kartipokhkho (RAJUK) are in charge of transportation and city development. All of these authorities are working together in order to create a standard environment for all kinds of transportation in Dhaka city as well as all over the country. Nasrin (2015) presented a figure mentioning the responsibilities of different organizations to ensure a safe and comfortable travel experience for commuters. Figure 1.2 is a concise demonstration of the summary of responsibilities under different transport and city development authorities in Dhaka city and all over Bangladesh.



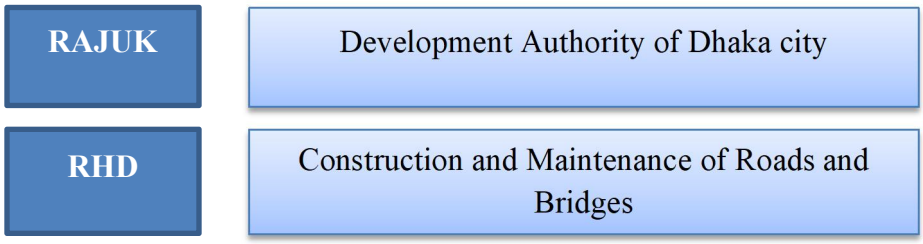


Figure 1. 2 Transport and city development authority in Bangladesh

However, the reality of bus service in these cities, especially in Dhaka, is completely unsatisfactory and tragic to witness. Researchers have found that the bus service in Dhaka city is extremely poor and therefore inadequate in terms of meeting the commuters' safety, comfort, and convenience (Hasnine, 2011). As a percentage of the overall city area, Dhaka City's road networks are just 8 to 10% (out of approximately 2230 km of total road network) , much below the recommended level of 25% ("Report on Traffic Congestion in Dhaka City"). Overcrowding, lack of comfort and security, unsafe driving practices, poor and dangerous boarding and alighting facilities, irregular service frequency, lack of cleanliness and law enforcement agency are all hallmarks of public buses as well as the whole transportation service in Dhaka (Rahman et al., 2017; Hadiuzzman et al., 2017). According to a 2010 investigation by the Dhaka Transport Coordination Board (DTCB), traffic congestion costs the city of Dhaka $1.68 billion annually on average (Dhaka Mirror, 2010).

1.1.3 Public Transportation in Dhaka City

The majority of Dhaka's transportation is road-based and offers a variety of motorized and non-motorized transit options (Haque et al., 2012). Buses are the primary mode of public transportation in the Dhaka metropolitan area, especially for middle and lower class commuters. It is to be said that more than half of Dhaka's population is comprised of members of the middle and lower classes. Public bus service serves an important role in providing an accessible and versatile transportation mode to a large number of urban people. This single transportation mode is frequently regarded as a mode capable of overcoming numerous traffic issues like traffic congestion, reducing travel time, and increasing dynamism in both urban and rural activities (Kamba et al., 2007).

Apart from that, bus service can decrease the large number of private transportation vehicles and thus make a contribution to minimizing environmental pollution. Mainly, public bus service is authorized by BRTC and the government of Bangladesh owns BRTC. BRTC provides and maintains the nation's public bus service. As a government-authorized system, the utmost goals and responsibilities of BRTC are to deal with the offering and ensuring of quality public bus service. However, BRTC alone is not enough to meet the huge transportation and service needs of the city. According to Niger (2013), Dhaka city has approximately 2,500 buses for public transportation, despite a current demand of over 5,000. This shows a clear picture of how the present bus services are inadequate and a means of suffering and harassment for a large number of people.

There are two types of bus services in Dhaka city: counter service buses and local service buses (Niger, 2013). Buses with counter service are quite helpful for passengers compared to local service buses because, in counter service buses, passengers are allowed to alight and board at a specific counter, whereas local service buses don’t have any specific counter to board and exit their passengers. On the counter service buses, passengers get a chance to purchase tickets shortly before the arrival of their desired bus, and most of the time, they don’t have to go through the boarding and alighting struggle. The picture is quite the opposite in the case of the local service buses. The conductor of these buses boards and alights passengers according to their own will and benefits, which sometimes causes fatal accidents. Furthermore, these local buses are a hotspot for female passengers’ harassment. In Dhaka, women's harassment on crowded buses is common, and women commuters face difficulties getting on and off the bus due to overcrowding and intentional or unintentional touching by male commuters (Rahman, 2010; Islam et al., 2016). According to a study conducted by the development organization BRAC (2018), approximately 90% of women were verbally and physically harassed while riding public transportation. However, in Dhaka city, the counter service buses are quite few compared with the local service buses. The public transportation system of Bangladesh is inefficient, nonproductive, hazardous, underfunded, and overcrowded. Numerous observations alleged that current bus services are inefficient, unproductive, and unsafe because of long wait times, delays in plying, longboarding times, overloading, discomfort, and a long walking distance from home/work to bus stops, passengers are dissatisfied for three reasons, according to earlier research: unsafe driving,

inappropriate boarding and alighting, and a lack of law enforcement surveillance (Rahman & Chowdhury, 2015).

Figure 1. 3Public bus scenarios in Dhaka city

Figure 1. 4 Inside environment of public buses (Image Source: (Islam, 2019)).

1.1.4 Women & Public Transport: A Dystopia

Women and suffering are synonymous while they travel by public bus in Dhaka city. In developing countries like Bangladesh, women have less access to both private and public transportation in any given metropolitan location (Peters 2013), and the main reason for it is the fear of being harassed by other male commuters as well as by the bus staff. The consequences of this poor bus service for women are clearly visible in the country's economy and workforce. In Bangladesh, the rate of women's participation in the labor force (LF) is quite unsatisfactory compared to those of its neighboring countries. Even before the COVID-19 pandemic, the labor force participation (LFP) rate for Bangladeshi women stood at only around 38%, compared to 84% for men (Chowdhury, 2022). This restriction on movement impedes not only female education, workforce entry, national and global economies, but also the achievement of the Sustainable Development Goals (SDGs). Among the 17 Sustainable Development Goals (SDGs) that are aimed at making the world a better place for all to live, Sustainable Goal No. 5, or gender equality, is the most important of all the goals (Sustainable Development Goals, n.d.). In other words, the achievement of the other SDGs is dependent on the achievement of Goal 5, which aims to achieve "gender equality and empower all women and girls" (UN Women, 2019).

Figure 1. 5 Female passengers travelling inside bus (Image Source: (Islam, 2019)).

Figure 1. 6 Seating arrangements inside public buses (Image Source (Islam, 2019))

Furthermore, the increasing incidence of female harassment and unsafe issues on public buses and stops are also affecting the service quality and women's emancipation. According to the previous studies focused on the problems faced by female commuters, women are identified as the worst sufferers of the current public bus service (Sultana et al., 2019). Unwanted touching by male co-passengers or the conductor, pinching, verbal and physical harassment are some of the forms of harassment experienced by female bus passengers across the country. Moreover, the number of rape accidents in moving buses is rising alarmingly in Dhaka and its nearby cities.

A frightening statistic from a survey carried out by the Aachol Foundation in March–May 2022 throws light on a well-known but little-discussed problem in the lives of women in the nation's capital. According to this survey, three-fourths of the victims were harassed by fellow passengers while they stood on crowded buses, followed by drivers' assistants, with a figure of 20.4 percent ("Harassment of women on public transport is unacceptable," 2022). It draws attention to the types of harassment that female passengers experience when they travel. Table 1.1 shows the survey percentage conducted by the Aachol Foundation, highlighting the type of harassment faced by a female commuter.

Table 1.1 Form of harassment in public bus

Form of harassment	**Percentages**
Touch	46.5%
Bullying	15.3%

Social discrimination	15.2%
Gender discrimination	14.9%
Body shaming	8.2%

With highlighting the types of harassment faced by a female commuter in bus, the survey also highlights the impact of such harassment on the mental health of the victim. According to the report, the harassment on public transportation has caused mental suffering in nearly 80% of those affected, usually students. The percentages of the various mental pressures that female passengers in buses experience as a result of these harassments are shown in Table 1.2.

Table 1.2 Types of mental instability due to the harassment in public bus

Types of Mental instability	**Percentages**
Fear about using public transports	30%
Traumatized	21.2%
Inferiority Complex	16.4%
Depression	13.8%

1.1.5 Improvement of Bus service quality and Willingness to Pay

For decades, the city's transport planners have been concerned with service quality measurement to acquire an overall scenario of consumer satisfaction on public transportation (Jenatabadi et al., 2016). In general, passenger comfort and satisfaction are important factors in residents' traffic mode choices and can be used to estimate the quality of public transportation services (Dell'Olio et al., 2011; Eboli & Mazzula, 2010). From time to time, these transport planners attempt to make an improvement in bus service quality, yet the overall picture of the service quality remains at the same unsatisfactory level. Various reasons are responsible for this, and the commuters' monetary support is one of them. For example, the government has launched a women's only bus service in Dhaka city to mitigate the harassment of female commuters, yet this service couldn't even run due to the absence of both government and the commuters' patronization. There are currently 9,311 registered buses and 8,459 registered minibuses in Dhaka, according to the executive summary of ActionAid's "Freedom to Move" report, however that is insufficient.

ActionAid estimates that an additional 3,000 buses are required to keep up with demand. Buying these 3,000 additional buses would cost over US$270 million, with each bus costing US$69,000 on average (not including operational costs). These cost estimates are for buses without ramps for those with impairments but with priority seating for women. They go on to say that it would likely cost an additional US$500 to install security cameras on each bus that the government finances. To install two security cameras in each bus in the city would cost about US$1.5 million.

So, to keep the development ongoing, the government of Bangladesh, as well as the people of the country, should come forward willing to pay for the improved services because meeting advanced service quality standards is impossible without increasing the fares or costs. And without the cooperation of the people, the government can't meet this huge demand.

1.2 MOTIVATION OF THE STUDY

Virginia Wolf, in her famous essay "A Room of One's Own," stated that "A woman must have money and a room of her own if she is to write fiction." The room that typically symbolizes a woman's perceptions and needs is equally significant if she wants to be economically and socially strong. In today's world, the necessity of ensuring a woman's room and needs are an afterthought, and the scenery is no different in evaluating the bus service through the lens of a woman.

Karla Dominguez Gonzalez in 2019 took a reference from Harvard Business Review and stated that women make up about 20% of engineering graduates, while nearly 40% of women with engineering degrees either leave the field or never enter this profession. As a result, transportation services in developing countries continue to be controlled by men and thus affect women's voices and needs (Gonzalez, 2019). However, it is reasonable to state that there are currently no systematic gender inclusion procedures in transportation, either in terms of professional training, user participation, or in the design and planning of systems, services, and equipment ("Gender and transport"). A proper evaluation of bus service performance in Dhaka city, taking into account women's needs and perceptions, can improve both bus service quality and women's labor force participation or safe movement. Also, considering women's needs in bus service performance ensures that the needs and issues of other women-dependent groups, including children and the elderly, are considered (Bhatt et al., 2018).

Moreover, another inspiration behind this paper is the SDGs goals that both directly and indirectly link to women's emancipation, rights, and comfort in public spheres. With targets for states to meet by 2030, the UN Sustainable Development Goals (SDGs) are an attempt to solve major issues. A key component of the answer is the empowerment and equality of women, and several of the objectives have connections to transportation, urban planning, and inclusive development ("Women in Public Transport"). Figure 1.7 shows the list of SDGs that are directly or indirectly linked to women's rights and welfare.

Figure 1. 7 Women' welfares and relatable SDGs (Source: "Women in Public Transport")

A sustainable world can't be developed without ensuring these goals, and to ensure these goals, a well-structured and gender-based consideration is necessary. Lastly, I would like to say, nothing could be better than a study conducted by a woman for women to evaluate the performance of bus services and establish a safe and accessible service quality for women.

1.3 CONCEPTUAL FRAMEWORK OF THE STUDY

This research attempts to evaluate the bus service performance based on women commuters in major cities in Bangladesh. Even though buses are considered the most accessible and cost-effective mode of transportation in Dhaka city, the service quality of these buses, especially for

women, is not satisfactory at all. An adequate evaluation of the bus service performance considering the needs of women commuters can improve the bus service quality in Bangladesh. Figure 1.8 shows the conceptual framework of the study.

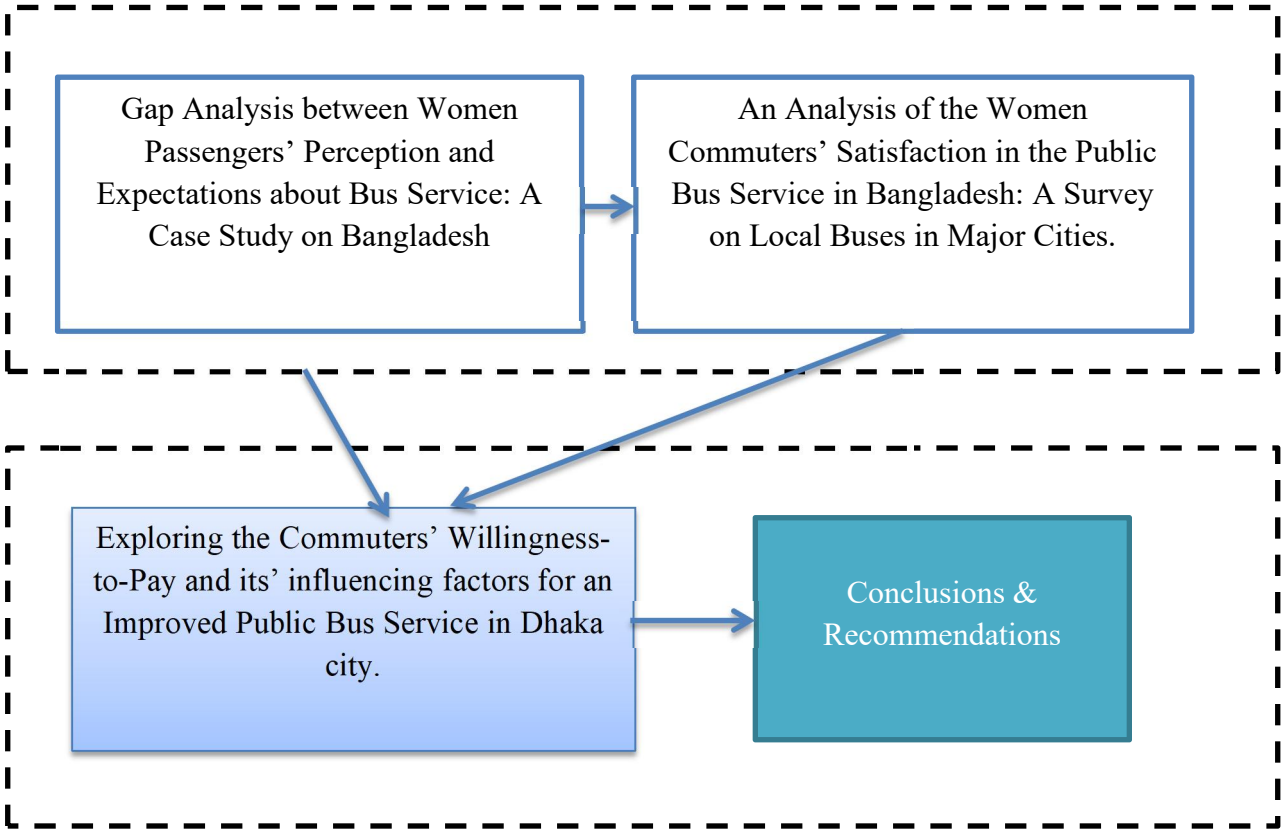


Figure 1. 8 Conceptual framework of research

1.4 RESEARCH PROCESS

Figure 1.9 illustrates the flowchart of the overall the research process for this study.

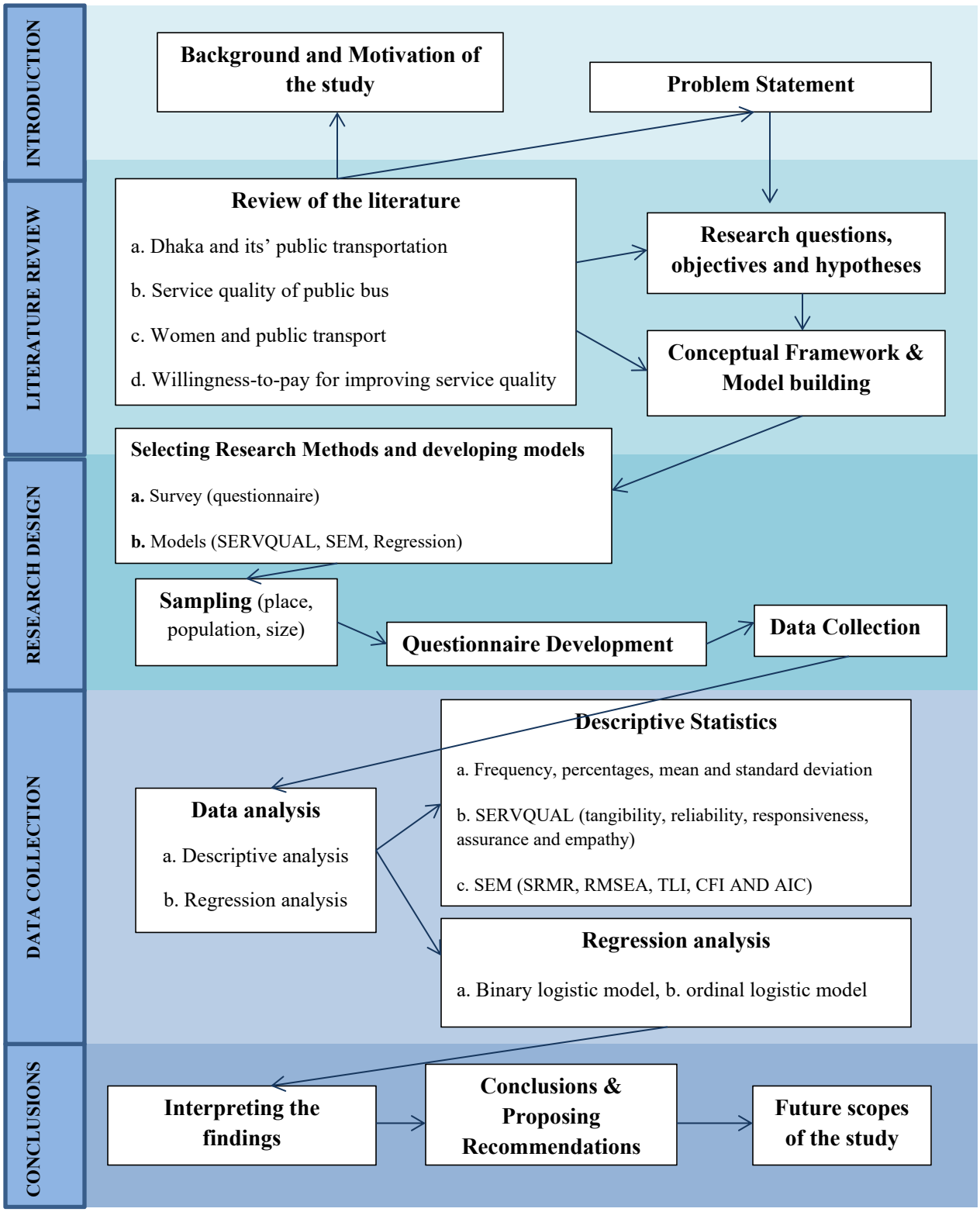


Figure 1. 9 Overall process of the research

1.5 SIGNIFICANCE OF THE STUDY

Bus service performance in Dhaka city needs to be observed from the point of view of a woman by a woman to ensure their comfort and safety. The availability of secure and dependable transportation services is not only desirable but also necessary to ensure the greater participation of women in economic activities (Drown, 2015). A woman can enjoy a safe and secure bus service if the public administration or authorities investigate the problems and harassment she encounters while traveling by bus and implement appropriate solutions. However, various researchers have suggested the authorities be more concerned about the problems a woman faces while travelling by bus, yet no overall evaluations of the bus service performance and solutions to the problems have been suggested. This study can contributes in these following aspects:

- The first focus of this study is to identify the gap between perceived and expected bus service quality based on female commuters as well as the current perception of both male and female passengers. To find the answers to the research questions, SERVQUAL models were applied and Dhaka, Gazipur, and Narayanganj were targeted as the spots for collecting data. Detecting the gap between perceived and expected bus service quality is significant to adopting necessary service policies and fulfilling the needs of women.
- The second focus of the research is to find out a list of service quality attributes on which women commuters' satisfaction with bus service quality depends. A Structural Equation Model (SEM) was applied to identify the female commuters' satisfaction with the public bus service in some major cities in Bangladesh.
- Estimating commuters' willingness-to-pay to improve public bus service quality is treated as a concern in this study. Apart from willingness-to-pay, a good number of improved service features for public buses are being explored. Furthermore, exploring the factors responsible for the commuters' willingness-to-pay was also analyzed.

1.6 LAYOUT OF THE THESIS

This thesis has been divided into six chapters to evaluate bus service performance based on women commuters in major cities in Bangladesh. The very first chapter, Chapter 1, provides a

general introduction of the whole study to the readers, highlighting the theoretical framework, objectives, and significance of the study as well as the outline of the thesis. In the next chapter, i.e., Chapter 2, analysis of the gap between women passengers' perceptions and expectations about bus service is the major focus. An analysis of the women commuters' satisfaction with the public bus service in Bangladesh is discussed in Chapter 3. Keeping in mind of the female commuters' satisfaction level, whether or not they are willing-to-pay or not, for the improvement of the bus service quality is described in Chapter-4. Chapter-5 is designed as concluding remarks, including the outcomes, recommendations, limitations, and future scope of the study. Figure 1.10 shows the diagram of relationship between each chapter.

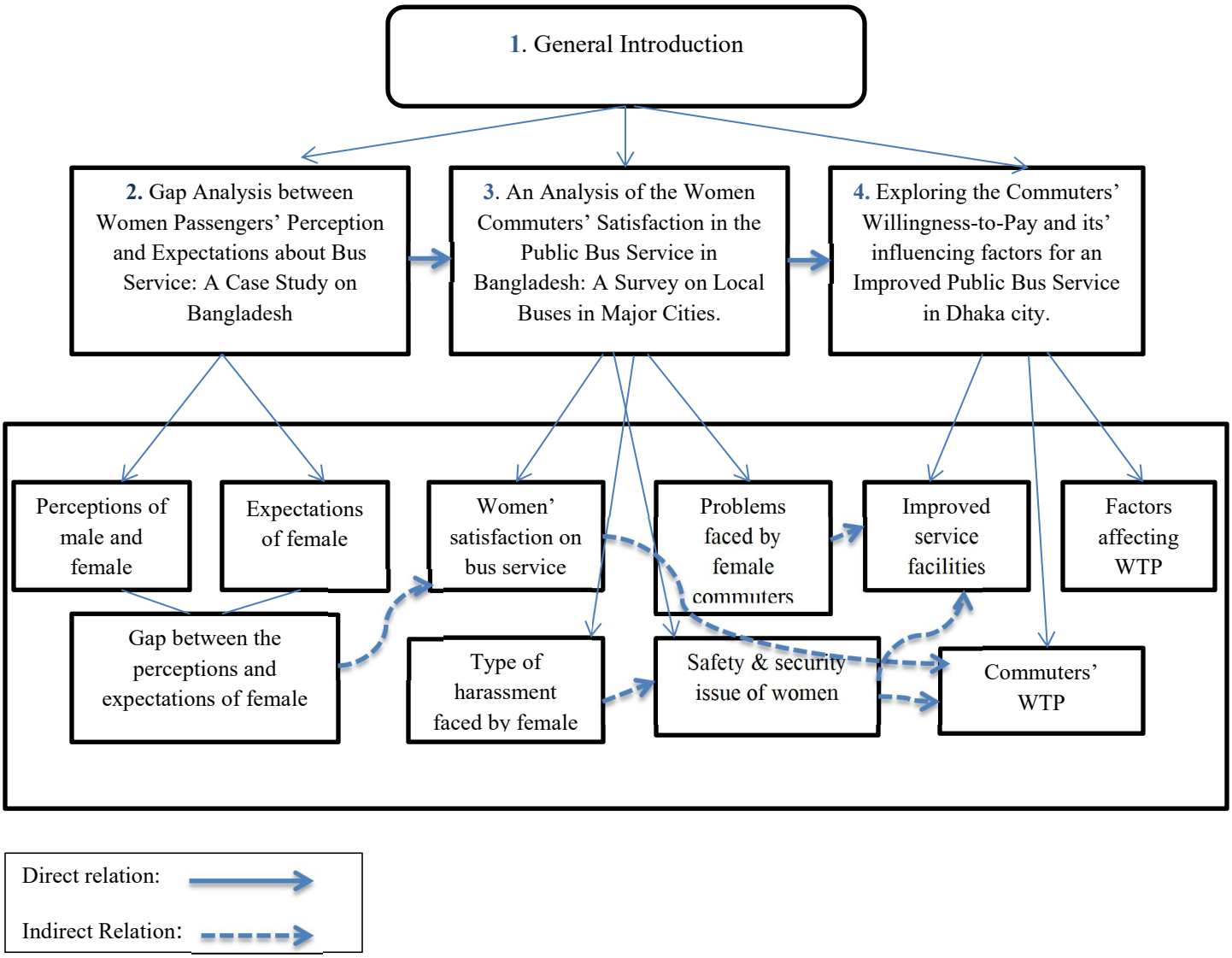


Figure 1. 10 Diagram of relationship between each chapter

1.7 REFERENCES

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Chapter-2

Gap Analysis between Women Passengers' Perception and Expectations about Bus Service: A Case Study on Bangladesh

Abstract

Since public bus service is frequently available and reasonably priced in major cities of Bangladesh including Dhaka, the capital city, a significant number of economically active women regularly commute to work utilizing public buses. Since female commuters experience unique challenges compared to their male counterparts, a gap analysis on the perception of men and women, as well as the difference between the female commuters' perceptions and expectations, could help to pinpoint the issues. The aim of this paper is to determine the gap between female commuters' perceptions and expectations of bus service quality in Bangladesh, as well as the current perception of both male and female passengers. In this paper, the data obtained is studied to determine the service quality needs which should be improved by analyzing the perception and expectation gaps for female passengers. SERVQUAL models were used to examine the disparities between perceptions and aspirations in Bangladesh's major cities. Tangibility, reliability, responsiveness, assurance, and empathy are the five dimensions of SERVQUAL. The data for this study was collected from 1500 commuters in Bangladesh's largest cities, including Dhaka, Gazipur, and Narayanganj. Primary data was gathered using a purpose-built questionnaire survey. The Gap values are negative in all dimensions, according to the findings of the study. In the data analysis, a negative gap value indicates that the expectation exceeds the perception. According to the gap analysis, the quality of bus service for passengers is insufficient. Bus service quality is seen and expected to be quite varied. It is vital to improve bus service to meet the needs of women. The findings could be valuable in planning future transportation policies that take female commuters 'needs into account.

Keywords: Public Bus, Public Transport, Women Commuters, Service Quality

2.1 Introduction

Dhaka is one of the fastest growing and highly dense cities in the world and the city holds a population of about 12 million people within its 1529 sq.km land area (Rahman, 2019). People migrate to Dhaka from various parts of Bangladesh in search of a better life, education, work, etc. Rural-urban migration contributes to this high population growth in Dhaka (Rahman, 2019 & Rahman, 2010). Unlike most other cities in Asia, the male to female ratio in Dhaka is around 1:1 (Rahman, 2010). Being the main commercial hub of Bangladesh, Dhaka is the hub of employment opportunities and all essential amenities, such as health, education, etc. In densely populated metropolitan areas, public transport (PT) is the most efficient means of transportation for meeting travel demands. People in cities must move on a regular basis to participate in economic activities, which enables the formation of social networks and makes family life easier. PT is the vein of any nation, because it permits the free movement of people, goods, and information, thereby allowing progress on the most efficient deployment of economic resources. In other words, PT has a direct impact on any nation's economic progress. Public transportation has the potential to reduce the number of private vehicles in cities while simultaneously providing mobility to an enormous number of people who do not own any car and cannot afford to pay the ever-changing paratransit or taxi fares (Rosenbloom, 2006). Globalization, motorization, urbanization, and socio-demographic shifts have had a significant impact on the transportation of both men and women globally. For the past two decades, policymakers and transportation planners have focused on gender issues in the public transportation sector, recognizing the differences in the travel modes and transportation routes and the related pattern of activities for both men and women globally (Nasrin, 2015 & Peters, 1999). The issue of women empowerment is positively gaining traction around the world as more women join the workforce, hence contributing positively to the economic progress of their nation (Peters, 2001). Although this has made a great impact, their mobility and access to their workplace are becoming a challenging requirement (Peters, 2001). As a result of the increasing female workforce, more travel times have to be met and higher demand for PT. Also, in both developing and developed nations where women have substantially less freedom than males, they make remarkable impact on the economy. They generate a significant number of journeys on a regular basis. Also, due to a greater variety of social classes, cultural backgrounds, and economic

situations in the urban context of developing countries, travel patterns between male and female members of the same household are different (Peters, 1999). Since most working women are low-wage earners, they do not have the financial means to pay for private or shared transportation. Therefore, public bus service is more convenient because it is more economical and cost- effective for commuters. Nowadays, the public bus service demand is increasing rapidly with the increase of female commuters. Researchers also have been studying the relationship between the quality of transport services and people's accessibility in recent decades (Peters, 1999; Peters, 2001; Wallin, 1995). Several studies on the quality of public bus services have been undertaken, but none have taken gender into account (Eboli & Mazzulla, 2007; Bola & Babatunde, 2013). Most of the existing research focused on the service quality of public bus service in Bangladesh in terms of perception, expectations, and passengers' satisfaction (Mahbubur, 2020; Deb & Ali). However, there is less research on the quality of public bus services that consider gender issues in developing countries like Bangladesh (Peters, 1999). In addition, the effects of society and culture in developing nations like Bangladesh, quite differ on the travel patterns of both the male and female commuters (Pojani & Stead, 2015; Riverson, 2006). Female commuters must relocate to gain access to services and job possibilities (Munira et.al., 2013). Therefore, the female passenger's safety, security, comfort level, reserved seat, boarding, alighting facilities, handicap facilities, accessibility of bus, etc., are the more important factors while traveling in public bus service. Using Bangladesh as a case study, it was observed that very few previous studies on bus service considered these issues regarding female commuters, hence the need for this study. The aim of this research is to determine the level of perception of men and women commuters about public bus service and measure the gap between the expectations and perception of women commuters. From the analyzed gap value, the authors made some decisions about the improvement of the level of service quality of the bus according to the female commuter's expectation. Also, the discussions on the findings were made on the attributes which significantly influenced the service quality of buses regarding the women passengers. This paper is structured with an introduction in Section 2.1, and a literature review to stress the research need with the unique contribution of this study is undertaken in Section 2.2. The data collection is presented in Section 2.3. Following that, the research approach is comprehensively presented in Section 2.4, while the methodology is presented in Section 2.5. The study's findings are and discussed in Section 2.6, and finally used to draw conclusions in

Section 2.7. Also, the policy ramifications are examined as some recommendations and action plans were presented.

2.2 Literature Review

2.2.1. Gender Issues in Public Transport Services

Most women in Bangladesh are active in social-cultural, economic, and political activities for which they need PT to meet up their daily necessities. However, the employed population has a significant discrepancy concerning gender. Even though both men and women are contributing to the country's economic development, there is serious inequity in the availability of efficient and safe transport for female commuters. Women are more dependent on PT than men, especially when they are lower income. The bus is the only mode of mass public transit available in Dhaka City for middle-income and low-income classes. In recent years, the number of female commuters is increasing rapidly for education, jobs, business, etc. Therefore, the public bus service quality is an important issue for the passengers, especially female passengers. The dwellers of Dhaka city faced various problems related to transportation in their day-to-day life (Rouf et.al., 2019).

A substantial part of this population, 49.4%, is women. According to the 2018 UNESCO report (Bangladesh's literacy rate rises; https://countryeconomy.com/demography/literacy-rate/bangladesh) the female literacy rate of Bangladesh is 71.18%. Unfortunately, Bangladeshi women had to deal with a variety of transportation issues. However, there is a paucity of studies on women's transportation pleasure, with most female passengers opting for public transit due to its accessibility and affordability. There have been some studies on the quality of public bus service and passenger satisfaction, with the majority of respondents being male or male and female. According to prior research, the environment of bus service is quite inadequate and barely meets the needs of passengers (Rahman & Chowdhury, 2015). Passengers are unsatisfied for three reasons: unsafe driving, improper boarding and alighting, and lack of law enforcement surveillance (Rahman & Chowdhury, 2015), several studies, including the one by Rouf et al., have focused on the safety of female riders on public buses. On public buses, they are harassed by male passengers or by the crew. Transportation planning does not take gender into account (Peters, 1999). Other than the risk of accident and sexual harassment, according to K.A. Rouf et al., safety is the most critical problem for female passengers riding the public bus. According to

the existing research, the passengers of public buses face some difficulty to travel, especially women commuters like harassment, poor boarding, and alighting facilities, etc. M.S. Rahman et al. 2012 are also worth mentioning. Passenger's boarding the bus has been waiting for an unknown amount of time, with no indication of when the bus will arrive. According to prior research, female passengers face serious issues such as safety, security, and bus personnel behavior. Because of distinct economic and cultural duties, obligations, and activities in the issue of gender inequality, men and women have varied travel patterns (McGukin & Nakamoto, 2005; Rosenbloom, 2006). Because of their dual obligations, they travel more frequently than working men to perform various household tasks such as childcare and transporting parents to doctors or health care facilities, shopping, visiting relatives, and so on (Anand & Tiwari, 2006; Rosenbloom & Plessis-Fraissard, 2009). In developing countries, women have less access to private motorized vehicles than men due to societal norms about women's appropriate travel behavior (Rosenbloom & Plessis-Fraissard, 2009); women are more concerned about their safety issues while using public transportation than men. Tarigan et al., (2010), women are frequently targets of sexual harassment when walking or using public transportation, according to Anand & Tiwari, (2006), and this scenario may be exacerbated by low lighting and small lonely routes connecting homes to bus stations. M.S. Rahman et al. (2012) while commuting in Dhaka City's public transportation, women suffer a variety of physical harassment and issues. In most cases, women in public transportation are unable to protect themselves against physical touching and other forms of abuse. They are restless and insecure in the majority of Dhaka City's public transportation facilities. On the other hand, male travellers have never had such a problem with public transportation. As a result, the most pressing topic for further inquiry is the perception of women passengers and what is the expectation level of public bus service. Since female passengers face problems while traveling public buses, so the mitigation of these problems is essential.

2.2.2 SERVQUAL

SERVQUAL could be a multidimensional research instrument designed to capture consumer expectations and perceptions of a service along five dimensions that are believed to represent service quality. SERVQUAL is made on the expectancy-disconfirmation paradigm, which, in

simple terms, implies that service quality is known because of the extent to which consumers' perception expectations of quality are confirmed or disconfirmed by passengers' actual perceptions of the service experience. When the SERVQUAL questionnaire was first published in 1985 by a team of educational researchers, to live quality within the service sector. In most cases, the authors tweaked these models to suit their study context. The subsequent may be a summary of varied research findings. Mikhaylov et al. presented one of the foremost, widely used and scientifically recognized methods of measuring service quality within the service sector, including the general public transportation industry, called the SERVQUAL (i.e. Service Quality) instruments (Cavana et.al., 2005; Frost & Kumar, 2001; Badri et.al., 2005) described SERVQUAL dimensions—tangibles, reliability, responsiveness, assurance, and empathy, as "a basic skeleton underlying service quality" (Badri et.al., 2005). The SERVQUAL, being a humanistic and customer-centric measurement instrument, is qualitatively different from the mechanistic, technical, and objective measures commonly utilized in the general PT industry (Cavana et.al., 2005). Using SERVQUAL instrument enables the researchers to spot additionally measure the weather of customers' expectations in such some way that a condition and views a few services are often captured, analyzed, and understood. The SERVQUAL paradigm was used in the (Islam et.al., 20014) study, which included five criteria: service, access, availability, time, and environment. They discovered that the service dimension had an impact on customer service using the multiple regression method. In a case study with a national highway passenger transportation firm in Europe, (Pakdil, 2014) employed the SERVQUAL scale, which includes qualities like tangibles, reliability, responsiveness, assurance, and empathy. Customers demand knowledgeable and compassionate staff, error-free services, and technological transportation specifications, according to the authors' analysis. By using Quality Function Deployment, this study offered various enhancements to the quality of highway passenger transportation services. To design a quality evaluation tool for transport operators to validate the offered service, (Barabino et.al., 2012) used a customized variant of the SERVQUAL technique that complied with a European standard on service quality in public transportation. The survey took done in the Italian city of Cagliari, and it indicated that on-board security, bus reliability, cleanliness, and regularity are all highly valued qualities of public transportation. Mikhaylov et al. evaluate the quality of public transportation from the customer perspective, in the form of a unified

SERVQUAL survey mode, and capture the personality traits, cultural peculiarities, and contextual factors that may influence customers' perception of quality.

2.2.3. Perception and Expectation:

Customer perception is an individual customer's mental interpretation of collected information and consumption of a product or service.

Customer expectation can be defined as the customer's assumption of his / her experience in fulfillment of a need with the available resources at his / her disposal.

This study consisted of two parts and the procedure for data collection consisted of two parts:

• Expectations: Future Improvement of public transport.

• Perceptions: Existing condition of public transport.

2.3 Research Hypotheses

A *p*-value is used in hypothesis testing to help support or reject the null hypothesis. The p value is the evidence against a null hypothesis. The smaller the *p*-value, the stronger the evidence that you should reject the null hypothesis. The significant level of p-value is 1%, 5% and 10% and also consider less than 1% is highly significant (Anderson et.al., 2019; Glen, n.d.). In this research, a SERVQUAL model was used to analysis the collected data. The SERVQUAL model is consisting of five dimensions which is tangibility, reliability, responsiveness, assurance, and empathy shown in Table 2.1 which is explained briefly in the 2.6.2 section.

H_1: Hypothesis (H_1) revealed that there is a significant gap in female passengers' and male passengers' perceptions of bus service quality in Bangladesh. It also showed the possibility of also realizing the opposite genders' perception about the bus service in Bangladesh. This hypothesis predicts that some similarity or dissimilarity of perception by both the males and female passengers on the bus service quality may arise under different attributes.

The p-values of most of the dimensions are lower than 0.01, which is the proposed alternative hypothesis is accepted, meaning that there is a significant difference between female and male passengers' perception of bus service quality in Bangladesh. The results of this study are like to the existing study (Kumar, 2012) and concluded that there is a significant difference between

male and female passengers' satisfaction levels regarding bus service quality. The reasons behind these are variations in travel pattern (Bola & Babatunde, 2013; Nasrin, 2015; Peters, 2001; Riverson, 2006; Rouf et.al., 2019) and safety & security (Karim & Mannan, 2008; Rahman, 2010).

H_2: The second hypothesis is that there is a large disparity in the perceptions and expectations of female bus passengers on bus service quality in Bangladesh. The outcomes of the study are more important and more significant than the gap in alternative hypothesis between perceptions and expectations. From the gap analysis, it would be possible to predict the best attribute that would be improved, by either increasing or reducing the attributive factors.

The results of Table 2.2 showed that the p-values of all dimensions are lower than 0.01 that is the proposed alternative hypothesis is accepted meaning that there is a significant difference between women Passengers' Perceptions and expectations about the Bus Service quality in Bangladesh. The results of this study are like the previous study of (Ulkhaq et.al., 2019; Valenzo-Jimenez et.al., 2019)..

2.4 Data Collection

In Dhaka city, the specific locations were selected where generated more trips by bus than other locations like Farmgate, Mohammadpur, Motijhil, Shahbagh, Kallayanpur, Dhanmondi, Mohakhali, Green Road, Mirpur and many-more. In this study, the sample size was restricted to 1500 (male respondents-750 and female respondents- 750) and a hypothesis was required for this sample data. The author and university going students were collected data as surveyors which detailed information are in the following:

Detailed schedule of survey:

Date	Time	Purpose	Location	Required Surveyor
01/5/2021 Saturday	11.00-16.30	Questionnaire survey for data collection	Gabtoli, Farmgate	Surveyor-1 to Surveyor-7
02/5/2021 Sunday	11.00-16.30	Questionnaire survey for data collection	New market, Azimpur	Surveyor-1 to Surveyor-7
03/5/2021 Monday	11.00-16.30	Questionnaire survey for data collection	Dhanmondi, Mohammadpur	Surveyor-1 to Surveyor-7
04/5/2021 Tuesday	11.00-16.30	Questionnaire survey for data collection	Mirpur 14, Sheorapara	Surveyor-1 to Surveyor-7Surveyor-2

05/5/2021 Wednesday	11.00-16.30	Questionnaire survey for data collection	Agargaon, Jatrabari	Surveyor-1 to Surveyor-7
06/5/2021 Thursday	11.00-16.30	Questionnaire survey for data collection	Motijheel, Polton	Surveyor-1 to Surveyor-7
07/5/2021 Friday	11.00-16.30	Questionnaire survey for data collection	Gulisthan, Sayedabad	Surveyor-1 to Surveyor-7
08/5/2021 Saturday	11.00-16.30	Questionnaire survey for data collection	Badda, Mugda	Surveyor-1 to Surveyor-7
09/5/2021 Sunday	11.00-16.30	Questionnaire survey for data collection	Jatrabari, Donia	Surveyor-1 to Surveyor-7
10/5/2021 Monday	11.00-16.30	Questionnaire survey for data collection	Fotulla, Narayanganj	Surveyor-1 to Surveyor-7
11/5/2021 Tuesday	11.00-16.30	Questionnaire survey for data collection	Chashara, Nawab Salimullah Road Khanpur	Surveyor-1 to Surveyor-7
12/5/2021 Wednesday	11.00-16.30	Questionnaire survey for data collection	Gazipur Sadar, Kaliakair	Surveyor-1 to Surveyor-7
13/5/2021 Thursday	11.00-16.30	Questionnaire survey for data collection	Gazipur Kapasia, Sreepur	Surveyor-1 to Surveyor-7
14/5/2021 Friday	11.00-16.30	Questionnaire survey for data collection	Gazipur Kaliganj	Surveyor-1 to Surveyor-7
15/5/2021 Saturday	11.00-16.30	Questionnaire survey for data collection	Gazipur Joydeppur, Shibbari	Surveyor-1 to Surveyor-7

Figure 2.1 shows some of the captures taken while collecting data.

Figure 2.1 Pictures taken while collecting data

Twenty-five questions were used to assess expectations and perceptions. The questionnaires were divided into three parts. The first part of the questionnaire consisted of eight demographic information. The second part was designed to measure the respondent's perceptions regarding service quality provided by public bus service. The third part of the questionnaire was designed to measure the respondent's expectations of service quality. It was observed that both male and female passengers faced similar challenges on PT. These challenges experienced on public buses include sexual harassment, particularly physical touching, and verbal abuses. However, these challenges are considered a greater problem for female passengers compared to male passengers. In Bangladesh, a large number of female passengers travel together in the bus with men, such as husband and wife, father and daughter, mother and son, brethren and sisters. In this case, the problems of female passengers (which are not faced by men) are similar to the perceptions of men in terms of whether they are actually perceived by women or not. However, there is a challenge towards understanding how women perceive the problems faced by men in PT. These men related-PT problems include the control of men, standing up for women that are harassed in public and defending the honour of women in PT. Hence, some men take pride in their masculinity by being men of integrity and honour in that regard. Contrarily, there may be some similarities with the female's perceptions of men as gathered in this study. A female respondent took her time to treat or perceive herself as a male respondent and at another time she perceived herself as a female respondent. Also on the same case, a male respondent took his time to treat or perceive himself as a female respondent and at another time treated as a male respondent. In this study, the five-point Likert scale is the most widely used form of scaled items where the respondent chooses a point on a scale that best represents his/her view. Scoring for the scale was as follows: 1) highly agreed, 2) agreed, 3) neutral, 4) disagreed, and 5) highly disagreed. By comparing each value difference between all 25 expectations and perceptions, the level of quality can be concluded by $SQ = P - E$, where P and E are perception and expectation respectively. If the perceived value is higher than the expected value, it can be concluded that the service is satisfactory or ideal. However, if the expected value is higher than the perceived value, the service quality level can be regarded as unsatisfactory or even unacceptable.

The service provider's main task is to maintain the service quality of customers and it is the crucial factor for creating customer loyalty, customer relationship, profitability, motivation, and retention and cost reduction. The five main dimensions of service quality model namely Tangibility, Reliability, Responsiveness, Assurance and Empathy which are adapted from (Lim et al., 1999).

Dimension	Definition
Tangibles	Physical facilities, equipment, external appearance of store and appearance of personnel.
Reliability	Company's potential of performing the promised service dependably and accurately.
Responsiveness	Company's willingness to help customers and provide prompt service.
Assurance	Employees' knowledge and courtesy levels and their ability to inspire trust and confidence. This dimension also includes competence, courtesy, credibility, and security.
Empathy	Caring and personalized attention that the firm provides to its customers. This dimension also includes access, communication and understanding the customer.

Source: adopted by; Lim *et al.* (1999).

Questionnaires are developed according to the above discussion of SERVQUAL model where we can see that each dimensions variables meets the requirements.

Table 2.1 Variables used in the study

Factors	Symbol of attributes	Statements
	T1	The bus stand is attractive.
	T2	Bus service providers have up-to-date technology.
Tangibility	T3	The bus stand has sufficient resources as well as capacity.
	T4	Bus service providers have a professional appearance.
	T5	The bus staffs are smart and wear neat and clean dresses.
	R1	The bus always arrives at the destination within

		convenient time.
	R2	The bus breaks down on the road unnecessarily and wastes time.
Reliability	R3	The prevailing ticket booking system is convenient for passengers.
	R4	Staffs always meet the passengers' requirements right the first time.
	R5	Bus service providers insists on error-face service.
	RP1	Bus staffs always inform passengers of the exact timetable and fees.
	RP2	Bus service providers provide timely and efficient service.
Responsiveness	RP3	Good communication always exists between passengers and staff.
	RP4	Bus staffs are always willing to co-operate passengers.
	RP5	Bus service providers are always ready to respond to requests.
	A1	Passengers feel safe in dealing with transactions at the ticket counters.
	A2	Passengers feel secure when dealing with transactions with staff.
Assurance	A3	Bus staffs are always polite.
	A4	Bus staffs have enough knowledge about their jobs.

	A5	Bus staffs inspire passengers to develop their confidence.
	E1	Staffs always concentrate on the best interests of their passengers.
	E2	Service hours are convenient to the bus passengers.
Empathy	E3	Passengers get information about bus services easily.
	E4	Bus passengers find and access the bus stand easily.
	E5	Bus staffs always give individual attention to each passenger.

Table 2.2 Differences between female and male passengers' perception about bus service

Factors	Statements	Perception (Average)		Difference	p-value
		Female	Male		
	T1	3.03	4.13	-1.1	0.000
	T2	4.19	4.17	0.02	0.137
Tangibility	T3	4.21	3.52	0.68	0.000
	T4	3.79	3.87	-0.08	0.000
	T5	4.19	4.34	-0.14	0.000
	R1	4.34	4.29	0.06	0.000
	R2	3.48	3.13	0.35	0.000
Reliability	R3	3.46	3.47	-0.01	0.84

	R4	3.51	3.64	-0.13	0.000
	R5	4.1	4.27	-0.16	0.000
Responsiveness	RP1	3.86	3.76	0.1	0.000
	RP2	3.95	4.02	-0.07	0.000
	RP3	3.83	3.79	0.05	0.001
	RP4	3	2.7	0.3	0.000
	RP5	3.42	3.64	-0.22	0.000
Assurance	A1	3.82	3.4	0.42	0.000
	A2	3.61	3.36	0.25	0.000
	A3	3.63	3.84	-0.21	0.000
	A4	3.8	3.62	0.19	0.000
	A5	3.78	3.93	-0.15	0.000
Empathy	E1	3.76	3.65	0.11	0.000
	E2	3.4	3.51	-0.11	0.000
	E3	3.86	3.83	0.04	0.01
	E4	3.8	3.79	0.01	0.472
	E5	4.02	4	0.02	0.089

Table 2.3 Differences between female passengers' perception and expectation about bus service

Factors	Statements	Female		Difference	p-value
		Perception (Average)	Expectation (Average)		

	T1	2.244	2	0.244	0.0000
	T2	2.4293	4.056	-1.62667	0.0000
Tangibility	T3	2.3533	3.896	-1.54	0.0000
	T4	2.466	3.6733	-1.20667	0.0000
	T5	2.46267	3.78667	-1.384	0.0000
	R1	2.462667	4.066667	-1.604	0.0000
	R2	2.357333	3.897333	-1.54	0.0000
Reliability	R3	2.397333	3.245333	-0.848	0.0000
	R4	2.389333	3.226667	-0.83733	0.0000
	R5	2.492	3.548	-1.056	0.0000
	RP1	2.388	3.865333	-1.47733	0.0000
	RP2	2.436	3.721333	-1.28533	0.0000
Responsiveness	RP3	3.778667	2.468	-1.37467	0.0000
	RP4	3.06667	2.352	-1.42667	0.0000
	RP5	2.397333	3.066667	-0.66933	0.0000
	A1	2.416	3.632	-1.216	0.0000
	A2	2.398667	3.221333	-0.82267	0.0000
Assurance	A3	2.454667	3.318667	-0.864	0.0000
	A4	2.430667	3.822667	-1.392	0.0000
	A5	2.404	3.445333	-1.04133	0.0000

	E1	2.414667	3.796	-1.38133	0.0000
	E2	2.398667	3.577333	-1.17867	0.0000
Empathy	E3	2.394667	3.808	-1.42333	0.0000
	E4	2.492	3.72	-1.228	0.0000
	E5	2.35333	3.749333	-1.396	0.0000

2.5 Methodology

The service quality was assessed using the SERVQUAL instrument (Parasuraman et.al., 1988). The instrument is widely applied by numerous studies to assess service quality in several fields (Galeeva, 2016). To be able to SERVQUAL instrument measuring the service quality of public bus service and the passenger's perception and expectation in Bangladesh, we developed a questioner formwork according to SERVQUAL model, where the SERVQUAL dimension is tangibility, reliability, responsiveness, assurance, and empathy. Tangibles are defined as the appearance of physical facilities, equipment, personnel, and communication materials. Reliability simply refers to the ability of the service provider to perform the promised service dependably and accurately. Assurance, which is referred to the knowledge, courtesy, skills, and trustworthiness of the employees, as well as freedom from danger, risk, or doubt. It also includes the ability of the employee to convey trust and confidence. Responsiveness is expressed as the willingness of the service provider to help customers, i.e., passengers and to provide prompt service. An empathy that deals with the caring and individualized attention that the bus service provides for passengers. According to the handling of the SERVQUAL dimension, twenty-five questions were developed and categorized as shown in Table 2.2. According to Mikhaylov et al. respondents were offered to evaluate questions on a scale from 1—strongly agree to 5—strongly disagree. Additional questions asked were related to demographic information are essential in connecting to the evaluation of service quality. To determine the sample size of the popularly we have adopted the following equation (Goldsmith, 1997; Mikhaylov et.al., 2015).

Sample Size = $2500 * N * (1.96)^2 / [25 * (N - 1) + 2500 * (1.96)^2]$

Where *N* is Total Population of the desired study area (N = 2,49,50,381 person). Confidence coefficient: Z-score = (1.96) for 95% confidence level. The desired sample size is 385 persons, which is below the entire 1500 respondents who participated in this survey. The respondents are current users and customers of the general public bus companies based within the city, which is ensured by the respective questions. From the response of respondents, it has been able to determine the extent of perceived service quality in each dimension and a private item and their expectations of the SERVQUAL model. This enabled the authors to spot and distinguish areas of the service process that are looked as if it would be the most important bottleneck of the service quality. The difference between the service performance (i.e. perceived quality) and therefore the highest possible rating of a service (customers' expectations) is that the number of quality improvements the customer still expects from the corporate particular areas of service. According to the dealing of SERVQUAL dimension, twenty-five questions were developed and categorized as shown in Table 2.2. In step with Mikhaylov et al. respondents were offered to judge questions on the dimensions from 1—strongly agree to five—strongly disagree. Additional questions asked to relate to demographic information are essential in connecting to the evaluation of service quality. To analyze the gap between women passengers' perceptions and expectations about bus service quality in Bangladesh, the following variables have been used (shown in Table 2.2) by reviewing the previous related literature. Each dimension has five attributes which are shown in Table 2.2.

2.5.1 Reasons to play dual character of male and female passengers

Dual characters played by both male and female actors minimizes the biasness of data. If a male passenger is only concerned with his own opinion of the bus service‘s quality, then his opinion represents only the male passenger's point of view, and in this sense, women's perceptions remain unaffected. But if a man gets the opportunity to act as both a man and a woman, he will have the opportunity to consider the situation from both a male and female passenger‘s perspective simultaneously.

The case is not even different for the female passengers. While women are given chance to act as a man as well as a woman and share their perceptions, this actually helps her to be aware about the different perspectives. Figure 2.2 shows a simple presentation of dual characters played by male and female passengers.

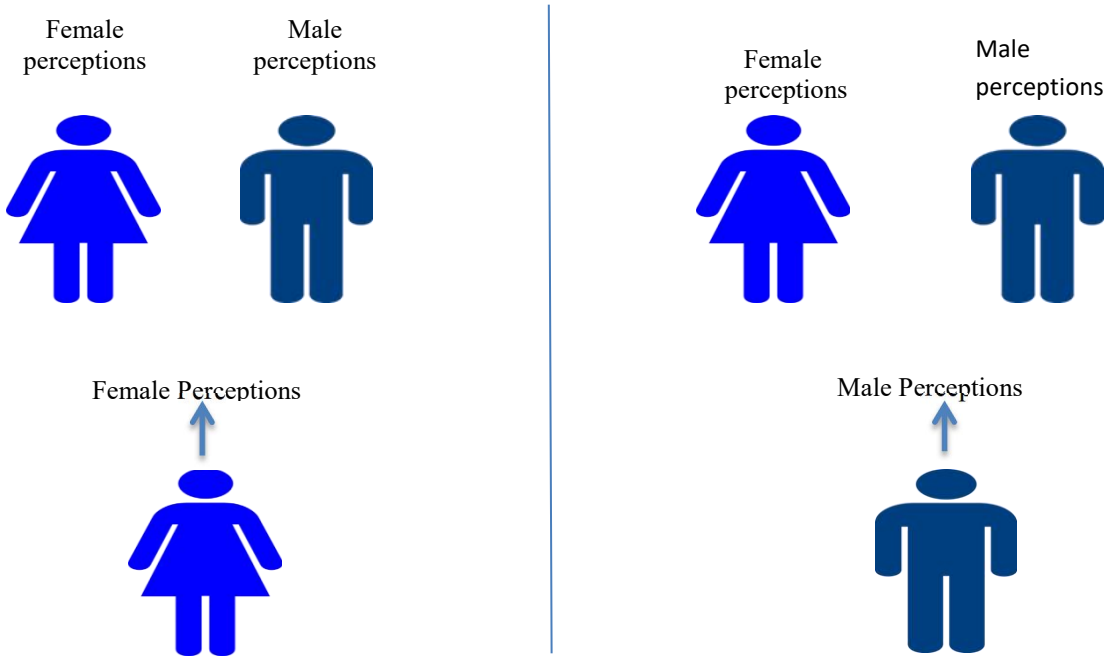

Figure 2. 2 Representation of dual characters played by male and female

2.6 Results and Discussions

2.6.1 Demographic Analysis

Demographic survey data of respondents is that such as gender, age, and education background are shown in Table 2.4 where the equal percentage of male and female, approximate 63%

respondents age in between 20 - 30 and 57.07% respondents are graduates. One thousand and five hundred respondents participated in this research work.

From the age result we can see that most of the respondents are young. It's because young population, when moving from their parents' house and stepping forward to make further life choices, are on a verge of certain challenges regarding decision of new residence and job which ultimately affects their health, social and family life, finance, leisure and overall quality of life (Munim et.al., 2020). Better public transportation can influence their quality of life by:

(1) reducing inequalities in pursuing residence, jobs and other public facilities,

(2) reducing lifestyle diseases,

(3) improving the environment and living condition by reducing GHG emissions, and

(4) making life more enjoyable and safer.

On the other hand, Older adults are have chosen to remain living in their homes that may have better access to services.According to Fatima et al., For older people who are no longer part of the main workforce, transportation is a way to maintain social bonds. As a result, transportation is strongly linked to independence, freedom of movement, choice, social activity and community involvement. Most of the traditional transportation & environmental planning ignores the older people's contribution. For emergency purpose they use private vehicle, para-transit amd ride sharing due to safety concern. For this reason older people's frequency is less than younger people.

Table 2.4 Demographic information of the respondents

Variables	Classes	Frequency	Percentage
Gender	Male	750	50%
	Female	750	50%
	Total=	1500	100%
Respondent's Age (Years)	10 to 20	437	29.13%
	20 to 30	943	62.87%
	30 to 40	110	7.33%
	40 to 50	8	0.53%

	50 to 60	2	0.13%
	Total=	1500	100%
Educational Background	Below SSC	95	6.33%
	SSC	124	8.27%
	HSC	385	25.67%
	Graduate	856	57.07%
	Postgraduate	40	2.67%
	Total=	1500	100%
Occupation	Students	655	43.27%
	Service holder	790	52.67%
	Businessmen	46	3.07%
The main mode chosen by respondents	Bus	1458	97.20%
	Rickshaw	9	0.60%
	Para Transit	23	1.53%
	Motor/ Bicycle	5	0.33%
	Car	5	0.33%

The respondents were consisting of students, service holders, businessmen, and others, where 43.67% are students and 52.67% are service holders (as shown in Table 2.3). Within 1500 sample sizes comprised of 750 males and 750 females, the data on the passengers' perceptions for both genders are represented in Figures 2.3-2.27 (Note that a clear presentable versions of these figures are given in a table form in Appendix II). These data were obtained from the respondents using the questionnaire of the survey. The female passengers consider their

problems due to bus service quality only as their own problems or do they consider those problems as problems of male passengers and the same and opposite for male passengers. Both male and female passengers are equally transported on public buses. Male and female passengers on public transportation may have similar or dissimilar feelings and perceptions about bus service quality. In this research, there is the consideration that a male passenger acts as both a female and a male passenger simultaneously.

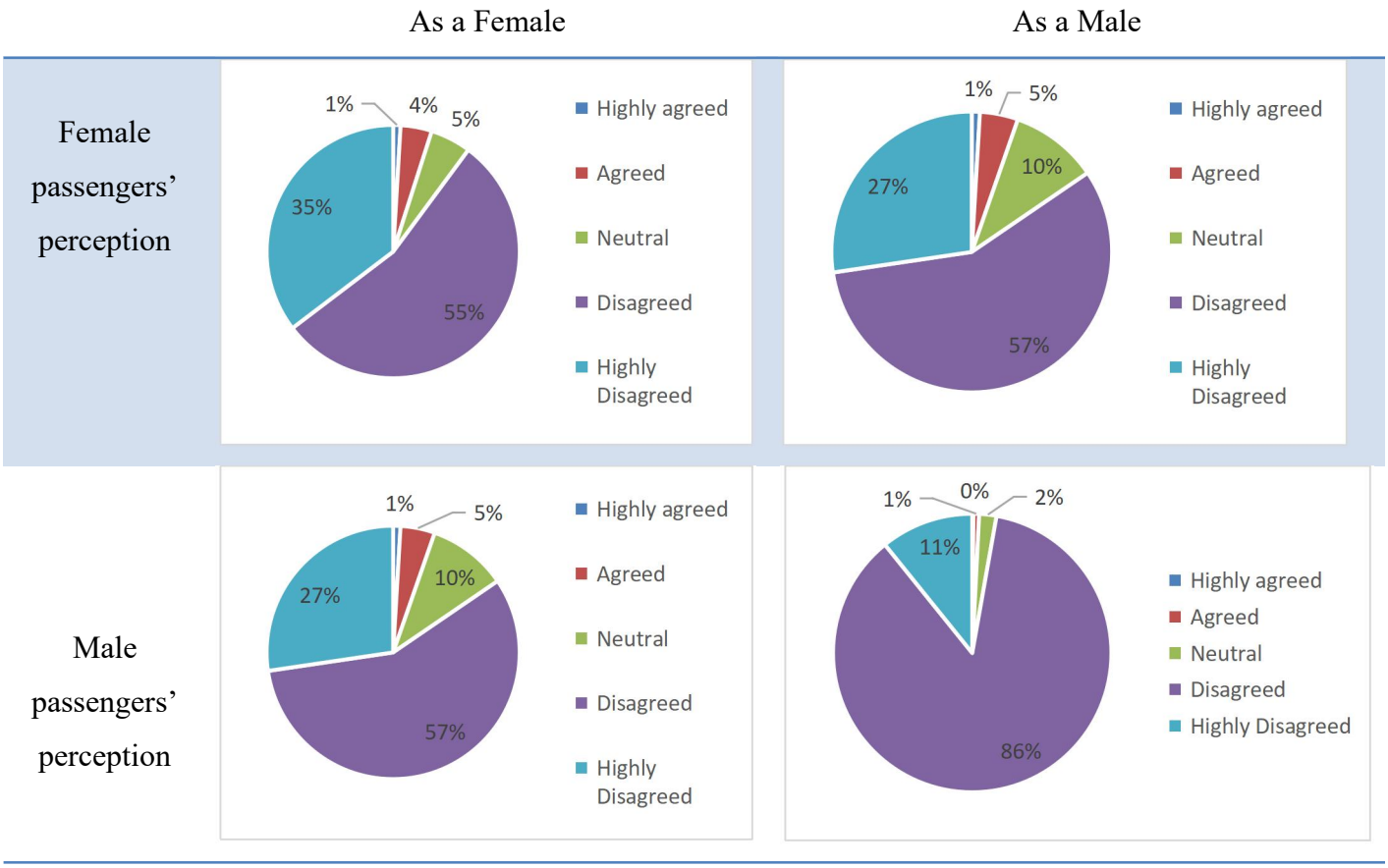

Figure 2.3 Perception of male and female (attractiveness of bus)

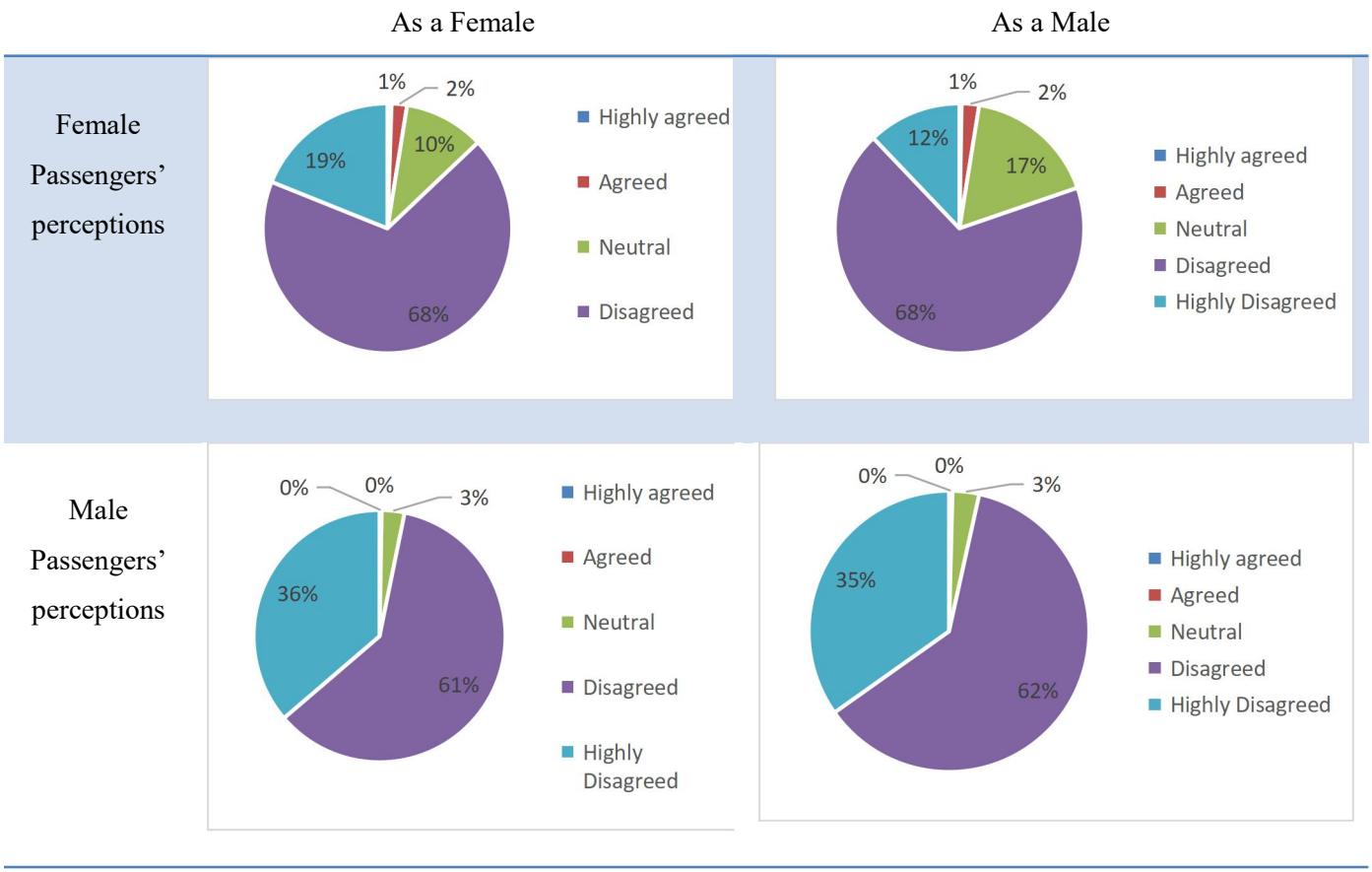

Figure 2.4 Perception of male and female (bus service provide up to date technology)

Figure 2.5 Perception of male and female (sufficient seat at bus stand)

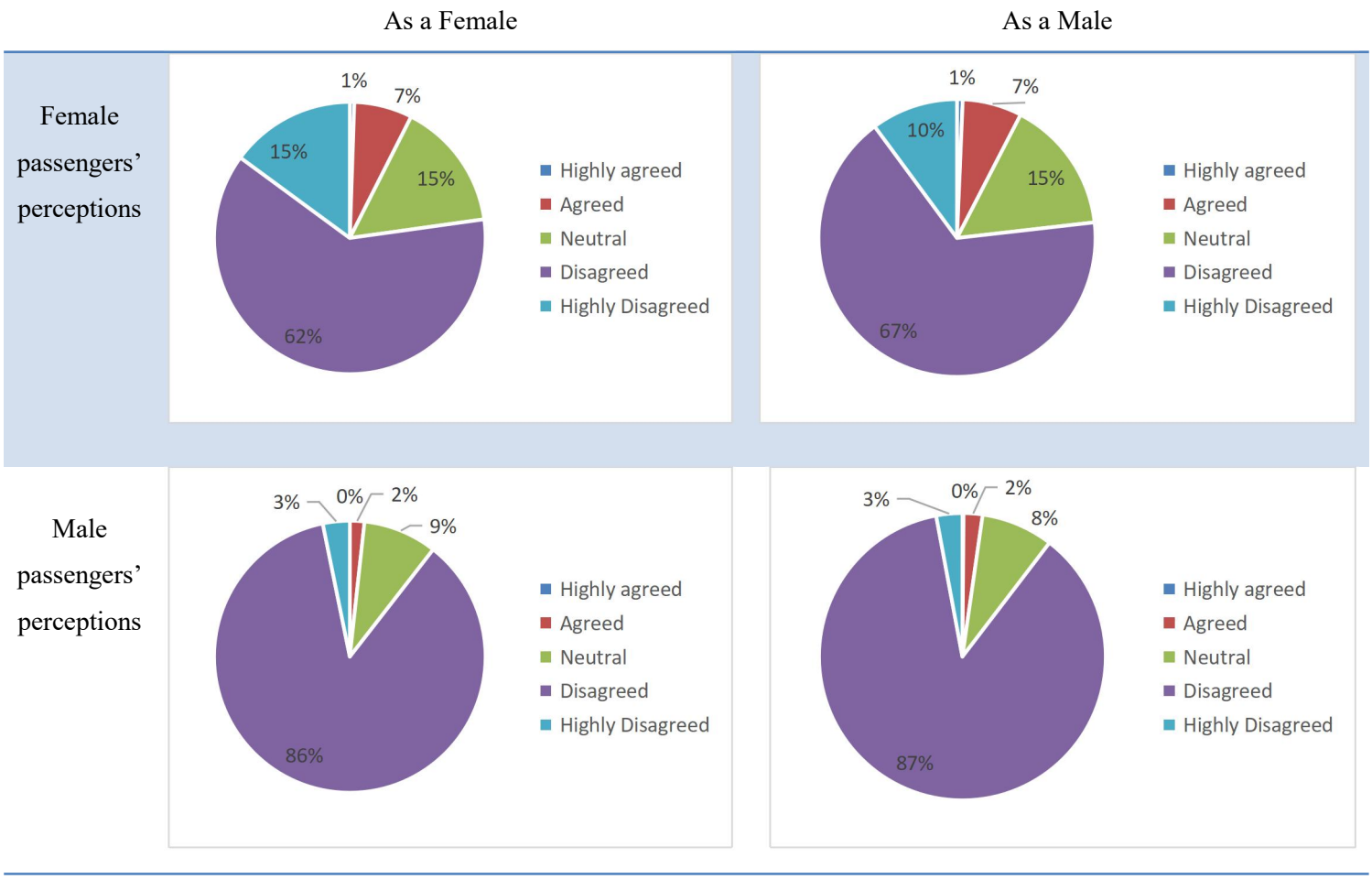

Figure 2.6 Perception of male and female (professional appearance)

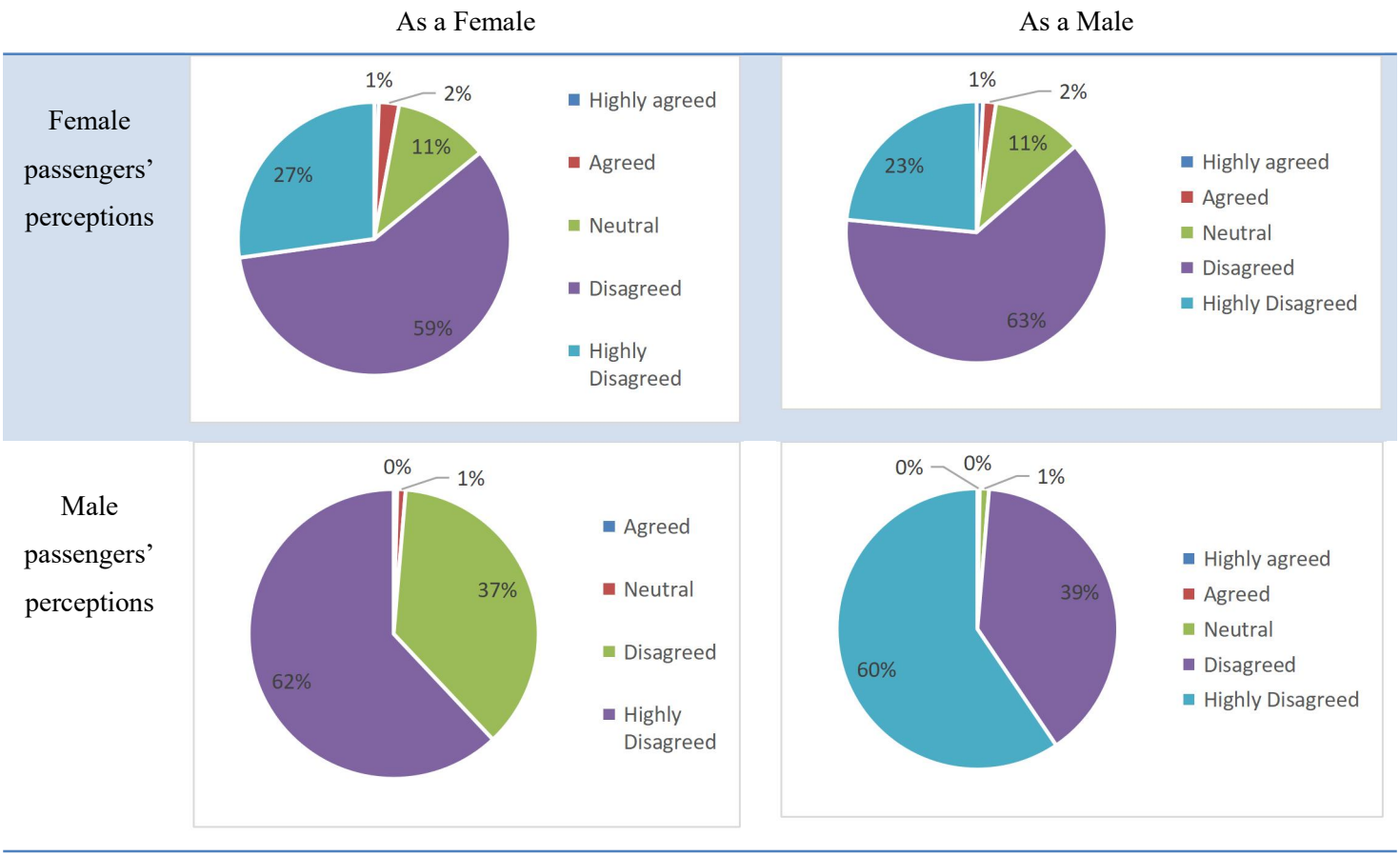

Figure 2.7 Perception of male and female (smartness and cleanness of bus staff)

Figure 2.8 Perception of male and female (timing of bus arrival)

Figure 2.9Perception of male and female (Stopped completely while boarding)

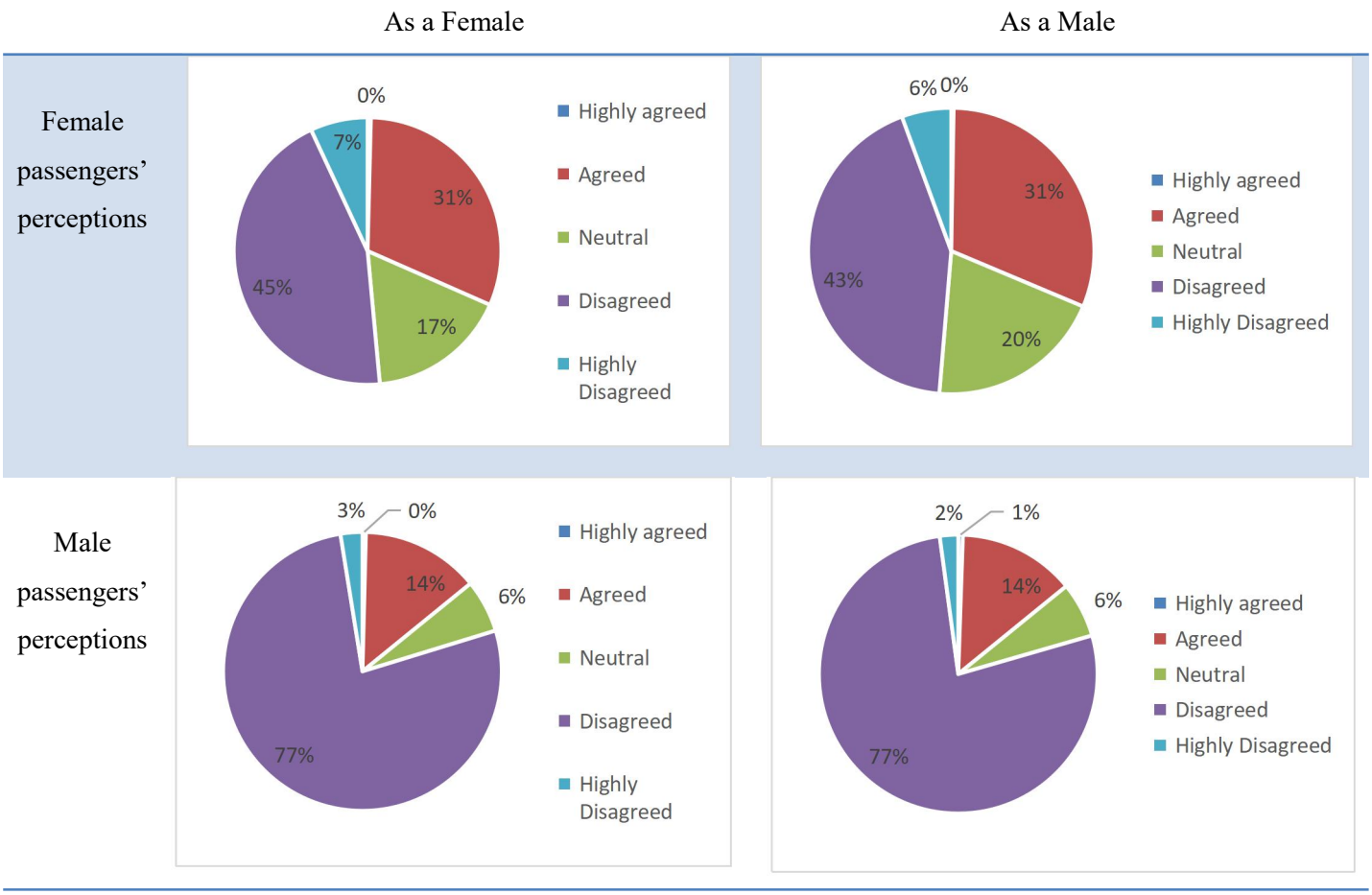

Figure 2.10 Perception of male and female (booking system of bus ticket)

Figure 2.11 Perception of male and female (met the requirements by the bus staffs)

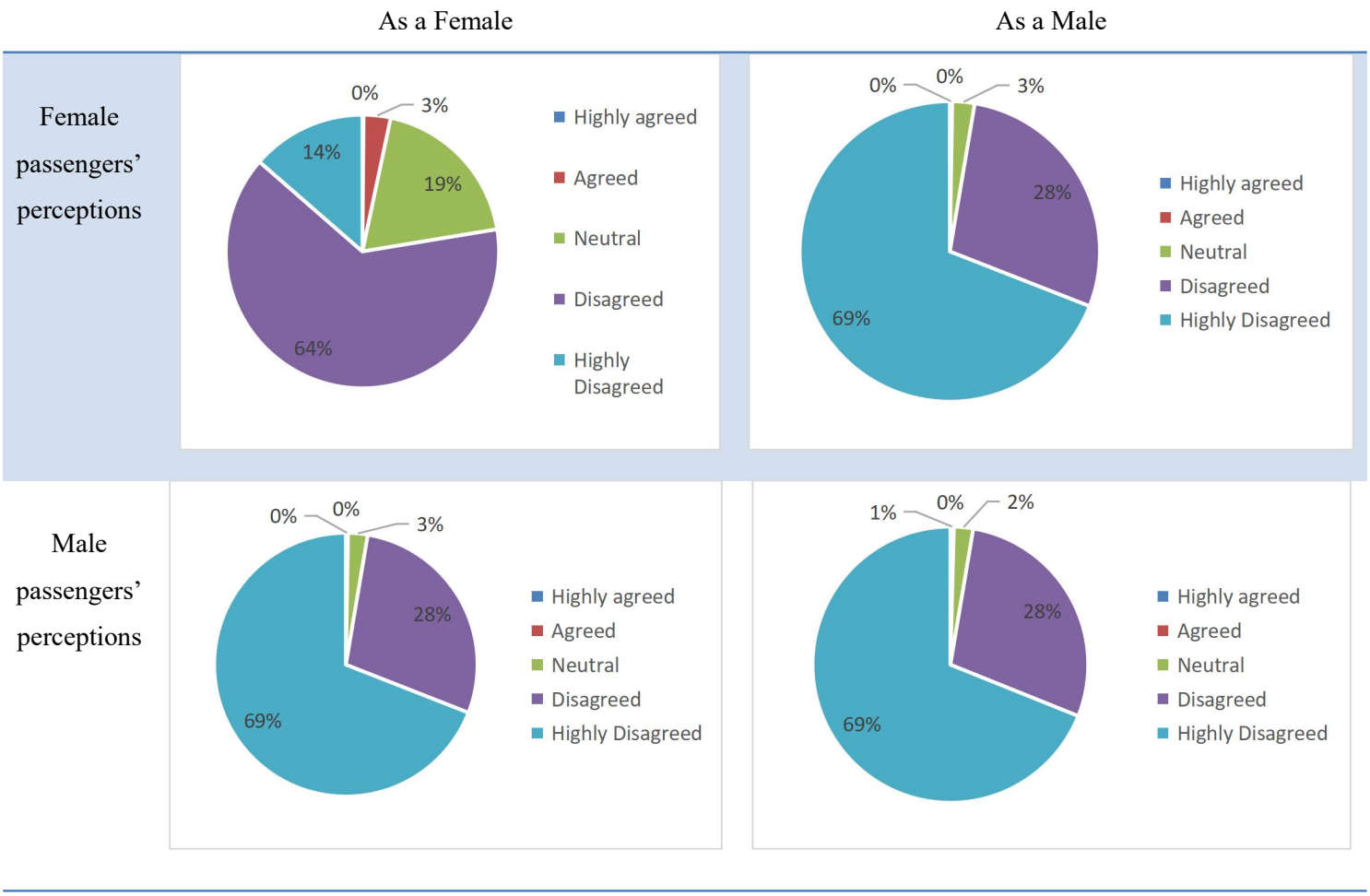

Figure 2.12 Perception of male and female (providing error free services)

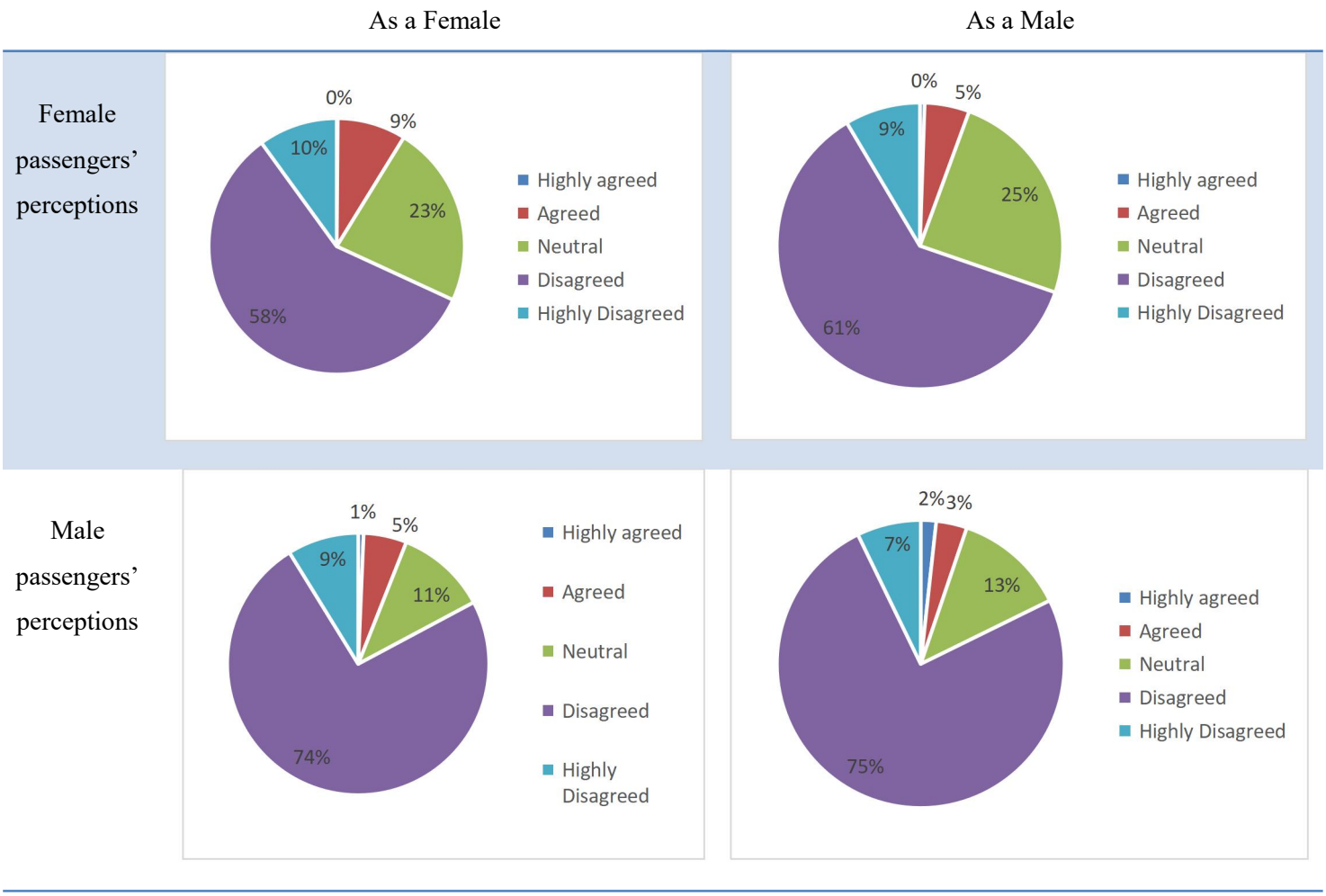

Figure 2.13Perception of male and female (timetables and fees' information)

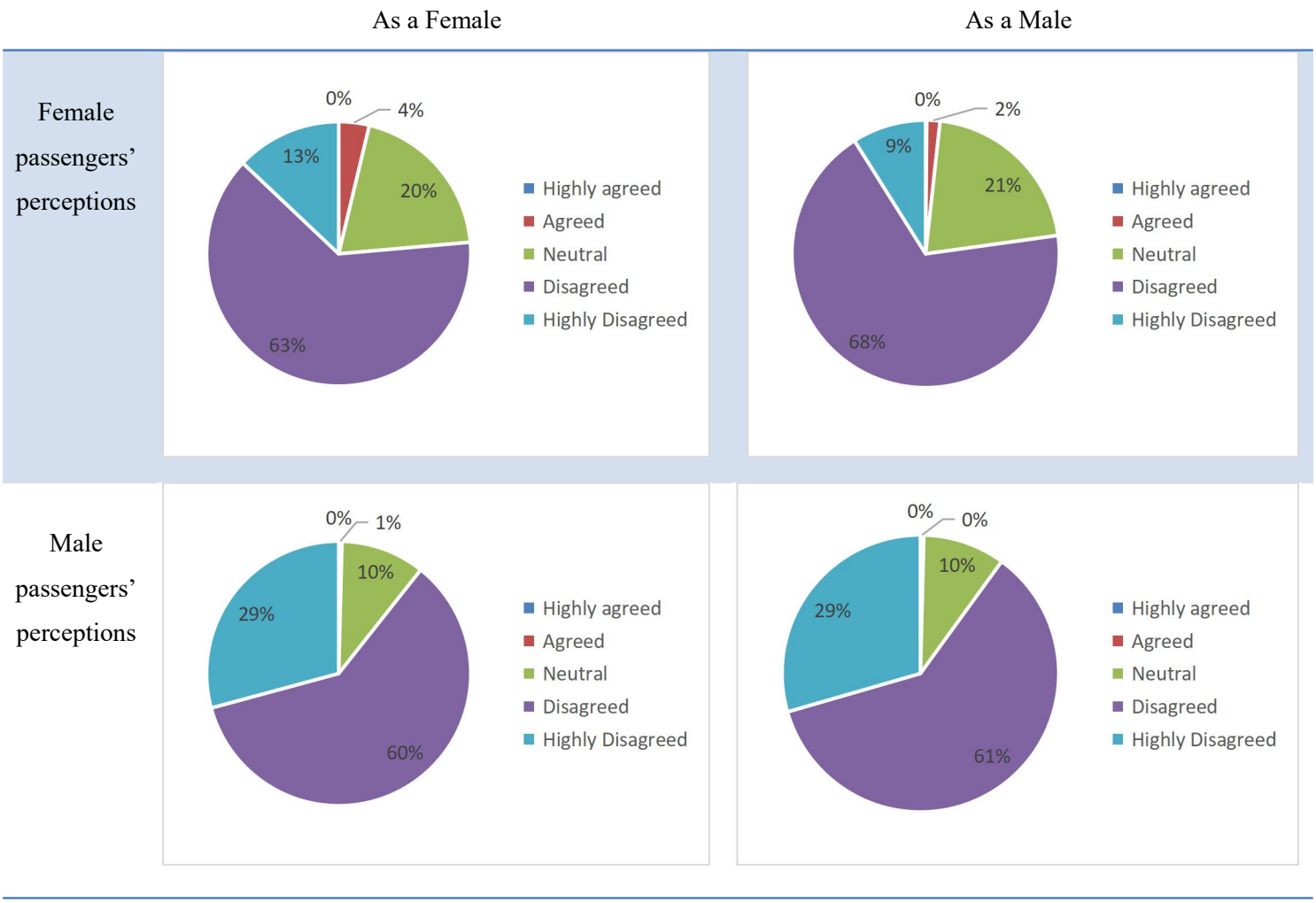

Figure 2.14 Perception of male and female (provides efficient service with time)

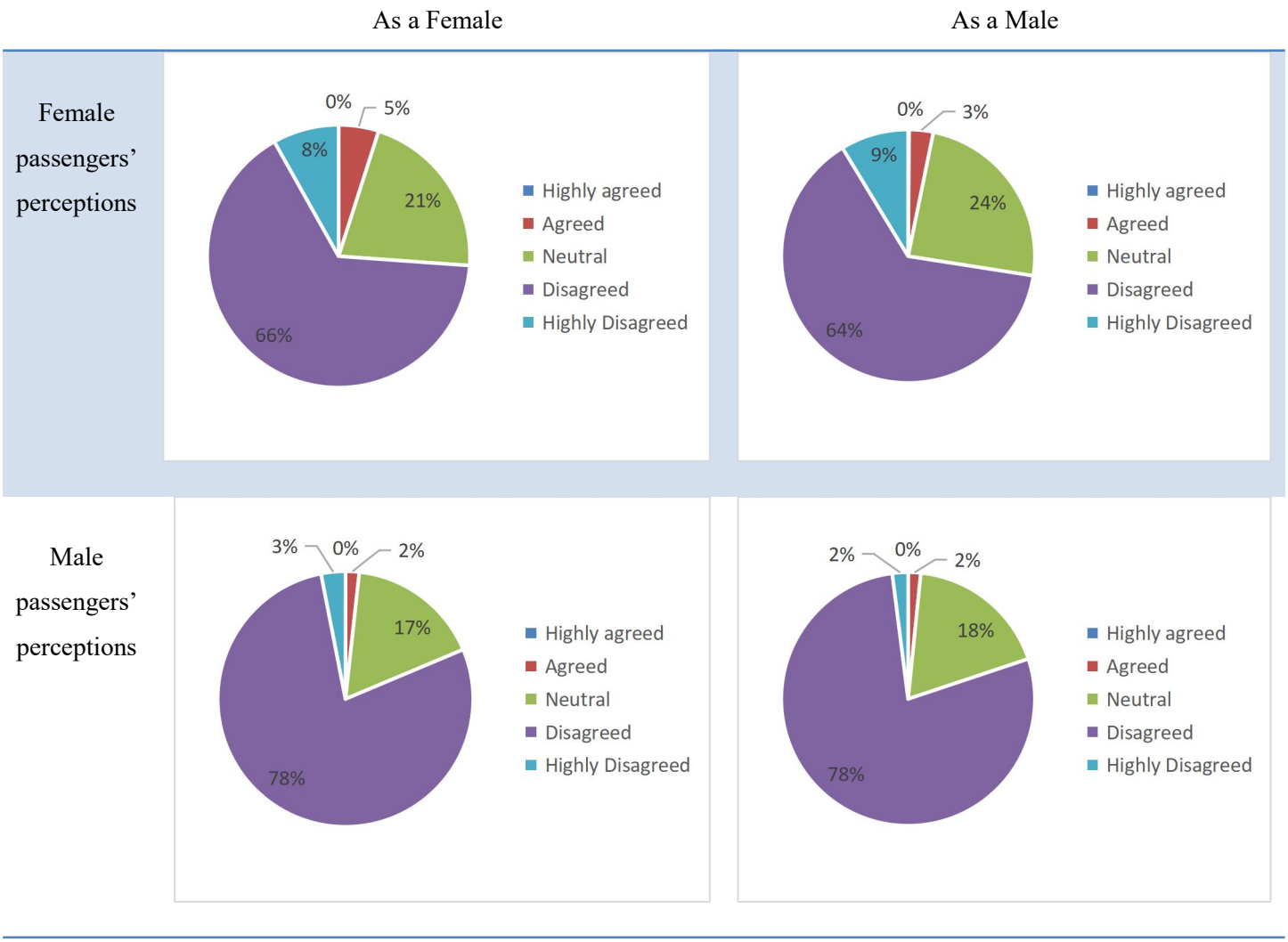

Figure 2.15 Perception of male and female (bus personnel have proper dealing ability)

Figure 2.16 Perception of male and female (bus staffs are willing to co-operate with old passengers

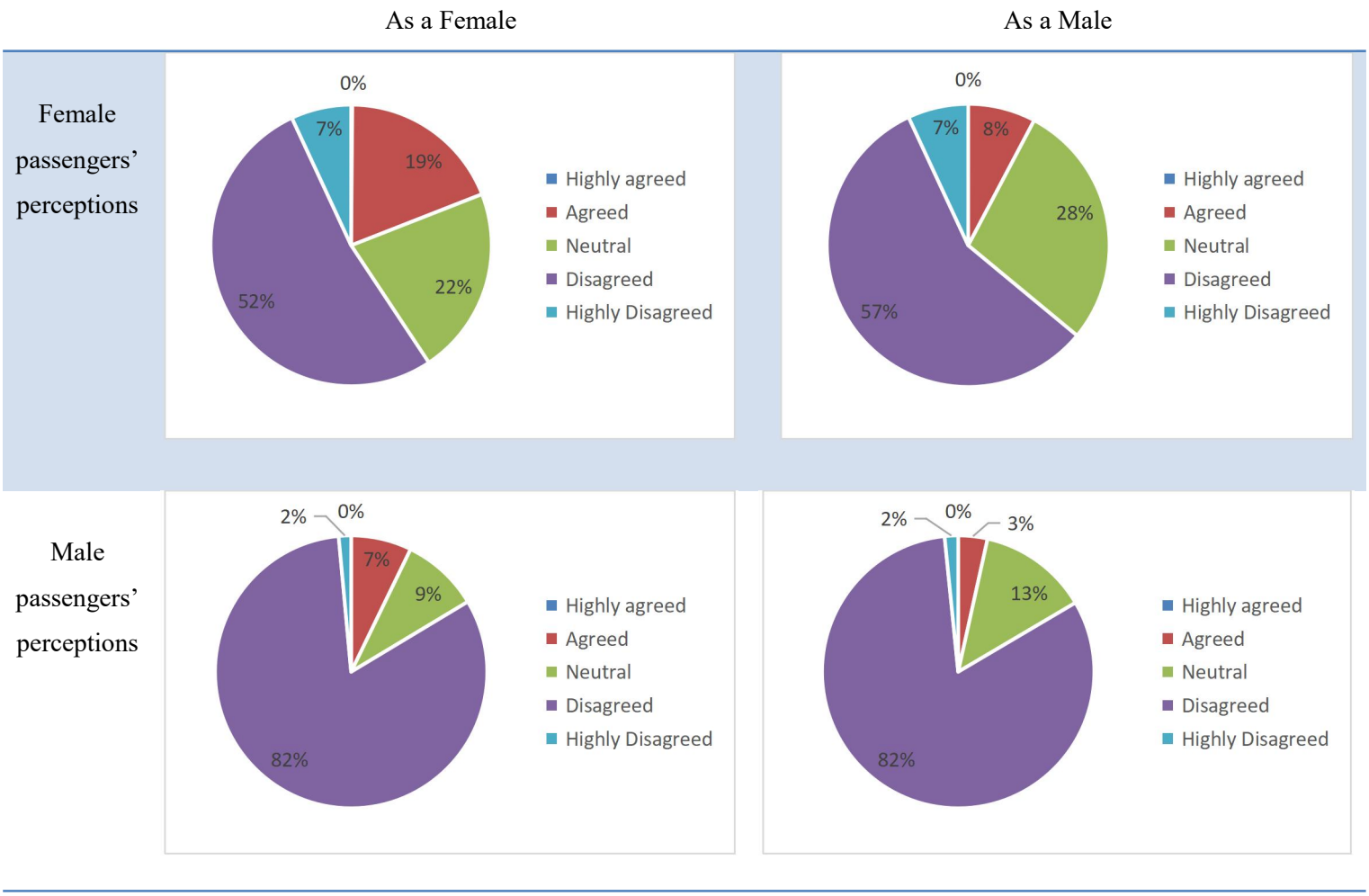

Figure 2.17 Perception of male and female (responded of bus commuters' request)

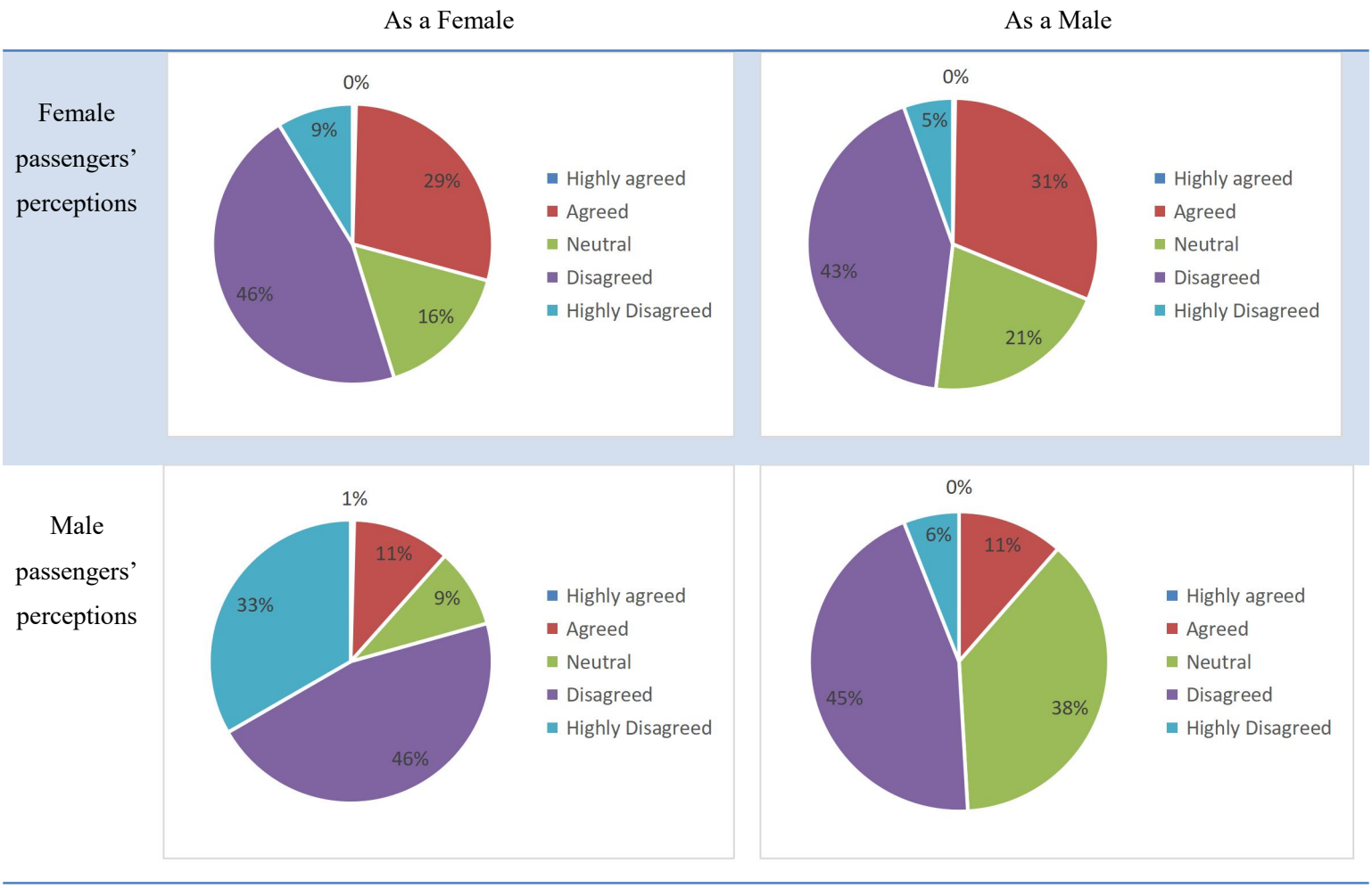

Figure 2.18 Perception of male and female (feel safe dealing transaction in bus stand)

Figure 2.19 Perception of male and female (feel secured dealing transaction inside bus)

Figure 2.20 Perception of male and female (bus staffs are always polite)

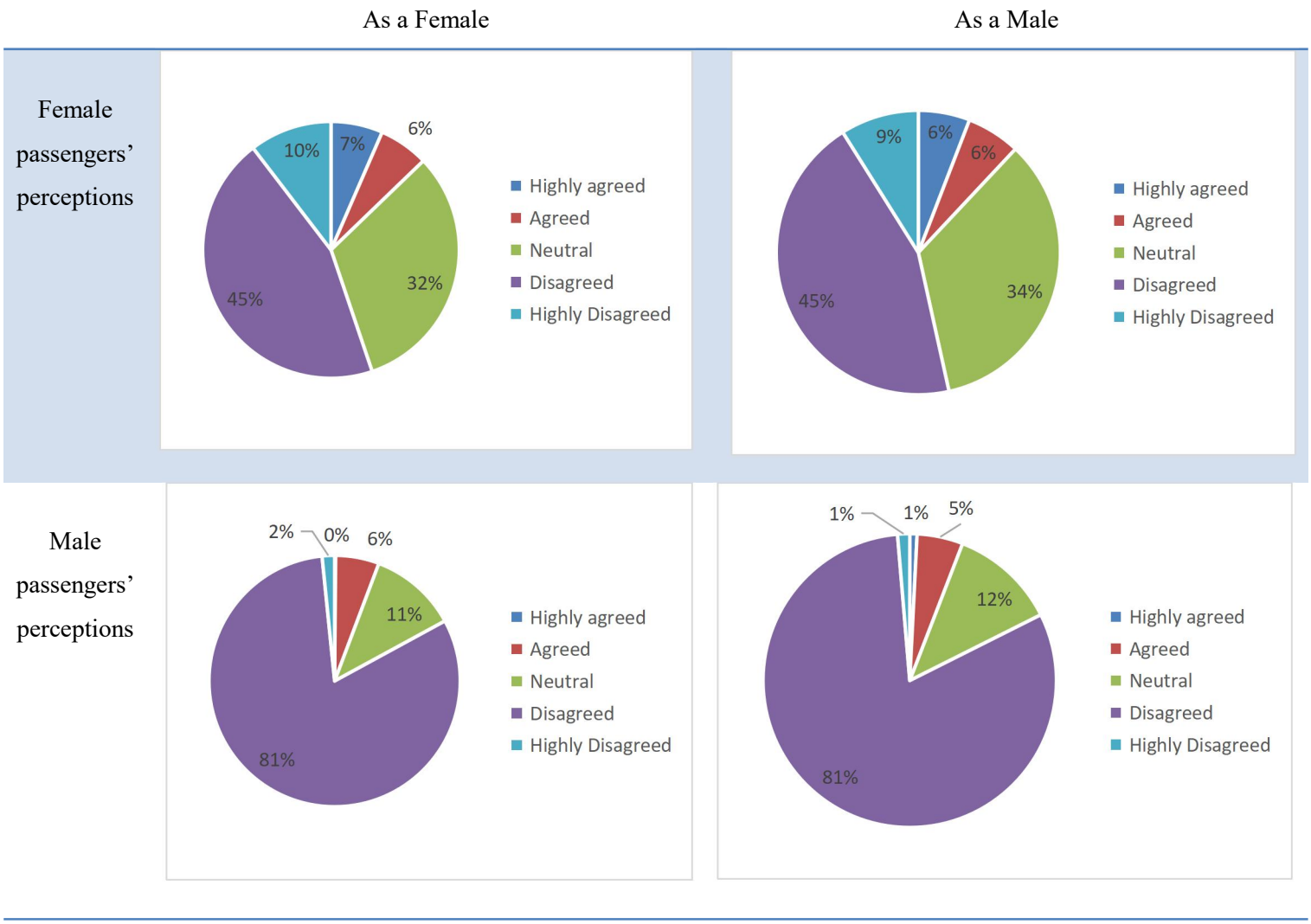

Figure 2.21 Perception of male and female (advance ticketing system)

Figure 2.22 Perception of male and female (inspiration development about women friendly service)

Figure 2.23Perception of male and female (concentration of best interest of passengers)

Figure 2.24 Perception of male and female (have convenient service hours)

Figure 2.25 Perception of male and female (bus commuters get information easily)

Figure 2.26 Perception of male and female (accessible bus stand)

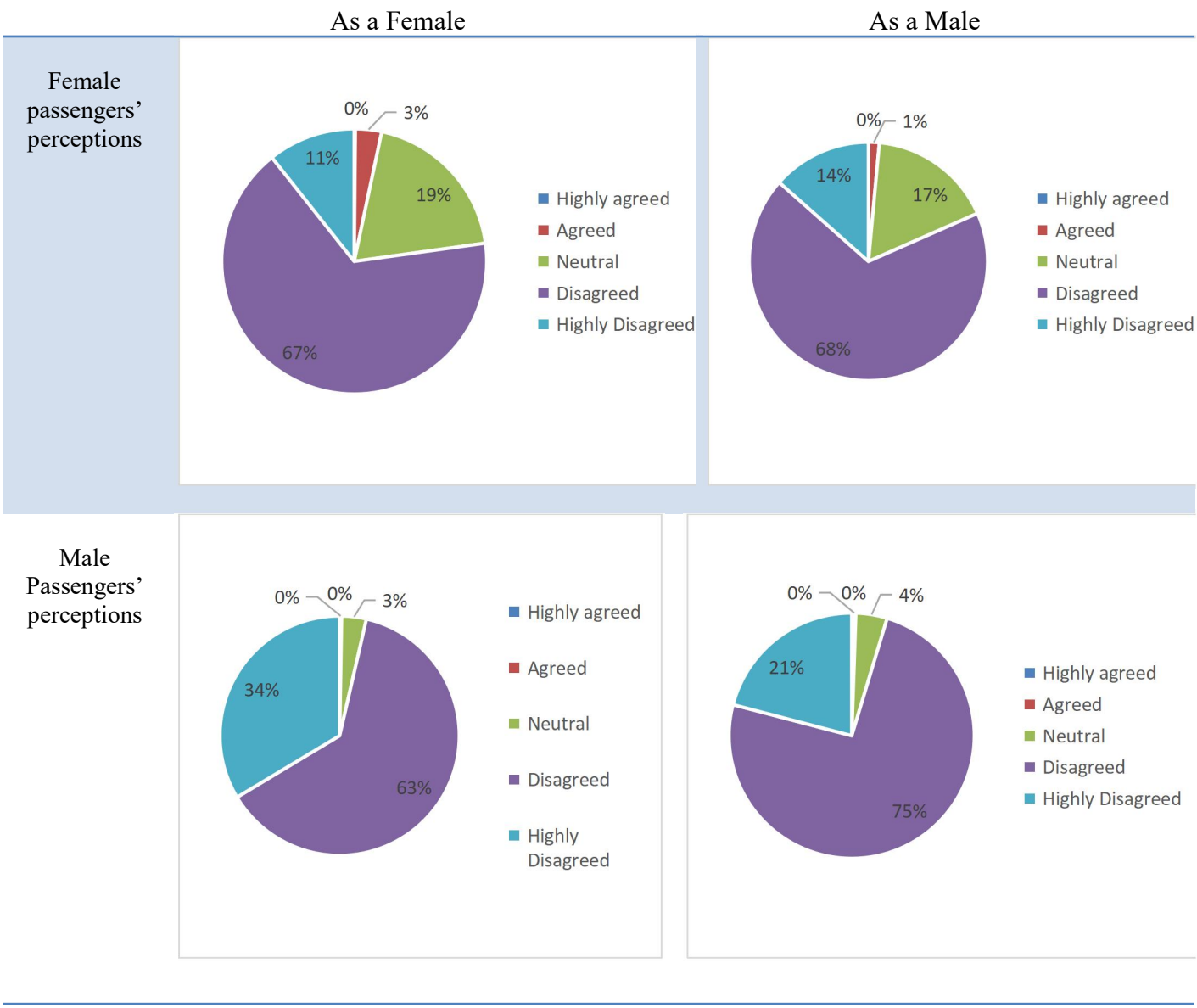

Figure 2.27 Perception of male and female (comfort and secure bus service)

This assumption is taken to ascertain the opposite gender's perceptions of the bus service's quality, for example, whether a female passenger's perceptions are identical to those of a male passenger or not. The same situation also holds true for a male passenger. If a male passenger is only concerned with his own opinion of the bus service's quality, he will, in opinion, respond only to the opinions of other male passengers. However, if an interview is conducted with a male subject in which he acts as both a man and a woman, he will have the opportunity to consider the

situation from both a male and female passenger's perspective simultaneously. Likewise, female travelers face the same challenges. Hence the decision to accept male passengers who responded as females and men, as well as male passengers who responded as males and females. This respondent's duo pass is also justified in this research by the use of the same questionnaire whereby a male person who plays a role as a male passenger, at a time also acts as a female. That is also the same case but opposite for female passengers. A female person's perception almost disagrees when playing a role as a female passenger and the same person acting as a male the perception has almost disagreed. That means the female considers the bus service quality problem which attributes faced by female passengers that also are a problem for male passengers except for the attribute of "sufficient seats at the bus stand for passengers", "bus staffs are willing to co-operate with old and handicapped passengers", "feel safe in dealing transactions with the bus service provider in the bus stand", "feel secure when dealing transaction with staff inside the bus". The same case is for a male person, who acts as a male and at a time acts like a female. Here the all-female and male passengers' perceptions are disagreed according to all variants of this survey shown in Figures 2.3-2.27 (except Figure 2.5, Figure 2.16 and Figure 2.19). Like the variant "the bus stand is attractive" when a female acts as a female passenger the perception is 55% and when she acts as a male the perception is 57% that's almost the same. Again, for the same variant a male person acting as a male passenger the perception is 86% and when he is acting as female the perception is 57%, and so on. That's also the same result. In another variant remains the same scenario. However, the four variants ("sufficient seats at the bus stand for passengers", "bus staffs are willing to co-operate with old and handicapped passengers", "feel safe in dealing transactions with the bus service provider in the bus stand", "feel secure when dealing the transaction with staff inside the bus") different scenarios. In the case of the attribute "sufficient seat at the bus stand for passengers", 56% of female passenger's responded as disagreeing when responding as a female, and when acting as a male 52% responded as disagreed but having a difference in male passengers, 64 % male passenger neutral, and when acting as a female 55% responded as highly disagreed (see Figure 2.5). The passenger's response about the perception of service quality attribute "bus staffs are willing to co-operate with old and handicapped passengers" is that the female passenger as a female respondent 36% response disagreed but when she acts as a male passenger, 36% respondents responded as agreed. For the male passengers in both situations, the respondents that agreed as a

male passenger were 78% while the respondents that agreed as female were 79%, as shown in Figure 2.16. The service quality attribute of "feeling secured when dealing transactions with staff inside the bus", 53% of male passengers responded disagreeing and 27% responded as highly disagreed while acting as a female passenger and 42% disagreed and 44.00% neutral while a male passenger responded with a male respondent. In addition, 42% of female passengers responded as disagreeing and 26% responded agreed while responding as a female passenger and 45% disagreed and 27% agreed while male passengers responded male respondents as shown in Figure 2.19. This implies that the perception gap analysis of male and female passengers regarding the bus service quality supports the first hypothesis (H_1).

2.6.2 Gap Analysis between Female Passengers' Perception and Expectation about Bus Service Quality in Bangladesh

This section is related to the discussion of findings of the present study in the light of the hypotheses already formulated. The following results were found from analyzing the collected data using different tools applied to the present study. Analyze the gap of perception and expectation of female passengers according to tangibility. There were five attributes and each attribute was denoted by T1, T2, T3, T4, and T5 as per Table 2.1. The average expectation value on this dimension is 3.484 that is very high. Many female passengers complain about the up-to date technology, sufficient resources as well as capacity, professional appearance, and cleanliness of the bus, as well as the appearance of the staff, resulting in the average value of perception with only 2.39. The gap of tangible T1, T2, T3, T4, and T5 is 0.24, −1.63, −1.55, −1.2, and −1.33 which are shown in Figure 2.28. Here all attributes of the tangibility dimension represent the minus value except the attribute T1 (The bus stand is attractive). Therefore, improvement is to be required. Represent the gap of perception and expectation of female passengers according to the dimension of reliability, which is denoted with the attributes as R1, R2, R3, R4 and R5. As per Table 1, the average value expectation of reliability is 3.6 and the perception value 2.42. The expectation value is higher than perception. The gap of perception and expectation in reliability R1, R2, R3, R4 and R5 is −1.61, −1.54, −0.85, −0.84, and −1.06 respectively. All attributes of reliability of bus service perception and expectation's gap represent

negative values shown in Figure 2.29. That means the female passenger expectations are high about bus services in Dhaka city.

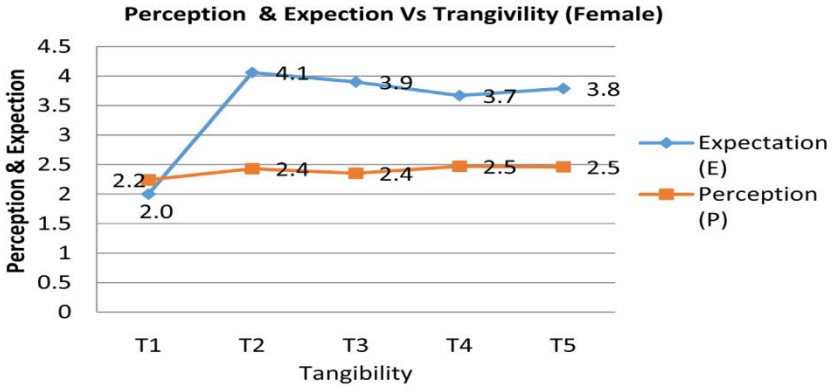

Figure 2. 28 Perception and Expectation Vs Tangibility

Responsiveness is the most important dimension to exhibit the expectations and perception of female passengers and analyze the gap. The average expectation of responsiveness is 3.09 and the perception value 2.81. The expatiation value is higher than perception. The gap of perception and expectation in responsiveness RP1, RP2, RP3, RP4, and RP5 is −1.48, −1.28, 1.31, 0.72, and −0.67 respectively. All attributes of responsiveness of bus service perception and expectation's gap represent negative values which are shown in Figure 2.30 except RP3 (Good communication always exists between passengers and staff.) and RP4 (Bus staffs are always willing to co-operate passengers.) That means the female passenger expectations are high about bus services in Dhaka city. The dimension of assurance, which is denoted the attributes as A1, A2, A3, A4, and A5. The average value expectation of assurance is 3.49 and the perception value 2.42. The expectation value is higher than perception. The gap of perception and expectation in assurance A1, A2, A3, A4, and A5 is −1.21, −0.82, −0.87, −1.39, and −1.05 respectively. All attributes of assurance of bus service perception and expectation's gap represent negative values shown in Figure 2.31. That means the female passenger expectations are high about bus services in Dhaka city. The dimension of Empathy is denoted by the attributes as E1, E2, E3, E4, and E5. The average value expectation of empathy is 3.73 and the perception value 2.40. The expectation value is higher than perception. The gap of perception and expectation in Empathy E1, E2, E3, E4 and E5 is −1.39, −1.18, −1.42, −1.23 and −1.4 respectively. The present cases also have the same scenario on the gap of perception and expectation which shows the negative values seen in Figure 2.32.

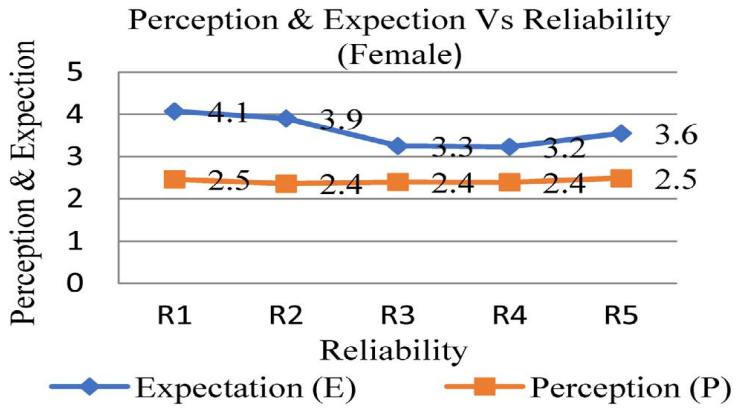

Figure 2. 29 Perception and Expectation Vs Reliability

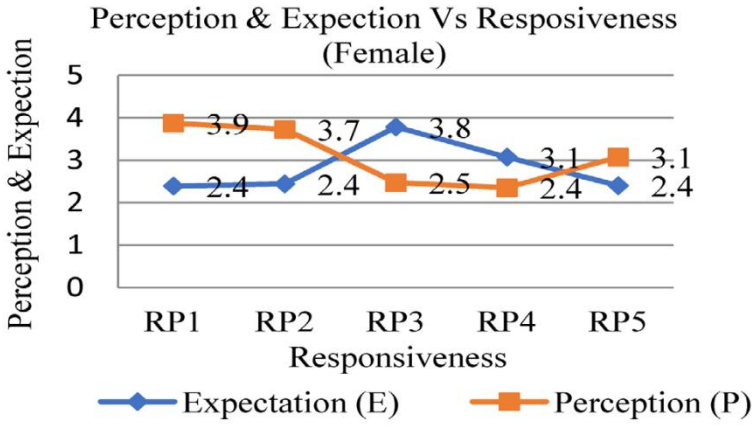

Figure 2. 30 Perception and Expectation Vs Responsiveness

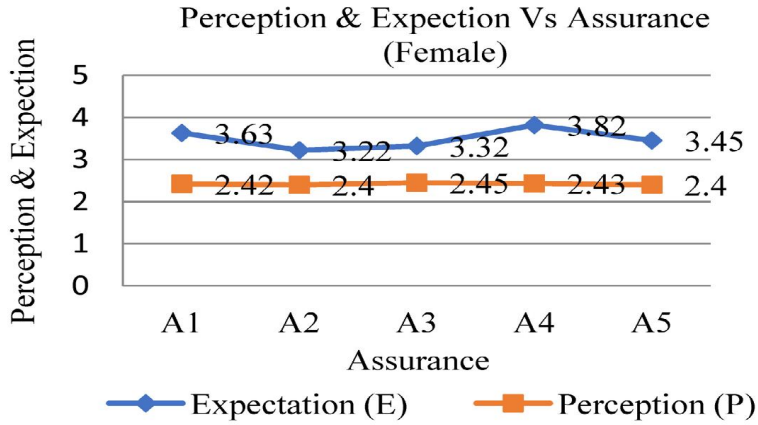

Figure 2. 31 Perception and Expectation Vs Assurance

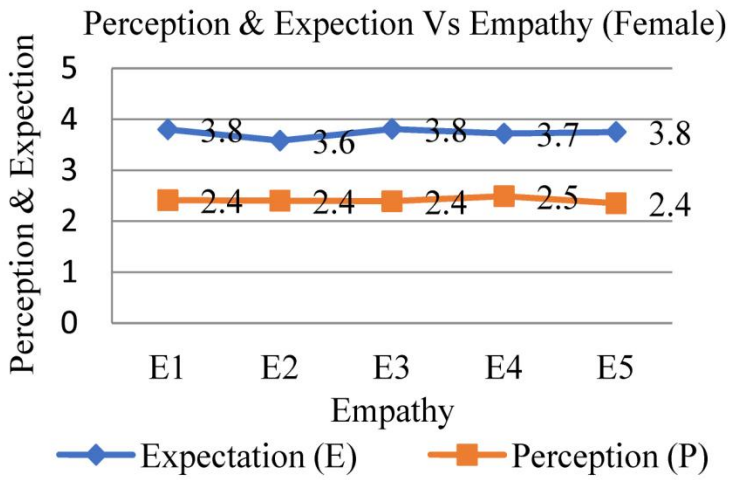

Figure 2. 32 Perception and Expectation Vs Empathy

This implies that the results of the gap analysis between perception and expectation of female passengers support the hypothesis (H_2). However, there are some recommended improvements to be required, presented in Section 2.7.

2.7 Conclusion

Customer happiness is crucial nowadays, as it authenticates and confirms any service's success. The current study investigated the perception of male and female passengers for the service quality attribute of bus service with both thinking's of male and female and investigated the difference between current service quality and expected service quality to improve bus service quality. A gap analysis of female passengers' perceptions and expectations was conducted using SERVQUAL questionnaires. The gap was depicted using five dimensions: reliability, tangibility, responsiveness, assurance, and empathy. Using the SERVQUAL approach to investigate the gaps was a promising first step toward potential solutions because the researchers felt it was critical to address the difficulties of public transportation specifically for women in Bangladesh urban areas. Analysis of the perception of male and female passengers during this study represents that the service quality of bus service is not fulfilling the passenger's satisfaction. The service quality problem, which attributes faced by female passengers and they think that is also a problem for male passengers as well as which problems are faced by male passengers and they also feel that is also a difficulty for female passengers while traveling in the public bus except for

a few attributes. From the overall twenty-five perceptions of male and female passengers, most of the perceptions on behalf of both males and females are disagreed and highly disagreed regarding the positive perception questionnaire except in the following statements: “The bus stand has sufficient seats for passengers, Bus staffs are willing to co-operate with old and handicapped passengers and Feel secured when dealing transactions with staff inside the bus.” From that exceptional analysis , we can clearly observe that female passengers are the most sufferer than male that’s why when we played dual character male acts as a female, that time they can feel the suffer of the female but when they male as a male, they think existing seats are sufficient for passengers. In practical observation only 9 seats are priority seats for women and sensitive groups, other remaining all seats are under men’s control. In this case, they have dissimiliar perception. From that exceptional analysis , we can clearly observe that female passengers think that bus staffs ignore old and handicapped passenger on the other hand male passenger while played dual character they think that bus staffs are willing to co-operate with them which is quiet unreal in Bangladesh perspective. In practically, this questionnaire is fluctuate. so in this case both male and female perception are correct as sometimes they help or sometimes not. From that exceptional analysis , we can clearly observe that female passengers are the most sufferer than male that’s why when we played dual character male acts as a female, that time they can feel the suffer of the female but when they male as a male, they think existing seats are sufficient for passengers. In practical situation, we directly observed that 99% female have the worst security issue while transaction as men do not have any security issue. This is the practical reason for dissimilar perception in this questionnaire. All other attributes of service quality features are more essential to improve for both males and females. In this study, the bulk of the dimension gap value is negative. In this situation, all dimension gap lines are below zero level. When the gap value is negative, it indicates that the expectation exceeds the perception. According to this survey, female passengers’ perceptions are quite low because of the issues. From the findings, the bus’s passenger service is substandard in Bangladesh. Both the perceived and expected quality of bus service were vastly different. Given that poor service quality in one area leads to negative opinions in others, gaps should be bridged by implementing appropriate solutions based on the passengers’ goals. As a result, the bus system should be updated to accommodate women’s requirements. The findings indicate that the assessment offers numerous potential benefits for the service provider. Identifying passengers’ views of service quality

performance for a certain attribute (and dimensions) may enable management to better adapt and validate that female commuters' expectations are met. This entails identifying, prioritizing, and improving areas of service deficiency to guarantee that valuable resources are directed to the most effective locations. Due to the data being acquired from primary sources, the findings of this study are reliable and valid. Furthermore, it is best matched to the research's stated aims. Regulators, service providers, passengers, researchers, and other transportation and environmental agencies are likely to benefit from this study. This information may be valuable to transportation businesses in improving their services and to regulators in developing recommendations and policies. In the future, researchers may conduct similar studies considering other valuable cities in Bangladesh with a larger sample size, allowing for better generalization of findings. Further study is recommended in the variables to be considered in the model as given in Table 2.1 to include distance of the bus stop from home/office, willingness of passengers to use bus service, time elapse between the arrival of two buses at the bus stop, etc.

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Chapter-3

An Analysis of the Women Commuters' Satisfaction in the Public Bus Service in Bangladesh: A Survey on Local Buses in Major Cities

Abstract

Bangladesh is one of the most populated developing countries where public bus service plays a vital role as a public transport mode since it is easily available and cost-effective. In the social, commercial, educational, and administrative spheres, women's participation in the labor force in economic enterprises is steadily expanding in the country. Very little research considers only women commuters to analyze the service quality of public buses and they selected only Dhaka city as a study area. However, a large number of trips were generated by women commuters in the industrial and commercial zones such as Gazipur, Narayanganj, and Dhaka. This paper ascertains the public bus service attributes that affect women commuters' satisfaction as well as finds out the major problems of women commuters while traveling on public buses and the possible solutions to them. This survey included 766 women commuters from Dhaka, Narayanganj, and Gazipur who were interviewed face to face. Structural Equation Model (SEM) was used as the instrument for identifying the service quality (SQ) attributes that influenced the women commuters' satisfaction. A series of models were developed based on the trial-and-error method and the model M_3 selected as the best fit according to SEM fit indices values. The study's main goal was to compile a list of service quality attributes that influence women commuters' satisfaction. Major issues with the current public bus service in terms of safety and security, as well as remedies, were identified through discussions with experienced female commuters. These findings reveal that women commuters' satisfaction is primarily influenced by safety and security, as well as the degree of comfort provided by bus service because they frequently encounter major safety and security issues on public buses and want an immediate remedy. This

paper offers some potential strategies for addressing the issues, which may prompt policymakers to pay more attention to these aspects in transportation planning.

Keywords: Public bus, Service quality, Women commuters' satisfaction, SEM

3.1 Introduction

Bangladesh's commercial and industrial cities are among the most densely populated cities with the world's highest population growth rate. The male to female ratio in Dhaka, the capital city of the country is roughly 1:1, as it is in most other cities. Dhaka, Bangladesh's primary commercial city, is the center of employment opportunities as well as all vital facilities such as health, education, and so on.

Public transport (PT) is the most efficient mode of transportation for addressing travel demands in heavily populated urban regions. People in cities are forced to relocate frequently to participate in economic activities, which help to develop social networks and make family life easier.

Women's participation in the labor force in economic undertakings is increasing day by day. In the social, commercial, educational, and administrative sectors, the majority of women have a considerable presence (Phun & Yai, 2016). The number of women working has increased from 54 million in 2010 to 61 million in 2017. Bangladesh is the world's second-largest exporter of Ready-made Garments (RMG) after China (Ali & Islam, 2017). The RMG sector employs approximately 4.2 million people, with women accounting for 80 percent of the workforce (World Bank, 2017), with a significant number of garment and textile industries located in Gazipur and Narayanganj. Women's economic participation is intimately tied to their mobility and ability to meet transportation demands, which increases the demand for safe and secure local bus service in major cities. In Dhaka city, more than 60% of passengers use public transportation to get to work ("Revised Strategic Transport Plan, RSTP for Dhaka," 2015). As a substantial number of individuals cannot afford personal vehicles owing to low-income levels, the bulk of trips in Dhaka are served by public transportation options, as they are in other Asian cities (Authority DTCA). Thus, the demand for public transportation modes (buses) is increasing. Because of social exclusion, women in Dhaka confront social barriers in gaining access to public transportation (Rahman et.al., 2017).

In today's world, the success of a public transportation system is determined by the number of passengers it can attract and maintain. As a result, service quality becomes a critical problem, as it is well recognized that improved service quality leads to higher passenger satisfaction and more use of the system. The quality of public transportation service is determined by several factors. Customer satisfaction is an excellent indicator of the quality of service. To develop an appropriate public transport service, previous researchers measured the perception of passengers and their satisfaction through surveys, and the data collected was used to develop indices providing useful information about the quality of the service and its evolution over time. However, to determine these, the researchers need not only to know the perceptions about the attributes of quality but also to identify which attributes have the highest influence on the passengers' satisfaction.

The public transportation system of Bangladesh is inefficient, nonproductive, hazardous, underfunded, and overcrowded (Karim & Mannan, 2008; Safiq-Ur-Rahman, 2010). Because of a greater variety of social classes, cultural backgrounds, and economic situations in the urban context of developing countries, travel patterns between male and female members of the same household are different (Peters, 2001). Researchers have been studying the relationship between the quality of transport services and people's accessibility in recent decades (Micocha et.al., 2008). Several studies on the quality of public bus services have been undertaken, but none have taken gender into account (Eboli and Mazzulla 2007; Peters, D. 2001; Margareta et al 2001; Wallin Andreassen, T. 1995; Markus & Margareta, 2008).

In Bangladesh, very few studies on bus service quality have taken into account the safety and security concerns of female commuters. The majority of the researchers looked at the quality of public bus service and passenger satisfaction from the perspective of all passengers as well as the main study region in Dhaka. However, the industrial and commercial cities, where large numbers of women, commute for employment, household, business, and other reasons, have yet to be considered. For the past two decades, policymakers and transportation planners have focused on gender issues in the public transportation sector, recognizing the differences in women's and men's travel and activity patterns around the world (Bola & Ibrahim, 2013; Peters, 2001). Women commuters must relocate to gain access to services and job possibilities (Pojani & Stead, 2015). As a result, it is considered critical to pay special attention to women commuters' satisfaction.

Improvement of the urban public transportation system (Goal 11) in the SDGs mentions urban public transportation system improvement in general for males and females. We need to focus on a gendered perspective. Because access to safe mobility directly relates to the fulfillment of the 2030 agenda for SDGs. Sustainable Development Goal (Goal 5) achieve gender equality and empower all women and girls, and both promote removing mobility constraints, ensuring a safe and reliable transport system for women to ensure their mobility rights. Thus, urban development must view and consider women's diverse needs as end-users of public transportation in Bangladesh.

This research aims to explore the variables that affect women commuters' satisfaction with the prevailing service quality of buses, and to determine the problems faced by women commuters while traveling by bus and the possible solutions to these problems. For the analysis, the Structural Equation Model (SEM) was used. SEM is a multivariate analysis technique that allows for the modeling of a situation in which latent and observable variables form a series of correlations. Multiple regression and factor analysis are combined in SEM. A more sophisticated analytical method, such as SEM, is now being used in services marketing research (Hooper & Mullen, 2008). It is not uncommon to use SEM to determine the fit-indices of a given model (Hooper & Mullen, 2008). Considering the intricacy of the phenomenon, the produced model can be deemed satisfactory, despite the literature's recommendations for creating an appropriate model.

The rest of this research work is divided into the following sections: The past research on SQ assessment of public transportation and bus service is discussed in Section 3.2. Section 3.4 discusses the sampling method and data collection, as well as the respondents' descriptive statistics, preliminary statistics, and recommended empirical models. The study's findings and discussions are presented in Section 3.4. Sections 3.5 and 3.6 summarize the findings and draw some inferences.

3.2 Literature Review

The majority of Bangladeshi women are involved in social, cultural, economic, and political activities, and they rely on public transportation to meet their everyday needs. Even though both men and women contribute to the country's economic success, female commuters face a significant disparity in the provision of efficient, safe transportation. The number of female

commuters has been rapidly increasing in recent years for reasons such as education, employment, and business, women especially low-income women, are more reliant on public transport than men (Peters, 1999) and produce a huge number of trips a day. Women, on average, have a stronger effect than men. So there have been different transportation patterns between men and women, (McGukin & Nakamoto, 2004) on gender issues and transportation in both the developed and developing worlds, which suggests that men and women use transportation in different ways.

In Bangladesh, the public bus is one of the most popular transport services. Although various research (Hoque, 2000; Karim & Mannan, 2008; Rahman, 2010) alleged that current bus services are inefficient, unproductive, and unsafe because of long wait times, delays in plying, longboarding times, overloading, discomfort, and a long walking distance from home/work to bus stops, among other things. Passengers are dissatisfied for three reasons, according to earlier research: unsafe driving, inappropriate boarding and alighting, and a lack of law enforcement surveillance (Rahman & Chowdhury, 2015). It is also worth mentioning (Rahman, 2012) that passengers waiting to board the bus have been waiting for an indeterminate period with no indication of when the bus would come.

In a study of female students in Lucknow, India, (Kartikeya et.al., 2017) discovered that sexual harassment occurs primarily on public buses. A comparable study of New York City students looked at the entire trip chain of a journey, including walk access to and from the subway station, and discovered that those female college students are vulnerable to sexual exploitation at all stages of their subway commute to and from campus (Natarajan et.al., 2017). The fact that women are subjected to sexual harassment when walking or on public transportation underscores the security needs of female passengers on public transportation (Anand & Tiwari, 2006; Smith, 2008).

The SEM approach has been widely employed in a variety of study fields, and it is now being used more frequently in the subject of evaluating mass transit efficiency. The proposed SEMs introduced several latent variables like tangible responsiveness, empathy, assurance, food, timeliness, safety, and information (Seedat et.al., 2006). The findings show that only tangible factors have a substantial impact on passenger happiness (Rahman, 2021).

SEM has some major advantages over traditional multivariate techniques. SEM models estimate the parameters of measurement error variance for both dependent and independent variables

(Micocha et.al., 2008). Hence, the measurement error can be lowered. Furthermore, SEM allows the estimation of latent unobserved variables from observed variables; thus, the formation of composites envisages measurement error. Besides, fully developed models can be tested against the data using SEM as a conceptual or theoretical structure, or the model can be assessed for sample data fit.

From the literature review, it can be identified that in most situations, SQ used data from developed countries to investigate consumers' opinions on public buses; on the other hand, a lot of dissimilarities are observed, like, indeed, expectations, personalities, perception, and needs between developing and developed countries. Women commuters face more difficulties in Bangladesh while traveling in public buses. Furthermore, very limited research has been conducted to address the authors' concern about women commuters' satisfaction with the quality of public bus service. This study is an endeavor to focus on the female commuters' satisfaction with bus service quality and determine their major problems and possible solutions.

3.3 Research Methodology

3.3.1 Sampling technique and data collections

A comprehensive questionnaire survey was conducted with female commuters on public buses in major cities (Dhaka, Narayanganj, and Gazipur) in Bangladesh. The survey was conducted during working days and holidays in June and July 2021, when users (women) of public bus services commute to different destinations. A total of 24 service attributes were asked of the respondents regarding their socio-economic characteristics and overall satisfaction level with the current condition of public bus service. To better understand the users, both qualitative and numerical scales have been used in the questionnaire. To evaluate the women commuters' satisfaction with bus service, passengers were requested to rate their experience on a cardinal scale of five points varying between1 to 5 (1 is for "excellent" and 5 is for "very poor"). A similar classification was also considered by (Rahman et.al., 2016; Quddus et.al., 2019).

A total of 800 samples were collected by interviewing the candidates face-to-face. After data screening, 766 were finally selected. A convenience sampling technique was implemented for the survey. Lei & Qu in 2007, mentioned that the sample size should be above 200. The model complexity and parameter distribution features determine the needed sample size. Three models were developed to explore the associations of public bus service quality with different service

variables. A two-tailed t-test with a critical value of 1.96 for a 95% confidence interval was considered as the boundary value to examine the model significance.

3.3.2 Descriptive statistics of the respondents

The sample size is defined by the total number of female commuters. About 68.71% of the respondents' age limits are between 21 and 30 years, while 21.57% and 9.45% of the respondents' age limits are between 11 to 20 and 31 to 40 years, respectively. About 62.05% of the respondents are household workers, while 34.35% are students and 3.33% are businessmen. 60.45% of the respondents' monthly income range is 10,000 BDT to 20,000 BDT, while 21.04% of their monthly income range is less than 10,000 BDT. The majority (97.87%) of the respondents use local buses on a daily basis as their main mode of travel. Table 3.1 shows the general characteristics of the respondents.

Table 3.1 Descriptive statistics of the respondents

Features	Statistics
Age	11 – 20 years old (21.57%)
	21 – 30 years old (68.71%)
	31 – 40 years old (9.45%)
	41 – 50 years old (0.27%)
Occupation	Service holder (62.05%)
	Students (34.35%)
	Businessman (3.33)
	Others (0.27%)
Monthly salary range features	<10,000 (BDT) (21.04%)
	10,000-20,000 (BDT) (60.45%)

	20,000-30,000(BDT) (13.45%)
	30,000-40,000 (BDT) (3.46%
Educational qualification	Below SSC (6.52%)
	SSC (11.45%)
	HSC (10.25%)
	Graduate (68.71%)
	Post Graduate (3.06%)

3.3.3 Preliminary Statistics

A cardinal scale of 1 to 5 was used to assess the respondents' level of importance and satisfaction with public bus service quality. Preliminary statistics of the public bus service quality demonstrate a mean range from 3.21 to 4.51 and standard deviations from 0.535 to 0.841. The lowest mean value of travel time in holidays is 3.21 and the highest mean value of travel time on an office day is 4.51.

3.3.4 Structural Equation Models

Twenty-four question attributes are used in this study, which are presented in Table 3.2 with mean, standard deviation, and scaling. To find the attributes which are influencing the female commuter's satisfaction and the best fit, SEM was chosen by trial and compared with the standard best range. This study recommended developing models with various structures and observing the fitness to determine the optimal model.

Table 3.2 Summary of the statistics of the observed variables

Item No.	Variables	Mean	Standard	Numerical	Qualitative

			deviation	Scale	Scale
1	Overall Physical Condition of the bus.	4.26	0.535	1-5	Excellent to very poor
2	Condition of reserved seats for women commuters.	4.13	0.719	1-5	Excellent to very poor
3	The comfort level for women commuters inside the bus.	4.19	0.646	1-5	Excellent to very poor
4	Frequency of bus service	4.18	0.585	1-5	Excellent to very poor
5	Punctuality of bus service	4.25	0.570	1-5	Excellent to very poor
6	The convenience of bus service	4.14	0.589	1-5	Excellent to very poor
7	Convenient ticketing system to women commuters.	4.05	0.660	1-5	Excellent to very poor
8	Reasonable transport cost for women commuters.	3.78	0.841	1-5	Excellent to very poor
9	Safety at Bus stands for women commuters.	4.14	0.719	1-5	Excellent to very poor
10	Security of women passengers (off-peak periods)	4.24	0.699	1-5	Excellent to very poor

11	Levels of women commuters' personal safety.	4.17	0.688	1-5	Excellent to very poor
12	Driving safety (drivers' skill)	4.17	0.630	1-5	Excellent to very poor
13	Convenient boarding and alighting facilities for women commuters.	4.05	0.551	1-5	Excellent to very poor
14	Punishment for women commuters' harassment.	3.89	0.763	1-5	Excellent to very poor
15	Behavior of drivers	4.10	0.585	1-5	Excellent to very poor
16	Courtesy of helpers/contactors	4.17	0.588	1-5	Excellent to very poor
17	The behavior of ticket counter's staffs	3.78	0.689	1-5	Excellent to very poor
18	Reliability of Bus services	4.06	0.574	1-5	Excellent to very poor
19	Accessibility of Bus	4.08	0.575	1-5	Excellent to very poor
20	Travel time (office days)	4.51	0.669	1-5	Excellent to very poor
21	Travel time (holidays)	3.21	0.834	1-5	Excellent to very poor
22	Accessibility of Bus stand	4.01	0.551	1-5	Excellent to very poor

23	Availability of information	4.08	0.573	1-5	Excellent to very poor
24	Do you think women commuters are satisfied with the prevailing overall bus services?	4.07	0.643	1-5	Excellent to very poor

Development of Model-1 (M_1):

The postulate of Model-1 is that the female commuter's satisfaction (C) prevailing in the public bus service quality has three latent: overall service quality, the behavior of personal, reliability, and accessibility. These latent are predicted by individual attributes of bus service, such as "Overall Physical Condition of the Bus," "Condition of reserved seats for women commuters," "The comfort level for women commuters inside the bus," "Frequency of bus service," "Punctuality of bus service," "The convenience of bus service," "Convenient ticketing system for women commuters," "Reasonable transport cost for women commuters," "Courtesy of helpers/contactors," "Behavior of ticket counter staff," "Reliability of bus services," "Accessibility of bus," "Travel time (office days)," "Travel time (holidays)," "Accessibility of bus stand," and "Availability of information," respectively. The constructed structural equation model (M_1) is shown in Figure 3.1.

Development of Model-2 (M_2):

Model-2 hypothesizes that female commuter satisfaction (C) is comprised of four latent variables: overall service quality, personal behavior, reliability and accessibility, and female commuters' safety and security. These latent are predicted by individual attributes of bus service, such as "Overall Physical Condition of the Bus," "Condition of reserved seats for women commuters," "The comfort level for women commuters inside the bus," "Frequency of bus service," "Punctuality of bus service," "The convenience of bus service," "Convenient ticketing system for

women commuters," "Reasonable transport cost for women commuters," "Behavior of drivers," "Courtesy of helpers/contactors," "The behavior of ticket counter's staff," "Reliability of bus services," "Accessibility of buses," "Travel time (office days)," "Travel time (holidays)," "Accessibility of bus stands," "Availability of information," "Safety of women commuters," "Driving safety (drivers' skill)," "Convenient boarding and alighting facilities for women commuters," "Punishment for women commuters' harassment" respectively. The conceptual structural model (M_2) is shown in Figure 3.2.

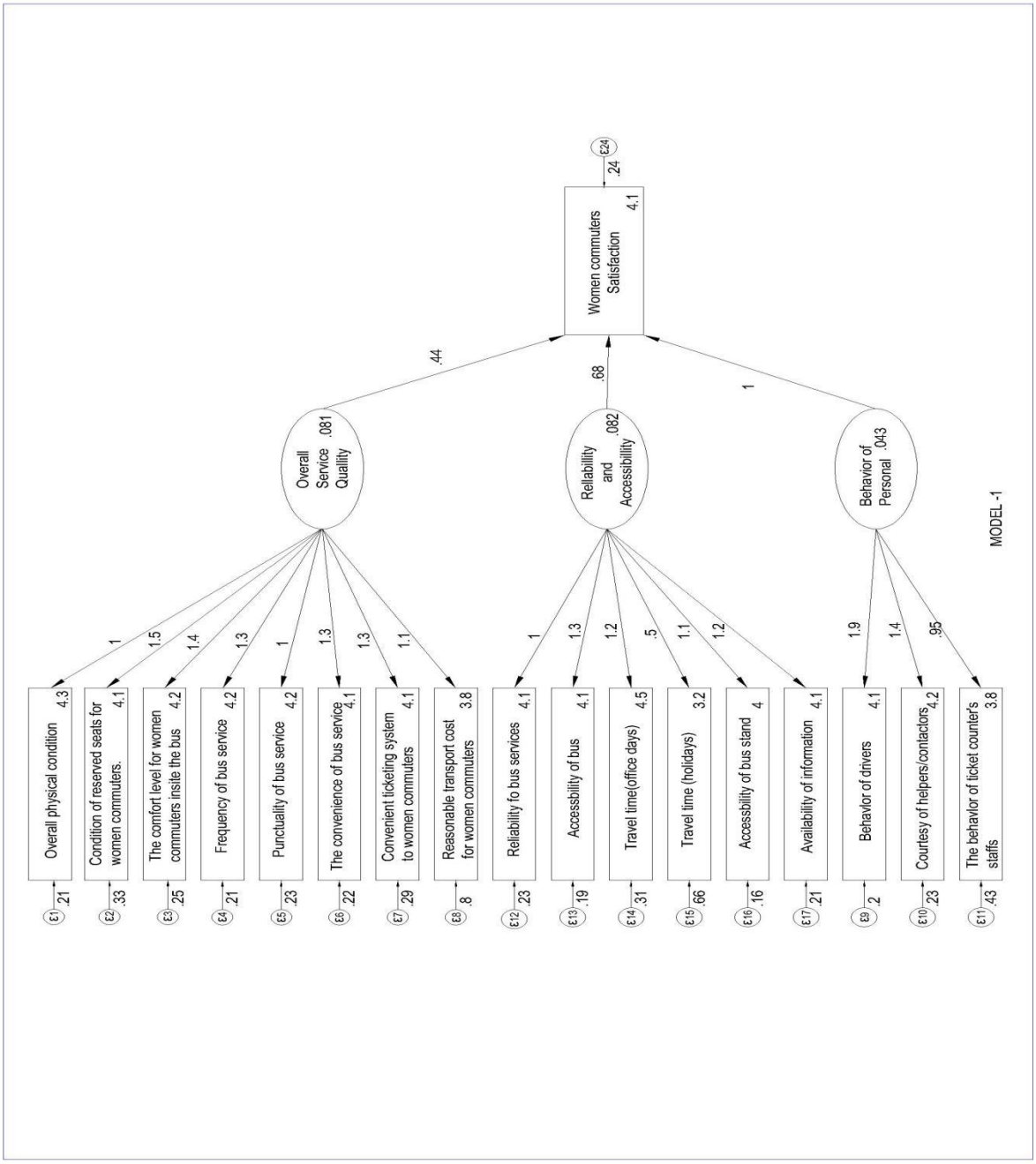

Figure 3. 1 Schematic diagram of SEM (Model-1)

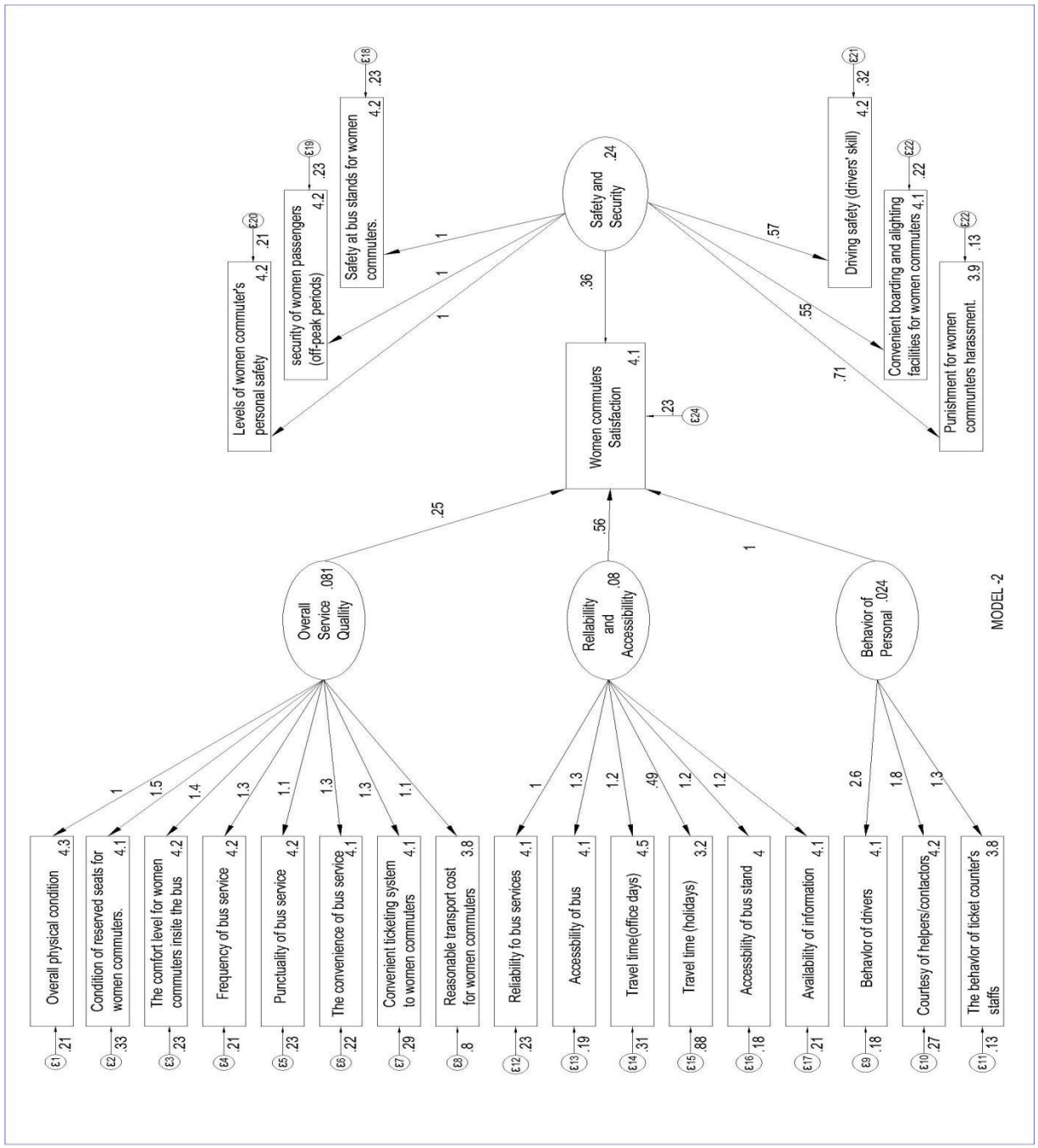

Figure 3. 2 Schematic diagram of SEM (Model-2)

Development of Model-3 (M_3):

Model-3 hypothesizes that the female commuters' satisfaction (C) has two main components: overall service quality and safety and security of female commuters. They also have two latent components (behavior of personal, reliability, and accessibility), which are correlated with the latent overall service quality. These latent are predicted by individual attributes of bus service, such as "Overall Physical Condition of the Bus," "Condition of reserved seats for women commuters," "The comfort level for women commuters inside the bus," "Frequency of bus service," "Punctuality of bus service," "The convenience of bus service," "Convenient ticketing system for women commuters," "Reasonable transport cost for women commuters," "Behavior of drivers," "Courtesy of helpers/contactors," "The behavior of ticket counter's staff," "Reliability of bus services," "Accessibility of buses," "Travel time (office days)," "Travel time (holidays)," "Accessibility of bus stands," "Availability of information," "Safety of women commuters," "Driving safety (drivers' skill)," "Convenient boarding and alighting facilities for women commuters" and "Punishment for women commuters' harassment" respectively. The optimal best-fit structural equation model (M_3) for this research is shown in Figure 3.3

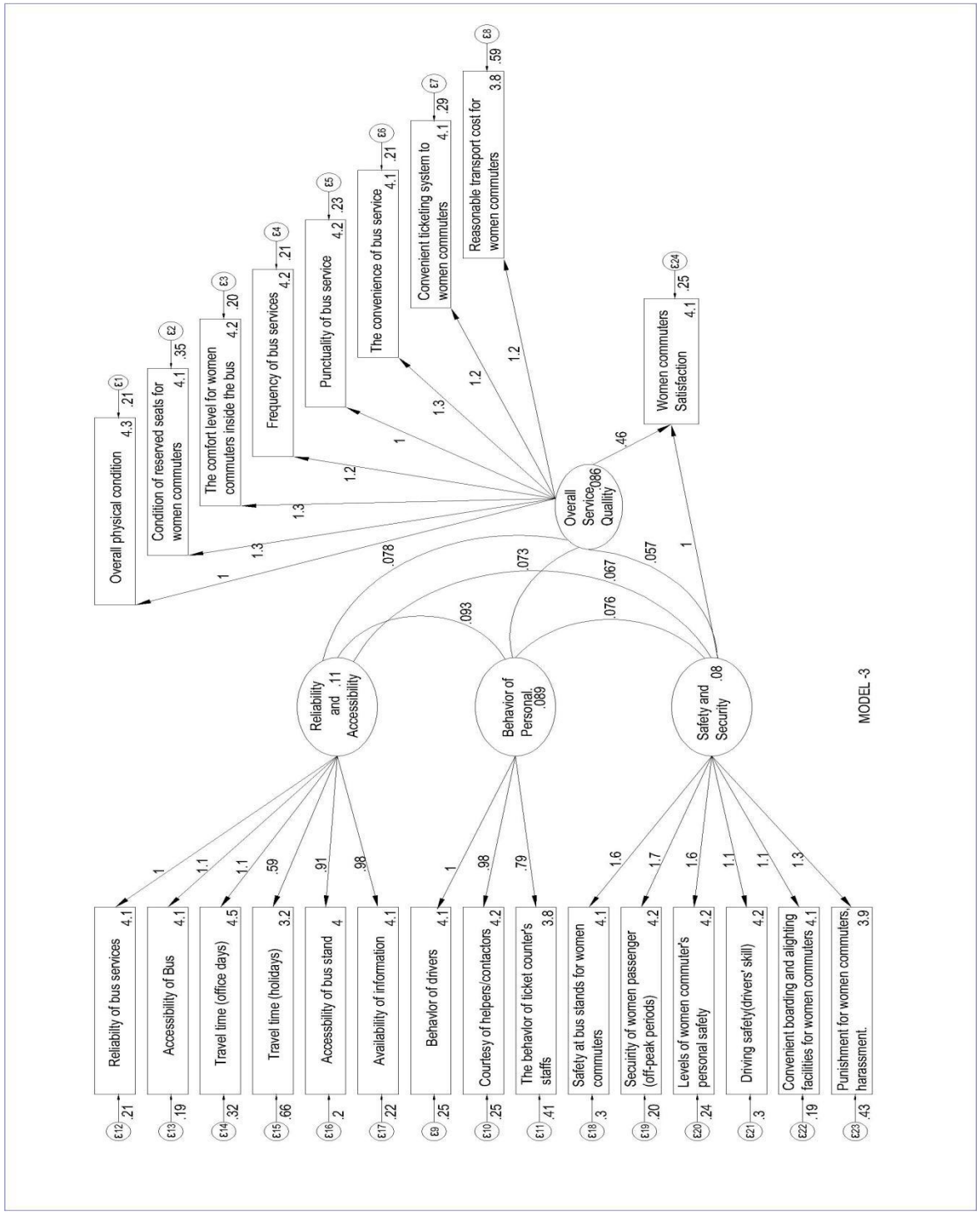

Figure 3. 3 Schematic diagram of SEM (Model-3)

3.4 Empirical Analysis and Result

The accuracy of the measuring technique is referred to as reliability. Though there are a variety of dependability factors, Cronbach Alpha is one of the most frequently utilized. It is a method of determining internal consistency. The degree to which a collection of objects is linked together. Cronbach Alpha for this study is 0.86, which is higher than (Byrne, 2010) the acceptable limit of 0.6 and also falls in the category of good (α=0.80 ~ 0.89) internal consistency. As a result, the internal consistency of the variables employed in this study is exceptional. This study used SEM methodology to examine the satisfaction of women commuters with the quality of public bus service. As Hayduk in 1987 suggested, the authors tested and compared three alternative SEM models to estimate the plausibility of best-fitted one. These models explored the associations of general service quality attributes with different variables. The parameter estimates of the variables used to create the models are shown in Table 3.3. To evaluate the produced models and to choose the best one, various indices evaluating model fitness are used. The fit indices of the three created models are listed in Table 3.4, including the Root Mean Squared Error of Approximation (RMSEA), Standardized Root Mean Square Residual (SRMR), Comparative Fit Index (CFI), Tucker-Lewis index (TLI), and Akaike's Information Criterion (AIC).

As shown in Table 3.3, M_1 is a three-factor model and had "Behavior of the Personnel" as the major contributor (b = 1, p<0.01) in "Women Commuters' Satisfaction" with the bus service, based on the factor loadings. The next significant contributor (b = 0.68, p<0.01) that positively drives the "Women Commuters' Satisfaction" has been "Reliability and Accessibility," whereas "Overall Service Quality" statistically has been the lowest contributor (b = 0.44, p<0.01). M1 somehow showed a poor fit on the data (CFI = 0.661, TLI = 0.610, RMSEA = 0.104, SRMR = 0.182, AIC = 22545.152). Therefore, re-specification of the model was inevitable (Hair et.al., 2019).

M_2 has been a four-factor model with the addition of the "Safety and Security" di-mension of the "Women Commuters' Satisfaction" (Figure 3.2, Table 3.3 & Table 3.4). "Personnel Behavior" (b = 1, p<0.01) and "Reliability and Accessibility" (b =.56, p<0.01) contributed in the same order as M_1. Based on the factor loadings, the newly added factor, i.e., "Safety and Security" (b =.36, p<0.01), was contributing more than "Overall Service Quality" (b =.25, p =.012) as compared

with M_1. With respect to model fitness, M_2 showed some improvement (CFI = 0.624, TLI = 0.583, RMSEA = 0.100, SRMR = 0.204, AIC = 30023.457), but still this improvement has not been sufficient. Therefore, testing of another alternative SEM model was necessary.

M_3 had the same factors as M_2, but the authors re-specified it by changing the rela-tionships among the contributing factors. Since "Behavior of the Personnel" and "Reliability and Accessibility" has been contributing significantly and consistently, the authors checked which of the other two variables contributes more. According to Figure 3.3, Table 3.3 & Table 3.4, "Safety and Security" (b = 1, p<0.01) contributed more than "Overall Service Quality" (b =.46, p =.001). Additionally, M_3 showed good improvement with respect to fitness of data with the model (CFI = 0.816, TLI = 0.793, RMSEA = 0.071, SRMR = 0.061, AIC = 29116.523). So, it was implied that M_3 is the best among the alternative SEM models.

Table 3.3 Estimated model results of female commuters

Item No.	Description	M-1		M-2		M-3	
		Estimated Parameter	p-value	Estimated parameter	p-value	Estimated parameter	p-value
1	Overall Physical Condition of bus	1[a]	0.00	1[a]	0.00	1[a]	0.00
2	Condition of reserved seats for women commuters	1.5[a]	0.00	1.5[a]	0.00	1.3[a]	0.00
3	Comfort level for women commuters inside the bus	1.4[a]	0.00	1.4[a]	0.00	1.3[a]	0.00
4	Frequency of bus service	1.3[a]	0.00	1.3[a]	0.00	1.2[a]	0.00
5	Punctuality of bus service	1[a]	0.00	1.1[a]	0.00	1[a]	0.00

6	Convenience of bus service	1.3[a]	0.00	1.3[a]	0.00	1.3[a]	0.00
7	Convenient ticketing system to women commuters	1.3[a]	0.00	1.3[a]	0.00	1.2[a]	0.00
8	Reasonable transport cost for women commuters	1.1[a]	0.00	1.3[a]	0.00	1.1[a]	0.00
9	Safety at Bus stands for women commuters	N/A	… … … …	1[d]	0.00	1.6[d]	0.00
10	Security of women passengers (off peak periods)	N/A	… … … …	1[d]	0.00	1.7[d]	0.00
11	Levels of women commuter' personal safety	N/A	… … … …	1[d]	0.00	1.6[d]	0.00
12	Driving safety (driver's skill)	N/A	… … … …	0.6[d]	0.00	1.1[d]	0.00
13	Convenient boarding and alighting facilities for women commuters.	N/A	… … … …	0.5[d]	0.00	1.1[d]	0.00
14	Punishment for women commuters' harassment	N/A	… … … …	0.7[d]	0.00	1.3[d]	0.00
15	Behavior of drivers	1.9[b]	0.00	2.6[b]	0.001	1[b]	0.00
16	Courtesy of helpers/contractors	1.4[b]	0.00	1.8[b]	0.00	0.98[b]	0.00

17	The behavior of ticket counter's staffs	0.95[b]	0.00	1.3[b]	0.001	0.79[b]	0.00
18	Reliability of Bus services	1[c]	0.00	1[c]	0.00	1[c]	0.00
19	Accessibility of Bus	1.3[c]	0.00	1.3[c]	0.00	1.1[c]	0.00
20	Travel time (office days)	1.2[c]	0.00	1.2[c]	0.00	1[c]	0.00
21	Travel time (holidays)	0.5[c]	0.00	0.5[c]	0.00	0.59[c]	0.00
22	Accessibility of Bus stand	1.1[c]	0.00	1.2[c]	0.00	0.91[c]	0.00
23	Availability of Bus stand	1.2[c]	0.00	1.2[c]	0.00	0.98[c]	0.00
24	Do you think women commuters are satisfied with the prevailing overall bus services?	0.43[s]	0.00	0.25[s]	0.012	0.46[s]	0.001
		1[s]		1[s]	0.00	1[s]	0
		0.68[s]		0.56[s]	0.00		
				0.35[s]	0.00		
25	Overall service quality	0.43[Lt]	0.00	0.25[Lt]	0.012	0.45[Lt]	0.001
26	Behavior of personal	1[Lt]	0.00	1[Lt]	0.00	N/A	… … …
27	Reliability and accessibility	0.68[Lt]	0.00	0.56[Lt]	0.00	N/A	… … ….

a= influences' Overall Service Quality', b= influences 'Behavior of personal' c= influences 'Reliability and Accessibility', d= influences 'Safety and security, s= indicates 'Endogenous Variables, t= indicates 'Exogenous Variables, Lt= influences 'Women commuters satisfaction

Table 3.4 Model fitness

Fit statistic	**M-1**	**M-2**	**M-3**	**Good fit**

Standardized Root Mean Squared Residual (SRMR)	0.182	0.204	0.061	<0.1
Root Mean Squared Error of Approximation (RMSEA)	0.104	0.100	0.071	<0.1
Tucker-Lewis Index (TLI)	0.610	0.583	0.793	Close to 1.00
Comparative Fit Index (CFI)	0.661	0.624	0.816	Closer to 1.0
Akaike's information criterion (AIC)	22545.152	30023.457	29116.523	N/A

Result of women commuters problems faced while traveling on bus:

Identifying the major problems faced by female commuters while traveling on public buses in Bangladesh, a survey was conducted with a predesigned questionnaire, where 766 women respondents participated. Table 3.5 and Table 3.6 show the summary of problems and the types of harassment faced by female commuters while travelling by public bus in Bangladesh. The responses reveal that 99.74% of female commuters are facing harassment while traveling on public buses, and the types of harassment are sexual, verbal, physical, humiliating, and pickpocketing. Among these types of harassment, 6.41% of women commuters are sexually harassed, and the ratios of verbal, physical, humbling, and pickpocketing are respectively 2.75%, 4.06%, 4.45%, and 2.75%. Furthermore, nearly 22.25% of female bus passengers reported being both physically and sexually harassed. 54.84% of female commuters are facing harassment above all categories (sexual, verbal, physical, humiliation, pickpocket) at different times on public buses. On public buses, female commuters are facing overcrowding and insufficient reserved seats. According to the survey results, 99.61% of women commuters have faced the problem. The boarding and alighting facilities are very poor in Bangladesh for public buses, especially for female commuters. The problem that is widely (almost 100%) faced by women commuters is poor and insecure boarding and alighting facilities. The infrastructure of the local buses in Bangladesh is poor and quite unsafe for female passengers. There is no maintenance of

rules and regulations while boarding and alighting from the bus, and thus female passengers become the worst victims of this poor maintenance. The safety condition of traveling in a public bus at the bus stand for women commuters is very poor. According to this survey, 99.74% of respondents' responses about the condition of the safety of bus stops are poor. Most of the city's people are service holders, and they travel to and from their offices, but it's a major issue to arrive at their destination on time using the public bus. The waiting time at the bus stand is too long. 99.48% of commuters expressed their long wait for the bus at the bus stand. In Bangladesh, women's safety and security are the most important issues while traveling by bus, and it is also a vital issue in the off-peak period. The survey data said that 100% of women commuters are facing insecurity in the off-peak period. The authorities of local buses are profit-oriented and don't bother about the comfort and safety of the passengers. They take passengers into the bus restlessly, and thus the overcrowding inside the bus. As a result, it is difficult to move inside the bus, and sometimes there is a lack of space to move. As shown in Table 3.5, 99.21% of commuters expressed that they struggled a lot due to the lack of space to move inside the bus. Usually, most of the buses are dirty and untidy in Bangladesh, so the passengers face the problem of dirtiness. This study finds that 99.61% of female commuters feel dirty and untidy inside the buses. The fitness of the bus is the most important issue, where the fan and lighting facilities are part and parcel of the physical condition of buses. 99.35% of passengers agreed that there is a lack of lighting and fan facilities on buses. When traveling on a bus, the driver's behavior and driving quality are most important because passengers' safety depends on the driver's driving quality. But most of the drivers drive in an aggressive mood and violate the traffic rules. About 99.48% of women commuters revealed that they have faced the bad and unfriendly behavior of bus drivers and contactors. The survey reports show that women commuters are day-to-day sufferers of these types of problems and harassment, and there is no means of safety and comfort for them on the local bus in Bangladesh.

Table 3.5 Summary of problems faced by female commuters

Type of problem	"Yes"- Faced (%)	"No"- Not Faced (%)
Harassment	99.74	0.26
Overcrowding and inadequate seats	99.61	0.39

Poor and insecure boarding and alighting facilities	100	0
Safety issues at bus stand	99.74	0.26
Long waiting at bus stand	99.48	0.52
Security issues during off-peak hour	100	0
Difficulties of movement inside bus	99.21	0.79
Dirty and untidy environment inside bus	99.61	0.39
Lack of fan and lighting facilities	99.35	0.65
Aggressive driving and violation of traffic rules	99.48	0.52

Table 3.6 Type of harassment faced by female commuters

Type of harassment	Percentage (%)
Sexual	6.41
Verbal	2.75
Physical	4.06
Humiliation	4.45
Pick Pocketing	2.75
Sexual and Physical	22.25
All of the above	54.84

The opinions of a number of female passengers were sought to resolve the major problem faced by female commuters while traveling by public bus in Bangladesh. Among them, 78% of women commuters suggested that "Several campaigns should be run against all types of harassment towards women commuters", "Complaint boxes or a hot-line should be introduced for reporting and recording events of harassment", "Number of buses should be increased to solve the overcrowding problem", "Installing CCTV cameras inside the bus and stoppages to ensure women commuters' personal safety", "Proper actions should be taken to keep the environment

neat and clean inside the bus", "Bus drivers and conductors should be trained properly on how to deal with women commuters in a civilized society," and "The concerned authorities should strictly monitor the proper execution of traffic laws" will be the possible solution. And also, 15.55% of women commuters suggested the above issues except that 'About 25% of seats should be reserved for women commuters considering the total bus commuters' to investigate further why they think such.

3.5 Conclusions

This study aimed to analyze women commuters' satisfaction with the public bus service in Bangladesh. Women have a direct contribution to the development of any economy. Public transport indirectly helps women workers to efficiently sustain their contributions by facilitating their commute to and from the workplace, especially in a growing economy like Bangladesh. So, virtually, there is an indirect link between the satisfied commute and the performance of women workers. Anyhow, our study has been an attempt and focused on figuring out the factors contributing to the satisfaction of female bus commuters in Bangladesh. The authors therefore analyzed three alternative SEM models by specifying different combinations of "Behavior of the Personnel", "Reliability and Accessibility", "Safety and Security", and "Overall Service Quality", and the results showed that M_3 (with CFI = 0.816, TLI = 0.793, RMSEA = 0.071, SRMR = 0.061, and AIC = 29116.523) was best suited for the research model. In general, the data showed that "behavior of the personnel" and "reliability and accessibility" are the most important factors in elevating the satisfaction levels of female commuters. Specifically, there have been some serious issues faced by women commuters too, which are discussed in the following parts along with recommendations and future possibilities of research focusing on the dynamics of women's commute.

Although more women have been joining the workforce in Bangladesh and their first choice is the public buses, the travel experiences have mostly remained unsatisfactory for them. Because of some issues like security of female passengers in off-peak periods, female commuters feel insecure from pickpockets, physical or sexual harassment, etc., and there is a lack of personal safety at the bus stand for female commuters. When waiting for the bus at the bus stand, the waiting room for female commuters and washroom facilities are essential for them, but there are

no such facilities for their safety. The majority of the female commuters on the bus were sexually, physically, or verbally harassed by bus staff or other male passengers. The treatment of female commuters is highly unsatisfactory as there is no provision in law for instant punishment for harassment. If there were such strict laws and simultaneous penalties for harassment of women, their security risks would be reduced, and their satisfaction would be increased. Moreover, in the survey report, 99.5% to 100% of women commuters have experienced harassment and overcrowding; inadequate seats; poor and insecure "boarding and alighting facilities," "Poor safety conditions at bus stands," "Long waiting times," "Lack of security for women commuters during the off-peak period," "Difficulties of movement inside the buses," "Dirty and untidy environment inside the bus," "Lack of fan and lighting facilities," and "Aggressive driving and violation of traffic rules."

The main conclusions from this study should be addressed by public bus service operators when evaluating methods to improve public bus services for female passengers. This study's findings are based on users' perspectives, which represent their expectations and desires. Advanced modeling tools can, however, be used to study stimulating consequences for public transit operators and policymakers when applied to this type of data. The outcome may also be effective in improving collaboration between academics and administrators. More samples from other cities may be included in future studies to represent the entire country. More research into passenger satisfaction in terms of security and comfort is needed.

3.6 Recommendations

Experienced female commuters suggested some applications to help them deal with their problems while riding the bus, such as an instant campaign system to combat all forms of harassment directed at female commuters in the bus and bus stop so that they can get help right away, and a complaint box and hot-line in the bus to expect proper harassment action. Since very poor conditions remain inside the bus for female commuters, such as it's not easy to move, a lack of reserved seats for female commuters, etc., the level of comfort inside the bus is badly experienced. Long waiting times at the bus stand for a bus cause insecure and unsafe circumstances for female commuters. The frequency of bus service should be increased to reduce the waiting time at the bus stand. The ticketing system is beneficial for female commuters as

they take a ticket from the ticket counter take their fixed seat according to the seat number given, and then they no longer have to travel standing, leading to a lower chance of physical harassment. The skills of drivers are a vital issue when traveling on buses because sometimes an unskilled person drives the bus. Sometimes they unnecessarily compete with another bus as well as whimsically go for over-speeding, which is very unsafe for passengers. So, the drivers must have authentic licenses with regular monitoring of their performances, and awareness training sessions need to be arranged for them to improve the drivers' efficiencies.

To alleviate overcrowding, the number of buses should be increased, and a separate gate for female passengers should be installed. More buses decrease bus wait times while also improving bus station safety and security. When compared to the overall number of bus commuters, approximately 25% of seats should be dedicated to women. This will reduce physical harassment on the bus because women will not be forced to ride standing. Besides, installing CCTV cameras inside buses and at bus stops, with an authority monitoring the footage and alerting authorities to take action against harassment and security.

Further recommendations include: "Proper actions should be taken to keep the environment neat and clean inside the bus," "Bus drivers and conductors should be properly trained on how to deal with women commuters in a civilized society," and "The concerned authorities should strictly monitor the proper execution of traffic laws."

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Chapter 4

Exploring the Commuters' Willingness-to-Pay and its' influencing factors for an Improved Public Bus Service in Dhaka city

Abstract

Improved transportation services are a crucial component of urban growth, particularly in emerging cities like Dhaka. Ensuring an improved public bus service quality is a challenge for the city's transport planners and policy makers. Nevertheless, this challenge can't be met without the support of the residents of this city. This study intends to evaluate the commuters' willingness to pay (WTP) for an improved and better public bus service quality in Dhaka city. It also attempts to explore the factors affecting the commuters' WTP amounts. In order to accomplish the study's goals, a stated preference survey was designed to enquire into the whys and wherefores of female passengers' harassment on public buses and also to prefer some influential service quality features. WTP values of respondents were calibrated using binary and ordinal logistic models, and these models were developed using SPSS version 26. The results indicate that the majority of respondents were willing to pay more for better service facilities, and they point to security as the most important factor in determining how much extra fare commuters are willing to pay. The results also demonstrate that commuters' WTP amounts are highly influenced by the respondents' monthly income. Results from this study have important policy implications, such as protecting women's safety on public transportation and taking commuters' sociodemographic characteristics into account before enacting any legislation or increasing fares.

Keywords: WTP, public bus, harassment, improved service quality, security, sociodemographic features

4.1 Introduction

Public transportation, particularly the public bus service, maintains a significant role in developing the urban infrastructure of a country. For decades, the city's transport planners have been concerned with service quality measurement to acquire an overall scenario of consumer satisfaction on public transportation (Jenatabadi et al., 2016). When accurately measured, the service quality of public buses can provide operators and public administrators with a clear picture of the utility function or quality of the services they are providing to users. In general, passenger comfort and satisfaction are important factors in residents' traffic mode choices and can be used to estimate the quality of public transportation services (Dell'Olio et al., 2011; Eboli & Mazzula, 2010).

With a population of 22.3 million in the urban area and 10.9 million in the city, Dhaka, the capital of Bangladesh, is the fifth-most densely populated city (World Population, 2022) and the fourth least livable city in the world ("Global Livability Index 2021 Report | Economist Intelligence Unit," 2021). Indeed, the present poor structure and service quality level of the public buses in this city are exacerbating its already dire condition. Dhaka city has approximately 2500 buses for public transportation, despite a current demand of over 5,000 (Niger, 2013). Overcrowding, lack of comfort and security, unsafe driving practices, poor and dangerous boarding and alighting facilities, irregular service frequency, lack of cleanliness and law enforcement agency are all hallmarks of public bus service in Dhaka (Rahman et al., 2017; Hadiuzzman et al., 2017).

Furthermore, the increasing incidence of female harassment and unsafe issues on public buses and stops are also affecting the service quality and women's emancipation. According to the previous studies focused on the problems faced by female commuters, women are identified as the worst sufferers of the current public bus service quality (Sultana et al., 2019). This results in people's indifferent attitude towards public bus service and an increase of private vehicles on the road. According to Bangladesh Road Transport Authority (BRTA), there are 17.8 lakh registered motor vehicles in Dhaka city and in last 10 years the ratio of registered motorcycles in the metropolitan area rose by 264% ("Which Vehicle dominates Dhaka city?", 2022). A city with a well-functioning transportation system requires 25% of its land for road transportation, whereas

Dhaka uses only 8% of its land for road transportation, with two-thirds of those roads having non-engineered surfaces (Andaleeb et al., 2007). The increasing number of private vehicles on these unstructured and unplanned roads not only makes the city's traffic system more fragile but also pollutes the environment at a large scale.

However, according to the World Economic Forum as cited in Palak (2019), Bangladesh has one of the world's fastest-growing economies, with a GDP growth rate of nearly 8%. In Bangladesh, Women' participation in the labor force in economic undertakings is increasing day by day. In the social, commercial, educational, and administrative sectors, the majority of women have a considerable presence (Phun & Yai, 2016). To keep the development ongoing, the government of Bangladesh, as well as intellectuals from the country and abroad, is proposing a variety of strategies to alleviate commuters' suffering on public buses and decrease the private vehicles from the road. However, meeting advanced service quality standards is impossible without increasing public bus fares and costs or relying on government subsidies (Jenatabadi et al., 2016). And, meeting the commuters' satisfaction level through offering a better service quality is the only way by which the public bus service providers or the government can enhance the commuters' willingness to pay (WTP).

The present study attempts to estimate the commuter's willingness-to-pay for improving the service quality level of public bus in Dhaka city. Another aim of this study is to find out the most influencing service quality features for which the commuters are willingness to pay. This study will go a step further by discovering the factors that has an influence on the commuters' WTP.

The rest of the paper is organized as follows. In section 4.2, a literature review specifying the major concerns of this paper, i.e., "public bus service quality level in Dhaka city", "willingness to pay for measuring services", and "stated preference with direct survey as the tool to estimate WTP" is highlighted. Section 4.3 discusses the methodology of research, including the questionnaire design and data analysis plan. Section 4.4 is about the data analysis of the study. Section 4.5 highlighted the results and discussion of the findings. Section 4.6 summarizes the major findings and proposed recommendations.

4.2 Literature Review

4.2.1 Public Bus Service Quality in Dhaka city

The transportation system of Dhaka Metropolitan City (DMC) is predominantly road based and covers a total area of about 1530 square kilometers (Ahmed et al., 2008, as cited in Ahmed et al., 2014). Every day, approximately 1.9 million passengers travel by bus (Mahmud, 2008), yet the operators and government fail to offer an average service to the commuters. Many researchers investigated the quality of service provided by public buses in Dhaka city, and unfortunately, all of them discovered that the public bus service in Dhaka city is tragic and inconvenient to use. Due to long waiting times, delays on plying, long boarding times, overloading, discomfort, and a long walking distance from the residence or workplace to bus stoppages, current bus services are inefficient, unproductive, and unsafe (Haque, 2000; Karim & Mannan, 2008; Rahman 2010). Apart from all, a female commuter has to face some specific gender-based harassment on public transport. Groping, stalking, Eve-teasing, intentional physical touch by the fellow male passengers and conductor, and other verbal or gestural abuse are some forms of gender-based harassment that a woman faces on a daily basis (King et al., 2021). However, the public bus service quality in Dhaka city is predominantly low due to the lack of proper Crime Prevention through Environmental Design (CPTED) facilities, lack of safety, shortage of buses, overcrowding, misbehavior of the bus drivers and conductors, lack of cleanliness, etc.

4.2.2 Willingness to Pay for Estimating Service Quality

Willingness to pay (WTP) refers to the maximum amount of money a customer or consumer is willing to spend for a product or services (Hensher & Rose, 2005). In general, it is a person's desire and ability to pay for something in order to protect, improve, or form (Nyamaliza, 2020). If measured accurately, WTP can become a crucial factor for finding or deciding the ideal price or value to sell a product or services to the consumer. WTP was previously widely used by environmental economists to value non-traded and non-property-rights goods such as air, forests, water, and wildlife populations (Tietenberg & Lewis, 2008). At present, with the increasing population and number of consumers, WTP is used by researchers from a variety of fields or majors for the purposes of policy planning (Kamaludin et al., 2015). In order to standardize the

country's transportation infrastructure, transportation engineers and policy makers from different areas have been exploring consumers' willingness to pay for different service attributes of transport. Kumar and Sinha (2021) decided to investigate commuters' WTP for improving the service quality of intermediate public transportation (IPT) modes by developing a Multinomial Logit Model (MNL) and collecting data through a stated preference survey. They discovered that IPT modes with high service quality, taking into account commuters' safety and comfort, are crucial for the commuters' willingness to pay. A Multiple Regression Model was developed by Nyamaliza (2020) to estimate the WTP for improved public transport in Dodoma City, Tanzania. The study explored various factors affecting commuters' willingness-to-pay for improved public transport, such as; travel distance in kilometers, travel time in minutes, monthly income, type of transport used, employment status, respondents' level of education, marital status, age, and gender. Several researchers have explored that household income, occupation, and price bid are statistically significant factors that influence commuters' WTP (Balcombe et al., 2009; Kamaludin et al., 2015; Sadhukhan et al., 2016). Chen et al. (2020) conducted a study in China, collecting data via a stated preference survey and analyzing the data using an ordered logistic model. The findings disclosed the effect of age on WTP and how, keeping those findings in mind, transport as well as the tourist industry can flourish. They found that the older respondents were 1.6–2.4 times more likely to spend an extra penny to reduce waiting time for transport than the younger respondents. By adopting the Contingent Valuation Method (CVM), Pujiati et al. (2019) provide a list of service attributes based on which the commuters are more willing to pay, and these are ticket service, rate suitability, conditions, speed and length of waiting for the bus, and the placement and conditions of good stops. Jenatabadi et al. (2006) came up with a new theoretical approach for measuring WTP accurately. A combination of Fuzzy Analytical Hierarchy Process (F-APH) and the Taguchi method were introduced to assess de-biased WTP and acquire a better understanding of the factors that stimulate the public transport users to be willing to pay for the fare.

4.2.3 Stated preference with direct survey as a tool to explore people' willingness to pay

When measured correctly, willingness-to-pay (WTP) can help an operator understand the utility function of his product or service or how much satisfaction this service can provide to the consumers. WTP can be measured by numerous ways. From time to time, various researchers

have established various frameworks of WTP measurement methods. Revealed preferences and stated preferences survey are two existing methods from the survey-based measurement technique. For this study, a stated preference with direct survey and customer survey methods has been chosen to assess the commuters' willingness-to-pay for the improvement of public transport service quality in Dhaka city.

A number of researchers (Antoniou, 2014; Eboli & Mazzulla, 2008; Khattak et al., 2001) use the stated-preference method (SP) to measure willingness-to-pay and justify the stated-preference method as an accurate model of WTP measurement. A stated preference method is basically a set of techniques that require a respondent's preference or liking for a particular aspect to measure its utility function (Andrejszki et al., 2015). The state reference survey has two categories, including direct surveys and indirect surveys. In the direct customer survey, consumers' preferences are the ultimate concern, i.e., how they value a service and what amount they will be willing to pay to consume better services are directly analyzed to assess WTP. It is stated in Hofstetter et al. (2021) that 76% of the surveyed firms use a direct approach due to its obvious advantages. A direct approach has three major advantages over any other measurement methods of WTP, and these are: it is simple and very easy to implement, especially in the case of data collection and analysis; it is also very budget-friendly and less time-consuming (Jedidi & Sharan, 2009).

4.3 Research Methodology

4.3.1 Stated preference questionnaire

A stated preference survey was conducted to estimate the commuters' willingness-to-pay for the improvement of the existing bus service quality in Dhaka city. The study was carried out in some major points of Dhaka city and got an overall of 400 effective respondents who use public bus as their main mode of transport. Keeping the objectives in mind, the stated preference questionnaire was divided into five sections and included a wide range of questions (socio-demographics, attitudinal, and WTP) in the form of ratings and multiple choices.

4.3.2 Sociodemographic questions

In the very first section, the respondents were asked to provide their sociodemographic information, including age, gender, educational qualification, profession, monthly income, and allocation for the monthly travel expenditure for bus. In many similar studies (Ha-Brookshire & Norum, 2011; Nyamaliza, 2020; Martinez-Espiniera & Lyssenko, 2012), the respondents' demographic information was asked to explore the relationship between the respondents' demographic features and WTP.

4.3.3 Attitudinal questions

To know the respondents' perceptions on bus service quality and preferences to see an improved service, this stated preference questionnaire include numerous ranges of attitudinal questions. In the second section, a set of questions were asked to the respondents in order to find out their perceptions (what, why, how, where, when) about women harassment in public bus in Dhaka city.

In addition, the respondents' preferred service quality level was asked in the third section. From the related and my previous two research, I came up with twelve most influential attributes of bus service quality, and these are (i) comfort level, (ii) safety and security level, (iii) travel cost, (iv) overcrowding, (v) women commuters' harassment, (vi) reserved seats for women commuters, (vii) board and alighting facilities, (viii) behavior of bus staff, (ix) cleanliness of bus, (x) ticketing system, (x) fitness of bus, (xi) frequency of bus service. The respondents were given a chance to reveal their preferred level of service of these twelve attributes into three level measures includes "same as now," "medium" and "high."

4.3.4 WTP measurement questions

In the next section, a total of eight questions were asked of the respondents in order to explore the most influential service quality features for which they are willing to pay. After considering the related literature and the authors' previous research, the author proposed eight elementary service quality features and asked the commuters whether or not they felt the necessity of these improved facilities on public buses. Table 4.1 shows the list of improved service quality features.

Table 4.1 Improved service facilities

Improved service facilities	Description
A separate door for male and female passengers.	If ‘Yes’= 1 and if ‘No’= 2
A separate seat arrangement for male and female passengers.	If ‘Yes’= 1 and if ‘No’= 2
CCTV camera and GPS tracker inside bus.	If ‘Yes’= 1 and if ‘No’= 2
Fare collected inside the bus using ticketing machine.	If ‘Yes’= 1 and if ‘No’= 2
No standing passengers are allowed.	If ‘Yes’= 1 and if ‘No’= 2
Setup possible nearest bus stop from the passengers’ house.	If ‘Yes’= 1 and if ‘No’= 2
Provide special security for female passengers at bus.	If ‘Yes’= 1 and if ‘No’= 2
Provide special security service bus for woman commuters at off-peak periods and after 10.00pm.	If ‘Yes’= 1 and if ‘No’= 2

Later, a dichotomous (Yes, No) question was asked to the respondents, enquiring whether or not they were willing to pay extra fare for public buses with these types of improved facilities. Finally, depending on the answer, the survey inquired how much extra fare they were willing to let go from their pockets for the improvement of public bus service in Dhaka city. In 2021, bus fares in Bangladesh were raised by 27%, and since then, city buses were charged BDT 2.15 per kilometer ("Bangladesh raises bus fares by 27%; transport leader calls for an end to strike," 2021). Keeping these things in mind, the respondents were given five options to choose from, including "not willing to pay extra fare," "willing to pay BDT 2.50 per km," "willing to pay BDT 3.00 per km," "willing to pay BDT 3.50 per km," and "willing to pay more than 4.00 BDT per km."

4.4 Data Analysis

4.4.1 Descriptive analysis

A descriptive and regression analyses have been conducted using IBM SPSS Statistics 26. The analysis was divided into three steps. The first step was to analyze the respondents’ demographic

features through highlighting frequencies and percentages. This step also includes the question of whether the current bus service quality is in satisfied level to the respondents. In addition, the similar statistical descriptive analyses were conducted for analyzing the responses of the second and third section of the questionnaire.

4.4.2 Regression analysis

In the next two steps, two types of logistic regression models were run in order to meet the research objectives. Logistic regression is a versatile statistical modeling technique that is widely used to analyze response data and establish relationships between binary or multilevel categorical variables, especially those which are not continuous or normally distributed (Eboli & Mazzulla, 2009). In the first phase, a binary logistic model was run in order to find out the respondents' preferred improved service features. The respondents' willingness to pay (No = 0; Yes = 1) was considered as the dependent variable, whereas the eight improved service quality features were the independent variables. While analyzing the data, a 95% confidence interval as well as the Hosmer-Lemeshow goodness-of-fit were used. The Hosmer and Lemeshow statistics are one of the most reliable tests of model fit for binary logistic models (Kostakis & Sardianou, 2011).

Lastly, an ordered logistic model was used to explore the most influential factors that are responsible for the amount the respondents are willing to pay. So, how much extra money respondents are willing to pay for better service quality was designated as a dependent variable, while gender, age, monthly income, and educational qualification were designated as independent variables. The ordinal logistic regression was modeled through the Polytomous Universal Model Procedure, or PLUM procedure.

4.5 Results and Discussion

4.5.1 Sociodemographic features

A total of 400 public bus commuters in Dhaka city were selected as the subjects of the study. Table 4.2 shows the profile of the respondents' sociodemographic information as well as highlights whether or not they are satisfied with the present bus service quality. Out of 400

respondents, 54.2% were male and 45.8% were female. It indicates that the frequency of male and female respondents in this study is almost equal. Most of the respondents in this study belong to the category of 30–40 years of age, and the percentage for that is almost 43.75. The demographic results show that most of the respondents are higher educated, i.e., out of 400 respondents, 227 are graduated and 119 are postgraduate. A total of 203 respondents, or 50.75%, are service holders by profession, and 110, or 27.5%, are businessmen. A major group of the respondents do not belong to the higher income group. Approximately 12% of respondents earn between 40,000 and 50,000 BDT (Bangladeshi taka), with only 1.5 percent earning more than 50,000 taka. Respondents' allocation for monthly travel expenditure is also very poor, i.e., only 6.75% of respondents spent more than 30% of their monthly income on travel. Moreover, a majority of respondents (40.5%) travelled 10-15 km per day whereas the number of people travelled 15-20 km is 119. Later, respondents' satisfaction with the current public bus service in Dhaka city was measured. Table 4.2 shows that almost 333 out of 400 respondents said that they are not satisfied with the quality of bus service.

Table 4.2 Profile of respondents' sociodemographic information and satisfaction on bus service

Variable	Category	Frequency	Percentage
Gender	Male	217	54.2
	Female	183	45.8
Age	20-30	39	9.75
	30-40	175	43.75
	40-50	123	30.75
	50-60	62	15.5
	Above 60	1	0.25
Education	SSC	6	1.5
	HSC	48	12
	Graduate	227	56.75

	Postgraduate	119	29.75
	Student	58	14.5
	Service holder	203	50.75
Profession	Businessman	110	27.5
	Others	29	7.25
	Below 10,000 BDT	48	12
	10,000-20,000	69	17.25
Monthly income	20,000-30,000	128	32
	30,000-40,000	101	25.25
	40,000-50,000	48	12
	Above 50,000	6	1.5
	1-10%	103	25.75
	11-20%	168	42
Allocation for monthly expenditure for bus	21-30%	102	25.5
	Above 30%	27	6.75
Is the present bus service quality in satisfied condition to you	No	333	83.25
	Yes	67	16.75

4.5.2 Respondents' opinions on present bus service quality

Respondents' opinions regarding the female harassment and insecurity in public bus were presented in Appendix-II. In general, Fig. 4.1 shows that 94% of the respondents think that women commuters are harassed while travelling on public buses. Previously, numerous researchers presented the actual scenarios of bus conditions for female passengers. In short, at present, public bus service quality is a kind of dystopia for female passengers. The respondents (94%) of this study, as shown in Fig. 4.2, also think that it's the lack of service, planning, and policies that's the ultimate reason for female passengers' insecurity on public buses. The passengers already had a negative view towards public buses, and according to Fig. 4.3, (88%) of them considered that overcrowding on public buses intensifies the present poor condition. Fig. 4.4 shows, however, that nearly 76% of commuters agreed that female passengers are harassed inside buses. From Fig. 4.5, it is clearly visible that while answering what they think, the female commuters are mostly harassed, about 62.75% answered that female commuters are mostly harassed while boarding and alighting the buses. On the other hand, to 21.50% of respondents, it's when the contactor tickets inside the bus. However, almost 8 and 7.75%, respectively, considered that female passengers are mostly harassed while they are coming to the bus stand and while they are waiting for a bus at the bus stop. Moreover, Fig. 4.6 gives us a clear picture of how the majority (93%) of total respondents think public buses in Dhaka city have no implement of CPTED (crime prevention through environmental design). Well-planned and well-designed transport can mitigate the number of crimes, but in Bangladesh, transport infrastructure is so poor that it results in the most harassment. Fig. 4.7 represents how 67% of respondents believed it's the male co-passengers by whom female passengers are mostly harassed. On the other hand, 33% of respondents viewed female passengers as the most harassed by bus staff. According to Fig. 4.8, 80% of total respondents said women commuters feel unsafe and insecure inside buses, while 14% and 8% said women feel insecure at bus stops and on the street, respectively. Lastly (shown in Fig. 4.9), when answering, a majority (47%) of the respondents agreed that female passengers are mostly unsafe between 9.00 and 10.00 pm. Following this, 42% responded that female passengers feel unsafe between 10.00 and 11.00 pm.

4.5.3 Respondents' preferred service quality level

Respondents were asked to reveal their expected service quality level for the twelve most influential attributes they want to experience in the future while traveling by public bus in Dhaka

city. Table 4.3 shows the percentages of the respondents' expected service quality level based on the twelve attributes. The most expected 'high' level of service is in boarding and alighting facilities, as 88.3% of respondents prefer a "high" level of service in boarding and alighting facilities. The second highly preferred attribute is the behavior of bus staff. The commuters (approximately 84.5%) preferred a "high" level of professionalism from the bus staff. The respondents expected the same high level of service (83%) from the two attributes, namely women commuters' harassment and the fitness of the bus. On average, 5.5% and 11.5% of respondents expected "same as now" and "medium" level of service for the formal attribute. On the other hand, for the latter attribute, there were respectively 0.5% and 16.5% of responses for "same as now" and "medium" level of service.

Table 4.3 Respondents' expected service quality level

Most influential service quality attributes	Service quality level (%)		
	Same as now	Medium	High
Comfort	12.8	66.5	20.8
Safety and security	8.8	10.5	80.8
Travel cost	12.8	71	16.3
Mitigating overcrowding	0.8	32	67.3
Women commuters harassment	5.5	11.5	83
Reserved seat for women commuters	7.2	17.5	75.3
Boarding and alighting facilities	0.8	11	88.3

Behavior of bus staffs	4.8	10.8	84.5
Cleanness of bus	0.5	22.8	76.8
Ticketing system	7.2	22	70.8
Fitness of bus	0.5	16.5	83
Frequency of bus service	0.8	16.5	82.8

Furthermore, the least three 'high' preferred services are, in order, travel cost (16.3%), comfort (20.8%), and overcrowding mitigation (67.3%). The respondents felt that an improved bus service can be assured if the authorities at least ensure a "medium" level of service quality for these three attributes, whereas a great concern should be on the mostly high-level preferred service attributes for providing better service quality.

4.5.4 Commuters' preference and improved service quality facilities

Public transport services in Bangladesh, especially in its capital Dhaka, need to be improved. Apart from implying better policies and observation, a better service quality that ensures women's safety and comfort is needed to improve the present state. As shown in Fig 4.10, the majority of respondents, i.e., almost 85% of total respondents, revealed their willingness to pay for the improvement of public bus service quality in Dhaka city, while 15% of respondents didn't agree to pay more. A binary logistic model was run to find out the most influential service features the respondents would like to pay for. Table 4.4 presents the result of the binary logistic model.

In comparison to the null model, the model was statistically significant x^2 (8, N = 400) =65.010, $p< 0.001$, indicating that the model has great explanatory power in addressing the most influential service facilities for which the respondents are willing to pay. The model correctly identified 89.5 percent of the instances and explained between 15% (Cox & Snell R square) and 26.6% (Nagelkerke R square) of the variation in the dependent variable. The Hosmer and Lemeshow test result is non-significant (0.152) or $p > 0.05$, which in fact shows that the model fits the data well.

Table 4.4 Result of the binary logistic model

Service quality features	B	*p*	Exp(B)	95% Confidence Interval	
				Lower Bound	Upper Bound
A separate door for male and female passengers	-18.960	1.000	.000	.000	
A separate seat arrangement for male and female passengers	-1.281	.127	.278	.054	1.438
CCTV camera and GPS tracker inside bus.	.594	.594	1.812	.203	16.145
Fare collected inside the bus using ticketing machine	.172	.870	1.187	.151	9.351
No standing passengers are allowed.	-.762	.406	.467	.077	2.814
Setup possible nearest bus stop from the passengers' house.	-.815	.354	.443	.079	2.484
Provide special security for female passengers at bus.	-1.629	.054	.196	.037	1.028
Provide special security service bus for woman commuters at off-peak periods and after 10.00pm.	-.791	.752	.453	.003	61.113

Table 4.4 shows that all the coefficients of improved service quality features are negative except for two features, including "CCTV camera and GPS tracker inside buses" (.594) and "fare collected inside bus using ticketing machine" (.172). This actually means that these two service features have a greater impact on the respondents' willingness to pay for better service quality or the respondents' like to see these types of improved features in public buses than the rest of the six attributes. The p-value for these service features is all non-significant, suggesting a non-zero correlation between the dependent and independent variables. Nevertheless, when asked about

the preference, most of the respondents said “yes” to these improved service facilities and agreed to use this type of public bus in the future.

4.5.5 Factors affecting the respondents’ WTP amount

The amounts respondents were willing to pay were ordinal in nature. As a result, an ordinal logistic regression model was developed to determine which factors were influencing the number of respondents who agreed to let go in exchange for better service quality. The regression model offers a satisfactory level of significance and a high explanatory power of the predicators over the baseline intercept-only model. Table 4.5 presents the result of the ordinal logistic regression model.

Table 4.5 Result of ordinal logistic model

Variables	B	SE	Wald	*df*	*p*	95% confidence Interval	
						Lower Bound	Upper Bound
Gender (1)	-.210	.220	.914	1	.339	-.641	.221
Gender (2)	0[a]			0			
Age Range (1)	-.20	2.277	.000	1	.993	-4.483	4.443
Age Range (2)	.092	2.240	.002	1	.967	-4.298	4.481
Age Range (3)	.101	2.233	.002	1	.964	-4.275	4.478
Age Rage (4)	-.808	2.241	.130	1	.718	-5.199	3.584
Age Range (5)	0[a]			0			
Educational qualification (1)	.127	.893	.020	1	.887	-1.624	1.877
Educational qualification (2)	-.353	.419	.708	1	.400	-1.175	.469

Educational qualification (3)	1.034	.300	11.898	1	.001	.446	1.621
Educational qualification (4)	0[a]			0			
Salary range (1)	-5.718	1.001	32.610	1	.000	-7.680	-3.755
Salary range (2)	-4.237	.939	20.340	1	.000	-6.078	-2.396
Salary range (3)	-3.561	.895	15.836	1	.000	-5.315	-1.807
Salary range (4)	-3.186	.886	12.945	1	.000	-4.922	-1.451
Salary range (6)	-2.055	.894	5.283	1	.022	-3.807	-.303
Salary range (7)	0[a]			0			

OLR results: -2 Log-likelihood= 435.942. Chi-Square test (with 13 degrees of freedom) = 130.947; the corresponding p-value is p<.0001. Goodness of fit test (Deviance= .580 and Pearson= .000). Nagelkerke R^2=.310.

The result shows that respondents' gender and age range have nothing to do with the amount they are willing to pay, whereas the respondents' WTP amount is highly affected by their monthly income. The negative coefficient of all income groups prior to the reference category (i.e., the highest income group) suggests that all of those income groups are less likely to pay WTP > 4.00 BDT than the highest income group. The coefficient of the lowest income group is (-5.718), indicating their unwillingness to pay more compared to the second or third income group. The more a respondent's income raises, the more likelihood he or she has of paying WTP > 2.50 BDT. However, the respondents' likelihood of paying WTP > 4.00 BDT or WTP 2.50 BDT isn't influenced by their highest education level. The positive coefficient (1.034) of education level (3) suggests the graduate respondents are more likely to pay more than the reference group, which is the highest educational group. The negative coefficient (-.353) of the second education group indicates they are less likely to pay more than the reference category. On the other hand, the positive coefficient (.127) of the lowest education group means that they are more likely to pay more than the reference category. Overall, respondents' highest education does not indicate that they are willing to pay a premium for higher service quality.

4.6 Conclusions

This study aimed to find out commuters' willingness to pay for better service quality on public buses in Dhaka. The present condition of public buses in Dhaka city is a kind of dystopia due to overcrowding, harassment, poor infrastructure of buses, insufficient service, etc. Women are the worst sufferers of these insufficient and poor services. The study found that most of the respondents believe that women are harassed inside buses by their male co-passengers. Also, a significant number of respondents agreed with the fact that it is after 9.00 pm when most female passengers feel unsafe and insecure travelling by bus.

When asked about the preferred service quality level for the most influential attributes, most of them expressed a high level of service for each of the attributes. Respectively, 88.3%, 84.5%, 83%, 83%, and 80.8% of total respondents preferred a high level of services for boarding and alighting facilities; improving the behavior of bus staff; mitigating women commuters' harassment; fitness of bus; and safety and security attributes. On the other hand, there were some influential service levels for which the respondents expected a "medium" and "same as now" level of service, such as comfort, ticketing system, reserved seats for women commuters, etc. Moreover, even though most of the respondents expect a high level of service quality for a majority of the influential service attributes, the number of respondents who agree with a high level of travel cost is quite low. Approximately 12.8% of total respondents anticipate the same level of travel costs as now, with only 16.3% agreeing to pay a premium for improved services.
In fact, 85% of respondents showed their interest in paying an extra fare in order to enjoy comfort and a better level of service on public buses in Dhaka city. To mitigate the women's harassment on public buses and offer a safe and comfortable travel experience, the study found some significant service quality facilities, and among them, CCTV cameras and GPS inside the bus and fare collected inside the bus through ticketing machines are the most influential ones that have the likelihood to drive the commuters' willingness to pay.
Moreover, the result of the ordinal logistic model shows that it is the respondents' monthly income that affects the respondents' willingness to pay. Respondents with 10,000 BDT< monthly incomes are less likely to have a WTP > 2.50 than respondents with 10,000 BDT> monthly income. Also, respondents with 60,000> monthly incomes are more likely to pay WTP > 4.00 BDT than respondents with 50,000> monthly income or 40,000> monthly income.

Unlike relative researchers, this study found that the respondents' gender, age, as well as education level were not affecting factors of their WTP.

The study has some limitations and one of the major limitations is its sample size. The sample this paper use was 400 in number which is quite poor while comparing with 22.3 million people living in this city. This small size of population used in the survey can't accurately standardize the perceptions and preferences of a large and various types of residents. In addition, the improved service facilities mentioned in the questionnaire weren't enough to offer an overall better and satisfactory service to the commuters. However, this study will create a chance to the authorities as well as policy makers to give emphasize on the preferences of the commuters and provide services that will ensure the commuters' comfort, security and satisfaction.

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Chapter-5

Conclusions

This chapter of the thesis is designed to make the conclusions of the whole thesis project including the thesis' contribution in this field of knowledge, limitations, recommendations as well as scopes of future research.

The aims of this study were to evaluate bus service performance based on female commuters' in Dhaka, Bangladesh. In order to achieve its goal, this study looked into numerous body of knowledge related to the main objectives. Three of the major objectives of this study are "gap analysis of women passengers' perceptions and expectations about bus service," "analysis of women commuters' satisfaction on bus service quality," and "measuring the commuters' willingness to pay for better service quality." To accomplish these objectives, a well-structured and well-planned approach was needed and throughout the research process the author tried to accomplish it.

This study looked into numerous methods and models to come into its conclusions and achieve its goals. From descriptive analysis to regression analysis, all different approaches were conducted to evaluate bus service performance based on the women commuters. Further, different types of models including SERVQUAL model, Structural Equation model, and Logistic Regression model were developed for the better and explanatory analysis of the data. The contributions of this study are presented respectively by chapter and are given below.

Chapter-2

Chapter-2 of this thesis concerned about the gap analysis of female commuters' perceptions and expectations about bus service in Dhaka city. It investigated the perception of male and female passengers for the service quality attribute of bus service with both thinking's of male and female and investigated the difference between current service quality and expected service quality to improve bus service quality. The study was conducted using SERVQUAL model and the gap was depicted using five dimensions: reliability, tangibility, responsiveness, assurance, and empathy.

An analysis of the perceptions of male and female passengers in this study shows that the service quality of bus services does not meet passenger satisfaction. We believe that the quality of service issues faced by female passengers is not only problematic to them only, but also for male passengers.

Based on the results, the bus's passenger service is not good in Bangladesh. There was a big difference in the quality of bus service perceived by riders and what they expected. This mismatch created gaps in the service that needed to be closed by implementing appropriate solutions based on what passengers wanted. The bus system should be updated to better accommodate women's needs. The results suggest that the assessment offers many potential benefits to the service provider, and determining passenger opinions about the service quality performance of a particular attribute (and dimensions) may enable management to better adapt and verify that traveler expectations are being met.

Chapter-3

The purpose of this study was to evaluate how satisfied Bangladeshi women commuters were with the public bus system. Every economy benefits directly from the work of women. By making it easier for them to go to and from work, public transportation, especially in a developing country like Bangladesh, indirectly aids female workers in efficiently maintaining their contributions. Thus, there is essentially a connection between women's performance at work and their satisfaction with their commute. In any case, the goal of our study was to identify the elements that affect Bangladeshi women's bus riders' pleasure.

The majority of the female passengers on the bus experienced sexual, physical, or verbal harassment from male passengers or bus employees. Female commuters are treated in a very unpleasant manner because there is no legal mechanism for immediate punishment for harassment. Women would be less at danger for security threats and more satisfied if there were such strong regulations with concurrent consequences for harassing them. Additionally, according to the survey report, 99.5% to 100% of commuting women have encountered harassment, overcrowding, insufficient seating, and poor "boarding and alighting facilities." Therefore "Poor safety conditions at bus stands," "Long waiting times," "Lack of security for women commuters during the off-peak period," "Difficulties of movement inside the buses,"

“Dirty and untidy environment inside the bus,” “Lack of fan and lighting facilities,” and “Aggressive driving and violation of traffic rules” are a day-to-day scenario of public bus service quality.

Chapter-4

The purpose of this study was to determine passengers' willingness to pay more for higher-quality service on Dhaka's public buses. Due to crowding, harassment, bad bus infrastructure, inadequate service, etc., the current state of public buses in Dhaka city is akin to a dystopia. The worst victims of these inadequate and subpar services are women. According to the study's findings, the majority of respondents think that men who ride buses with women harass them. Additionally, a sizable proportion of respondents believed that most female bus passengers feel uneasy and insecure after 9.00 pm.

When asked about the preferred service quality level for the most influential attributes, most of them expressed a high level of service for each of the attributes. Respectively, 88.3%, 84.5%, 83%, 83%, and 80.8% of total respondents preferred a high level of services for boarding and alighting facilities; improving the behavior of bus staff; mitigating women commuters’ harassment; fitness of bus; and safety and security attributes. On the other hand, there were some influential service levels for which the respondents expected a “medium” and “same as now” level of service, such as comfort, ticketing system, reserved seats for women commuters, etc. Moreover, even though most of the respondents expect a high level of service quality for a majority of the influential service attributes, the number of respondents who agree with a high level of travel cost is quite low.

Moreover, the result of the ordinal logistic model shows that it is the respondents’ monthly income that affects the respondents’ willingness to pay. Respondents with 10,000 BDT< monthly incomes are less likely to have a WTP > 2.50 than respondents with 10,000 BDT> monthly income. Also, respondents with 60,000> monthly incomes are more likely to pay WTP > 4.00 BDT than respondents with 50,000> monthly income or 40,000> monthly income. Unlike relative researchers, this study found that the respondents’ gender, age, as well as education level were not affecting factors of their WTP.

5.1 Future Scopes of Study

This study, because it drew attention to the most pressing issue confronting developing countries, as well as women's empowerment in those countries, has the potential to be a valuable source of concern and knowledge for future researchers, authorities, and policymakers. The majority of this portion of the thesis contains the results of primary data that was collected from the commuters of public buses in some major cities in Bangladesh. This primary data can be of great help to future researchers who want to expand the solutions in this particular field.

However, as mentioned earlier, this thesis sheds light on multiple covered issues, like the gap analysis of female passengers' perceptions and expectations, dealing with commuters' willingness to pay for the betterment benefits of both passengers who traveled on public buses and the authorizers who guide and implant policies for the public bus service. Moreover, in Chapter 4, the author dealt with the eight most improved public bus service qualities and commuters' preferences for these service qualities. Keeping this aspect in mind, future researchers or scholars could analyze the possibility of introducing these measures from the viewpoint of cost.

5.2 Limitations of the Study

There are numerous limitations and shortcomings in this study. Due to the limited timespan and capability, this study wasn't able to focus on some related subjects, and thus the main limitation of this study is in the study design. Furthermore, the data gathered for the study is not free of bias. There were numerous ranges and types of questions where the respondents had the chance to get bias and answer according to their own opinion, which ultimately affected the results of the study. There is a maximum chance of getting bias data from the respondents in socio-demographic questions like the respondents' income, profession, and education as well as from a large and important portion of the study, i.e., the respondents' decisions on whether or not they are willing to pay.

There are some limitations in the case of model development for the data analysis of the study. The numerous types of models that have been developed from time to time may not be totally appropriate.

5.3 Recommendations of the Study

After considering the findings and the study design, the following recommendations can be proposed to flourish the public bus service quality not only in Dhaka but also the rest of the cities in Bangladesh.

I. While analyzing the service quality of any transportation, it's necessary to keep the difference requirements of different gender.
II. In order to increase interest in the transportation industry, buses should be equipped with modern technology like GPS maps. More AC vehicles are being introduced, along with features like bus tracking systems, e-ticketing, easy accessibility, and window coverings for non-AC vehicles.
III. To prevent the collection of excessive fares, a proper fare schedule and timetable should be displayed both inside the bus and at bus stops. An e-ticketing system could also be implemented.
IV. Launching efforts to combat rudeness and poor behavior toward other passengers, particularly female ones.
V. Programs to educate women about their rights, teach bus drivers and conductors professionalism, and teach them how to interact with female passengers in a civilized society.
VI. An instant campaign system to combat all forms of harassment directed at women commuters in the bus and bus stop so that they can get help right away.
VII. A complaint box and hot-line in the bus to expect proper harassment action.
VIII. The frequency of bus service should be increased to reduce the waiting time at the bus stand.
IX. The drivers must have authentic licenses with regular monitoring of their performances, and awareness training sessions need to be arranged for them to improve the drivers' efficiencies.
X. To alleviate overcrowding, the number of buses should be increased, and a separate gate for female passengers should be installed.

XI. When compared to the overall number of bus commuters, approximately 25% of seats should be dedicated to women.

XII. Installing CCTV cameras inside buses and at bus stops, with an authority monitoring the footage and alerting authorities to take action against harassment and security.

XIII. Proper actions should be taken to keep the environment neat and clean inside the bus.

XIV. Bus drivers and conductors should be properly trained on how to deal with women commuters in a civilized society.

XV. The concerned authorities should strictly monitor the proper execution of traffic laws.

XVI. While providing better service quality, it's important to provide the facilities that ensure women's safety and security first.

XVII. While increasing the fare of the bus for any improved facilities, it’s important to keep the commuters’ socio-demographic information in mind and then come to any conclusions.

APPENDICES

APPENDIX-I

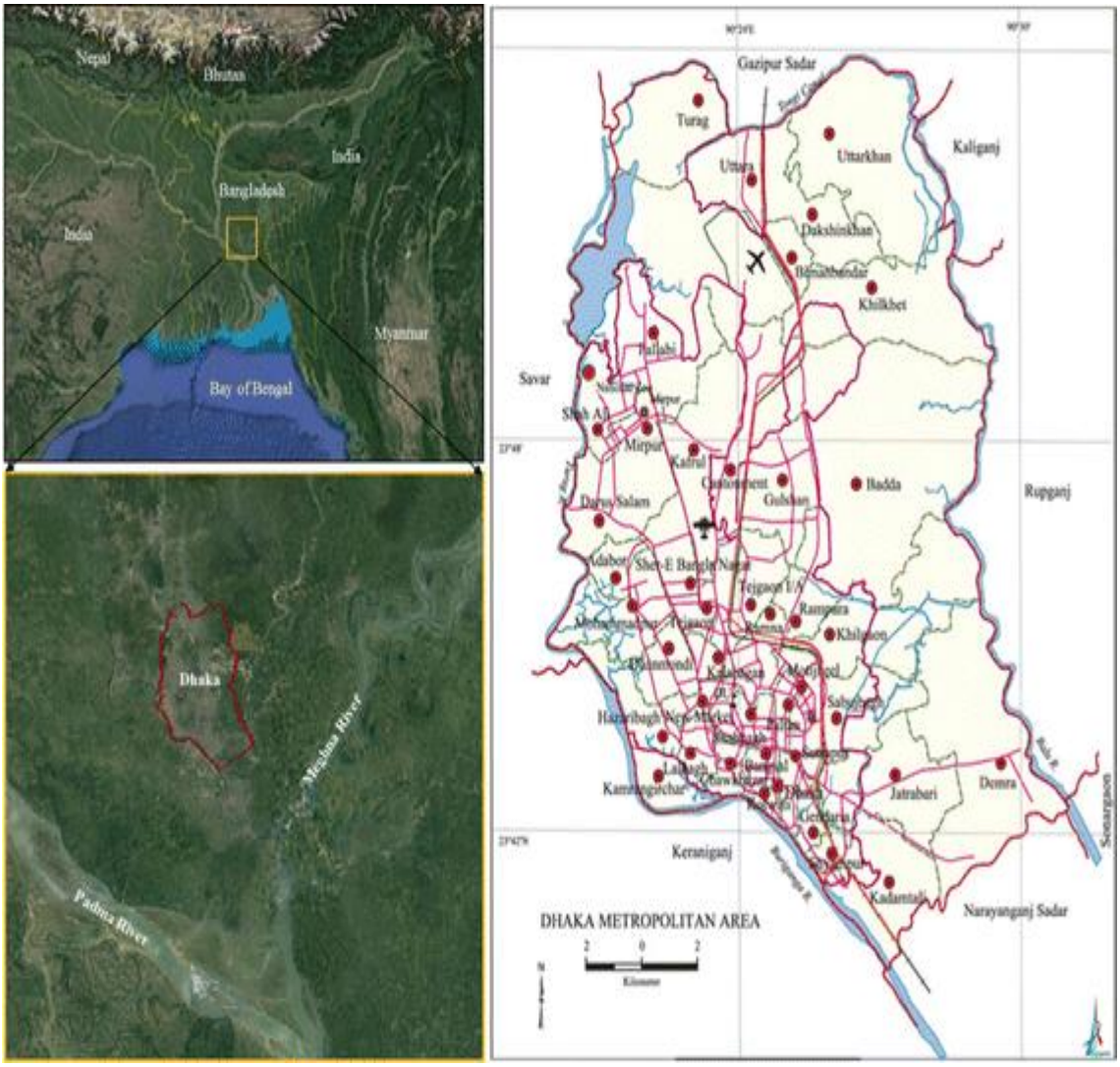


Figure: Dhaka city map (Source: Rahman et.al., 2018))

APPENDIX II

Table 2.3 The bus stand is attractive

Female passenger perception				Male passenger perception		
	Female(As a female)	**Female(As a Male)**			**Male (As a Female)**	**Male(As a Male)**
Highly agreed	0.93%	0.93%		Highly agreed	0.27%	0.13%
Agreed	4.00%	4.40%		Agreed	0.67%	0.67%
Neutral	5.20%	10.13%		Neutral	1.87%	2.00%
Disagreed	54.53%	57.20%		Disagreed	86.27%	86.40%
Highly Disagreed	35.33%	27.33%		Highly Disagreed	10.93%	10.80%

Table 2.4 Bus service providers have up to date technology

Female passenger perception				Male passenger perception		
	Female(As a female)	Female(As a Male)			Male (As a Female)	Male(As a Male)
Highly agreed	0.53%	0.27%		Highly agreed	0.00%	0.00%
Agreed	2.00%	2.27%		Agreed	0.27%	0.40%
Neutral	10.40%	17.20%		Neutral	2.93%	3.07%
Disagreed	68.13%	68.13%		Disagreed	60.53%	61.73%
Highly Disagreed	18.93%	12.13%		Highly Disagreed	36.27%	34.80%

Table 2.5 The bus stand has sufficient seats for passengers

Female passenger perception				Male passenger perception		
	Female(As a Female)	Female(As a Male)			Male(As a Female)	Male(As a Male)
Highly agreed	1.33%	0.27%		Highly agreed	0.00%	0.53%
Agreed	7.33%	7.87%		Agreed	0.80%	6.67%

Neutral	18.00%	28.00%		Neutral	1.73%	64.40%
Disagreed	56.00%	52.00%		Disagreed	42.53%	25.33%
Highly Disagreed	17.33%	11.87%		Highly Disagreed	54.93%	3.07%

Table 2.6 Bus service providers have a professional appearance

Female passenger perception				Male passenger perception		
	Female(As a Female)	**Female(As a Male)**			**Male(As a Female)**	**Male(As a Male)**
Highly agreed	0.53%	0.67%		Highly agreed	0.00%	0.13%
Agreed	6.93%	6.93%		Agreed	1.73%	2.13%
Neutral	15.33%	15.60%		Neutral	8.80%	8.13%
Disagreed	62.27%	66.67%		Disagreed	86.27%	86.67%
Highly Disagreed	14.93%	10.13%		Highly Disagreed	3.20%	2.93%

Table 2.7 The bus staffs are smart and wearing neat and clean dress

Female passenger perception				Male passenger perception		
	Female(As a Female)	**Female(As a Male)**			**Male(As a Female)**	**Male(As a Male)**
Highly agreed	0.53%	0.80%		Highly agreed	0.00%	0.00%
Agreed	2.40%	1.60%		Agreed	0.40%	0.27%
Neutral	11.20%	11.20%		Neutral	0.93%	1.07%
Disagreed	58.67%	62.93%		Disagreed	36.67%	39.20%
Highly Disagreed	27.20%	23.47%		Highly Disagreed	62.00%	59.47%

Table 2.8 The bus always arrives at the destination within the given time

Female passenger perception				Male passenger perception		
	Female(As a Female)	**Female(As a Male)**			**Male(As a Female)**	**Male(As a Male)**
Highly agreed	0.27%	0.27%		Highly agreed	0.00%	0.00%
Agreed	1.73%	2.53%		Agreed	0.13%	0.13%
Neutral	14.67%	18.80%		Neutral	5.47%	6.67%
Disagreed	66.67%	64.00%		Disagreed	26.80%	26.67%
Highly Disagreed	16.67%	14.40%		Highly Disagreed	67.60%	66.53%

Table 2.9 The bus driver doesn't stop bus completely while boarding passengers

Female passenger perception				Male passenger perception		
	Female(As a Female)	**Female(As a Male)**			**Male(As a Female)**	**Male(As a Male)**
Highly agreed	10.27%	10.53%		Highly agreed	2.53%	1.47%
Agreed	16.53%	17.73%		Agreed	27.87%	29.47%
Neutral	18.00%	15.73%		Neutral	32.13%	36.67%
Disagreed	48.93%	48.67%		Disagreed	34.93%	30.80%
Highly Disagreed	6.27%	7.33%		Highly Disagreed	2.53%	1.60%

Table 2.10 Prevailing ticket booking system is convenient to the bus commuters

Female passenger perception				Male passenger perception		
	Female(As a Female)	**Female(As a Male)**			**Male(As a Female)**	**Male(As a Male)**
Highly agreed	0.40%	0.27%		Highly agreed	0.40%	0.53%
Agreed	31.20%	31.07%		Agreed	13.73%	13.60%

Neutral	16.93%	20.00%		Neutral	6.13%	6.40%
Disagreed	44.53%	43.07%		Disagreed	77.20%	77.33%
Highly Disagreed	6.93%	5.60%		Highly Disagreed	2.53%	2.13%

Table 2.11 Bus staffs always meet the passengers requirements while facing difficulties

Female passenger perception				Male passenger perception		
	Female(As a Female)	**Female(As a Male)**			**Male(As a Female)**	**Male(As a Male)**
Highly agreed	0.80%	0.40%		Highly agreed	0.13%	0.13%
Agreed	19.20%	10.27%		Agreed	7.20%	3.07%
Neutral	21.87%	30.67%		Neutral	8.40%	12.93%
Disagreed	51.20%	51.47%		Disagreed	81.33%	81.07%
Highly Disagreed	6.93%	7.20%		Highly Disagreed	2.93%	2.80%

Table 2.12 Bus service providers insist on error free service

Female passenger perception				Male passenger perception		
	Female(As a Female)	**Female(As a Male)**			**Male(As a Female)**	**Male(As a Male)**
Highly agreed	0.13%	0.13%		Highly agreed	0.00%	0.00%
Agreed	3.20%	2.00%		Agreed	0.27%	0.40%
Neutral	19.07%	19.33%		Neutral	2.40%	2.27%
Disagreed	64.00%	68.27%		Disagreed	28.27%	28.40%
Highly Disagreed	13.60%	10.27%		Highly Disagreed	69.07%	68.93%

Table 2.13 Bus service providers always inform bus commuters of exact timetable and fees						
Female passenger perception				Male passenger perception		
	Female(As a Female)	**Female(As a Male)**			**Male(As a Female)**	**Male(As a Male)**
Highly agreed	0.13%	0.53%		Highly agreed	0.67%	1.73%
Agreed	8.67%	5.07%		Agreed	5.33%	3.47%
Neutral	23.07%	24.67%		Neutral	11.20%	12.53%
Disagreed	58.13%	61.20%		Disagreed	74.00%	75.07%
Highly Disagreed	10.00%	8.53%		Highly Disagreed	8.80%	7.20%

Table 2.14 Bus service providers provide timely and efficient service						
Female passenger perception				Male passenger perception		
	Female(As a Female)	**Female(As a Male)**			**Male(As a Female)**	**Male(As a Male)**
Highly agreed	0.00%	0.13%		Highly agreed	0.00%	0.00%
Agreed	3.73%	1.60%		Agreed	0.40%	0.40%
Neutral	19.87%	21.07%		Neutral	10.27%	9.60%
Disagreed	63.47%	68.27%		Disagreed	60.13%	60.53%
Highly Disagreed	12.93%	8.93%		Highly Disagreed	29.20%	29.47%

Table 2.15 Bus personnel have proper dealing ability with passengers						
Female passenger perception				Male passenger perception		
	Female(As a Female)	**Female(As a Male)**			**Male(As a Female)**	**Male(As a Male)**
Highly agreed	0.00%	0.13%		Highly agreed	0.00%	0.00%

Agreed	4.93%	3.07%		Agreed	1.73%	1.60%
Neutral	21.20%	24.27%		Neutral	16.93%	18.27%
Disagreed	65.73%	63.87%		Disagreed	78.27%	78.13%
Highly Disagreed	8.13%	8.67%		Highly Disagreed	3.07%	2.00%

Table 2.16 Bus staffs are always willing to co-operate with old and handicapped passangers

Female passenger perception				Male passenger perception		
	Female(As a Female)	**Female(As a Male)**			**Male(As a Female)**	**Male(As a Male)**
Highly agreed	0.67%	0.80%		Highly agreed	2.67%	2.53%
Agreed	34.00%	36.27%		Agreed	79.07%	77.60%
Neutral	21.07%	22.80%		Neutral	12.53%	15.20%
Disagreed	36.40%	35.73%		Disagreed	5.07%	3.87%
Highly Disagreed	7.87%	4.40%		Highly Disagreed	0.67%	0.80%

Table 2.17. Bus Service providers are always ready to respond bus commuters' request

Female passenger perception				Male passenger perception		
	Female(As a Female)	**Female(As a Male)**			**Male(As a Female)**	**Male(As a Male)**
Highly agreed	0.13%	0.00%		Highly agreed	0.00%	0.00%
Agreed	18.93%	7.73%		Agreed	7.20%	3.47%
Neutral	21.60%	28.27%		Neutral	9.20%	13.07%
Disagreed	52.40%	57.07%		Disagreed	82.13%	81.87%
Highly Disagreed	6.93%	6.93%		Highly Disagreed	1.47%	1.60%

Table 2.18 Bus commuters feel safe in dealing transaction with the bus service providers in the bus stand						
Female passenger perception				Male passenger perception		
	Female(As a Female)	**Female(As a Male)**			**Male(As a Female)**	**Male(As a Male)**
Highly agreed	0.40%	0.27%		Highly agreed	0.40%	0.00%
Agreed	28.80%	30.93%		Agreed	11.20%	11.47%
Neutral	16.00%	20.67%		Neutral	9.07%	37.60%
Disagreed	46.00%	42.67%		Disagreed	46.00%	44.93%
Highly Disagreed	8.80%	5.47%		Highly Disagreed	33.33%	6.00%

Table 2.19 .Bus commuters feel secured when dealing transactions with staff inside the bus						
Female passenger perception				Male passenger perception		
	Female(As a Female)	**Female(As a Male)**			**Male(As a Female)**	**Male(As a Male)**
Highly agreed	0.27%	0.27%		Highly agreed	0.00%	0.13%
Agreed	26.53%	27.33%		Agreed	8.67%	9.33%
Neutral	23.87%	20.00%		Neutral	10.67%	44.00%
Disagreed	41.73%	45.07%		Disagreed	53.47%	41.60%
Highly Disagreed	7.60%	7.33%		Highly Disagreed	27.20%	4.93%

Table 2.20 .Bus staffs are always polite towards passengers		
Female passenger perception		Male passenger perception

	Female(As a Female)	Female(As a Male)			Male(As a Female)	Male(As a Male)
Highly agreed	0.13%	0.00%		Highly agreed	0.00%	0.00%
Agreed	5.07%	1.47%		Agreed	1.07%	0.80%
Neutral	21.33%	21.73%		Neutral	5.60%	8.53%
Disagreed	65.07%	69.87%		Disagreed	91.60%	89.07%
Highly Disagreed	8.40%	6.93%		Highly Disagreed	1.73%	1.60%

Table 2.21 Advance ticketing facility exists for passengers						
Female passenger perception				Male passenger perception		
	Female(As a Female)	Female(As a Male)			Male(As a Female)	Male(As a Male)
Highly agreed	6.53%	5.87%		Highly agreed	0.13%	0.80%
Agreed	6.27%	6.13%		Agreed	5.60%	5.07%
Neutral	32.00%	34.53%		Neutral	11.33%	11.73%
Disagreed	44.80%	44.53%		Disagreed	81.33%	81.07%
Highly Disagreed	10.40%	8.93%		Highly Disagreed	1.60%	1.33%

Table 2.22 Bus staffs inspire to develop passengers' confidence with their women friendly service						
Female passenger perception				Male passenger perception		
	Female(As a Female)	Female(As a Male)			Male(As a Female)	Male(As a Male)
Highly agreed	0.40%	0.40%		Highly agreed	0.00%	0.00%
Agreed	3.60%	2.67%		Agreed	1.33%	1.47%
Neutral	23.73%	21.20%		Neutral	12.53%	13.73%

Disagreed	62.00%	68.40%		Disagreed	60.00%	60.00%
Highly Disagreed	10.27%	7.33%		Highly Disagreed	26.13%	24.80%

Table 2.23 Bus staffs always concentrate the best interests of passengers inside the bus

Female passenger perception				Male passenger perception		
	Female(As a Female)	**Female(As a Male)**			**Male(As a Female)**	**Male(As a Male)**
Highly agreed	0.27%	0.40%		Highly agreed	0.13%	0.13%
Agreed	14.00%	14.00%		Agreed	8.93%	9.47%
Neutral	21.73%	22.40%		Neutral	10.67%	11.73%
Disagreed	53.87%	53.87%		Disagreed	78.27%	76.80%
Highly Disagreed	10.13%	9.33%		Highly Disagreed	2.00%	1.87%

Table 2.24 Bus service providers have service hours convenient to the bus commuters

Female passenger perception				Male passenger perception		
	Female(As a Female)	**Female(As a Male)**			**Male(As a Female)**	**Male(As a Male)**
Highly agreed	0.13%	0.13%		Highly agreed	0.27%	1.20%
Agreed	4.00%	3.47%		Agreed	23.33%	22.67%
Neutral	20.67%	21.20%		Neutral	30.53%	31.33%
Disagreed	64.67%	65.87%		Disagreed	45.47%	44.40%
Highly Disagreed	10.53%	9.33%		Highly Disagreed	0.40%	0.40%

Table 2.25 Bus commuters get information about facilities and bus services easily

Female passenger perception		Male passenger perception

	Female(As a Female)	Female(As a Male)			Male(As a Female)	Male(As a Male)
Highly agreed	0.13%	0.13%		Highly agreed	0.00%	0.00%
Agreed	4.27%	3.47%		Agreed	0.67%	0.80%
Neutral	24.53%	28.53%		Neutral	11.73%	12.27%
Disagreed	60.40%	60.00%		Disagreed	82.53%	84.67%
Highly Disagreed	10.67%	7.87%		Highly Disagreed	5.07%	2.27%

Table 2.26 .Bus passengers find and access the bus stand easily

Female passenger perception				Male passenger perception		
	Female(As a Female)	**Female(As a Male)**			**Male(As a Female)**	**Male(As a Male)**
Highly agreed	0.27%	0.00%		Highly agreed	0.40%	1.60%
Agreed	4.13%	5.20%		Agreed	5.07%	4.40%
Neutral	21.47%	24.27%		Neutral	8.27%	14.13%
Disagreed	60.40%	60.93%		Disagreed	79.47%	78.27%
Highly Disagreed	13.73%	9.60%		Highly Disagreed	6.80%	1.60%

Table 2.27 Bus staffs provide individual attention to bus commuters for ensuring comfortable and secure bus service

Female passenger perception				Male passenger perception		
	Female(As a Female)	Female(As a Male)			Male(As a Female)	Male(As a Male)
Highly agreed	0.13%	0.00%		Highly agreed	0.00%	0.13%
Agreed	3.20%	1.47%		Agreed	0.27%	0.40%
Neutral	19.47%	16.93%		Neutral	3.33%	4.13%

Disagreed	66.53%	68.13%		Disagreed	62.80%	74.40%
Highly Disagreed	10.67%	13.47%		Highly Disagreed	33.60%	20.93%

APPENDIX III

Survey Questionnaire for Bus Commuters in Bangladesh

User information:

1. User Information: Gender	Male	1
	Female	2
2. Division	Dhaka	1
	Gazipur	2
	Narayanganj	3
3. Age range (Years)	10 – 20	1
	20 – 30	2
	30 – 40	3
	40 – 50	4
	50 – 60	5
	Above 60 Years	6
4. Educational Qualification	Below SSC	1
	SSC	2
	HSC	3
	Graduate	4

	Post Graduate	5
	Students	1
	Service holder	2
5. Profession	Businessmen	3
	Others	4
	Below 10,000 taka	1
	10,000-20,000	2
	20,000-30,000	3
6. Salary Range (Taka)	30,000-40,000	4
	40,000-50,000	5
	Above 50,000	6
	Bus	1
	Rickshaw	2
7. Main mode of travel	Para-transit	3
	Motor, bi-cycle	4
	Car	5
	1%~10%	1
8. Allocation for monthly travel expenditure for bus	11%~20%	2
	21%~30%	3
	Above 30%	4

A. SERVICE QUALITY

Perceptions: The following statements relate to your feelings about the prevailing bus service. You should rank each statement as follows:

	Statement		Score				
			Highly agreed	Agreed	Neutral	Disagreed	Highly Disagreed
			1	2	3	4	5
Tangibility	**1.** The bus stand is attractive.	For male					
		For Female					
	2. Bus service providers have up to date technology.	For male					
		For Female					
	3. The bus stand has sufficient seats for passangers.	For male					
		For Female					
	4. Bus service providers have a professional appearance.	For male					
		For Female					
	5. The bus staffs are smart and wearing neat and clean dress.	For male					
		For Female					
R	**6.** The bus always arrives at the	For male					

	destination within the given time.	For Female					
	7. The bus driver doesn't stop bus completely while boarding passangers.	For male					
		For Female					
	8. Prevailing ticket booking system is convenient to the bus commuters.	For male					
		For Female					
	9. Bus staffs always meet the passangers' requirements while facing difficulties	For male					
		For Female					
	10. Bus service providers insist on error free service.	For male					
		For Female					
Responsiveness	**11.** Bus service providers always inform bus commuters of exact timetable and fees.	For male					
		For Female					
	12. Bus service providers provide timely and efficient service.	For male					
		For Female					
	13. Bus personnel have proper dealing ability with passangers.	For male					
		For Female					
	14. Bus staffs are always willing to co-operate with old and handicapped passangers.	For male					
		For Female					
	15. Bus Service providers are always	For male					

	ready to respond bus commuters' request.	For Female					
Assurance	**16.** Bus commuters feel safe in dealing transaction with the bus service providers in the bus stand.	For male					
		For Female					
	17. Bus commuters feel secured when dealing transactions with staff inside the bus.	For male					
		For Female					
	18. Bus staffs are always polite towards passangers.	For male					
		For Female					
	19. Advance ticketing facility exists for passengers	For male					
		For Female					
	20. Bus staffs inspire to develop passengers' confidence with their women friendly service	For male					
		For Female					
Empathy	**21.** Bus staffs always concentrate the best interests of passengers inside the bus	For male					
		For Female					
	22. Bus service providers have service hours convenient to the bus commuters.	For male					
		For Female					
	23. Bus commuters get information about facilities and bus services easily.	For male					
		For Female					
	24. Bus passengers find and access the	For male					

	bus stand easily.	For Female					
	25. Bus staffs provide individual attention to bus commuters for ensuring comfortable and secure bus service.	For male					
		For Female					

Expectations: This section of the survey deals with your expected bus service quality in Bangladesh. You should rank each statement as follows:

	Statement	**Score**				
		Highly agreed	Agreed	Neutral	Disagreed	Highly Disagreed
		1	2	3	4	5
Tangibility	**1.** It is expected to have an attractive bus stand.					
	2. Bus service providers will have up to date technology.					
	3. The bus stand will have sufficient seats for passangers.					
	4. Bus service providers will have a professional appearance.					
	5. The bus staffs will be smart and wearing neat and clean dress.					
Relia	**6.** The bus will always arrive at the destination within the given time.					

	7. The bus driver will stop bus completely while boarding passangers.					
	8. Prevailing ticket booking system will be convenient to the bus commuters.					
	9. Bus staffs will always meet the passangers' requirements while facing difficulties					
	10. Bus service providers will insist on error free service.					
Responsiveness	**11.** Bus service providers will always inform bus commuters of exact timetable and fees.					
	12. Bus service will provider provide timely and efficient service.					
	13. Bus personnel will have proper dealing ability with passangers.					
	14. Bus staffs will always be willing to co-operate with old and handicapped passangers.					
	15. Bus Service providers will always be ready to respond bus commuters' request.					
Assurance	**16.** Bus commuters will feel safe in dealing transaction with the bus service providers in the bus stand.					
	17. Bus commuters will feel secured when dealing transactions with staff inside the bus.					
	18. Bus staffs will always be polite towards passangers.					

	19. Advance ticketing facility will exist for passengers					
	20. Bus staffs will inspire to develop passengers' confidence with their women friendly service					
Empathy	**21.** Bus staffs will always concentrate the best interests of passengers inside the bus					
	22. Bus service providers will have service hours convenient to the bus commuters.					
	23. Bus commuters will get information about facilities and bus services easily.					
	24. Bus passengers will be able to find and access the bus stand easily.					
	25. Bus staffs will provide individual attention to bus commuters for ensuring comfortable and secure bus service.					

APPENDIX IV

A. Survey Questions for Women Commuters' Satisfaction on Bus Service Quality:

This section of the survey deals with your satisfaction about the existing bus service quality in Bangladesh. You should rank each statement as follows:

Attributes	**Statement**	**Score**				
		Excellent	**Good**	**Satisfactory**	**Poor**	**Very Poor**
		1	**2**	**3**	**4**	**5**

Overall Service quality	**1.** Overall Physical condition of bus.					
	2. Condition of reserved seats for women commuters.					
	3. Comfort level for women commuters inside the bus.					
	4. Frequency of bus service					
	5. Punctuality of bus service					
	6. Convenience of bus service					
	7. Convenient ticketing system to women commuters.					
	8. Reasonable transport cost for women commuters.					
Safety and Security	**9.** Safety at Bus stands for women commuters.					
	10. Security of women passengers (off peak periods)					
	11. Levels of women commuters' personal safety.					
	12. Driving safety (drivers skill)					
	13. Convenient boarding and alighting facilities for women commuters.					

	14. Punishment for women commuters' harassment.					
Behavior of Personnel	**15.** Behavior of drivers					
	16. Courtesy of helpers/contactors					
	17. Behavior of ticket counter's staffs					
Reliability and Accessibility	**18.** Reliability of Bus services					
	19. Accessibility of Bus					
	20. Travel time (office days)					
	21. Travel time (holidays)					
	20. Accessibility of Bus stand					
	21. Availability of information					
Customer Satisfaction	**22.** Do you think women commuters are satisfied with the prevailing overall bus services?	Strongly Satisfied	Satisfied	Neutral	Dissatisfied	Strongly dissatisfied

B. Problems faced by women commuters while traveling in bus:

1. Do you think women commuters usually face harassment while traveling in bus?

Yes

No

If yes, what types of harassment they face from the followings? (Multiple options can be chosen).

Sexual
Verbal

Physical
Humiliate
pick pocket

2. **Do women commuters have to deal with overcrowding and inadequate seats for women commuters on the bus?**

   Yes

   No

3. **Do you think boarding and alighting facilities are poor and insecure?**

   Yes

   No

4. **Other problems:** Please give the tick mark (√) on "Yes" if you are agreed to the following statements or "No" if you are disagreed.

Statements	**Yes**	**No**
Poor safety condition at bus stand.		
Long waiting time.		
Lack of security of the women commuters during off-peak period.		
Difficulties of movement inside the bus.		
Dirty and untidy environment inside the bus.		
Lack of fan and lighting facilities.		
Frequent engine and mechanical problem in the busy road.		
High noise level which takes place sound pollution.		
Aggressive driving and violation of traffic rules.		

C. Give your opinion about how to solve your above mentioned problems.

Please give your opinion to solve the above mentioned problem.

Several campaigns should be run against all types of harassment towards women commuters.

Complain box or a hot-line should be introduced for reporting and recording events of harassment.

Number of busses should be increased to solve the overcrowding problem.

About 25% seats should be reserved for women commuters considering the total bus commuters.

Boarding and alighting facilities should be more convenient to women commuters.

Installing CCTV camera inside the bus and stoppages to ensure women commuters' personal safety.

Proper actions should be taken to keep environment neat and clean inside the bus.

Bus drivers and conductors should be trained properly on how to deal with women commuters in a civilized society.

The concerned authority should strictly monitor the proper execution of traffic law.

APPENDIX V

A. Socio-demographic information questions:

1. Gender	Male	1
	Female	2
2. Age range (Years)	10 – 20	1
	20 – 30	2
	30 – 40	3
	40 – 50	4
	50 – 60	5
	Above 60 Years	6
3. Educational Qualification	Below SSC	1
	SSC	2
	HSC	3
	Graduate	4
	Postgraduate	5
	Students	1
	Service holder	2
	Businessmen	3

	Others	4
5. Salary Range (Taka)	Below 10,000 taka	1
	10,000-20,000	2
	20,000-30,000	3
	30,000-40,000	4
	40,000-50,000	5
	Above 50,000	6
6. Is the present bus service quality in satisfied condition to you	**Yes**	**1**
	No	**2**

B. Survey questionnaires for evaluating the commuters' willingness-to-pay by considering the quality level of service aspect:

Attributes (Independent variables)	The quality level of service	Willingness to pay for
Comfort level	Same as now	1
	Medium	2
	high	3
Safety and security level	Same as now	1
	Medium	2
	high	3
Travel cost	Same as now	2.50 BDT (current fare)
	Medium	3.00-3.50
	high	>4.00
Overcrowding	Same as now	1
	Medium	2
	high	3
Women commuter's	Same as now	1

	Medium	2
	high	3
Reserved seat for women commuters	Same as now	1
	Medium	2
	high	3
Boarding and alighting facilities	Same as now	1
	Medium	2
	high	3
Behaviour of bus staff	Same as now	1
	Medium	2
	high	3
Cleanness of bus	Same as now	1
	Medium	2
	high	3
Ticketing system	Same as now	1
	Medium	2
	High	3
Fitness of bus	Same as now	1
	Medium	2
	High	3
Frequency of bus service	Same as now	1
	Medium	2
	high	3

C. Survey Questionnaires for predicting the possible improvement of service quality to mitigate the woman commuters' harassment, safety and security level.

1) Do you think the woman commuters are harassed while traveling on public buses? [Female and Male]

a) No [1]

b) Yes [2]

2) Woman commuters are harassed for lack of service, planning, and policies.

a) No [1]

b) Yes [2]

3) Overcrowding is the major difficulty to use the bus.

a) No [1]

b) Yes [2]

4) Do you think where they are mostly harassed?

a) Bus stand

b) Inside bus

5) Do you think while the woman commuters are mostly harassed?

a) While waiting for bus at bus stop

b) While board and alight the buses

c) while women commuters are coming to bus stand

d) while contactor ticketing inside

6) The interior design of bus is not woman friendly or there is no implement of CPTED?

a) No [1]

b) Yes [2]

7) The women commuters are harassed by whom you think?

a) Bus staffs

b) Male co-passengers

8) Do you think where they are mostly unsafe and in secure?

a) Bus stops

b) Inside bus

c) On street

9) When do the women commuters feel unsafe and insecure mostly?

a) off-peak period

b) after 8:00-9.00 pm

c) after 9.00 -10.00 pm

d) 10.00 -11.00 pm

D. Survey questionnaires for finding the women commuters are willing to pay for the improvement of harassment and safety and security issues:

1) A separate door for male and female passengers

a) Yes

b) No

2) Separate seat arrangement for females and male passenger

a) y e s

b) No

3) CCTV and GPS tracker inside the bus

a) yes

b) no

4) Fare collected inside the bus using ticketing machine

a) Yes

b) No

5) No standing passengers are allowed

a) Yes

b) No

6) Setup possible nearest bus stop from passengers' house

a) yes

b) No

7) Provide special security for female passengers at bus stops

a) Y e s

b) No

8) Provide special security service bus for woman commuters at off-peak periods and after 10.00 pm

a) Y e s

b) No

E. Questions for WTP analysis

1) Are your willing to pay an extra fare for this type of bus service (depended variable consider)

a) No [1]

b) Yes [2]

2) How much extra fare you are willing to pay (BDT per km)

a) not willing to pay

b) 2.50 BDT (current fare)

c) 3.00-3.50

d) 3.5 -4.00

e) >4.00

APPENDIX VI

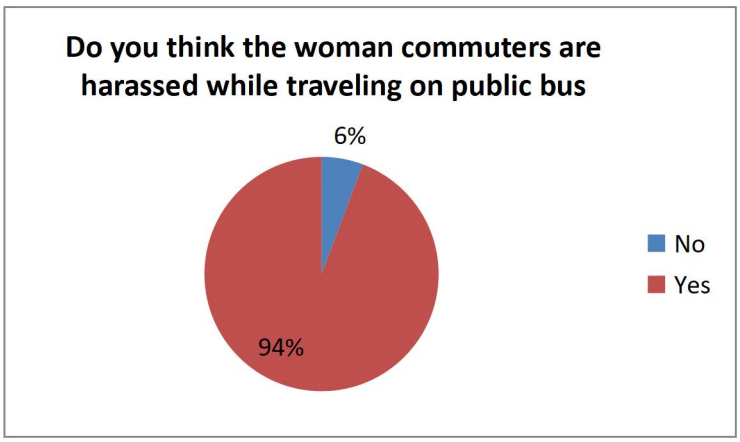


Figure 4.1

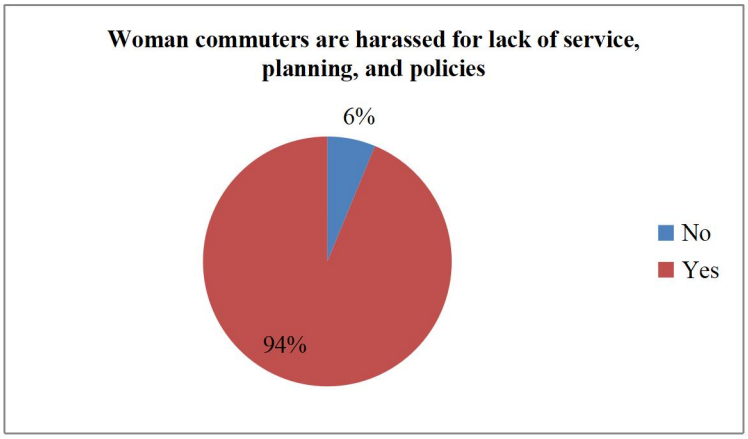
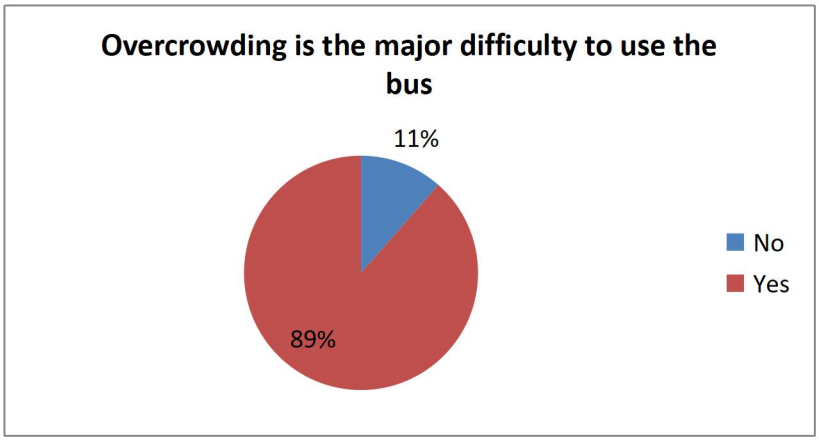


Figure 4.2



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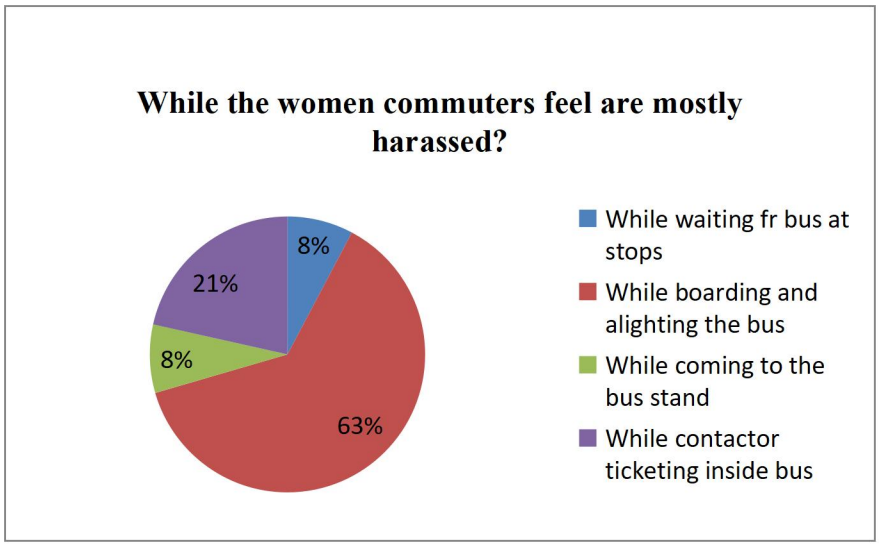


Figure 4.4

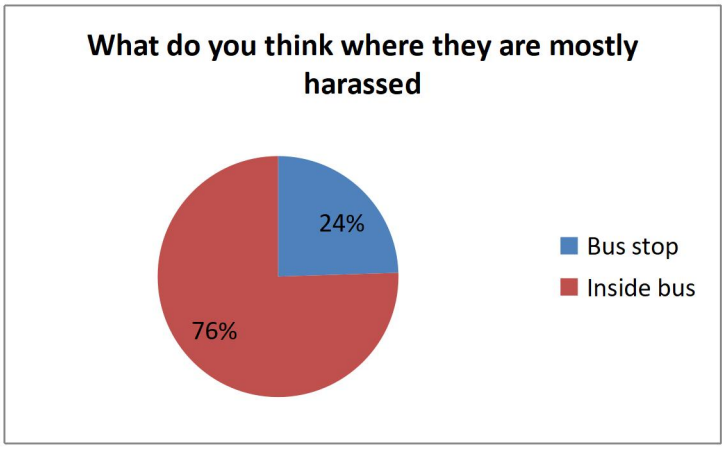


Figure 4.5

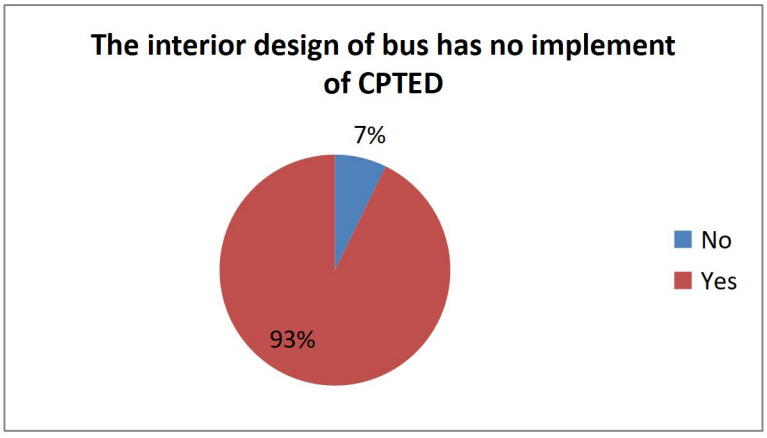


Figure 4.6

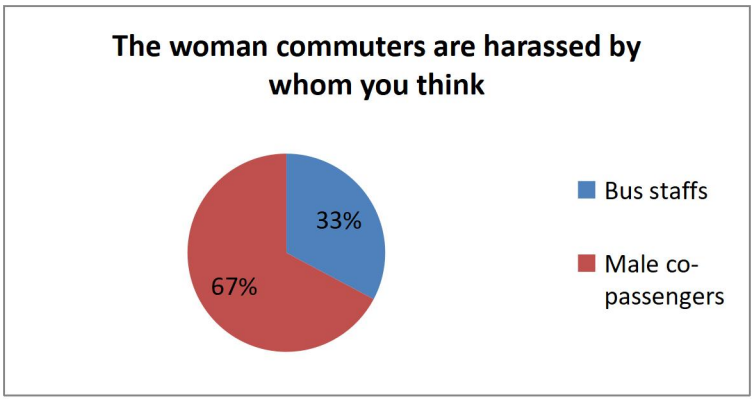


Figure 4.7

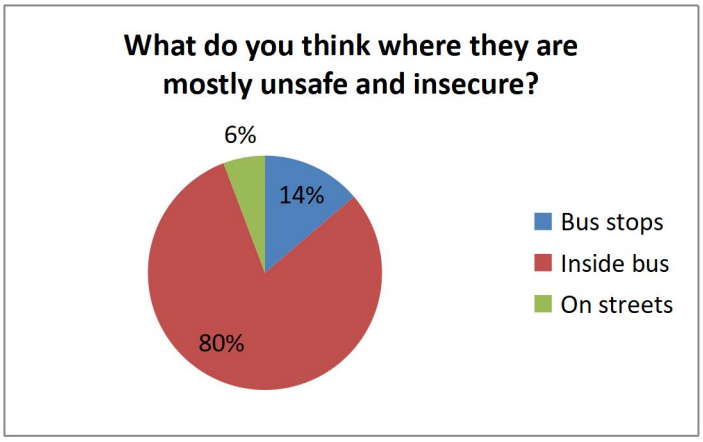
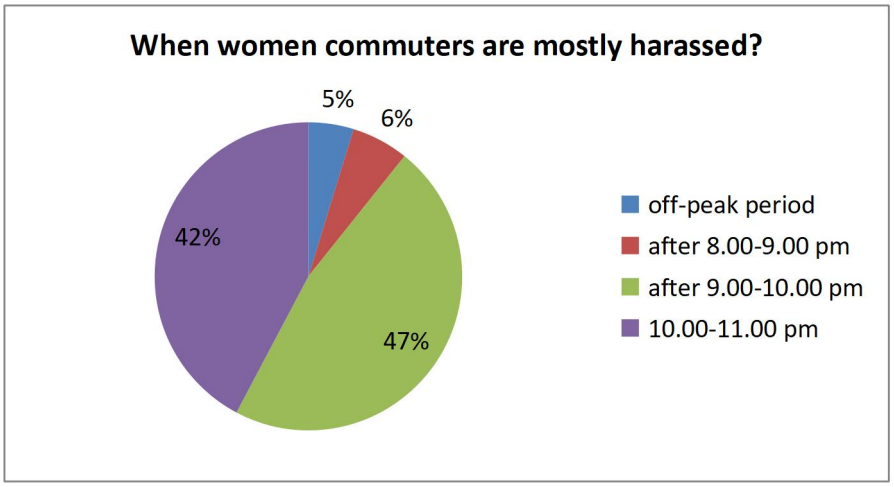


Figure 4.8



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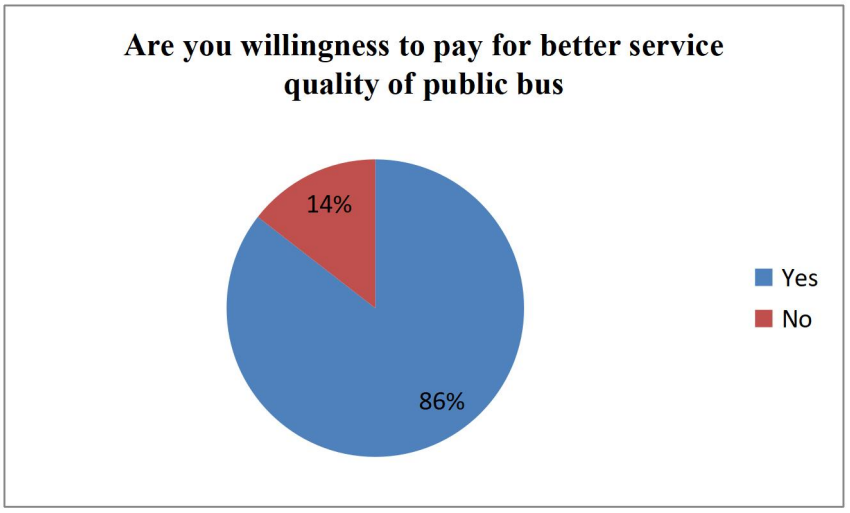


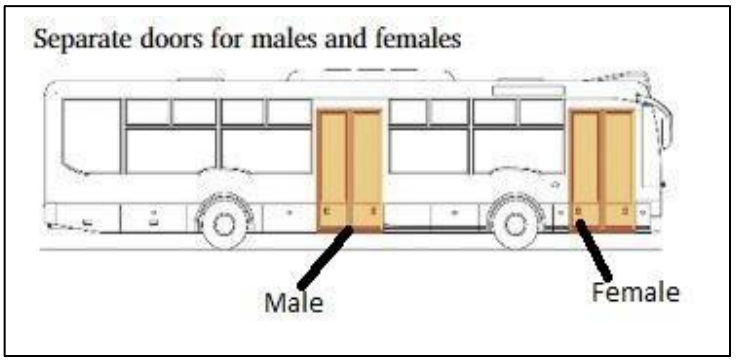
Figure 4.10

Appendix VII: Survey questionnaires for finding the women commuters are willing to pay for the improvement of harassment and safety and security issues:

1) A separate door for male and female passengers

   a) Yes

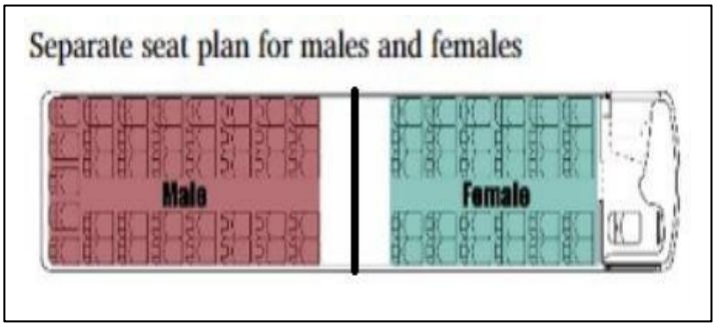
   b) No



2) Separate seat arrangement for females and male passenger

a) y e s

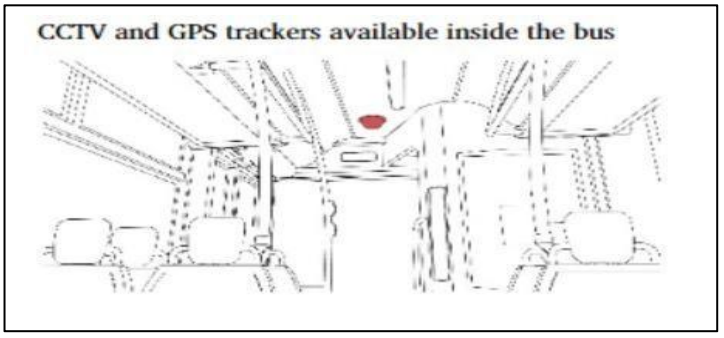
b) No



3) CCTV and GPS tracker inside the bus

a) yes

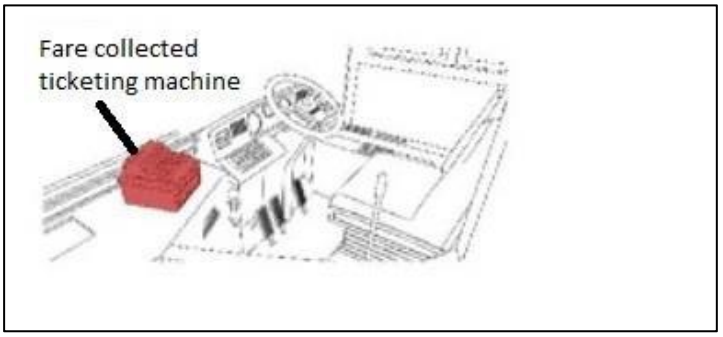
b) no



4) Fare collected inside the bus using ticketing machine

a) Yes

b) No



5) No standing passengers are allowed
    a) Yes
    b) N o

6) Setup possible nearest bus stop from passengers' house

a) yes

b) No

7) Provide special security for female passengers at bus stops a) Y e s

b)
No

8) Provide special security service bus for woman commuters at off-peak periods and after 10.00 pm

a) Y e s b)
No

10) Are your willing to pay an extra fare for this type of bus service (depended variable consider)

a)
No
[1]

b)
Yes
[2]

11) How much extra fare you are willing to pay (BDT per km)

a) not willing to pay

b) 2.50 BDT (current fare)

c) 3.00

-3.50

d) 3.5 - 4.00

e) >4.00