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Thesis title:

A Service Quality analysis of Pakistan's first mass transit project: A case study of Lahore Metro Bus Service.

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## Summary

Lahore, the second largest city of Pakistan, is encountering environmental degradation and traffic congestion issues. Few major reasons for the above said are absence of a respectable public transport system and large number of private vehicles roaming in the city. In reply to these issues, the Government of the Punjab province of Pakistan launched Lahore Metro Bus Service (LMBS) under ambit of Punjab Mass Transit Authority (PMA) in 2013. LMBS aims to provide safe, efficient, and comfortable urban transport network to its users. However, since its establishment there has been no evaluation to gauge its performance. Additionally, an added problem encompassing LMBS is that users have started to perceive the service quality of LMBS as insufficient, which is vindicated by reported news and few studies. PMA should understand what people want to see in LMBS. If PMA does not improve service quality of LMBS, its users might stop using it which would result in decrease in LMBS ridership. It gives birth to two questions as to which are the most significant service quality and user characteristics that influence the ridership of LMBS the most. Hence, it is imperative to comprehend the characteristics of service quality that might influence the ridership of LMBS. The service quality characteristics that are discussed in this study are Tangibles, Connectivity and Access, Reliability - Safety & Security and Cost & Fare. This research focusses on the perception of these service quality characteristics on the ridership of LMBS. The ridership of LMBS has been distributed in three levels in this study, based on how a user utilizes the service. These levels are frequent user, occasional user and seldom user. Likewise, in this study Socio-Demographic Characteristics and Characteristics of a Trip Maker are discussed as characteristics of the users that can have a likely influence on ridership of LMBS.

The objective of this research is to understand the impacts of perception of service quality and user characteristics on the ridership of Lahore Metro Bus Service, first mass transit project of Pakistan. This study further aims to contribute to a neglected aspect of service quality evaluation of LMBS.

It is an explanatory research and the primary research strategy used is quantitative survey method. By using questionnaires as research instrument, this study has collected 383 survey responses from online questionnaires only because LMBS was suspended. Furthermore, qualitative data was also collected via 8 online interviews from experts for sake of validation of the main data. The analysis of data has been done through ANOVA, SPSS, Frequency Analysis, Descriptive Analysis, Compare Mean Analysis and Cross Tabulation Analysis via Microsoft EXCEL.

The research findings elucidated that the users perceive the overall service quality of LMBS as fair with exception of seat availability and security standards. The results further concluded that tangibles, connectivity, and cost are the contributing factors of the ridership of LMBS. However, connectivity & access has the most significant influence on the ridership of LMBS. It can alter ridership by 58.3% with one unit increase in perception of the users. Another characteristic which largely influences the LMBS ridership is its fare. Its users are extremely satisfied with the affordability of LMBS. Similarly, all user characteristics were found to influence the ridership of LMBS positively except age, income, and ownership of a driving license. The ridership was found to be most significantly influenced by employment status and employment type. Lastly, the most important conclusion of this study is that ridership of LMBS is strongly influenced by perceived service quality and characteristics of its users and its users perceive the service quality as satisfactory/ good.

PMA must improve service quality aspects which are perceived as unsatisfactory by its users. PMA must also ensure periodic service quality evaluation of LMBS to retain its users and attract potential users. COVID-19 has resulted in extra ordinary circumstances and LMBS must be

adaptive to cope up with the emergent challenges. The data acquired from this study can be used as a feedback for the transit authority to enhance the LMBS service quality and to improve the LMBS ridership.

Key Words:

Bus rapid Transit, Perceived service quality, User characteristics, Ridership, Frequency of use.

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## **Foreword**

This thesis is authored as an important completion prerequisite of the Masters in Urban Management and Development (UMD 16), at the Institute for Housing and Urban Development Studies, Erasmus University Rotterdam, Netherlands, for the specialized field of Managing Infrastructure in the Green Cities. The aim of this thesis is to understand the impacts of perception of service quality and user characteristics on the ridership of Lahore Metro Bus Service, first mass transit project of Pakistan. The motivation to work on this theme commenced with my interest in the transport sector and dissatisfaction over lack of service quality evaluation studies on Lahore Metro Bus Service (LMBS). As a Government functionary, I wanted to contribute towards improving the service quality of this multi-billion-rupee project by gauging its performance. I feel my feedback will help in developing an improved outlook for this pioneer public transit project (LMBS).

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## Abbreviations

IHS	Institute for Housing and Urban Development Studies
LMBS	Lahore Metro Bus Service
PMA	Punjab Mass Transit Authority
JICA	The Japan International Cooperation Authority
BRT	Bus Rapid Transit
ICT	Information, Technology and Communication
LUTMP	Lahore Urban Transport Master Plan
ANOVA	Analysis of Variance
SPSS	Statistical Package for Social Sciences
GoP	Government of the Punjab
PTC	Public Transport Company
CEN	The European Committee for Standardization
AFNOR	French national organization for Standardization
UNDP	United Nations Development Programme
PKR	Pakistani Rupee

## Chapter I - Introduction

This chapter encompasses the global significance of transport infrastructure for sustainable growth in general and then narrows down the focus on the Lahore Metro, first Bus Rapid Transit System (BRT) in Pakistan. Subsequently, the literature gives a broad synopsis of the over-all study, highlighting the backdrop, problem statement and research question. It also outlines the research question, importance of the study and closes with its limitations.

### 1.1 Background:

Transport infrastructure is an essential component of the transport system of any city or state. Transportation as a financial element is a gauge of the economic activity (Skorobogatova and Kuzmina-Merlino, 2017). A well balanced and adequate system of transport is an imperative to meet the growing demands of population. However, with the ever-increasing focus on progress and economic development, a new paradigm of “*sustainability*” has emerged. The notion of sustainable development promotes the necessity to pursue an equilibrium between economic, environmental, and social aims of development (Steg and Gifford, 2005).

The world, particularly Asia is undergoing rapid urbanization. The human population is forecasted to increase approximately four-folds between 1950 and 2050. It is expected that by mid of this century there will be 2.2 billion new urban residents in the developing countries (Litman, 2016). Rapid urbanization induced by economic growth in Asia is leading to increased levels of motorized vehicles on the roads. This has several negative repercussions including environmental degradation, longer travel times, congestion and an extensive energy consumption etcetera (UN Habitat, 2013). Non availability of any alternative and social norms in a certain area are also a reason for the people to use private vehicles. South Asia is facing similar problems with respect to transport and the focus has been a move in the direction of more sustainable means of transport such as public transport (Barter, 2000).

The solution to the transportation problem lies in shifting from “*ease of moving*” to “*ease of reaching*” (Litman, 2016). This can be achieved by giving the people diversified options to reach their destinations, for example, walking, biking, public transport. Public Transportation has the capability to transport more people, therefore it takes reduced operating space, mitigates congestion, lowers pollution and enhances the efficiency of overall transport network (Litman, 2016; Vashisht et al., 2018). As the way forward lies in accessibility, that can only be managed by establishing and improving the public transportation (Litman, 2016). Though public transportation projects are costly, but a cost-effective solution is to spend on road-based public transportation like Bus Rapid Transit (BRT). BRT is cheaper than a Light Rail Transit system and underground or elevated rail system (Majid et al. , 2018).

BRT is a flexible, rubber tired, high-class, and useful mass transport mode, delivering reasonable size, capability, and pace equivalent to all sorts of urban rails (EMBRAQ, 2013). BRT systems have earned popularity across the world as efficient and cost-efficient alternative to pricy urban rail ventures (Cervero, 2013). Today more than 150 cities of the world have BRTs running over 4,000 kilometres of bus corridors and carrying almost 30 million passenger per day (EMBRAQ, 2013). In 2013, Pakistan introduced its first BRT project in Lahore. Since then, BRT has been replicated in three mega cities of Pakistan (PMA, 2013).

The provision of transport infrastructure is closely linked to its “ridership”. The transit agencies and operators must make sure that their service is being used. They must know the characteristics

of its users and how do they perceive its service quality (Eboli and Mazzulla, 2010). This knowledge continuously helps the process of improvement of public transport services as per expectations of its users. A service having confidence of its users not only retains the existing users but also attracts new potential users (van Lierop and El-Geneidy, 2016). Hence, the service provider must concentrate on its users and ensure that they have a positive feel about the service quality of the transit whenever they use it. It has been established that an improved perception about service quality has a positive co-relation with the desirability, hence increases the patronage of the transit system (Eboli and Mazzulla, 2010). A pleased customer is expected to not only continue using a service but also propose the service to others. Therefore, to retain a regular/frequent user and to attract a potential user the transit agency must understand the characteristics of perceived service quality and attributes of its users. It is because the travellers' view towards provision of good or bad service by the transit agency, is significant (van Lierop and El-Geneidy, 2016).

## 1.2 Problem Statement:

Lahore, the second largest city of Pakistan is the capital of its most populated province, Punjab. It is a booming metropolis with a population of approximately 11 million, growing at an annual rate of 3% over an area of about 2000 square kilometres. This city is the administrative base of 120 million residents of Punjab province, educational and medical hub, home to several recreational facilities and surrounded by gigantic industrial zones which generate huge travel demand (Javid et al., 2018). Lahore has also seen a sharp rise in vehicle registration, from 95 vehicles per ten thousand population in 2001 to 238 vehicles per ten thousand in 2008 (Government of Punjab, 2015). Motor Cycles according to Javid et al. (2018) constitute the major portion of vehicles on the roads of Lahore. The population growth combined with high motorization growth (36.7% per annum in last 10 years) has resulted in frequent traffic jams (JICA, 2019). The prevailing public transport system consists of traditional bus and wagon system and the majority users are not satisfied due to its inconvenient and uncomfortable nature. Environmental degradation is another consequence of motorization. Lahore has been ranked among 10 most polluted cities by IQAir AirVisuals<sup>1</sup> reports.

To cater for the needs of a rapidly growing Lahore, the Provincial Government of Punjab (GoP) adopted a JICA<sup>2</sup> supported “The Project for Lahore Urban Transportation Master Plan Study in Pakistan (LUTMP)”. The BRT Lahore or Lahore Metro Bus Service (LMBS) was established in 2013 as a short-term LUTMP<sup>3</sup> top priority plan to tackle the transportation problems of Lahore.

LMBS is the first BRT of Pakistan and is regarded as an essence of infrastructure transformation in Punjab, Pakistan. It was constructed in 11 months on a dedicated corridor, at the expense of 29.8bn PKR (PMA, 2013). Lahore metro bus service (Line – I) has a 27 km route (8.5 km elevated) and a total of 27 stations between *Gajjumata* and *Shahdra (North to South)* (Government of Punjab, 2015; Javid et al., 2018). LMBS and its feeder bus service is operated by the Punjab Mass

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<sup>1</sup> AirVisual – IQ Air is an internationally acclaimed software company which runs an air quality app. It measures the pollution levels of cities worldwide based on real time data from public monitoring sources.

<sup>2</sup> Japan International Co-operation Agency is a governmental agency executes Development Assistance programs for Japanese Government. It funds and assists social and economic sector development programs in the developing countries and promotes international co-operation.

<sup>3</sup> The Project for Lahore Urban Transportation Master Plan is a joint study project of JICA and the Government of Punjab to improve the transport infrastructure in the province.

Transit Authority<sup>4</sup> (PMA, 2013). PMA has introduced many technological intervention in the operations of LMBS, such as E-Ticketing/ Automated Fare Collection/ Bus Scheduling System (AFC/ BSS), Vehicle Location System (VLS), On and Off Bord Passenger Information System (PIS) and Intelligent Traffic System (ITS) (PMA, 2013).

**Figure 1. Aerial view of a Metro Station (photo courtesy: [www.paksteel.com](http://www.paksteel.com))**



The transport network must provide its users a good feel and it shall meet its user expectation in order to ensure their loyalty and patronage (van Lierop and El-Geneidy, 2016). It is imperative for transport planners and service providers to understand the perceptions and expectations of the users in relation to the service. Passengers' contentment with service features is considered to improve the desirability of transit by increasing ridership and ensure long-term continual usage (van Lierop and El-Geneidy, 2016). However, there has been limited and low quality research on the user perspective of Lahore Metro Bus (Zolnik et al., 2018).

The objective of the LMBS is to provide safe, superior class, cost effective and comfortable urban transport network to the people of Lahore and to reduce congestion on the roads and improve city environment (PMA, 2013). LMBS is a single corridor transit service and as per midterm transport plan of Lahore, a lite train corridor of 27 kms (Orange Line) was to be added by 2020 to augment its connectivity (JICA, 2019). This project is yet to be completed resulting in a small coverage efficiency of LMBS. Likewise, work on six other proposed corridors is yet to be started. In addition to its low coverage area, LMBS is not integrated with other forms of public transport networks and its feeder buses do not attract maximum travellers (Daily Dawn, 2014). This results in overcrowding and impedes the ease of connections. Furthermore, 1.2 km of LMBS corridor (a bridge over river Ravi) is not segregated and is open for mix traffic (PMA, 2013). It occasionally results in congestion; traffic hazards and causes delays in LMBS operations. Some of the evidence of the above said can be observed through a study of public transport in Lahore, from (Rathore and Ali (2015) which mentions that there are complaints from the travellers about various *service*

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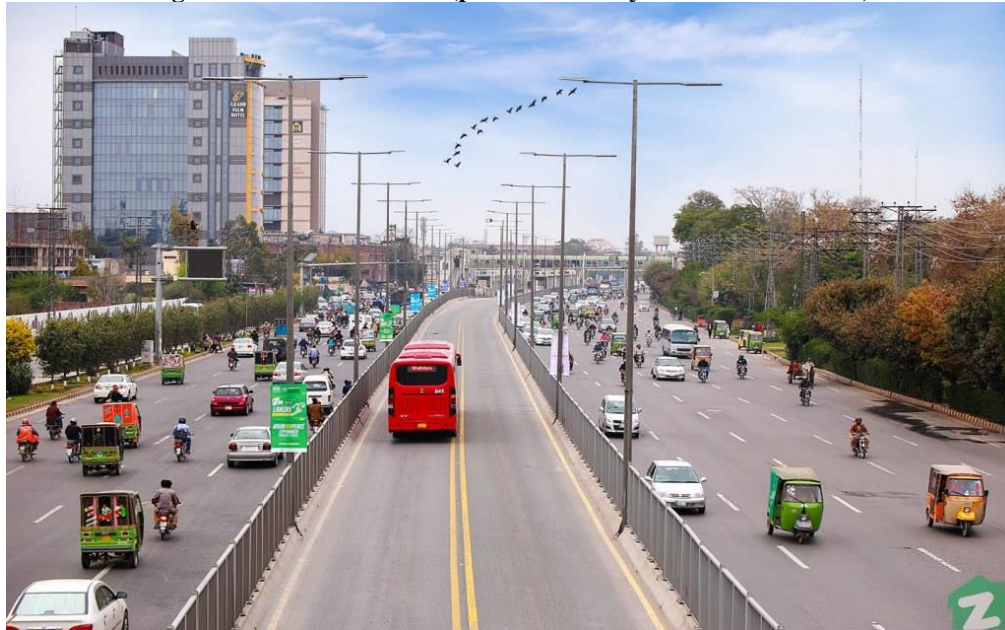
<sup>4</sup> Punjab Mass Transit Authority was created exclusively to execute and operate reliable, affordable, and safe mega transport projects in Punjab. It is financially autonomous and administratively empowered by regulations to ensure smooth operationalization of its projects

*quality characteristics* of LMBS such as availability of seats in the bus, overall security standards, station cleanliness and total travelling time. Additionally, although the fare of LMBS is still considerably low yet the Government has recently taken an unpopular decision of increasing the fare of LMBS and its feeder buses (Daily Dawn, 2019). Although a huge majority is happy with the ticket price, still sporadically the commuters are often found criticizing the reduction in subsidy. They are occasionally found quarrelling with PMA staff over lack of facilities, cleanliness at the stations, filthy washrooms and broken escalators at the stations (Rathore and Ali, 2015). Similarly, incidents of pick pocketing and loss of luggage have also raised question marks on LMBS security standards (Rathore and Ali, 2015). Another aspect of the problem is the barrage of unlicensed motorcyclists on the roads of Lahore, LMBS was supposed to help in their reduction (Daily Times, 2017). However, the outcomes have not been studied yet. The results from several news items and authors reveal that there is a demand for betterment in some service quality aspects of LMBS such as, maintenance of stations, connectivity, safety, overall comfort & cleanliness, reliability, and rush in the buses. In addition to the above, understanding the perception about the service quality characteristics of LMBS is never given priority by PMA. There are hardly any substantial evaluation studies done. There is a dire need to address this unresearched aspect of LMBS (Saadat, 2015).

LMBS is a public transit for various segments of the society and its users vary in terms of their characteristics. The varied nature of user characteristics, that is, age, education, gender, and attributes of the trip maker is an influencing factor for the ridership of LMBS (The Nation, 2014). Evidences from the study of Zolnik et al. (2018) reveal that students working class and low income people are majority users of LMBS. Few media houses have blamed LMBS of not been able to influence the rich and car owners to abandon their private vehicles and start using LMBS (Majid et al. , 2018). Likewise, LMBS is also blamed for not being women friendly (Daily Dawn, 2014). Nevertheless, if LMBS does not better its service quality and fail to come up to the expectations of its users, it will squander its desirability and will not be able to achieve its objective. Its users will switch to other modes of transport and ultimately the ridership of LMBS will decrease.

Emphasis of this study is on “*users*” because they determine the success of a transit. Users choice of a transit mode is greatly influenced by service quality (Eboli and Mazzulla, 2009). Different users think differently about the service quality even if under consideration are the same service quality features. A service provider must address its users’ expectations to maintain an optimal level of service quality (Bozbura et al., 2010). Else, users will not prefer the transit service as their main choice. How users perceive the service quality of a transit service, determines its success, and reflects on ridership of a transit service (LMBS in this case). Thus, it is of vital importance to see the influence of characteristics of perceived service quality and user attributes on the ridership of LMBS.

Figure 2. LMBS Corridor (picture courtesy: www.zameen.com)



### 1.3 Research Objective:

This study aims to understand the impacts of perception of service quality and user characteristics on the ridership of Lahore Metro Bus Service, first mass transit project of Pakistan. It further aims to evaluate which service quality parameters have the most substantial impact on the frequency of use of LMBS. Furthermore, understanding the characteristics of service quality of LMBS will ultimately help the service provider to fix the issues with LMBS.

#### 1.3.1 Research Question:

To what extent do the **perceived service quality** and **user characteristics** influence the **ridership** of Lahore Metro Bus Service (LMBS)?

*Independent Variables:*

i) Perceived Service Quality

ii) User Characteristics

*Sub-Variables:*

- a) Tangibles
- b) Connectivity and Access
- c) Cost and Fare
- d) Reliability, Safety and Security

*Sub-Variables:*

- a) Socio-Demographic Characteristics
- b) Characteristics of trip make

*Dependent Variable*

i) Ridership of LMBS

*Sub-Variable:*

a) Ridership of LMBS

### **1.3.2 Sub-questions:**

- 1) How do users perceive the service quality of LMBS?
- 2) To what extent does the perceived service quality influence the ridership of LMBS?
- 3) What is the level of influence of user characteristics on the ridership of LMBS?

## **1.4 Significance of the Study:**

### **1.4.1 Scientific Relevance:**

*Firstly*, this study undergoes a user specific and governance-based analysis of user perception of service quality of LMBS and its impacts on the ridership. Previous studies on LMBS service quality lacked this aspect (Zolnik et al., 2018).

*Secondly*, a wholistic study regarding service quality aspects of LMBS has not been done before. Even PMA has not conducted any evaluation study of LMBS (Zolnik et al., 2018).

*Thirdly*, this study is unique in a way that it analyses the component of security and safety of users of LMBS. In a terror hit Pakistani society, this significant aspect is found missing in erstwhile researches (Masoor et al., 2016).

*Fourthly*, this research will serve future researchers and academicians, through the added niche of this research to literature.

### **1.4.2 Societal Relevance:**

The results of this study will be an important data base for the transit agency, policy makers and the government to:

- a) mitigate the user concerns regarding service standards,
- b) improve the existing quality by having an insight of service loopholes,
- c) design policies and methods to attract more passengers.

This document can add value to the routine evaluation and monitoring process of LMBS.

## **1.5 Limitations:**

Firstly, COVID-19 impeded the (qualitative and quantitative) data collection process and the researcher had to change the methodology by being extremely adaptive (further explained in Chapter 3). Secondly, this study is concentrating on only one feature of service quality, that is perceived service quality. Although few other factors namely, expected delivered and targeted quality also play a vital role. Thirdly, this study is restricted to influence of personal characteristics of users and perceived service quality on ridership of LMBS. Practically, user's choice of one transit mode over other is not merely because of how they rate the service quality of one transit mode (LMBS in this case) but how they rate other transit options as well. Lastly, travel restriction, lockdowns, and closure of offices during the corona pandemic resulted in serious paucity of time, additional resources for data collection and completion of field work.



## Chapter II - Literature Review

### 2.1 Introduction:

The chapter two gives an insight into the academic background of various theories related to this study. Firstly, it explains the concept of Bus Rapid Transit along with the notion of service quality, which is linked with the perceived service quality and its characteristics. Next, it discusses the characteristics and travel behaviour of transit users, how that influences transit ridership. This part also throws light on few state-of-the-art theories which impact the choices users of transit networks make. In the end, there is a graph exhibiting the conceptual framework.

### 2.2 Bus Rapid Transit:

Bus Rapid Transit is a bus-centered, rubber-tired transit system which provides high-speed, comfortable, and cost-efficient public transportation services (APTA, 2017; EMBRAQ, 2013; ITDP, 2007). BRT includes attributes akin to a light rail or metro system, hence it is more dependable, expedient, and quicker than the conventional bus service (Kogdenko, 2011). A BRT can be termed as an improved version of bus transport network because of its peculiar identity, flexibility and frequency of operations (Hess and Bitterman, 2008; Levinson et al., 2002). The rationale for an improvement in existing conventional bus transportation systems is to increase the capacity of public transport, lessen the congestion, mitigate pollution and save passenger time (Rizvi and Sclar, 2014). Therefore, it is now a contemporary class of metropolitan passenger transportation with a constantly expanding global reputation due to its bulk transportation capability, rapidity of execution at low to moderate investment and operational costs (Deng and Nelson, 2011; Hensher, 2007).

Miller and Buckley (2001) indicate that BRT is not a new concept and can be traced back to the middle of last century. Relevant literature mentions that the characteristics of modern BRT, including separated busways, priority signaling mechanisms, fast ticketing practices and quick passenger handling had been conceived since mid-60's (Hensher, 1999; Hidalgo and Gutiérrez, 2013). Several authors have argued that these features have played a significant role in the success of a BRT and are crucial for deriving maximum system gains (Cervero, 2013; ITDP, 2007). An unprecedented success of BRT systems is linked to its following traits:

- i. extremely short execution time,
- ii. improved operative elasticity in comparison to rail transport owing to the compatibility of the system with feeder services,
- iii. moderately low execution cost in comparison to other modes of mass transit,
- iv. fairly high-grade output and
- v. healthy impacts on the urban environment (APTA, 2017; EMBRAQ, 2013; Hensher, 1999; ITDP, 2007; Zimmerman et al., 2011).

Nikitas and Karlsson (2015) after reviewing concept of BRT have put forward following characteristics of a BRT:

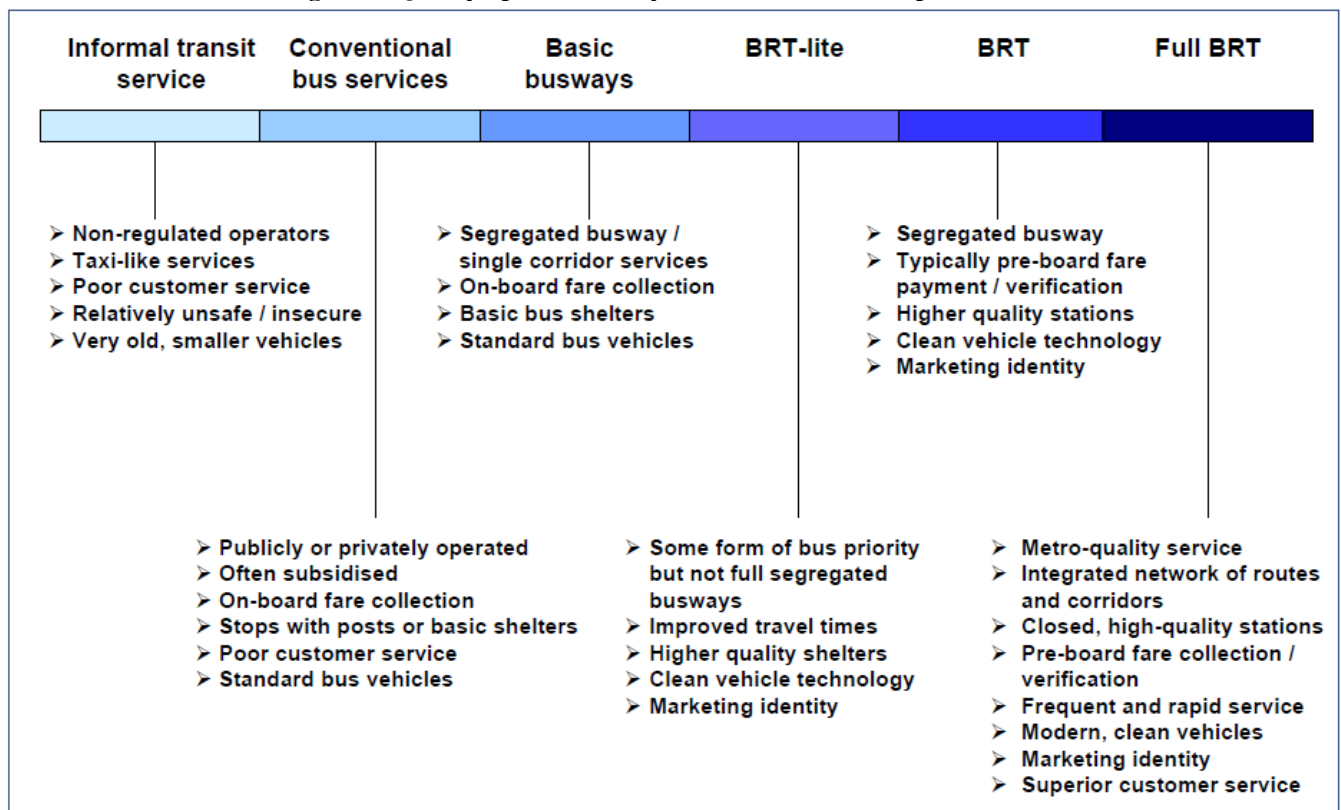
- i) *Vehicles*: It is connected to vision, character, and quantifiable performance achievement of a BRT.
- ii) *Stops – Stations – Terminals & Corridors*: They describe functioning space.

- iii) *A wide variety of rights of way:* Exclusive BRT corridor which is completely segregated from usual road traffic.
- iv) *Pre-Board Fare Collection:* Issuing tickets before embarking the bus.
- v) *Information and Communication:* Information Communication and Technology (ICT) interventions add value and help in user well-being, security and ease, system trustworthiness and integration & over all speed of the network.
- vi) *All-day Service:* minimum sixteen hours in one day.
- vii) *Brand Identity:* Visual attributes that specify a BRT system, strategies and qualities which promote and advertise the system.

### 2.2.1 BRT Categorization:

The comparison of different tyre-based public transport system is given below:

Figure 3. Quality Spectrum of Tyre-based Public Transport



Source: (Write and Hook, 2007)

The said comparison is named “quality spectrum of tyre based public transit”. As shown in figure 3, *BRT* is split up into three different standards, which are:

- I. BRT-Lite,
- II. BRT &
- III. Full BRT

Whereas the other *non-BRT tyre-based* public transport are informal transit service, conventional bus services, and basic busway. The informal Transit Service is unregulated and sits at the lowest

tier of public transportation while the Conventional Bus Service is weakly standardized and has inferior user service. The Basic Busways resembles a BRT system because of the standard vehicles operating on a single corridor. BRT-Lite or superior bus service has semi segregated bus corridors/lanes, improved ticketing system and service identity. BRT is equipped with exclusive busways and few distinguished features of a full BRT. Finally, Full-BRT is the model that will inhabit the highest tier. To attain the status of a Full BRT, a BRT should meet certain minimum standard characteristics including dedicated busways, an assimilated network of routes, pre-board integrated ticketing system with feeder networks, well-equipped stations with level access between ground and stand, distinguishing branding, market identity and *high-end service quality* etc.

### **2.3 Service Quality:**

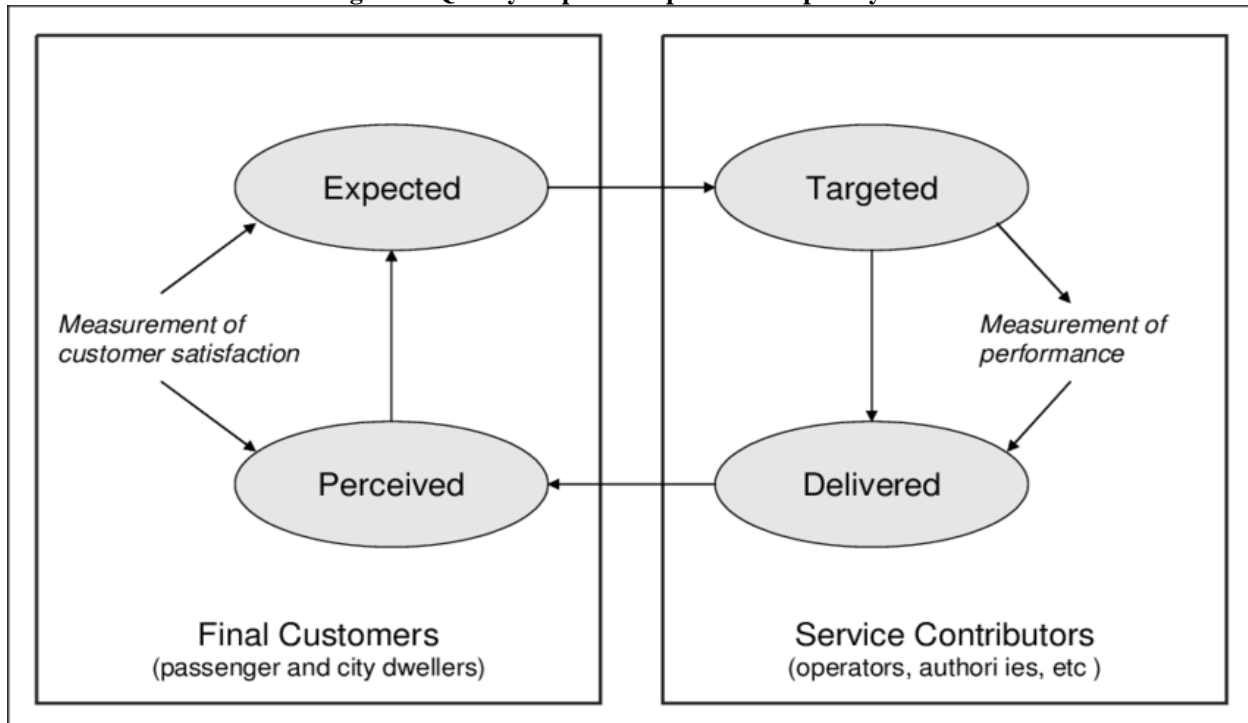
Quality is an extraordinarily dicey notion, simple to imagine yet frustratingly tricky to describe (Vincent, 2001). Service Quality is the capacity of transport operators to deliver a service as per the needs of existing and prospective users of the system (Lai and Chen, 2011). Mahmoud et al. (2011) state that service quality is a gauge of how nicely the performance level being provided is matching the expectations of the users. Various authors believe that the service quality is a measure of user expectations on a constant service standard base (Eboli and Mazzulla, 2011; Mahmoud et al., 2011).

Public transport must present an optimal level of service coupled with required features that fulfil the requirements of existing users, and vitally, the needs of likely users (Mahmoud and Hine, 2016). The success of a transit system is linked to the number of its users, it must have an ability to attract prospective passengers, convert them into regular users and then retain them (Kogdenko, 2011; Lai and Chen, 2011). In order to achieve the needful, the project layout, routine upgradation, maintenance, and operationalization should be mainly *demand oriented* (Arun et al., 2016). A dedicated emphasis on the demand-side means Public Transport Companies (PTCs) will focus more on the *quality of service* (Barabino and Di Francesco, 2016). The increased focus on quality of service bears two pronged results. Firstly, with improved service quality the transit agency will enter a healthy competition with its competitors knowing that the people will only select the best service provider which will satisfy their needs better. Secondly, the satisfied customers will recommend the service to the people with similar needs. Hence, the amount of consumer happiness presents a service quality gauge (de Oña et al., 2013; Eboli and Mazzulla, 2009; Vincent, 2001). Another important target for the transport agencies is to win the loyalties of their customers by providing better service quality. This is achieved by pulling likely users of their service by improving the desirability of network, nurturing patronage by growing the ridership regularity and inspiring long term continued use. Hence, emphasis on service quality shall pave the way for a sustainable public transportation network by motivating people to use public transport instead of private vehicles (Andreasson and Lindestad, 1998; Bozbura et al., 2010).

Bozbura et al. (2010), Mahmoud and Hine (2016) & Morfoulaki et al. (2007) believe that for a comprehensive understanding and monitoring of the bus transit service quality, the procedure of quality supervision must be disintegrated into workable pieces. The European Committee for Standardization for Transportation (CEN) & French Organization for Standardization (AFNOR) initially in 1998, and finally in 2001 established and suggested a service quality loop which explains the procedure of quality supervision/ management (Vincent, 2001). This quality loop is one of several tools to measure the transit service quality. The quality loop tool is a vigorous customer leaning process to define the essential service. It identifies the main areas for change,

triggers service quality upgrades and can be employed at the system level as well as inside the system (Vincent, 2001).

**Figure 4. Quality loop for the public transport system**



Source: AFNOR & CEN (Mahmoud and Hine, 2016)

The figure 4 shows the connection between the perceived and expected quality (customer side) and targeted and delivered quality (operator or supplier side) of services. The loop results from a sequence of connections between the components in it, hence establishing four distinctive gaps. The bigger the gap between two successive components of the loop, the bigger the problem is in the specific public transport service or system. Enhancing service efficiency and quality means shutting the four gaps. It is also based on four unique standards:

- i) Expected quality: level of quality imagined by the user/ customer
- ii) Targeted quality: level of quality that the operator intends to deliver to its customers/ passengers.
- iii) Delivered quality: level of quality that is attained in routine on daily basis by the operator.
- iv) Perceived quality: level of quality a customer/ passengers feels/ senses during travels (Vincent, 2001).

There is a consensus that the consumers are the only judge of service quality. The transit quality depends on the users' perceptions about each trait describing the service (de Oña et al., 2013). Thus, the knowledge of how the customer perceive the service is imperative for transit agencies (de Oña et al., 2013; Lai and Chen, 2011).

### **2.3.1 Perceived Service Quality:**

The customer perception constitutes the most significant component of the quality loop. Service Quality is reliant on the personal perceptions of the customer (Parasuraman et al., 1985). Perceived

Service Quality is consumer's evaluation of product's overall quality. Customers consider personal inclinations, anticipations, and experiences to decide the quality of a service. They often build their assessments on several aspects, or even several incidents, of a service experience (Parasuraman et al., 1985).

A transit agency can study and utilize the customers perspective to analyse their performance and make necessary improvement/ interventions in the service, where and when required (Grujičić et al., 2014). Passengers who perceive good quality of public transit service are therefore expected to have a greater level of perceived value and contentment, so they keep using this service (Lai and Chen, 2011). Understanding the evaluation procedure on which customers choice of the transportation mode for their journey is based, according to Eboli and Mazzulla (2010), is vital for transit agencies. These agencies can then enable themselves to make strategies and plans accordingly which eventually impact the choices of the consumers. Kyoon Yoo and Ah Park (2007) linked the perceived service quality with the personal experiences gained over a period which then determine the quality of the service or product. In the quality loop as well, the customer's perceived quality epitomizes the overall service quality which is established because of various experiences of the customers in terms of several service-related characteristic (dell'Olio et al., 2010; Vincent, 2001).

Hence, even a technically ideal service, that does not satisfy customers' expectations will not succeed (Kyoon Yoo and Ah Park, 2007). When an operator is aware of consumers' assessment of the quality of service, it will be better equipped to influence these assessments in a preferred direction by linking service delivery to customer benefits (Zeithamal et al., 1996).

### 2.3.2 Perceived Service Quality Characteristics:

Strawderman and Koubek (2008) believe that the services consist of two parts namely *technical* and *functional outcomes*. The former is usually discussed as *what* of service. The latter is usually discussed as the *how* of service. The customers make service quality assessments on the *outcome* (what was delivered) and *process* (how the service was delivered) of service delivery (Barabino and Deiana, 2013). Services are unquantifiable as they have no physical unit (Barabino and Di Francesco, 2016). Similarly, services are consumable and diverse, nonetheless, quality is considerably subjective (Zeithamal et al., 1996). Many researchers have suggested that characteristics of service are vital in evaluating the quality of service (Guirao et al., 2016; Hi-Trans, 2005; Ribeiro, 1993). These crucial quality attributes are the underlying concerns that influence service quality (Zeithamal et al., 1996).

#### 2.3.2.1 Tangibles: (Comfort- Cleanliness and Representation of the Service)

This attribute includes many important indicators including:

- a) overall cleanliness & look of the facilities
- b) acceptable comfort levels (Hess and Bitterman, 2008; Zeithamal et al., 1996).

A customer would like to use a service and buses which presents a neat look, has a comfortable setting, has a modern demeanour and offers attractive and reasonable paraphernalia (Rohani et al., 2013).

### **2.3.2.2 Access and Connectivity:** (Approachability and Ease of Connection)

It means the accessibility and availability of transit. It is the basic stage in the decision-making process of a user since they would only use the service if it is connected (directly or with minimum possible transfers) to their destinations, else they will opt for any other option. The transit service must be available close to the origin and destination of the users, ideally at convenient walking distance and with reasonable parking facilities (park and ride & bicycle racks) (TCRP Report 88, 2003). The coverage and access should be so designed that it must have reasonable distance between stops, sufficient number of stops, and convenient approachability of stops (Redman et al., 2013). This attribute is also linked to the total time spent (*Total Trip Time*) in travelling (TCRP BRT Volume II, 2003). It is the total of the in-bus and off-bus time. Off-bus time is the time taken by a user to reach the stop to board the bus and time taken to reach the destination after disembarking from the bus (TCRP Report 88, 2003). Transfers between various transit vehicles increase or decrease the travel time considerably (TCRP Report 88, 2003). Coordinated and synchronized transit timetables between Feeding Vehicle (FV) and Receiving Vehicle (RV) could enhance the service quality of transit (Tabassum et al., 2017). On the contrary, ill managed transfers discourage the users from using the service (TCRP BRT Volume II, 2003; TCRP Report 88, 2003).

### **2.3.2.3 Cost and Fare:** (Ticket Price, Travel Expenditures)

Likely passengers evaluate the expense and significance of boarding transit versus the out of pocket costs and price for travelling by different modes (Redman et al., 2013).

- Out-of-pocket journey expenses comprise of the ticket for every single tour, or the price for a month-long pass,
- Out-of-pocket auto expenses consist of various tolls and parking fees.

Hence, the public transit service will only be more acceptable to general public if it offers affordable fare, free parking and subsidized travel passes or other ways of promoting transit use as a substitute to the private vehicle (Redman et al., 2013).

### **2.3.2.4 Reliability, Safety and Security:** (Regularity & Freedom from Danger)

Reliability is believed to be a key trait in establishing public transport quality (Mikhaylov et al., 2015). It alters the customers waiting time at a stop for a vehicle to arrive, as well as the regularity in the customer's arrival time at a destination on daily basis (Zeithamal et al., 1996). Reliability is affected by traffic conditions, vehicle upkeep and staff readiness and by how aptly the operators follow the schedules (Zeithamal et al., 1996). When and how with respect to the availability of a transit service are important factors in user's judgment to use transit (Eboli and Mazzulla, 2010). A transit mode will not be chosen by the passenger if service is not offered on users desired time even if the distance to the transit station is very less (Levinson et al., 2002). The operator must keep the public updated with relevant details like routes, fares, schedule etc. (Ribeiro, 1993).

Safety and security are thought to have an influence on user satisfaction (Mahmoud et al., 2011; Rohani et al., 2013). These traits become more important in developing countries like Pakistan, which have been a victim of several terrorist attacks particularly at public places. Safety is related to the possibility of an accident, personal irritants, or protection against any personal crime (Eboli and Mazzulla, 2011). Customers are concerned about safety because they wait, pass by and travel

in crowded stops and vehicles respectively (Mikhaylov et al., 2015). The security aspect is more related to crimes and can be improved by deploying security guards, surveillance gadgets etcetera (TCRP Report 88, 2003).

## **2.4 Ridership of Lahore Metro Bus Service (LMBS):**

Eboli and Mazzulla (2011) & Lai and Chen (2011) believe that public transport should be capable to attract the attention of people to try it. It is vital to comprehend the travel attitude of individuals to get a greater knowledge of the way of thinking of users. The intentions of the people to utilize a public means of transport are inspired by how they perceive the service quality dimensions (Florida Tourism Department, 2008).

It is not only the travel mode which influences the satisfaction of users, rather it is the optimistic mindsets about travelling which will have a positive impact on travel satisfaction. The preferred travel mode of travellers' influences satisfaction of travel (De Vos, 2019). To Sociologists, people are identified as being distinct with variations in desires and aspirations and hence with unique inclinations (Aarts et al., 1998). This suggests that people receive various options, acquire distinct resources, and select the most suited substitute of behaviour matching with both, their inclinations, and aptitudes (Olsson, 2003). Whereas, Economists believe that people assess their options of behaviour, limitations, and expenditures, and ultimately decide logically the most suitable option as per their inclinations (Verplanken et al., 1994). Researchers have tried to explain customer's mode of travel by employing both microeconomic and behavioural theories.

### **2.4.1 Maximum Utility Theory:**

The commuter's selection for mode of travel is based on perception of the advantages of commuting, rating of the travel types and their availability (Singleton, 2013). The travel form which is available with the lowest efforts and maximum advantage is mostly desirable. The basic hypothesis is that the individuals can assess their personal advantages by comparing various attributes of available options (Davidov, 2003).

### **2.4.2 Theory of Planned Behaviour:**

Theory of Planned Behaviour or Theory of Reasoned Action formulated by Ajzen and Fishbein (1975) tries to foretell human behaviour (Ajzen, 1991). The theory deals with possible linkages between attitudes. It is presumed that people have a free choice. According to this theory, people act logically, and their decisions are consciously well thought. The purpose behind a certain behaviour is reliant on three factors or influencing factor of intent:

- *the attitude toward the behaviour*: an extent of a person's assessment of the behaviour in discussion.
- *the social norm*: perceived societal pressure to do or avoid the behaviour.
- *the perceived behavioural control*: capability of performing the behaviour and it is believed to signify previous familiarity as well as expected difficulties. (source): (Ajzen, 1991; Olsson, 2003)

Bamberg et al. (2003) explained the connection between the perceived behavioural control and the travel behaviour. This theory suggests that people act rationally, and their acts are closely linked to their past behaviours, an intervention can influence their future behaviour (Anable, 2005). Several researchers have discussed this theory with another dimension which involves the use of rational reasoning in defining and determining the behaviour of an individual (Aarts et al., 1998).

This idea is built because of individuals' perception of previous experiences. Hence, an individual will use transit service again if he had a pleasing experience in the past (Davidov, 2003).

### **2.4.3 Theory of Repeated Behaviour:**

*Theory of Repeated Behaviour* by D. L. Ronis, J. F. Yates, J. P. Kirscht in 1989, quoted by Singleton, (2013) described the roles of attitudes and habits on actions that are constantly repeated. The theory implies that habit is the biggest determining factor of repeated behaviour; while intent may push the beginning of a behaviour, its perseverance is more influenced by habit.

Lovelock (1975), Rokeach (1968) and Dobson et al. (1978) studied the selection of transit service on the pattern of a product selection, and linked it to the *frequency of use*. They deduced that a pleasing experience with the transit service would induce more future uses of the same service. Anable (2005) calculated the degree of mobility or the extent of use of a certain mode of travelling in United Kingdom by looking at the frequency of its use by different groups. Similar frequency-based, level of transit usage measurements/ deductions were also carried out by (Diana and Mokhtarian, 2009; Jensen, 1999).

However, the decision regarding choice of travel mode is more of a habit than a deliberation of options for majority of the people (Aarts et al., 1998; Chang and Krosnick, 2003; Garling and Fujii, 2009). Repetition of an act or behavior leads to a habit. There is abundance of literature which measures habit in terms of the repetitions of an act or the frequency of similar behavior being carried out in the past (Verplanken et al., 1994). Loyalty of a customer is linked to the frequency of use or habitual use and vice-versa and is termed as a commitment to retain and re-use the service wefb34 g5rrrrrrrrrrrragain (van Lierop and El-Geneidy, 2016).

Another important aspect of behavioral studies is to understand the perception of distinct users of a service e.g. there are frequent and infrequent users, rare or non-users of the transit service (Florida Tourism Department, 2008). There is every likely hood that different users will gauge the service quality of the same transit in a different way, even if the evaluation is based on same attributes (Johnston, 1995). That results in a varied perceived quality of service as well as deviant satisfaction levels among different groups of users (dell'Olio et al., 2010; Grujičić et al., 2014). The public transit service must plan and operate in way that it should be able to foresee and accommodate the demands of its prospective users in addition to satisfying and retaining its current users (de Oña et al., 2013; Lai and Chen, 2011; Mahmoud and Hine, 2016). Hence, the variation in the frequency of use must be considered to evaluate the perceived service quality (Ouellette and Wood, 1998). Succinctly, a policy of bettering the service quality established on how and what individuals from various groups perceive will result in a successful transit service with several reasons to attract many users (Andreasson and Lindestad, 1998; Mahmoud et al., 2011; TCRP, 2020). Hence, this research has chosen "the theory of repeated behavior" because of its relevance with the frequency of use and behavior of the transit users.

### **2.5 Personal Characteristics of the Transit Riders:**

*Why to travel is strongly connected with who is travelling.* Attributes, like, age, gender, profession, education, social norms, financial stature, and place of residence etcetera influence the decision regarding choice of travel mode (Florida Tourism Department, 2008; Olsson, 2003). Another research from Eboli and Mazzulla (2011) considers women, elderly and school goes to be the most common users of a transit service because they cannot drive. However, as per Jing and Fan



(2018) low income working class and students are more likely to use public transport because of social and economic reasons. Zolnik et al. (2018) nevertheless believe, that LMBS attracts majority of working-class male users and students. He further suggests that women are less likely to use LMBS owing to the conservative nature of Pakistani society.

Juan De-Dios Ortuzar and Luis G Willumson has mentioned few factors influencing the choice of a transit mode. These are as following:

- 1) Attributes of trip maker: related to personal characteristics that is, age, gender, income, education, vehicle ownership, occupation etcetera.
- 2) Attributes of journey: related to reason to travel, time to travel and if travelling solo or having company.
- 3) Attributes of transport facility: related to the quantitative and qualitative attributes of service quality of transit (See: Service Quality Attributes) (Ortuzar and Willumson, 2011)

## **2.6 Relationship between Perceived Service Quality, Ridership of Lahore Metro Bus Service, and the Characteristics of Transit Users:**

In order to motivate people to use a transit service, its service quality has to be aligned with the needs of people (Zeithamal et al., 1996). The perceived quality plays a pivotal role in impacting the inclinations of a traveller (Davidov, 2003). The service quality of the transit ought to get better in a manner as to address people's requirements. An encouraging experience will reinforce the likelihood of selecting the same options in the future (De Vos, 2019). When the behavioural inclination of an individual rises, so does the probability to use a specific transit mode. As elaborated by *the theory of repeated behaviour*, it ultimately increases the usage frequency of that transit mode, which in this study is Lahore Metro Bus Service.

A satisfied customer is more likely to use to the same service again, hence resulting in increased loyalty of the service. Similarly, a bad service experience will have impact future ridership adversely (Lai and Chen, 2011). There are various reasons which result in individual's mistrust on public transit and ultimately make them switch to private vehicles (Anable, 2005). Most common reasons are affordability, lack of safety, disorderly transit management, overloading, inadequate infrastructure, inconvenient stops etcetera. Numerous aspects which influence the travel mode selection were further divided into various factors:

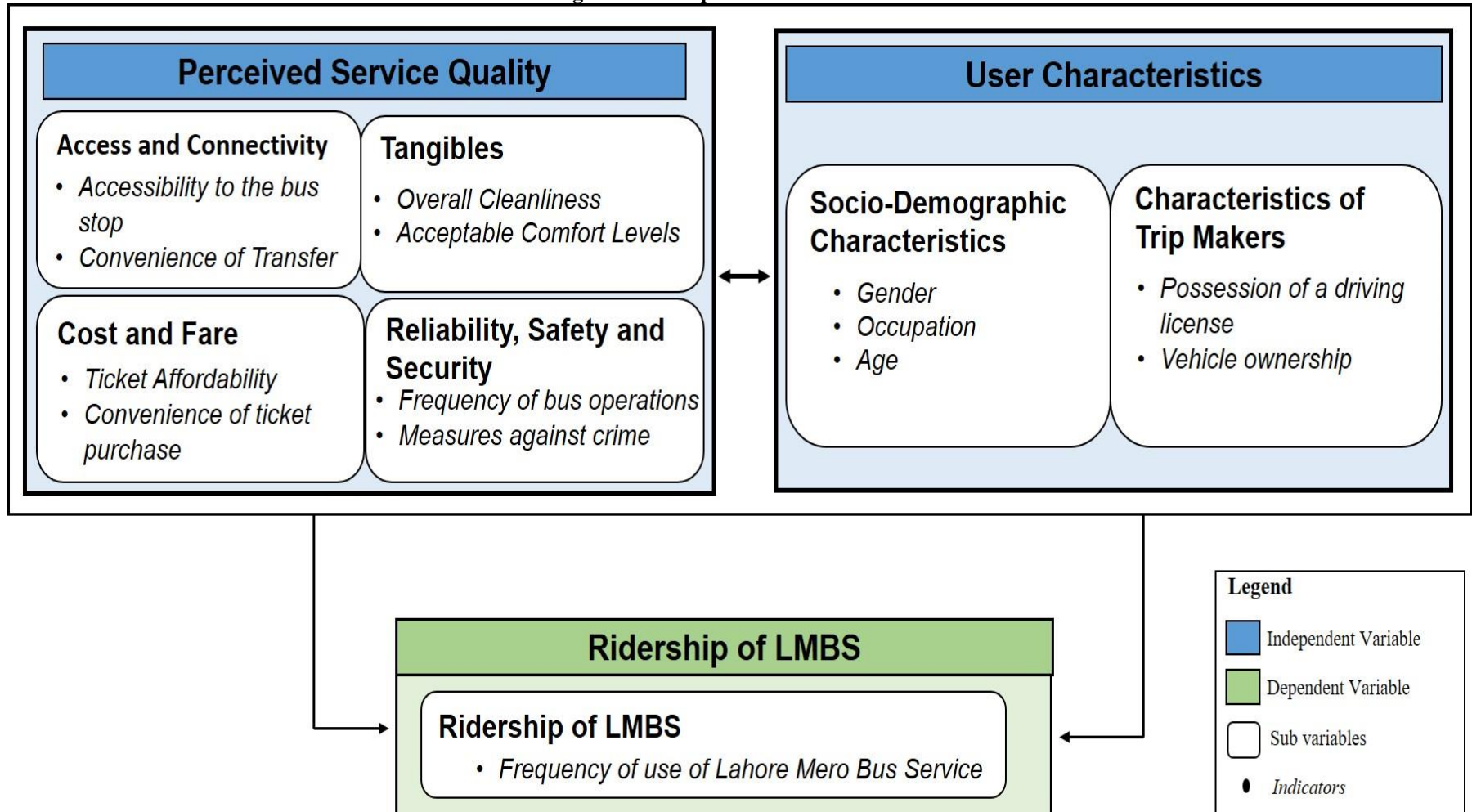
- i. hard (travelling time – frequency of service – fares) and soft (service – comfort – information),
- ii. Internal (attitude-habits-perceived level of control) and external (travelling time-cost),
- iii. subjective (security-environment-weather) and objective (characteristics-lifestyle) (Olsson, 2003).

## **2.7 Conceptual Framework:**

A conceptual framework is intended to depict the relationship between independent and dependent variables of the research. The conceptual framework adopted for this research has been drawn in figure 5. The below given conceptual framework is devised based on the theory of repeated behaviour. In the literature review preceding theory and concepts have been used to establish the three significant aspects of a transit service, that is, perceived service quality, user characteristics and the ridership, respectively. These three aspects are classified as variables with perceived service quality and user characteristics being independent variables and the ridership of LMBS being the dependent variable. The analysis of literature has highlighted that tangibles, connectivity

and access, cost and fare, reliability - safety & security are linked to the perceived service quality. While the user characteristics are determined by the socio-demographic and trip-maker characteristics. Lastly, the ridership of LMBS is connected to the frequency of use of LMBS. Hence, the conceptual framework is based on the idea that ridership of LMBS is influenced by the perceived service quality and user characteristics.

Figure 5. Conceptual Framework



Source: (Bamberg et al., 2003) (Vincent, 2001) (Parasuraman et al., 1985) (Anable, 2005)

## Chapter III – Research Design, Methods and Limitations

### 3.1 Introduction:

This chapter explains the methodology and designs used in this research. It begins with the description of the research design and methods. It then throws light on explanation of data collection methods, the sampling techniques used here-in, and the processes applied for analysis of data. It continues with validity, reliability, and the operationalization of variables and indicators. This section concludes with limitations of this research.

### 3.2 Description of Research Design and Methods

#### 3.2.1 Research type:

Explanatory research normally deals with understanding the relationship between things/variables. It is performed to find and analyse a problem that was not studied before in-depth (Van Theil, 2014).

Zolnik et al. (2018) has mentioned that existing academic research work on the subject matter is extremely limited and sub-standard. However, this is a comprehensive academic study which undertakes a wholistic evaluation of LMBS by assessing the relationship between ridership, users' characteristics, and perceived service quality characteristics. This study not only adds to existing low quality and limited research material on the subject matter but also explains a relationship between two things. Hence, it is an “*explanatory research*”.

#### 3.2.2 Research Strategy:

Research Strategy is an overview to the vital components of a research. The research strategy illustrates how the research will be done. A research strategy can utilize several methods to collect data (Van Theil, 2014).

There are two main determining factors for selection of the research technique for this study. Firstly, this study intends to collect highly subjective knowledge of user perception about the service quality (having substantial variables) of LMBS from different categories of users. Secondly, population size of Lahore, that is around 11 million. Meaning there by, this study had large units and variables to study and desk research (secondary data) alone could not prove beneficial. An empirical research technique capable to study the subjectivity of perceived service quality while dealing with high number of units and variables could only be used (Van Theil, 2014). For this study, “*survey research*” was best suited, hence been chosen as a research technique. A classic feature of survey is its large-scale methodology, when there is something to describe, test or diagnose about the research (Van Theil, 2014). It is extremely efficient to answer the questions which involve large number of units of study and large number of variables. Moreover, surveys are extremely cost and time efficient, flexible, reliable, and generalizable methods of primary data collection when compared to other techniques (Jackson, 2011).

The main data source is from *quantitative method* (survey). The statistical analysis is based on the quantitative data gathered through survey only. The data collected from the survey (quantitative data) helps to see the relationship between the perceived service quality, user characteristics and the ridership as well. Furthermore, the variables are obvious, measurable, and shorter in

quantitative data. However, to support and validate the quantitative data, the researcher collected *qualitative data* via semi structured interviews from selected respondents/ experts.

### **3.2.3 Data Collection Instruments:**

This study is using:

- i) *Questionnaires:* Questionnaire are the primary instrument to collect data in this study having a mix of open and closed ended questions. This study is examining the perceived service quality on the Likert Scale and the respondents of the questionnaires are the “*users of the LMBS*”.  
The initial plan to collect the primary quantitative data was solely via face to face questions in local languages. However, COVID-19 forced the government to suspend the LMBS operations. Hence, online distribution of the same questionnaire was done through various social media forums including Facebook, Twitter, LinkedIn, Instagram, and WhatsApp. The objectivity and comprehensibility of the questionnaire was ensured by pilot testing. The pretesting was done by requesting feedback from the experts/ PMA staff and LMBS users. At the time of pre-testing, LMBS was operational, the preliminary questionnaire was shared randomly with 5 users of LMBS and 5 staff members of PMA, respectively. The responses and proposed improvements were duly incorporated to offer extra validity to the questionnaire. The questionnaire (Annex I) had 6 sections and 30 questions.
- ii) *Semi Structured Interviews:* The data collected through questionnaires was augmented by semi-structured interviews. The respondents of the interviews were “*the staff of Punjab Mass Transit Authority (PMA), experts and transportation consultants of the Government*”. The interviews had 13 discussion oriented and open-ended questions (Annex I). All offices were shut down because of COVID-19, hence the interviews were conducted via skype.
- iii) *Secondary Data/ Literature Review:* Additional knowledge was assembled through secondary data from the literature review. Research articles, books, journals, and government documents of Punjab Transport department were also consulted. This data was used to support the primary data in its validation.

### **3.2.4 Sampling design:**

#### **3.2.4.1 Population:**

There is no information and data available with respect to the overall population using LMBS or the people living in its coverage area, therefore the study is considering total population of Lahore City, that is, 11 million (PMA, 2013).

#### **3.2.4.2 Sample size:**

This study is using Slovin’s Formula to calculate the sample size considering the confidence level of 95% at a confidence interval of 5 ( $e = 0.05$ ) and  $N = 11000000$  (Punzalan and Tejda, 2012). The sample size  $n$  is calculated below.

$$n = \frac{N}{1 + N (e)^2}$$

$$n = \frac{11000000}{1 + 11000000 (0.05)^2}$$

$$n = 399$$

### 3.2.4.3 Sampling procedures:

This study had planned to use *Random Sampling*<sup>5</sup> for Quantitative Data (Questionnaires) and *Purposive*<sup>6</sup> *Sampling* for Qualitative Data (Semi Structured Interviews) collection.

Respondents of the *questionnaires* were the “*users of LMBS*”. Therefore, random sampling was to be used during transit (on-board) across the complete route of LMBS across 27 stations during peak and off-peak hours throughout 7 days of the week. The random selection for on-board respondents was to be based on the criteria of their travel time, that was, those passengers who had minimum 15-20 minutes to respond were to be given the questionnaire. Unfortunately, as mentioned in section 3.2.3, the suspension of the bus service forced the researcher to switch to online distribution of the same questionnaires among the population of Lahore. However, to reach out to the desired respondents the researcher used the following platforms:

- a- Official Facebook pages and Twitter handles of LMBS/ PMA & Lahore City Metropolitan Corporation, Punjab Transport Department etcetera.
- b- Contact numbers and email addresses of the LMBS users from PMA complaint redressal cell.
- c- Whatsapp groups of PMA staffers and official websites of PMA & Government

A total of 750 questionnaires were distributed online out of which 473 responses were received. After scrutiny of the received questionnaires 90 were discarded because they were filled by the respondents who had never used LMBS. Thus, 383 questionnaires were used for data analysis.

*Semi-Structured Interviews* were conducted using *Purposive Sampling* technique. 15 administration officers/ consultants (experts) of PMA and Transport Department were selected to be interviewed via open ended/ discussion-oriented questions.

These experts were selected using *Expert Purposive Sampling*<sup>7</sup> and following was the criteria used for their selection:

- i. Minimum work experience with PMA or in Transportation Field: 5 years
- ii. Minimum Qualification: Masters Level
- iii. Expertise: Work experience at decision/ policy making levels in operations/ maintenance and repair/ quality management departments.

However, only 8 interviews were conducted owing to *force majeure* which included closure of offices, respondents getting sick/ going into quarantine, regretting to respond owing to their family member(s) contracting the virus and death of one selected respondent etcetera.

<sup>5</sup> Every sample has an equal chance of being selected.

<sup>6</sup> Researcher relies on his own judgment.

<sup>7</sup> A purposive sampling technique in which knowledge is sought from individuals with expertise in a specific field.

**Table 1. Interviewee Details**

Name	Designation	Department	Interviewee #
Mr. Ozair Shah	General Manager Operations	Punjab Mass Transit Authority	1
Mr. Adil Mumtaz	Deputy General Manager (Operations & Maintenance)	Punjab Mass Transit Authority	2
Dr. Waseem Akhtar	Director Transport Planning Unit	Government of Punjab	3
Mr. Kamran Ihsan	Transport Demand Modeler	Government of Punjab	4
Mr. Imran Khan	Ex-Deputy GM	Punjab Mass Transit Authority	5
Mr. Suleman Majeed	Director Planning	Punjab Provincial Transport Authority	6
Mr. Usman Hameed	Research Assistant	Government of Punjab	7
Mr. Wajeeh Usman	Transport Economist	Researcher/ Transport Analyst	8

Above table gives a detail of the interviewees, all interview respondents are allocated distinct “*interviewee numbers*”. Thereafter, the related findings from the questionnaires will be associated and compared with the interview answers in the proceeding chapter. The interview responses are recorded at (Annex: III)

### 3.2.5 Validity and Reliability:

There was a significant challenge posed by COVID-19 which could have jeopardized the validity and reliability of this research. This research validated data by using data from different sources. Although the *survey research* does not necessarily need *triangulation*, however for better validation, this research has used the triangulation of the primary quantitative data from questionnaires filled by LMBS users, qualitative data from the interviews of the experts and the secondary data from the literature review, documentation of PMA, research articles, books, etcetera.

#### *Validity:*

Validity is of two type: *external and internal*. Internal validity describes “the coherence of the study itself” and is ensured by the fact that the sample size of this research is substantial (Van Theil, 2014). The external validity is ensured if the research results are generalizable. Moreover, survey results are the easiest to generalize (Van Theil, 2014).

To ensure the internal validity, control questions were incorporated. These control questions are generally used to defeat the challenge of inclinations of responses of the respondents. These inclinations suggest to when people are untruthful about their responses; they are inclined to give a response which they believe can positively impact the study (Van Theil, 2014). The control questions were likewise created but meant almost the same. Thusly, several responses for the same indicator were collected. Likewise, the usage of operationalization improved the internal validity in which theoretic variables were designated distinct indicators. These indicators were

subsequently well-defined, and it was ensured that they only determine their corresponding theoretical sub-variable.

#### *Reliability:*

Reliability in a research refers to accuracy and consistency (Van Theil, 2014). In this study it was ensured by the fact that various indicators are being used to measure the same variable in the questionnaire. This study further applied Cronbach's alpha test to evaluate the uniformity of these indicators. Reliability of the study was further enhanced by seeking advice from methodologists and experienced researchers on the same field. Non-responsiveness was one of the tests and as per Van Theil (2014), it is the main concern while employing online questionnaires. To tackle this threat, the researcher was extremely cautious in selecting the sample volume and then distributed ample questionnaires in anticipation of non-responsiveness (as explained in section 3.2.4.3).

### **3.2.6 Data analysis**

Primarily this research used quantitative analysis to answer the research question, however qualitative analysis was also conducted to validate the main analysis. Qualitative data obtained from interviews was analyzed via manually examining the transcripts to create a summary of responses which recorded the main concepts discussed by the interviewees. The qualitative data were then presented in the forms of quotations to endorse quantitative findings.

To analyze sub-question 1, a descriptive analysis was done, and data acquired was produced in form of rationalizations. Frequency analysis, percentage tables and compare means analysis was used by deploying Microsoft Excel, which provided graphic analysis such as charts, tables and graphs for the data obtained from questionnaires. The descriptive figures also helped the researcher to assess the profile of the sample size. The mean values and standard deviation made it feasible to examine the standard data scores and to examine how scattered out the data results were, correspondingly.

To analyze sub-question 2, Statistical Package for Social Sciences (SPSS) was used as the quantitative data analysis tool. Before progressing with the analysis, data cleaning was done. This was done by making sure that values were properly defined and coded. After arranging the data, internal consistency of the indicators allocated to their sub-variables was assessed by performing Cronbach's Alpha Test. Subsequently, Pearson Correlation test and Multiple regression was run to investigate the extent of influence of the independent variable on the dependent variable.

To analyse sub-question 3, cross tabulation analysis (via Microsoft Excel) and regression analysis (via SPSS) was used to examine the influence of user characteristics on the ridership of LMBS. Prior to running the inferential analysis, the sub variables were tested for their correlations among themselves and with the dependent variable by using Pearson Correlation.

### **3.3 Operationalization**

Operationalization is a shift from theory to practical research. It is the procedure of converting the theoretical ideas (variables) into measurable units, called indicators. It demonstrates "what" is being explored or calculated and "how" the calculation is taking place. It is a three-step process (Van Theil, 2014).



### 3.3.1 Definition of theories, concepts, variables, and indicators

*Definitions of Concepts and Theories:*

Step one of Operationalization is the demarcation of the study and is done by defining key concepts (Van Theil, 2014). This study revolves around the following concepts and theories:

**Table 2. Definition of Theories and Concepts**

Concept/ Theory	Definition	Reference	Cited at
Bus Rapid Transit	Bus Rapid Transit is a bus-centred, rubber-tired transit system which provides high-speed, comfortable, and cost-efficient public transportation services.	(APTA, 2017; EMBRAQ, 2013; ITDP, 2007)	Section 2.2
Perceived Service Quality	Perceived Service Quality is consumer's evaluation of product's overall quality.	(Parasuraman et al., 1985)	Section 2.4
User Characteristics	Why to travel is strongly connected with who is travelling and trip maker's attributes influence the travel mode choice.	(Olsson, 2003; Ortuzar and Williamson, 2011)	Section 2.5
Ridership	That is assessed by studying the frequency of using a specific mode of transport. In this research, frequency of using LMBS.	(Anable, 2005)	Section 2.4
Theory of Repeated Behaviour	The theory implies that habit is the biggest determining factor of repeated behaviour.	(Singleton, 2013)	Section 2.4

*Variables and Indicators:*

*Step two* of the operationalization process is about explaining the variables and indicator.

The *independent variables* for this study are

- i. Perceived Service Quality
- ii. User Characteristics

While the dependent variable is

- i. Ridership of Lahore Metro Bus Service

1- "*Perceived Service Quality*", it includes:

- a) Tangibles,
- b) Access & Connectivity,
- c) Cost and Fare,
- d) Reliability, Safety & Security (Mahmoud and Hine, 2016; Rohani et al., 2013; TCRP Report 88, 2003).

2- "*User Characteristics*", it includes:

- a) Socio-Demographic Characteristics,
- b) Characteristics of Trip Makers (Olsson, 2003; Ortuzar and Williamson, 2011).

The *dependent variable* for this study is “*Ridership of LMBS*” which has been split into three categories:

- a) Frequent User,
- b) Occasional/ Infrequent Users &
- c) Seldom/ Rare Users (Florida Tourism Department, 2008).

### 3.3.2 Operationalization Table:

**Table 3. Operationalization Table**

Research Sub-Question	Theories/Concept	Variables	Sub-Variables	Indicator	Scale	Source	Data Type	Collection Technique	Value
How do users perceive the service quality of LMBS?	Theory of Repeated Behaviour	Service Quality (Independent Variable)  Quality is consumer's evaluation of product's overall quality (Parasuraman et al., 1985).	Tangibles (Physical evidence of the service)	Overall cleanliness (Internal & External)	Ordinal	(Rohani et al., 2013)	Quantitative	Questionnaire	Likert Scale
				Acceptable comfort levels	Ordinal	(Rohani et al., 2013)	Quantitative	Questionnaire	Likert Scale
				Availability of seats	Ordinal	(Rohani et al., 2013)	Quantitative	Questionnaire	Likert Scale
			Access and Connectivity (Approachability and ease of connection)	Accessibility to the bus stop	Ordinal	(TCRP Report 88, 2003)	Quantitative	Questionnaire	Likert Scale
				Availability of Parking	Ordinal	(TCRP Report 88, 2003)	Quantitative	Questionnaire	Likert Scale
				Convenience of transfer	Ordinal	(TCRP Report 88, 2003)	Quantitative	Questionnaire	Likert Scale
				Proximity of stop to the destination	Ordinal	(TCRP Report 88, 2003)	Quantitative	Questionnaire	Likert Scale
			Cost and Fare (Expenditure to board the bus)	Affordability of ticket	Ordinal	(Redman et al., 2013)	Quantitative	Questionnaire	Likert Scale
				Convenience of purchasing ticket	Ordinal	(Redman et al., 2013)	Quantitative	Questionnaire	Likert Scale
			Reliability, Safety and Security (Regularity & freedom from danger)	Adherence to the service schedule	Ordinal	(Redman et al., 2013)	Quantitative	Questionnaire	Likert Scale
				Frequency of bus arrival and departure	Ordinal	(Redman et al., 2013)	Quantitative	Questionnaire	Likert Scale
				Security against crime	Ordinal	(Eboli and Mazzulla, 2011)	Quantitative	Questionnaire	Likert Scale
				Safety measures against accidents	Ordinal	(Mahmoud et al., 2011)	Quantitative	Questionnaire	Likert Scale

Research Sub-Question	Theories/Concept	Variables	Sub-Variables	Indicator	Scale	Source	Data Type	Collection Technique	Value
				Service information (website, apps, phone, maps, announcements)	Ordinal	(Mahmoud et al., 2011)	Quantitative	Questionnaire	Likert Scale
To what extent does the perceived service quality influence the ridership of LMBS?	Theory of Repeated Behaviour	Ridership (Dependent Variable) The degree of mobility or the extent of use of a certain mode of travelling can be calculated by looking at the frequency of its use by different groups (Anable, 2005).	Ridership of LMBS	Frequency of using LMBS	Nominal	(Anable, 2005)	Quantitative	Questionnaire	One day in a year, 1 day in a month, 1 day in a week, 2 days in a week, 3-6 days in a week, and Daily.
What is level of influence of user characteristics on the ridership of LMBS?	Theory of Repeated Behaviour	User Characteristics (Independent Variable)  Why to travel is strongly connected with who is travelling and trip maker's attributes influence the travel mode choice (Olsson, 2003; Ortuzar and Williamson, 2011).	Socio – Demographic Characteristics	Age	Ratio	(Bamberg et al., 2003)	Quantitative	Questionnaire	Years
				Gender	Nominal	(Bamberg et al., 2003)	Quantitative	Questionnaire	Male/ Female
				Occupation	Ordinal	(Bamberg et al., 2003)	Quantitative	Questionnaire	Occupation Category
				Income	Ordinal	(Bamberg et al., 2003)	Quantitative	Questionnaire	Likert Scale
		Attributes of Trip Makers (related to personal attributes of a user)	Possession of a driving license	Nominal	(Ortuzar and Williamson, 2011) & (Bamberg et al., 2003)	Quantitative	Questionnaire	Yes/ No	
			Vehicle ownership	Nominal	(Ortuzar and Williamson, 2011)	Quantitative	Questionnaire	Yes/ No	

### 3.4 Challenges and Limitations of the Study

Firstly, COVID-19 totally altered the scope and data collection plans of this research. It badly impeded the data collection process. Lockdown in Pakistan led to suspension of LMBS operations (public transport) and closure of all government and private offices. Face to face data collection via questionnaires (quantitative data) was converted to online surveys and interviews of experts (qualitative data) too were conducted online. These unforeseen reasons caused a reduction in the sample size. Likewise, the pandemic triggered circumstances made data collection extremely challenging and more time consuming. In addition to the above said, this pandemic affected people psychologically as well. It resulted in lack of cooperation regarding responding to the questionnaire. Several reminders were sent to get responses from the people.

Secondly, this study is concentrating on one feature of service quality, that is perceived service quality. Although few other factors namely, expected delivered and targeted quality also play a vital role (as explained in chapter 2 at quality loop).

Thirdly, this study is restricted to influence of personal characteristics of users and perceived service quality on ridership of LMBS. Practically, user's choice of one transit mode over other is not merely because of how they rated the service quality of one transit mode (LMBS in this case) but how they rated other transit options as well.

Fourthly, In qualitative method, the opinion of a certain individual regarding the independent variable of this study (perceived service quality) cannot be a representation of an entire group/ population, since generalization of subjective views is not possible (Krosnick et al., 2012).

Fifthly, for quantitative method, the results are in numeric form and the problem lies with the translation of numbers into perception (Van Theil, 2014). This leads to a narrowing down of information and causes interpretational issues.

Sixthly, there is negligible availability of good quality and relevant academic material on service quality aspects of LMBS. Hence, validation of primary quantitative data was an uphill task.

Seventhly, pictorial evidence to corroborate the findings of the study could not be incorporated because of the suspension of LMBS.

Eighthly, the qualitative data collected via interviews from the experts of PMA has every likelihood of being compromised because of the biases of the respondents. They would like to paint a pleasant picture of their organization and can give answers which are not factual.

Lastly, data collected via online surveys is less reliable as compared to the data collected face to face. People have this tendency to respond casually while answering online surveys. Similarly, the interviewees tend to respond with some degree of bias when asked about the performance of their organization. Furthermore, in online surveys a serious problem arises when people skip questions which raises slightest of confusion in their minds and in case of Likert scale most people tend to stay neutral by selecting the middle value.

## **Chapter IV - Research Findings**

### **4.1 Introduction:**

The chapter encapsulates the research findings built on the data collection methodologies explained in the preceding chapter. It starts with an outline of the research case which summarizes the unit of analysis and the emphasis of the study (4.2). The characteristics of the respondents are explained in the next section (4.3). Lastly, it presents descriptive and statistical results and analyses of the data regarding each sub-question of the research by using various analyses tools (4.4).

### **4.2 Description of the Case:**

The unit of analysis in the research is Lahore Metro Bus Service (LMBS). It was inaugurated in 2013 as a pioneer BRT service of Pakistan. LMBS is being operated by Punjab Mass Transit Authority (PMA) which works under the ambit of the Transport Department of the Government of Punjab, Pakistan. LMBS was executed as a Public Private Partnership project between the Government of Punjab Province of Pakistan and Al-Bayrak Group of Turkey as a multi-billion-rupee infrastructure project. PMA was created in 2013 as a statutory body solely to manage the operations of LMBS and extend the BRT services to other major cities of Punjab Province. Since 2013, PMA has established BRT service in 3 major cities of Pakistan with an aim to provide its users with safe, efficient, and comfortable public transport system.

The rationale for selection of this unit of analysis is that LMBS has achieved almost 8 years of operations since its inauguration in the second largest city of Pakistan (Lahore). It is now expected to achieve high levels of user satisfaction with respect to its service quality. It is not only the extremely high construction cost of LMBS but the hefty government subsidy as well, which requires LMBS to provide complete customer satisfaction. Above all, there has been no evaluation study on LMBS since its inauguration. Hence, it is in view of the preceding that a research was carried out to understand the influence of the perceived service quality and characteristics of the LMBS users on its ridership.

### **4.3 Description of the Sample:**

Various serious challenges impacted the fieldwork of this study. Thus, several modifications had to be made as alternative to the initial plans. The researcher was forced to adjust accordingly because of COVID-19. The amendments have already been discussed in the previous chapter.

#### **4.3.1 Interviews**

The selection of the respondents of the interviews was done through expert purposive sampling from within and outside the PMA. The selected respondents from inside PMA and Transport Department included important decision/ policy makers and two independent experts. This selection was done to ensure thorough abstraction of knowledge and a comprehensive range of views on the under-study subject. The final list of respondents contained eight interviewees; four senior level managers; two middle level management professionals and two external experts; an ex-employee of the PMA and a subject expert from the Punjab Provincial Transport Authority.

**Table 4. Profile of Interviewees**

Department	Management Level	No.
O&M/ Planning/ Finance	Senior	4
Commercial/ Research	Middle	2
Ex-employee	Former Deputy General Manager (Technical)	1
Subject Specialist	Transport Economist	1 (n=8)

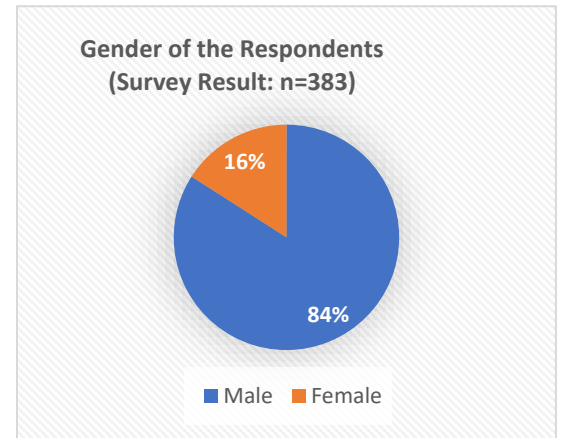
### 4.3.2 Questionnaires

COVID-19 forced a shift from face to face interviews to online distribution of quantitative survey. Hence, 750 questionnaires in the local language (see Annex II) were distributed via a link on various social media platforms. A total of 473 responses were received, out of which 90 were discarded as they did not fulfil the basic requirement of the survey. This study analysed data from 383 questionnaires which is 16 less than the original sample size (399). Before commencing the collection of data, a pretesting of questionnaire was carried out from 5 users of LMBS. Luckily, LMBS was operational at the time of pre-testing. The suggested improvements were incorporated in the final questionnaire.

### 4.3.3 Characteristics of the Respondents of Questionnaire:

#### *Socio-Demographic Characteristics of Respondents:*

The number of male respondents was overwhelmingly more than female users. Out of 383 respondents sampled for this research, 322 were men and 61 were female. A likely reason for an extremely low representation of women in the sample is that women in Pakistani conservative society are difficult to reach out via online sources. As official pages of LMBS/ PMA and Government Departments were used to send the questionnaires, these forums have a limited women participation.

**Figure 6. Gender of the Respondents**

Explanations about the monthly income, occupation and employment of the respondents was examined with frequent user, occasional user and seldom user. It helped to observe the socio-demographic characteristics amongst every groups of users which has varied frequency of LMBS usage.

**Table 5. Type of Users with respect to Frequency of Use**

Type of User	Frequency of LMBS Use
Frequent User	Daily
	3-6 Times a Week
	Twice a Week
Occasional User	Once a Week
	Once a Month
Seldom User	Once a Year

Those users who used LMBS daily, 4-6 times a week and twice a week are categorized as *frequent users*. A frequent user is the maximum level of LMBS usage, which is being looked for in this study. Users who used LMBS once a week and once a month were described as *occasional users*. On the contrary, those users who used LMBS only once in a year were demarcated as *seldom users*. The respondents who had never used LMBS were not a sample for this study because this study relates to respondents who had used LMBS no less than once in a year as the minimum level of usage. 90 questionnaire samples were discarded because of the preceding reason, as the respondents had never used LMBS.

**Table 6. Frequency of using LMBS (Survey Result: n=383)**

Frequency	Count	%
Frequent user	186	49%
Occasionally user	103	27%
Seldom user	94	24%
Total	383	100%

*Gender:*

The data from above table reveals that almost half of the respondents (186 out of 383) are frequent users of LMBS. While the total sample has almost equal distribution of occasional and seldom users. One of the reasons for a considerably moderate number of seldom users (24%) is the online distribution of questionnaires. The questionnaires were randomly sent via a link on various social media forums. As explained already, majority of LMBS users are male. One significant aspect of the data gathered from the survey is that almost half of male and female users are frequent travellers. This result appears to be a deviation from the research of Eboli and Mazzulla (2011) who believe that women are major transit riders because of their inability to drive in the conservative societies. An interviewee also pointed out towards low women ridership of LMBS in the following words:

*Interviewee # 1: "Initially women were reluctant to ride it. This is now slowly changing."*

**Table 7. Gender of Respondents (Survey Result: n=383)**

Gender	Seldom user	Occasional user	Frequent user	Total	%
Male	70	95	157	322	84%
Female	24	8	29	61	16%
Total	94	103	186	383	100%

*Occupation:*

Most respondents were white-collar employees/ working class, particularly from public sector. They have the highest percentage for every group of users and constitute more than half of the total respondents (55%). Private sector employees come second in terms of the overall LMBS usage (16%). Although they are not the second most frequent users of LMBS. It is observed from the data that students are the second most frequent users of LMBS after government employees (count = 37) while overall LMBS ridership has a 12% share from students. Housewives and Private Businessperson have an extremely low ridership, 4% and 8% respectively. Additionally, more than half of women users of LMBS are found to be seldom users. This fact was also established in the



literature review by Zolnik et al. (2018), who argued that working class in Pakistan is the most common LMBS user while women rarely use the public transport.

**Table 8. Occupation of the Respondents (Survey Result: n=383)**

Employment status	Seldom user	Occasional user	Frequent user	Total	Total %
Unemployed	2	7	0	9	2%
Housewife	7	2	5	14	4%
Student	5	6	37	48	12%
Private Employer	24	11	25	60	16%
Govt. Employer	45	59	106	210	55%
Own Business	4	13	13	30	8%
Other	7	5	0	12	3%
Total	94	103	186	383	100%

#### *Monthly Income:*

Three fourth of the total respondents are from the low-income earning class. Majority of low-income class LMBS users are frequent users as well. Low and moderate-income earners are undeniably the target of LMBS that the government intends to attain.

The data reveals that the ridership of LMBS decreases with an increase in the income levels. The high-income group only constitute 12% of the overall LMBS ridership, while the extremely low-income class (less than 15k Pak Rupee) has a 9% LMBS ridership. This fact is consistent with literature of Majid et al. (2018), who rate LMBS as a pro-poor service.

**Table 9. Family Monthly Income of the Respondents (Survey Result: n=383)**

Monthly Income (PKR)	Seldom user	Occasionally user	Frequent user	Total	%
Less than 15000	7	10	17	34	9%
15000-30000	30	26	49	105	27%
30000-45000	29	42	85	156	41%
45000-60000	12	10	19	41	11%
More than 60000	16	15	16	47	12%
Total	94	103	186	383	100%

#### *Age:*

Data reveals that majority of LMBS users are young people. As the age increases, the ridership of LMBS decreases.

**Table 10. Age of the Respondents (Survey Result: n=383)**

Age	Seldom user	Occasional user	Frequent user	Total	Total %
15-25	32	23	54	109	28%
26-35	42	56	100	198	52%
36-45	9	15	25	49	13%
46-55	9	7	5	21	5%
More than 56	2	2	2	6	2%
Total	94	103	186	383	100%

More than half of LMBS's frequent travellers are aged between 26-35 years. One *probable reason* is the online distribution of the questionnaires and its usually the youth in Pakistan, which uses the social media platforms the most. Another reason for this is that students make a handful chunk of overall LMBS ridership and they all belong to the same age group. Further details about Marital Status and Education of users are available at Annex – VII.

The Trip Characteristics of the Respondents of the Questionnaire (Main Mode of Transport of Respondents & Purpose of Travel of Questionnaire respondents by Mode Type) are detailed at Annex - VII.

#### **4.4 Presentation and Analysis of Data:**

In this section, data corresponding to the sub-questions of this study is presented and arranged in conformity with the indicators under each sub research question. The assessment in all sub sections will begin with a summary of the key interview responses. Subsequently, the pertinent results from the questionnaires are presented. Lastly the interview and survey results are associated and compared with the relevant literature. The interview respondents are given number from “*interviewee # 1 to interviewee number 8*” (Table 1, Chapter 3). Secondary data is also utilized to back the results for the purpose of validation. A brief explanation of considerable results which are coherent with previously reviewed literature will be presented at the end of the analysis of every sub research question.

##### **4.4.1 How do users perceive the service quality of Lahore Metro Bus Service?**

The responses from the interviews and survey results have been used to answer this sub research question. The data from survey has been utilized for descriptive and frequency analysis. Additionally, the findings are also complemented by compare means analysis based on the survey data (see Annex – VIII). To elaborate the above sub question following indicators were used to determine the pertinence under sub variables 1) Tangibles, 2) Connectivity & Access, 3) Reliability – Safety & Security & 4) Cost and Fare.

- |   |  |
|---|--|
| i) Overall Cleanliness (Inside the bus and at the Stations) | ix) Convenience of Purchasing Ticket               |
| ii) Acceptable Comfort Levels                               | x) Adherence to the Time Schedule                  |
| iii) Availability of Seat                                   | xi) Frequency of Service                           |
| iv) Accessibility to the bus stop                           | xii) Security against Crime                        |
| v) Availability of parking at the stop                      | xiii) Safety Against Accidents                     |
| vi) Convenience of Transfer                                 | xiv) Service Information (On Board and Pre-Travel) |
| vii) Nearest Stop (Travel Time and Distance)                |  |
| viii) Ticket Affordability                                  |  |

##### ***Findings from the Interviews:***

To substantiate the answer for sub-variables of perceived service quality interview answers are discussed to give more insight about the real service quality of LMBS.

**Table 11. Summary of Interview Responses for Sub-Question 1 (n=8)**

Indicator	Summary Responses from Interviews	Frequency
Safety and Security	LMBS presents a satisfactory situation with respect to the safety and security standards. PMA has outsourced the security of LMBS (buses-stations) to a well reputed and licensed security agency which is responsible for security of the LMBS track, buses, and stations. In terms of safety, the stats have been extremely positive. There have been only two deaths in 7 years of LMBS. Its way better than similar projects in other developing countries.	3
	Petty crimes are often reported by the LMBS users.	5
Connectivity	Surely, it is not a complete network. It is an ongoing and continuous process and we have had few feasibility studies to improve the connectivity and LMBS network. Feeder network provides around 50% connectivity to LMBS.	5
	There were some issues in start of operation which were rectified accordingly. It is a well-connected system.	3
Frequency of Service	Its adequate and well-handled because is passenger demand-based set frequency. Frequency of LMBS is analysed based on the data of passengers entering the metro stations at various hours of the day	6
	It needs improvement to enhance integration with feeder and other transport networks.	2
Reliability	LMBS has a high efficiency percentage. In terms of reliability, it is achieving 99% efficacy.	7
	Occasional delays occur at Ravi Bridge due to mixed traffic and congestion.	1
Cost and Fare	It is extremely cheap in comparison to other modes of transport (30 PKR for 27kms).	8
Pre- and On-Board Information	LMBS is a modern BRT system and has many intelligent passenger information systems.	8
Cleanliness & Comfort (Tangibles)	There are scattered complaints of unclean toilets at the stations. Overall, cleanliness is good as a dedicated janitorial company is looking after the affairs. Comfort standards are as per prevalent BRT benchmarks.	5
	There is always a need to improve because more than 150 thousand people are using LMBS daily. At times seat availability, air conditioning and non-operational escalators are an issue.	3
Nature of Complaints against LMBS	A dedicated complaint management cell addresses all sorts of complaints. Usual complaints are about unavailability of seats, non-working of air conditioning in summer and lost baggage/thefts etc.	6
	Delays and non-availability of drinking water at stations is also reported occasionally.	2

Regarding *Tangibles*, out of 8 total respondents 5 agreed that despite scattered complaints about cleanliness and general maintenance of buses/ stations, overall outlook of LMBS is acceptable to its users. They further mentioned that LMBS follows the internal benchmarks for comfort levels. However, 3/8 believed that non availability of seat in the peak hours, air conditioning issues and maintenance of buses and stations were areas of concern. Few interview responses are reproduced below:

*Interviewee # 1: "There are scattered complaints of unclean toilets at the stations. Overall, cleanliness is good as a dedicated janitorial company is looking after the cleanliness affairs."*

*Interviewee # 4: "What I have gathered from my experience with complaints management, I think its satisfactory. However, passenger's complaint of non-availability of seats although there is ample space to stand. The objective of LMBS is to accommodate as many passengers as we can keeping in mind the cleanliness and comfort."*

*Interviewee # 5: "Most passenger complaints are from peak hours LMBS operations, such as seat availability and nonfunctioning of air conditioners."*

Referring to *Connectivity and Access*, 7/8 experts supported the notion of LMBS being an accessible, well connected, and convenient mode of transit which has ample parking space at every station. 5/8 respondents believed that integration of LMBS with other modes of transfer is unsatisfactory and needs improvement. However, they suggested that with creation of two more links of metro service in Lahore by next year, the problem of unintegrated network shall be resolved. A few selected responses are mentioned below:

*Interviewee # 2: "Yes, passengers are satisfied with connectivity of feeder with metrobuses. there were some issues in start of operation which were rectified accordingly."*

*Interviewee # 4: "LMBS provides adequate number of stops and facilities for parking etc at the stops however, number of buses needs an increase."*

*Interviewee # 5: "Feeder network is not well connected with LMBS."*

*Interviewee # 7: "PMA has installed mechanized parking system at Shama Chowk Station and dedicated parking slots at all major LMBS stations."*

*Reliability, Security and Safety* received a mixed response from the respondents. All 8 respondents told that LMBS is a tech savvy service and it is equipped with latest information and ICT gadgetry. Likewise, 7/8 respondents agreed that LMBS is an extremely reliable service with 99% system efficiency. However, while discussing safety and security standards 5/8 respondents pointed out that security standards need improvement and there have been several complaints from users regarding thefts and lost baggage etc. A few responses of interviewees are reproduced below:

*Interviewee # 3: "Safety and Security standards need improvements though they are being managed through outsourcing model. LMBS has a video surveillance control centre as well, yet security complaints do come."*

*Interviewee # 6: "Through electric boards / announcements / signs at LMBS stations and though audio announcements with buses, LMBS offers state of the art travel information."*

Interviewee # 7: “Yes, LMBS is a reliable service.”

Interviewee # 4: “Frequency of service needs improvement.”

Interviewee # 5: “Through website and passenger information system at stations and in buses. LMBS offers latest ICT interventions to its users.”

Cost and Fare of LMBS in view of 8/8 respondents is extremely affordable and poor friendly. Government gives a substantial subsidy and users are charged with a flat fare of 30 PKR. According to the experts traveling by LMBS is cheaper than any other mode of transport and it is its low fare which attracts majority of low-income class and students. A few interview responses are mentioned below:

Interviewee # 8: “Absolutely Cheap Service. LMBS charges Flat Fare of PKR 30/ Trip for 27 KMs, while other mode of transport charges much higher than this.”

Interviewee # 1: “Its way cheaper than other available modes of transport.”

Interviewee # 3: “Yes, LMBS is cheap when compared to other travel modes.”

### **Findings from the Questionnaire:**

To answer this question, responses were collected on a 5-point Likert Scale, with 1 being “very poor”, 5 being “very good” and 3 being “neutral”. The results are presented in the form of percentage derived from the answers of the interview respondents.

#### **Perception of Tangibles:**

Sub-variable Tangibles has several indicators which include, cleanliness inside the bus, cleanliness at metro stations, comfort levels of service and seat availability in the metro bus.

**Table 12. Perception of Tangibles (Survey result in Percentage: n=383)**

Tangibles	Very Poor	Poor	Neutral	Good	Very Good
	(Percentage %)				
Cleanliness in the Bus	3.26	16.84	34.51	33.42	11.95
Cleanliness at the Station	4.87	9.75	32.79	40.10	12.46
Overall Comfort Levels	6.01	15.02	34.15	33.87	10.92
Seat Availability	26.27	21.19	30.01	10.63	11.90

The results reveal that 33.42% respondents perceived the cleanliness of the bus to be good. The inner cleanliness has been perceived very good by 11.95% of the respondents. However, a lowly 3.26% LMBS users perceived it as very poor. The results reveal that overall perception about cleanliness in the bus was considerably good.

With regards to the cleanliness at the LMBS stations, 10.92% respondents perceived it as very good and an overwhelming 40.10% users perceived it as good. Likewise, less than 10% users perceived it as unsatisfactory. The cleanliness of stations perceived by the users exhibited a similarity to preceding indicator of under discussion sub-variable.

Like previous indicators, overall comfort levels of LMBS presented similar patterns with respect to the responses of the users. 34.15% respondents perceived the comfort levels to be satisfactory while 33.87% users perceived them as good. A small portion (6%) showed extreme dissatisfaction with the comfort levels of LMBS.

Seat availability showed dissimilar model as compared to other indicators of the same sub-variable. 26.27% respondents perceived seat availability as very poor. Only 10.63% passengers perceived it as good and 11.90% as very good. The overall analysis of these results demonstrates that seat availability is perceived as poor by LMBS users.

The above presented results are also complemented by Compare Mean Analysis (Annex – VIII) which shows that out of a total score of 5 (with 1 being the lowest), the respondents gave an average mean score of greater than 3 (neutral) to cleanliness inside the bus, cleanliness at stations and overall comfort levels. However, a poor mean score of 2.7 was given to seat availability.

*Perception of Connectivity and Access:*

Perception of Connectivity and Access is being examined under several indicators as shown in the table 13 below. Starting with the perception of parking spaces at the LMBS stations, it is observed that 33.88% users perceived it as good. 11.57% LMBS users perceived the availability of parking spaces at stations as poor and 13.77% perceived it as very good. However, overall responses presented a satisfactory user perception

**Table 13. Perception of Connectivity and Access (Survey result in Percentage: n=383)**

Connectivity & Access	Very Poor	Poor	Neutral	Good	Very Good
	(Percentage %)				
Parking facility at the Stations	11.57	14.87	25.89	33.88	13.77
Accessibility to the Bus Stop	3.62	6.68	28.41	39.83	21.44
Convenience of Transfer	2.22	10.55	25.83	41.94	19.44

Connectivity and access are also related to the ease with which users reach their nearest bus stop. Referring to accessibility to the bus stop, a handsome majority of users perceived it as good (33.88) and very good (21.77%). A few users (3.62%) thought that reaching the nearest LMBS station was not convenient.

Convenience of Transfer from one mode of transport to LMBS is also an important aspect of connectivity and access. The users just like the case of accessibility to stop perceive this indicator in a relatively good way. 41.94% respondents perceived it as good and 19.44% respondents as very good. A very small number of users (2.22%) however, perceived it as poor.

Overall, the users of LMBS perceived Connectivity and Access as good. These results are also complemented by compare mean analysis (Annex – VIII) which shows that the LMBS users gave an average mean score of more than 3/5 (with 1 being the lowest).

The users perceived the time spent in reaching to the nearest LMBS stop and the waiting time for a bus at LMBS stop as low. Details can be seen at Annex – IX.

### *Perception of Reliability, Safety and Security:*

This sub variable has been bifurcated into six different indicators as shown in the table 14 below.

**Table 14. Perception of Reliability, Safety and Security (Survey Result in Percentage: n=383)**

Reliability, Safety and Security	Very poor	Poor	Neutral	Good	Very Good
	(Percentage %)				
Adherence to the Time Schedule	3.33	5.83	36.66	40.27	13.88
Frequency of Bus Service	2.79	6.98	28.21	44.13	17.87
Security Against Crime	10.05	27.59	30.44	20.44	11.45
Safety from Traffic Accidents	1.90	13.62	25.61	32.69	26.15
Pre-Travel Information	6.17	14.60	28.65	30.05	20.50
On-Board Information	3.34	7.52	32.31	33.70	23.11

Regarding the adherence to the time schedule, majority of LMBS users were found to be satisfied. 40.27% percent perceived it as good and 13.88% as very good. 36.66% respondents perceived the schedule adherence of LMBS as satisfactory by staying neutral.

Reliability sub-variables relate to the frequency of the buses to reach at the stops. Frequency of the service was perceived as good by 44.27% users and by 17.87% users as very good. Only 2.79% users perceived it as very poor.

Safety and Security contribute towards enhancing the reliability of the service. With respect to the safety standards of LMBS only 1.90% users perceived it as very poor and 13.62% as poor. Nevertheless, more than half of the users perceived safety standards as satisfactory/ good with 32.69% as good and 26.15% as very good.

Security against crimes although presented a dissimilar pattern to the preceding indicators. A sizable number of LMBS users (27.59%) perceived them to be poor and 10% perceived the security standards as very poor. Although, 20.44% users perceived security as good and 11.45% as very good, still overall security standards were perceived as unsatisfactory.

A transit's reliability also rests on the availability of on and off board information as well. The LMBS users showed satisfaction regarding these indicators. More than 50 percent users perceived pre-travel information and on-board information as good/ very good.

Compare Mean Analysis results are also consistent with the above presented results. Overall user perception of connectivity and access can be rated as satisfactory except for the indicator, security against crime (Annex – VIII).

### *Perception of Cost and Fare:*

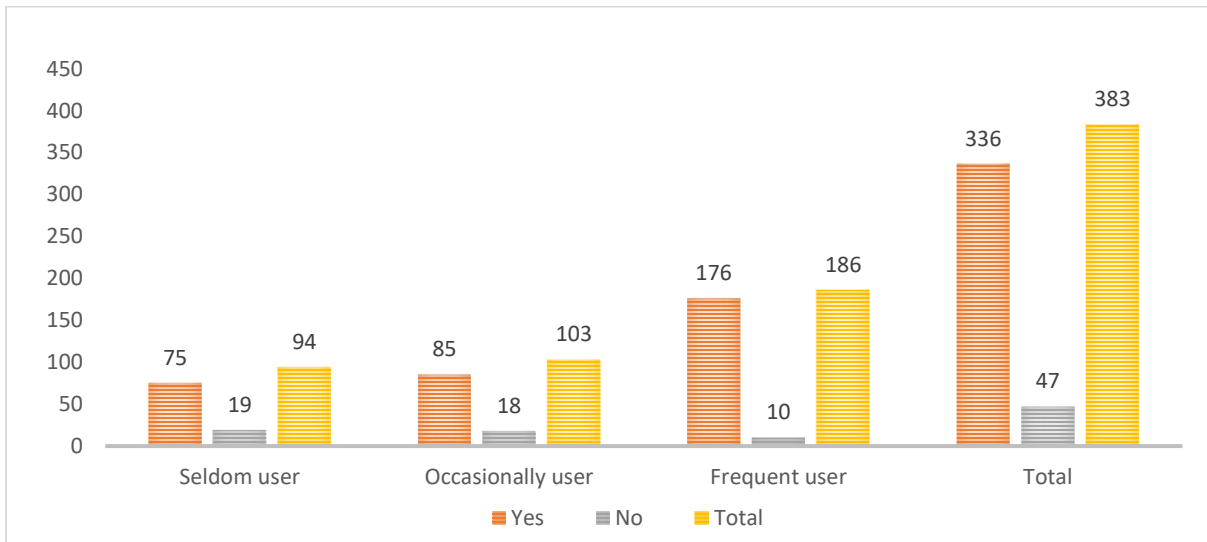
This sub variable has two indicators as shown in the table 15 below. As for the perception of the convenience of purchasing ticket, 17.34% respondents perceived its convenience as very good and 38.75% respondents rated its convenience as good. A small portion of users (3.25%) perceived it as very poor. The fare of LMBS is flat and remains the same regardless of the distance. A substantial majority of LMBS users perceived the fare of LMBS as very affordable. More than 80 percent users showed complete satisfaction with ticket price of LMBS.

**Table 15. Perception of Cost and Fare (Survey Result in Percentage: n=383)**

Cost and Fare	Very Poor	Poor	Neutral	Good	Very Good
	(Percentage %)				
Ease of Purchasing Ticket	3.25	10.29	30.35	38.75	17.34
Ticket Affordability	4.67	5.76	26.64	40.65	22.25

The above-mentioned results are also vindicated by the outcomes of compare means analysis (Annex – VIII) where users of LMBS have given healthy average mean score of 3.4/5 to both the indicators (with 1 being the lowest). Detailed perception tables can be seen at Annex – IX.

In survey, the respondents were asked if there are satisfied with overall service quality standards of LMBS or otherwise. The figure 8 below represents the answers of the users. An outstanding 336/383 respondents showed satisfaction with LMBS service. An interesting observation from the following figure is that even majority of seldom users were found to be satisfied with the LMBS service quality (75/94). Hence, from survey it is seen that the users perceived the overall service quality of LMBS as satisfactory/ good.



**Figure 7. Overall User Satisfaction (Survey Result: n=383)**

***Evidence from the Literature:***

Although overall user perception about *tangibles* is good, however the seat availability has been perceived poor by the users. One of the *probable reasons* for this result is that seating capacity of each LMBS bus is only 38+1 although it is spacious and can accommodate around 120 standing passengers (PMA, 2013). Similarly from the study of Rathore and Ali (2015) it has been observed that are complaints from the travellers about various *service quality characteristics* of LMBS such as availability of seats in the bus. The results are in line with the argument of Rohani et al. (2013) that customers like to use a service and buses which presents a neat look, and has a comfortable setting.

The results with respect to overall perception of *connectivity and access* are aligned with survey and interview responses. The literature from TCRP BRT Volume II (2003) also suggests that a BRT should be so designed that it must have stops conveniently located for its target users, the



feeder service must be perfectly integrated to the main system to increase ridership. Likewise, even PMA (2013) believe that feeder network of LMBS needs improvement in terms of integration and expansion. However, the evaluation study by UNDP (2017) mentions that LMBS provides good connectivity and with construction of additional routes its coverage will increase many folds.

Regarding *reliability, safety and security* the literature from Masoor et al. (2016) authenticates that LMBS has achieved good degree of user satisfaction when gauged in terms of reliability and ICT interventions. As per PMA (2013) the latest technological interventions of LMBS are at par with most modern transit services of the world.

LMBS has the most modern integrated ticketing system, passenger information system, vehicle tracking system and through verbal and visual announcements the passengers are kept well informed on and off board as well (PMA, 2013). However, security standards have been under questions and a poor user perception is consistent with the study of Rathore and Ali (2015) which mentions that various news reports have pointed out security lapses at LMBS stations.

*Fare* has been the hallmark of LMBS as per the results of survey and interviews. The relevant literature is also found consistent with the results. The data from PMA reveals that owing to the subsidy the GoP is giving to LMBS, it is the cheapest mode of public transport and tickets are extremely convenient to get from machines and manual booths PMA (2013). The results are also consistent with the study of Rathore and Ali (2015), who mention that fare of LMBS is acceptable to its users.

#### ***Summary of the Findings:***

The results from survey exhibits that 88% (majority of whom are frequent travellers) of LMBS users perceive its service quality to be good. Only 12% perceive the LMBS service quality to be not up to the mark. Seldom users perceived the minimum score for the LMBS service quality, the occasional user gave a higher score than the seldom user, and the frequent user gave the highest score (Annex – VIII and Annex – IX).

In summary, the overall user perception regarding service quality standards of LMBS is satisfactory/ good with exception of two aspects, which are the availability of seats in the bus and security standards at LMBS stations/ buses. These results are in accordance with the relevant literature on LMBS and interview responses as well.

#### **4.4.2 To what extent does the perceived service quality influence the ridership of LMBS?**

To know the extent to which the perceived service quality influences the ridership of LMBS, Analysis of Variance (ANOVA) and Regression Analysis (based on the answers of Likert scale from the questionnaire) are the two inferential analysis used in this section in addition to the responses from the interviews. This sub-question has been explained under the *indicator: "Frequency of using LMBS"* and the users have been bifurcated into frequent user, occasional users and seldom users.

#### ***Findings from the Interviews:***

In the onset, the summary of response from the interviews from experts is shared next (table 16).

According to 7 out of 8 interview respondents the perceived service quality of a transit influences its ridership significantly (LMBS in this study). Further an interviewee highlighted the importance of the perceived service quality and its influence on the ridership in the following words.

*Interviewee # 5: User perception about service quality spreads information in public over period and influence ridership both positively and negatively. The link is extremely strong, and success of transit is pretty much related to the perception of its users. A drastic increase in LMBS ridership is user perception oriented.”*

**Table 16. Summary of Interview Responses for Sub-Question II (n=8)**

Questions	Summary Response from Interviews	Frequency
Service quality Characteristics needing improvement	i. Cleanliness at Stations	2
	ii. Bus Frequency	
	iii. Integration with other modes of transport	
iv. Seat Availability		
	i. Security against Crime	5
	ii. Maintenance of LMBS Stations & Track	
	i. Adherence to Schedule	1
Factor encouraging LMBS ridership	i. Low Fare	6
	ii. System Reliability/ Service Timings	
	iii. Convenient Stops	
	iv. Service Outlook	
	i. Saves Time	2
Influence of Service Quality Attributes on Ridership	Ridership is directly related to the satisfaction of the users. Transit agency should also keep user perception in view for the betterment of service because they are ultimate user of this service.	7
	Some attributes need to be improved for further increase in ridership.	1
Factor discourages LMBS ridership	i. Low Coverage Area	6
	ii. Cleanliness	
	iii. Seat Availability	
	iv. Security Standards	
	i. Overcrowded Buses	2
Service Quality Evaluation Studies	PMA has never undergone any evaluation study to gauge the service quality of LMBS.	8

In terms of factors which encourage and influence the ridership of LMBS, 6 out of 8 respondents ranked connectivity and fare of LMBS as the most important reasons. An interviewee emphasized on the above said in the below mentioned words:

*Interviewee # 1, “People need connectivity and then the most important encouraging factor is the low fare of LMBS.”*

*Interviewee # 1: “Our buses come at a station at every 2 min 15 second in peak hour to 3-4 minutes in off peak hours. It is a high bus operations frequency and we are maintaining a 99 percent*

*frequency level. Users want bus whenever they reach a metro station and we try to satisfy their demand.”*

When asked about the factors adversely affecting the ridership of LMBS, 6/8 respondents mentioned seat availability, security standards, and low coverage area of LMBS as the potent reasons. A few responses from the interviewees are reproduced below:

*Interviewee # 6: “We are receiving large number of complaints regarding theft in buses and at stations. For women, elderly and children it is a serious concern.”*

*Interviewee # 2: “We receive complaints about petty thefts and cleanliness issues at the stations.”*

All respondents of the interviews agreed that there is a need to have a wholesome service quality evaluation of LMBS because there has been none since the start of its operations. The experts also lamented the lack of research on service quality aspect of LMBS. The detailed interview results can be seen at Annex – III.

### ***Findings from the Questionnaire:***

#### ***Inferential Analysis:***

Multiple linear regression is used to establish the extent of relation between an independent and dependent variable. The finding from the Likert scale in the questionnaire are used to run the regression analysis. The responses were collected on a 5-point Likert Scale, with 1 being “very poor” and 5 being “very good”.

#### ***Reliability and Validity Analysis:***

The first step before running any inferential analysis (regression in this case) is to test the reliability and validity of the indicators. Various indicators which are acquired from the questionnaire<sup>8</sup> are aggregated into one sub-variable. The reliability test among indicators in one sub variable must be high to justify the aggregation of these indicators.

#### ***Cronbach’s Alpha:***

The value of Cronbach’s alpha<sup>9</sup> must be higher than 0.7 to combine the indicators. In few cases, even 0.6 is also suitable.

From the results of the reliability test (table 17), it is apparent that sub-variables tangibles, connectivity and access and reliability - security and safety, have a superior reliability test, having a Cronbach’s alpha of more than 0.7.

Therefore, these indicators from three different sub variables can be aggregated. The remaining sub-variables (cost and fare) has a low-reliability test.

Two important tests namely Normality Test and Pearson’s Correlation must be carried out prior to performing inferential analysis.

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<sup>8</sup> Total Number of respondents (n) = 383

<sup>9</sup> Cronbach’s Alpha (0.9 - 0.7 = good/acceptable, 0.7 - 0.6 = questionable, less than 0.5 = unacceptable)

**Table 17. Cronbach's Alpha (Reliability Analysis Matrix)**

Aggregated Variable	Indicator	Cronbach's Alpha
Tangibles	Cleanliness in the Bus	0.744
	Cleanliness at the Stations	
	Availability of Seats in the Bus	
	Overall Comfort	
Connectivity and Access	Parking facilities at the Bus Stop	0.714
	Accessibility to the nearest Stop	
	Convenience of Transfer	
Reliability, Safety & Security	Adherence to Schedule	0.806
	Frequency of Service	
	Security against Crimes	
	Safety from Accidents	
	Pre-Travel Information	
	On Board Information	
Cost and Fare	Ease of Purchasing Ticket	0.555
	Ticket Affordability	
	Price of Ticket	

Normality test is conducted to confirm whether the data gathered from the survey is normal (has a normal distribution) or otherwise (Sarstedt and Erik, 2018).

*Normality test:*

The normality graph (see Annex VI) reveals that it is not a bell curve or not normally distributed which is mostly the case with survey data (Van Theil, 2014). The regression analysis will still be utilized to solve the main research question in this study with the assumption that the gathered data has a normal distribution (Uyanik and Nese, 2015). Sarstedt and Erik (2018) have indicated that even in the case of data which is not normally distributed, the regression analysis will show a correct outcome, though it will be challenging to ascertain the importance of the end result.

*Pearson's Correlation:*

A correlation is a relationship between two variables. The reason of using correlations in research is to determine which variables are connected. While a correlation co-efficient is defined as a numerical depiction of the strength and track of a connection. Pearson's correlation is utilized when there are two quantitative variables and it is to be seen whether there is a straight relationship between those variables (Sarstedt and Erik, 2018). *Pearson's Correlation*<sup>10</sup> is the most suited technique because it deals with the data which is not normally distributed. In this case, we see in the first test that the data is not normal.

<sup>10</sup> 0.1 – 0.29 = small relationship, 0.3 – 0.49 = medium relationship, more than 0.5 = strong relationship  
Range (-1 to +1) wherein -1 = perfect negative correlation & +1 = perfect positive correlation.  
0 = no correlation.

**Table 18. Pearson's Correlation Co-efficient between perceived service quality and ridership of LMBS**

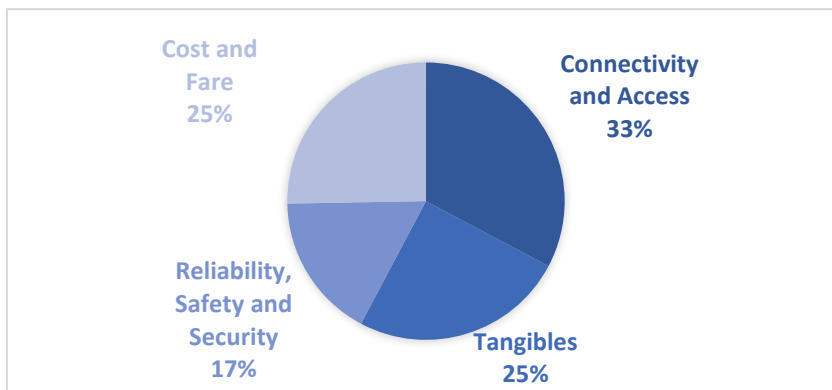
Correlation						
No	Probability	1	2	3	4	5
1	Ridership	1				
2	Tangibles	0.1571	1			
3	Connectivity	0.1780	0.5339	1		
4	Reliability	0.1044	0.5949	0.7298	1	
5	Cost & Fare	0.155	0.498	0.690	0.636	1

There must be sufficient correlation between each perceived service quality sub-variables (Uyanik and Nese, 2015). It is apparent from the table above that all four sub-variables are positively correlated to the independent variable (ridership). However, their relationship is small. Likewise, all independent sub-variables have a positive relationship amongst themselves. These results can be compared to the responses from interviews as well.

*Interviewee # 7: "All user attributes are connected to each other. They do influence the overall ridership, yes their influence can vary from week to strong."*

Florida Tourism Department (2008) has evaluated that service quality attributes do have some sort of relationship between them, their strength varies so does their influence on the ridership of a transit mode.

The relationship between different attributes of a same service is neither too strong nor small, hence the model qualifies for multiple linear regression.



**Figure 8. Encouraging service quality factors to use LMBS (Survey Result: n=383)**

In the questionnaire, the respondents were questioned to select one service quality characteristic that encourages them to use LMBS. The result (in percentage) illustrates that Connectivity and Access is the major encouraging factors with 33% users said that this attribute is the contributing factor for them to use LMBS. As per Redman et al. (2013) accessibility is the basic step

in decision-making process of a user since they would only use the service if it is connected (directly or with minimum possible transfers) to their destinations. This explains the answer of majority of LMBS users. Cost & Fare was mentioned by 25% users and Tangibles (Cleanliness and Comfort level) by 25% users as most encouraging factor to use LMBS. Least number of users (17%) deemed Reliability and Safety to be the most encouraging factor of their choice for LMBS.

*Regression Analysis:*

After knowing the main influencers of the ridership of LMBS, it is important to comprehend the extent to which these perceived service quality attributes influence the ridership of LMBS. Multiple regression analysis is vital to obtain a greater grasp of which service quality characteristic has a higher influence on the ridership of LMBS. Regression analysis can display how much the perceived service quality (independent variables) is affecting the ridership of LMBS (dependent variables), which is the frequency of use.

**Table 19. Model Summary for Sub-Question II (Survey Result: n=383)**

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change	F Change	df1	df2	Sig. f change
1	.209 <sup>a</sup>	.044	.034	11.205	.044	4.321	378	382	.002 <sup>a</sup>

a. Predictors: (Constant), Cost and Fare, Tangibles, Reliability, Safety and Security, Connectivity

b. Dependent Variable: Ridership

Value of the *R square*<sup>11</sup> in the above table shows how much change in the dependent variable is explained by the change in the independent variable (Uyanik and Nese, 2015). R square can assume any value from 0 to 1. It is measured to analyse the goodness of fit (goodness of regression equation to fit for the data). In this study the result exhibits value of R square to be 0.044. It means that the perceived service quality can explain 4.4% of the difference in the ridership of LMBS. This low percentage implies that it can describe a modest variance in the independent variable. One of the probable reasons why this study reveals a small outcome is because the service quality may possibly not be the single rationale for selecting one transport mode. Supplementary considerations beyond the LMBS service quality may impact the frequency of using one mode of transport, for example, how they perceived other transit modes beside LMBS. The justification for occasional users not riding on LMBS can be that regardless of how they perceive the service quality of LMBS, they simply prefer to use their personal/ private vehicle. The above said reason is also one of the *limitations of this study*.

**Table 20. Regression analysis about relationship between perceived service quality and ridership of LMBS**

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations			Collinearity Statistics	
	B	Std. Error	Beta			Zero-Order	Partial	Part	Tolerance	VIF
(Constant)	3.379	2.370		1.426	.155					
Tangibles	.334	.195	.110	1.711	.064	.157	.088	.086	.614	1.628
Connectivity	.583	.294	.162	1.983	.048	.178	.101	.100	.377	2.654
Reliability, Safety & Security	-.245	.163	-.121	-1.506	.133	.104	-.077	-.076	.390	2.561
Cost & Fare	.358	.396	.066	.904	.366	.155	.046	.045	.478	2.091

**(Result from the Likert Scale of Questionnaire: n=383)**

The results are shown in form of coefficient (B) (the effect) and significance (size of effect). In regression analysis the quantitative interpretation of Likert scale variables is difficult. Hence, the discussion on results will mainly focus on sign of coefficient (+/-) and significance. This discussion

<sup>11</sup> R2: It is the percentage of variation in the data explained by the model i.e. 0<R2<1.

will enable us to analyse the below mentioned hypothesis. There are two hypotheses in multiple regression analysis.

$H_0 - b=0$  means there is no effect &  $H_1 - b \neq 0$  means there is an effect

First and foremost, important aspect to look at is *unstandardized B coefficient*. It explains the degree of change in the dependent variable produced by an increase of one unit in the independent variable. The way to comprehend unstandardized B coefficient is that for each unit increase in the perceived service quality (predictor variable), the ridership of LMBS (result variable) will rise by the beta coefficient value. The value of the beta coefficient can answer the level of variations in the ridership of LMBS that were caused from the perception of service quality. It has been analysed that all independent variables have direct positive effect on the dependent variable except Reliability, Safety and Security. This means that the relationship between reliability, safety and security and the ridership of LMBS is such that increase in perception of independent variable (reliability) does not increase the dependent variable (ridership). A probable reason for this inverse relation is a “poor” perception of the users of LMBS about the security standards. While other three sub-variables have a direct positive relationship with the dependent variable. Meaning there by, with the increase in perception of these independent variables, the dependent variables increase as well. Connectivity has the highest B coefficient (0.583). This means that when the users have a good quality experience with the connectivity of LMBS by one unit, the equation calculates that the ridership of LMBS will increase by 58.3%. Similarly, if the respondents give a better score for tangibles and cost by one point, the equation predicts that the ridership will increase by 33.4% ( $B=0.334$ ) and 35.8% ( $=0.358$ ) respectively.

**P value or significance** explains the reality of the null hypothesis and impact of sub-variables on the dependent variable. Regression results further show that “*connectivity*” has a p-value of less than 0.05 (i.e. 0.04). The statistical significance value of this variables rejects the null hypothesis and it can be argued that its effect can be applied to larger population in general. Moreover, “*tangibles*” exhibits a p-value slightly outside the margins of significance (i.e. 0.06).

The *statistical insignificance* of other two sub-variables (Cost and fare & Reliability) can be linked to the respondent’s selection of the neutral answer (middle) on the Likert scale for all indicators linked to service quality. This answer generates bias to the significant result.

Furthermore, According to Sarstedt and Erik (2018) strong correlation between independent variables can result in the coefficients of specific variables turning out to be insignificant, although the whole regression is significant. The reason is that the highly correlated independent variables tend to explain the same changes of the dependent variable, hence the descriptive power of coefficients and significance gets shared among them. In this study, due to the high correlation at 0.72 between connectivity and reliability and connectivity and cost at 0.69 as shown in table 18, the explanatory power in coefficients and significance was divided between them.

Thus, running the regression gave the reliability and cost as insignificant coefficients. The overall regression analysis, however, was significant. Hence, from the data acquired from survey it has been analyzed that tangibles, connectivity and cost has the positive direct relation with the ridership of the LMBS. (Further details at Annex – VI).

### ***Evidence from the Literature:***

The Perceived Service Quality is consumer's evaluation of product's overall quality. Understanding the evaluation procedure on which customers choice of the transportation mode for their journey is based, according to Eboli and Mazzulla (2010) is vital for transit agencies.

From literature review we know that what matters the most to a user is the availability of transit and *availability means connectivity* (Barabino and Deiana, 2013). The importance of connectivity of transit is further elaborated by the literature from (APTA, 2017). It reveals that users want accessibility with a respectable outlook. They will select a transit mode which is close to their starting point and takes them to their destination with minimal of inconvenience. Similarly, Jing and Fan (2018) believe the most important motivating force for users to select a transit mode is the ease with which it takes them to their destination.

Another evidence regarding influence of fare and tangibles on ridership of LMBS comes from Saadat (2015), he suggests LMBS offers its users a presentable outlook and its stops are well planned. Similarly, the research of Redman et al. (2013) elucidates that public transit service will only be more acceptable to general public if it offers affordable fare, free parking and subsidized travel passes. With regards to how the cleanliness standards and overall outlook of the transit matters, the study of Hess and Bitterman (2008) suggests that transit users are more inclined towards a service which is comfortable and clean. Hence, the results of survey and interview responses are consistent with the relevant literature.

### ***Summary of the Findings:***

In summary, the findings of the sub research question two can be presented by mentioning that the ridership of LMBS is positively influenced by three service quality characteristics namely, tangibles, connectivity & access, and cost & fare. While reliability, safety and security does not have a direct influence on the LMBS ridership. A probable reason is that the users perceive the security standards of LMBS to be poor. However, the most *significant influence* on the ridership of LMBS is linked to the increase in the perception of connectivity. Additionally, from the regression analysis it has been observed that with one unit increase in the user perception of Connectivity and Access, the ridership is influenced (increased) by 58.3%, with one unit increase in perception of cost and fare, the ridership is influenced (increased) by 35.8% and with one unit increase in perception of tangibles, the ridership is influenced (increased) by 33.4%. Finally, the triangulation between literature, interview responses and survey results reveal consistency in the findings as well.

#### **4.4.3 What is the level of influence of user characteristics on the ridership of LMBS?**

The user characteristics described in this study are gender, age, education, occupation (employment status & employment type), income, possession of a driving license, and vehicle ownership. The cross-tabulation analysis, regression analysis (from data of survey responses) and interview answers are used to answer the third sub-research question of this study.

### ***Findings from the Interviews:***

To start with, the summary of responses from the interviews is presented in the table below. The interview respondents were asked about their view regarding influence of user characteristics (socio demographic characteristics and trip maker characteristics) on the ridership of LMBS.



Their responses along with the frequency of an answer is recorded in the table below.

**Table 21. Summary of Interview Responses for Sub-Question III (n=8)**

Indicator	Summary of Responses from Interviews	Frequency
Influence of Socio-Demographic User Characteristics on the Ridership of LMBS (gender, age, occupation, income)	The socio-economic and demographic characteristics of the rider have a significant influence on ridership. LMBS is majorly used by low income and middle-income working class, students and lately women ridership is increasing as well.	7
	The relationship is positive although non availability of other respectable public transport service is also influencing the ridership of LMBS.	1
Influence of Trip Maker Characteristics on the Ridership of LMBS (License and Vehicle Ownership).	Licensing in Pakistan is different concept when compared to developed world. Owning a vehicle does not mean to have a license as well. Most LMBS user's own vehicle yet prefer LMBS because its cheap and convenient.	6
	Families with vehicles will prefer to use their private cars instead of LMBS for leisure trips.	2

7/8 respondents of the interviews have agreed that socio-demographic characteristics of the users influence the ridership of LMBS. They have further agreed to the fact that LMBS is majorly used by people from low income working class, students, and white-collar government employees. However, women ridership is still considerably low. The above said is further highlighted in the words of the interviewees below:

*Interviewee # 4: "User attributes play vital role in the ridership of LMBS and influence it significantly. A transit cannot attain success if it fails to attract its target users."*

*Interviewee # 2: "Yes, user attributes have influence on ridership. For example, in LMBS average ridership is 135,000 and its composition most likely is that 70% passengers are from poor background and working class, male female ratio is 65:35 and more than one third are students."*

Likewise, another interviewee emphasized on the fact that students and poor class patronize LMBS the most owing to its extremely decent fare and high level of operational efficiency.

*Interviewee # 5: "Due to low fare, the system mostly attracted students and low-income people. Due to safety in the system, attracted maximum number of females. Due to punctuality, attracted office holder and time conscious people."*

With respect to the characteristic of the trip makers and the impacts of owning a vehicle on the ridership of LMBS, 6 out of 8 respondents believed that vehicle ownership did not reduce the ridership of LMBS. They believed that majority of LMBS users own a vehicle (mostly motorcycles), yet they prefer LMBS for individual use. However, families prefer using their private vehicle (mostly cars) instead of LMBS. Few respondents expressed their views in the following words:

*Interviewee # 6: "I will personally use LMBS if its more convenient, although I have a vehicle."*

*Interviewee # 4: "Vehicle owners at times prefer LMBS because it save time and money."*

Out of 8, 6 interview respondents believed that license ownership is irrelevant in Pakistan because majority of motorcyclists do not even have a driving license.

*Interviewee # 1: “I think license ownership is not directly affecting ridership.”*

*Interviewee # 8: “Vehicle ownership is not directly related to license ownership as majority motorcycle owners do not get licenses.”*

Responding to the overall influence of user characteristics an interviewee summarised this aspect in the following words:

*Interview # 1: “PMA as an organization has not conducted any study on determining the influence of user attributes on the ridership of LMBS. However, most of the riders of LMBS they come from middle and lower middle-income class. Our service receives users from all genders and age groups, and it is an acceptable system for majority of working class, student and even women.”* (see Annex – III).

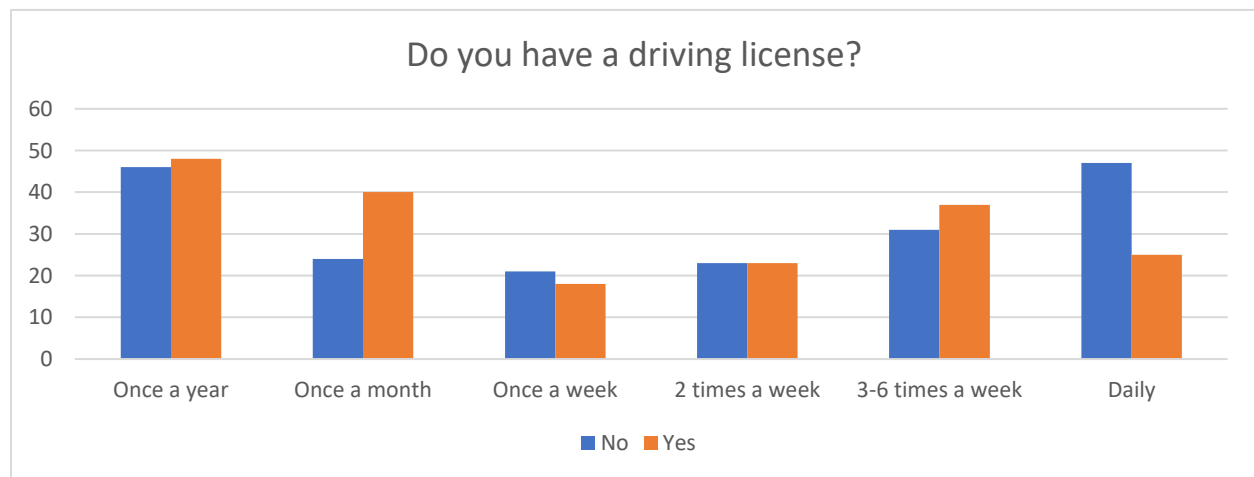
**Findings from the Questionnaire:**

Socio-Demographic Characteristics of Users (gender-age-income-occupation-marital status) have already been explained under section 4.3.3 and are annexed at (Annex IV). However, a detailed description can be seen at Annex-VII.

Based on the data of survey, the Cross tabulation between Characteristics of Trip Makers (Vehicle Ownership and Driving License Ownership) and ridership of LMBS is explained in this section.

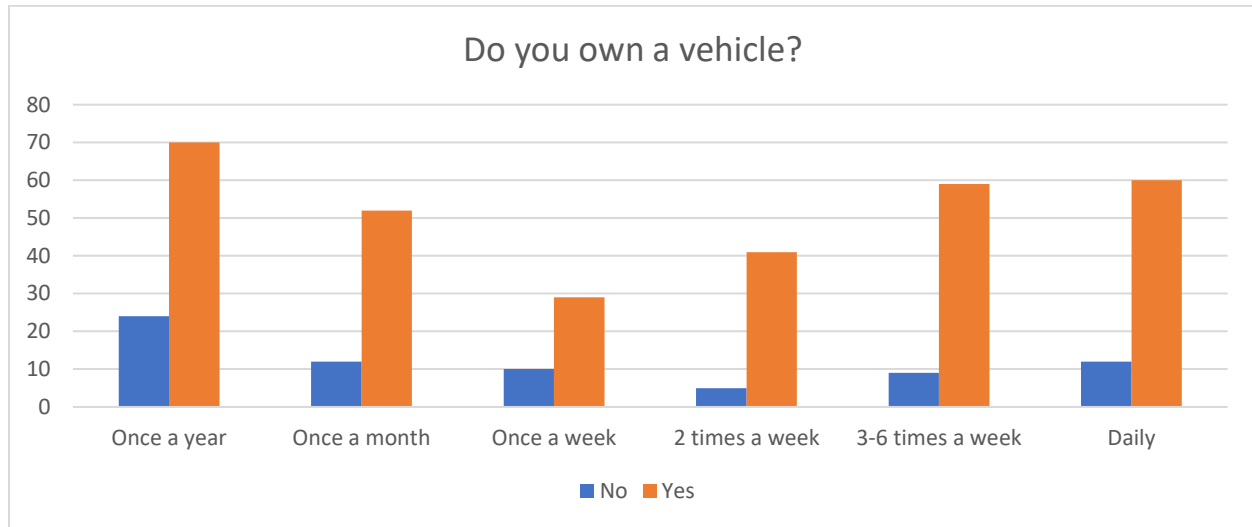
*Possession of Driving License:*

The survey respondents were asked about possessing a driving license or otherwise. The pattern (based on their responses) between having a driving license and not having it with regards to the ridership of LMBS is similar in nature. With respect to overall figures, license ownership or otherwise is not a major factor in users’ choice of LMBS. Almost equal number of license holders use LMBS to those who do not have a license. However, most daily users do not own a driving license. The most probable reason is that most bikers in Pakistan do not possess a driving license.



**Figure 9. Cross Tabulation between License Ownership and LMBS Ridership (Survey Result: n=383)**

### Vehicle Ownership:



**Figure 10. Cross Tabulation between Vehicle Ownership and Ridership of LMBS (Survey Result: n=383)**

The survey respondents were asked if they own a family vehicle or otherwise. The results exhibit that a high percentage of vehicle owner are observed to have been frequent users of LMBS. This pattern is contradictory to the one observed in the case of License ownership because in Pakistan there is a serious issue with motorcycle owners, they seldom get driving licenses for two wheeled vehicles. Since common user of LMBS comes from lower middle class (section 4.3.3) who can only afford a motorcycle. 81% users of LMBS from all ridership categories own a vehicle and majority of them are frequent travellers.

### *Inferential Analysis:*

To gauge the extent to which the user characteristics influence the ridership of LMBS, multiple regression analysis (from survey data) was run. It is worth mentioning here that based on the questionnaire the sub variable occupation was further categorized into employment status and employment type (formal/ informal employment).

### *Pearson's Correlation:*

*Pearson Correlation* is used to analyse the nature and strength of relationship between the dependent variable and independent variables and among independent variables as well. The outcomes of the analyses given in the table 22 below, reveal that only “Employment Status” and “Vehicle Ownership” are positively related to the ridership. However, the associations are considerably small.

All other variables have a negatively weak correlation with the dependent variable. Referring to the relationships of independent variables among themselves, majority are negative and weak. The results from the table below reveal further that there is no strong relationship<sup>12</sup> between sub-variables, hence the regression analysis can be run.

<sup>12</sup> 0.1 – 0.29 = small relationship, 0.3 – 0.49 = medium relationship, > 0.5 = strong relationship  
Range (-1 to +1) wherein -1 = perfect negative correlation & +1 = perfect positive correlation.  
0 = no correlation.

**Table 22. Pearson Correlation Coefficient between user characteristics and ridership of LMBS (Survey Result: n=383)**

Correlation											
No.	Probability	1	2	3	4	5	6	7	8	9	10
1	Ridership	1									
2	Age	-0.115	1								
3	Gender	-0.022	0.126	1							
4	Marital Status	-0.066	0.382	0.157	1						
5	Education	-0.004	0.183	0.066	0.108	1					
6	Income	-0.047	-0.213	0.073	-0.220	0.266	1				
7	Employment Status	0.237	-0.309	-0.180	-0.424	-0.168	0.093	1			
8	Employment Type (Formal/ Informal)	-0.029	0.097	0.219	0.298	-0.073	-0.089	-0.585	1		
9	Vehicle	0.079	0.047	0.065	0.095	0.054	-0.090	0.021	-0.048	1	
10	License	-0.120	0.144	0.249	0.092	-0.030	-0.070	-0.125	0.130	0.146	1

**Table 23. Model Summary for Sub-Question III (Survey Result: n=383)**

Model	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change	F Statistic	Mean Dep. Var.
1	0.106922	0.085373	10.90032	.1072	4.961832	10.97128

a. Predictors: (Constant), Gender, Age, Marital Status, Education, Employment (Status), Employment (Type), Income, License, Vehicle

b. Dependent Variable: Ridership

*Regression Analysis:*

Multiple regression (based on the results of the survey) is run to gauge the influence of user characteristics on the ridership of LMBS. There were no strong relations between the variables (Pearson Correlation), hence, no collinearity was observed. Therefore, all the variables are included in the regression analysis.

**Table 24. Regression Analysis between User Characteristics & Ridership of LMBS**

Variable	B-Coefficient	Std. Error	t-Statistic	Sig.
Age	-0.076687	0.071189	-1.077234	0.2821
Gender	0.911712	1.629010	0.559673	0.5760
Marital Status	0.356696	1.328074	0.268581	0.7884
Education	2.561985	1.476288	1.735423	0.0835
Income	-2.389837	1.303391	-1.833554	0.0675
Employment (Status)	11.94949	2.298042	5.199855	<b>0.0001</b>
Employment Type	4.656471	1.577974	2.950918	<b>0.0034</b>
License	-2.662132	1.176153	-2.263422	0.0242
Vehicle	2.412915	1.462522	1.649832	0.0998
Constant	7.191799	3.094117	2.324346	0.0206

(Survey Result: n=383)

Table 23 exhibits the value of *R square* to be 0.106 which means that user characteristics can explain 10.6% of the difference in the ridership of LMBS. This low percentage suggests that it can describe a modest variance in the independent variable. One of the probable reasons why this study reveals a small outcome is because the service quality may possibly not be the single rationale for selecting one transport mode. This is also a *limitation* of this study.

The results are shown in form of coefficient (B) (the effect) and significance (size of effect). Hence, the discussion on results will mainly focus on sign of coefficient (+/-) and significance.

Looking at the *unstandardized B coefficient* it has been analysed that all independent variables have direct positive effect on the dependent variable except Age, Income and License Ownership. Meaning there by, with increase in the income of the users, age of the users and license ownership, the ridership of LMBS will decrease, as they have a negative relation with the dependent variable. However, with a positive B coefficient value, other independent variable including gender, marital status, education, employment, and ownership of a family vehicle influence the ridership positively and have a direct relation with the dependent variable. A probable reason for license ownership to adversely impact the ridership of LMBS is that in Pakistan people tend to get licenses upon owning a car and car owners are seldom users of LMBS.

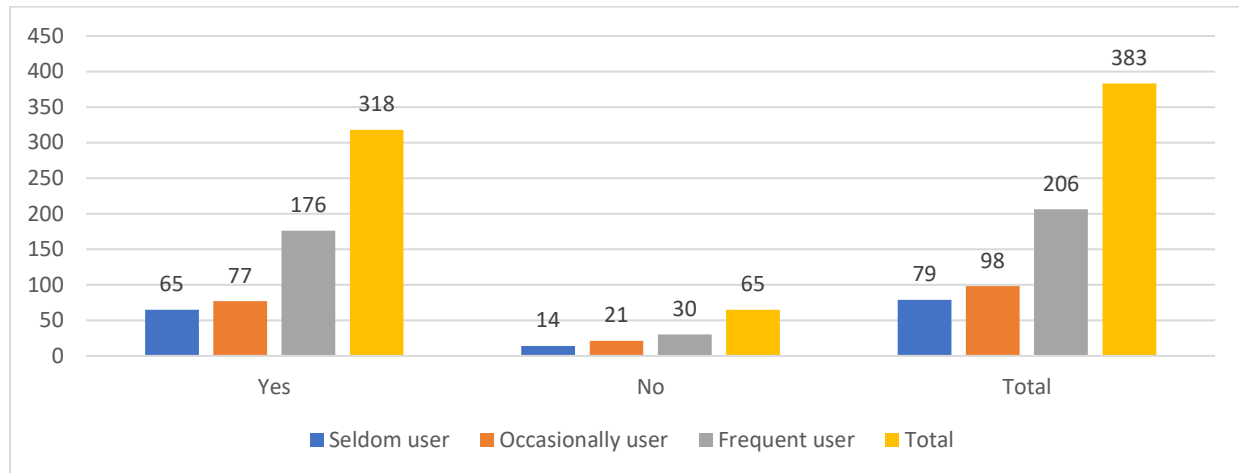
Independent variable “employment” displays the largest B coefficient value. It has been already explained that this variable has been bifurcated into two sub dimensions, employment type and employment status. The data analyses reveal that formal sector employment and students influence the ridership of LMBS in a significant manner.

Similarly, *p-value or significance* explains the reality of the null hypothesis and impact of sub-variables on the dependent variable. Regression results show that “employment type”, “employment status” and “license ownership” has a p-value of less than 0.05, that is 0.003, 0.0001, 0.02, respectively. However, license ownership has a significant negative effect on the ridership. It can be argued that occupation/ employment status (formal sector employee or

otherwise) and employment type (whether a student or otherwise) has a significant positive effect on ridership of LMBS and this hypothesis can be applied to larger population in general because their values reject the null hypothesis.

Hence, it has been evaluated that gender, education, occupation, employment status and vehicle ownership all have the direct positive relation with the ridership of the LMBS. However, the most *significant influence* on the ridership of LMBS is linked to the education levels, and employment type.

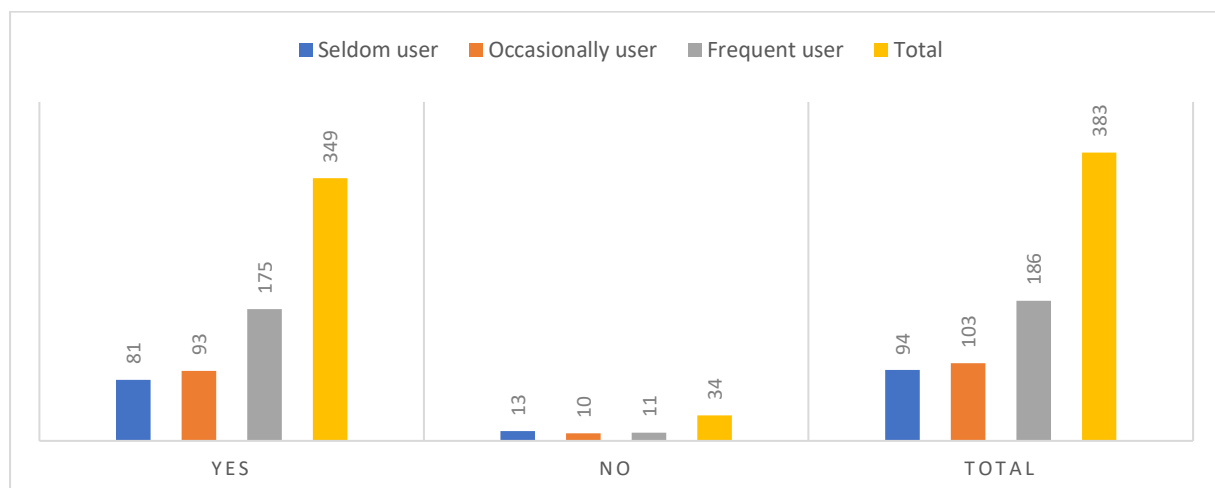
*User’s Trust on LMBS:*



**Figure 11. Will you use LMBS if it improves its Service Quality? (Survey Result: n=383)**

In the questionnaire, the LMBS users were asked two questions regarding their level of trust on the service. In the first question they were asked if they would continue to use LMBS if it bettered its service quality characteristics (Figure 11 above). An overwhelming majority 318/383 said yes, while the remaining 65/383 said no. Majority of the frequent users were seen to be committed to LMBS as well. An interesting outcome of the response was that even most seldom users showed their desire to use LMBS if its service quality was upgraded (65/79).

Likewise, respondents were asked in the questionnaire if they would suggest LMBS to other potential users. 349/383 respondents replied in affirmative. The responses collected from the survey are presented in the Figure 12 below. The results exhibited in figure 11 & 12 shows a positive user trust on LMBS.



**Figure 12. Will you recommend LMBS to other? (Survey Result: n=383)**

### ***Evidence from the Literature:***

The reluctance of Pakistani bikers to have a license has been explained by a survey which mentions that only 19% bikers in Pakistan possess a driving license (Daily Times, 2017). The outcome regarding majority of vehicle owners (mostly motorcycles) using LMBS is contradictory to the research of Majid et al. (2018) who think that most LMBS users do not have private vehicles. However this result is in line with the study of Jing and Fan (2018) who suggest that low income working class and students are more likely to use public transport because of social and economic reasons and with increase in age and income, ridership decreases. As per Zolnik et al. (2018) LMBS attracts majority of working-class male users, students and low income motorcycle owners. This literary evidence is consistent with the findings of survey as well. A document from UNDP (2017) reveals that LMBS has not been able to attract car owners and majority of women too are reluctant to use it. Another finding of the same document is that the high-income group does not prefer to use the public transit because of the social stigma attached to it (Saadat, 2015; UNDP, 2017). This outcomes of the study is also explained by Barter (2000), who suggests that the social norms in the third world are the reason for the rich to not use public transit.

Finally, Olsson (2003) has stated that why to travel is strongly connected with who is travelling. Another evidence of influence of user characteristics on the ridership of transit comes from Ortuzar and Williamson (2011) who suggest that attributes of trip maker (users) are the major influencing factor with respect to the ridership of any transit.

Therefore, from the above discussion it can be stated that the findings of the survey and interview responses are consistent with the literature.

### ***Summary of the Findings:***

Summarily, the major findings of sub research question three is that the ridership of LMBS is significantly influenced by the occupation (employment status and employment type) of the users. However, there is an inverse relationship between the ridership of LMBS and age and income of the users. It means that the ridership decreases with the increase in the income levels of its users, similarly the ridership of LMBS decreases with the increase in the age of its users. The most frequent users of the LMBS are the students, low income class people and white-collar working people.

A probable reason for adverse relation of high income with the ridership of LMBS is that the rich people prefer cars over a public transit, because in Pakistan it is still a social taboo for the rich to use public transport. Likewise, a probable reason for decrease in ridership of LMBS with increase in age is that majority of students and working class uses LMBS belonging to the age group from 15 to 35 years. Affordability is a major concern for this group of people. Once they are out of educational institutions and start earning well enough to afford a car, they prefer using their private vehicle instead of LMBS.

Finally, LMBS follows the pattern of majority of transits in the Global South whose users are students, women, formally/ informally employed working and lower income class.

## **Chapter V - Conclusions and Recommendations**

### **5.1 Introduction:**

In this chapter the key findings and inferences extracted from the survey, interviews, and literature to answer the main and sub research questions are summarized. This section subsequently connects the outcomes of the study to the literature in its entirety. It closes with few recommendations for strategy decisions, recommendations for further study and author's outlook.

### **5.2 Conclusion:**

#### **5.2.1 Conclusion for Sub-Research Question One**

To answer this question, the replies of survey respondents were recorded on a 5-point Likert scale. In Likert scale, 1 was the lowest value (very poor), 3 (neutral) and 5 was the highest value (very good).

Sub-variable Tangibles has been studied under various indicators, which are cleanliness inside the bus, cleanliness at stations, overall comfort levels and seat availability. Outcomes from the study suggest that majority of users have selected neutral, good, and very good as their options. In terms of cleanliness at the stations more than 40% users perceived it as good. An exception however has been the seat availability. The percentage of users who perceived it as poor is more than who perceived it as good. 21.19% respondents perceived seat availability as poor and 26.27% users perceived seat availability as very poor. The same has been mentioned in the literature by Rathore and Ali (2015). It states that the users of LMBS are often found complaining about overcrowding and non-availability of seats. A similar admission has also been made by PMA (2013) that LMBS buses have the seating capacity of only 38 passengers, however the bus cabin is large enough to accommodate 120 standing passengers. The results are in line with the argument of Rohani et al. (2013) that customers like to use a service and bus which presents a neat look, and has a comfortable setting.

LMBS performed fairly in all indicators of connectivity and access with almost 75 percent users rating all indicators of the said sub variable as satisfactory, good, and very good. The best performing area was the convenience of transfer, which was perceived as good by 41.94% users and very good by 19.44% users. LMBS users perceived the time to reach the nearest station and waiting time for the bus at the station as short. Similarly, perception about parking facilities and convenience of transfer were also perceived as fair. An evaluation study by UNDP (2017) mentions that LMBS provides good connectivity and with construction of additional routes its coverage will increase many folds.

Reliability, Safety and Security did fine in connection with frequency of service, adherence to schedule, safety from accidents, pre-travel and on-board information with all indicators receiving respectable scores from majority of users. In case of service frequency and system reliability less than 10 percent users perceived them as poor or very poor. However, the users perceived the security standards of LMBS as poor with 27.59% users perceiving it as poor and 10.05% as very poor. These results regarding deteriorating security standards are consistent with literature of Rathore and Ali (2015), which mention that there have been several complaints by LMBS users about security issues at the stations and in the buses.

In respect of fare, the users perceived LMBS as affordable. 40.65% users perceived the fare as good/ affordable and 22.25% users as extremely affordable while 26.64% users showed satisfaction about it. Owing to the smart ticketing system of LMBS the ease of purchasing



ticket was also perceived as fair by the users. This result is consistent with the report of Daily Dawn (2019) which suggests that Fare is the most acceptable quality attribute of LMBS.

Hence, the overall user perception about LMBS service quality turns out to be *good*. This ultimately answers the first sub-research question; “*How do users perceive the service quality of Lahore Metro Bus Service?*”

The results of this sub research question might have got affected by the *limitations of this study*. As discussed already, Likert scale question in online surveys have the tendency of exhibiting compromised results. It can be linked to the respondent’s selection of the neutral answer (middle) on the Likert scale for all indicators linked to perceived service quality. This answer generates bias to the significant result. Another limitation which resulted in a reduced level of validation is the total number of interviews. Out of 15, only 8 interviews were conducted due to the lockdown. It badly impacted the authenticity check of the outcomes of quantitative data.

### **5.2.2 Conclusion for Sub-Research Question Two**

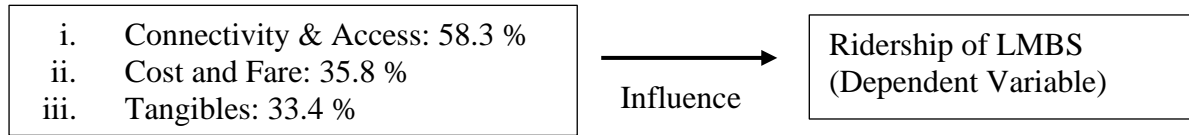
The second sub-research question “*To what extent does the perceived service quality influence the ridership of LMBS?*” was answered by regression analysis (based on Likert Scale results from survey), ANOVA and responses from the interviews. Consequent upon the results of interview responses, Likert scale of survey and inferential analysis, it is observed that the perceived service quality has a connection with how often the user uses a transit. van Lierop and El-Geneidy (2016) believe likewise and suggests that the service provider must concentrate on its users and ensure that they have a positive feel about the service quality of the transit whenever they use it. It has been established that an improved perception about service quality has a positive co-relation with the desirability, hence increases the patronage of the transit system (Eboli and Mazzulla, 2010).

Frequent users perceive a high level of service quality as compared to the occasional and seldom users and the highest perceived service quality score came from the frequent users. This outcome holds true for all four service quality attributes, meaning there by the more frequently the people use LMBS, the better they perceive the service quality of the service as compared to other groups of LMBS users. The more is the feel good experience of a transit user, more likely is he to use it again and again (Mahmoud and Hine, 2016).

Although Pearson Correlation revealed that all service quality attributes are positively related to the ridership of LMBS, multiple regression helped in knowing the exact strength and extent of relationship between independent and dependent variable. Multiple regression analysis determined that for each element of the service quality the indicator which has the most *significant influence* is “connectivity” as compared to other elements. Connectivity can increase the ridership by 58.3% when the respondents increase their perception of connectivity and access by one unit and conversely. As per Rohani et al. (2013) and TCRP BRT Volume II (2003), a reduced total trip time, parking facilities at the stations, convenient transfers, proximity of bus stop and availability of transit influences the ridership of a transit positively.

Also, “cost and fare” shows a noteworthy influence on the ridership of LMBS with B-coefficient of 0.358. This specifies that if perception of users with respect to cost and fare increases by one unit, then as per the prediction of the equation, the possibility of additional people using LMBS more frequently will increase by 35.8%. LMBS is a pro poor service and majority of its users are extremely satisfied with its ticket price. A probable reason is heavy government subsidy which has kept the ticket price within the reach of low income class UNDP (2017).

Finally, the service quality attribute “tangibles” affects the ridership by 0.334. The interpretation of this B-coefficient is that with one-unit improvement in the perception regarding tangibles, the prediction of the equation is that the ridership of LMBS will improve by 33.4%. Likely passengers evaluate the expense and significance of boarding transit versus the price for travelling by different modes and always select the cheapest Redman et al. (2013). Hence, cost & fare and tangibles also have a *large influence* on ridership as well.



The results of this sub research question might have got affected by the *limitations* of the study. The tool used to find the extent to the relationship between an independent and dependent variable was regression analysis which utilized the Likert scale answers of the survey. There is every likelihood that the results are not absolute facts, because it can be linked to the respondent’s selection of the neutral answer (middle) on the Likert scale for all indicators linked to perceived service quality. This answer generates bias to the significant result.

Similarly, another limitation of this study is that survey was conducted online and there are ample chances that the respondents are not the true representatives of the target sample. Hence, the opinion of a certain individuals regarding the independent variable of this study (perceived service quality) cannot be a representation of an entire group/ population.

### 5.2.3 Conclusion for Sub-Research Question Three

To answer the third sub-research question “*What is the level of influence of user characteristics on the ridership of LMBS?*” regression analysis (based on survey data), interview responses and cross tabulation analysis was used. Regarding service quality there is no diversity of opinion in terms of gender because of extremely low female representation in overall sample. Reports also suggest that LMBS is blamed for not being women friendly Daily Dawn (2014). Age group that patronized LMBS the most is majorly adults from the range of 15-35 years, which constitutes more than 75% of total respondents of the study. The reality that adults from a certain age group are the foremost users of LMBS is also demonstrated in the employment status/ type (students), and education levels of the users. Majority of respondents are educated (bachelor’s and master’s degree holders) and employed in formal (public and private) sector jobs. There are evidences from literature of Zolnik et al. (2018) which validates the outcome and states that that students working class and low income people without a private vehicle are majority users of LMBS.

In case of Income, an inverse relationship exists between family income of users and the ridership of LMBS. The higher the family income of the users gets, the lesser they use LMBS. This can be linked to the fact that high income recipients choose to use their private vehicles (cars, motorcycles) or taxis etcetera which is otherwise expensive for middle or low-income recipients (Javid et al., 2018). Majid et al. (2018) has pointed out the same by writing that LMBS has not attracted the rich and car owners. Certain social reasons are also blamed for non-usage of LMBS by the high income groups (Barter, 2000).

With regards to the perceived service quality standards, low income recipients have given more score to all perceived service quality characteristics as compared to the scores given by the middle and high-income recipients. This outcome can be traced back to the fact elucidated by De Vos (2019) where he suggests that the more people will use a transit, the more satisfied

they will be with its service. Since, the majority LMBS users are low income recipients, they value its service more.

Ownership of a family vehicle and possession of a driving license exhibits a dissimilar model, because more than three fourth of total users of LMBS from different user groups own vehicles (motorcycles). This can be linked back to the fact that LMBS has not attracted car owners as much as it has done in case of motorcycles (Daily Dawn, 2014). However, license ownership is significantly low. The reason for this unique pattern is that motorcycle owners usually do not get driving licenses and prefer LMBS over motorcycles for certain travelling needs (Daily Times, 2017).

B-coefficient from multiple regression analysis determines that *largest influence* of user characteristics on ridership of LMBS comes from “employment status” and “employment type” with *significant p-value*. Students and formal sector employees are the most frequent LMBS users.

The *limitation* to this study has been the random online distribution of the questionnaire. It might have resulted in a sample which is not exactly representative. Therefore, the results cannot be treated as accurate. This shortcoming could have been overcome by the qualitative data, however in this study that too was not completely possible. Only 8 interviews were conducted because of COVID lockdown, hence the validation of the primary data was not done as per initial plans.

#### **5.2.4 Conclusion for overall Research Question**

To answer the main research question “To what extent do the perceived service quality and user characteristics influence the ridership of Lahore Metro Bus Service (LMBS)?” all three sub-research questions have been examined.

An important finding of this study is that from descriptive analysis of the survey data, it has been revealed that the frequent users of LMBS have better perception of its service quality as compared to the occasional and seldom user. The more a person uses a transit, the more is the likelihood of him perceiving its quality to be good and vice versa (de Oña et al., 2013)

Based on regression analysis (from the survey data) and interview responses the service quality attributes which *significantly influence* the ridership of LMBS are, connectivity and access (58.3%), cost and fare (35.8%) and tangibles (33.4%). The literature from APTA (2017) tells that users want convenient accessibility (connectivity). They will select a transit mode which is close to their starting point and takes them to their destination with minimal of inconvenience. LMBS as per the UNDP financed study offers a cheap and convenient mode of travel to the people of Lahore (Saadat, 2015).

However, there are certain service quality indicators which the users of LMBS perceived as poor. They include availability of seat and security against crime. In addition to that, the users did not perceive reliability, safety and security as a service quality characteristic which influences ridership of LMBS significantly. A similar result has been put forward by a research which mentions that there are complaints from the travellers about various service quality characteristics of LMBS such as availability of seats in the bus, overall security standards, reliability of service etcetera (Rathore and Ali, 2015).

Likewise, with regards to the user characteristics, employment type and employment status (occupation) *largely influence* the ridership of LMBS. Nevertheless, the ridership decreases with increase in age of users and income levels of the users. From various data sources it has been established that like other public transits of the global south, the LMBS attracts more poor

than the rich and majority of students prefer travelling by LMBS (Daily Dawn, 2014; Javid et al., 2018; PMA, 2013).

*To conclude, it can be stated that connectivity & access, tangibles, fare (service quality characteristic) and employment (user characteristic) most significantly influence the ridership of LMBS.*

The results of this study might be impaired by the *limitations* of this study. Firstly, this study intended to study perception of LMBS users while the data collected was numeric. The transformation of digits into perception can result in distorted conclusions. Secondly, COVID affected people physically and psychologically. The respondents might have answered the questions under stressful situation or when they were not fully concentrating. It might have affected the data authenticity and resultantly the outcomes of the study.

### **5.2.5 Linking back the overall study to the literature**

This section links the study back to the literature in its entirety. Consequent upon the findings, it is evident that the frequent users have a better perception of service quality in comparison of occasional and seldom users regarding majority of perceived service quality characteristics. This outcome is consistent with the argument of Davidov (2003) and De Vos (2019) where they suggest that people will most probably carry a good perception whenever they use the transit mode which they like the most or which is their preferred mode of travel. This finding aligns with the relevant “theory of repeated behaviour” as well, which reveals that a pleasing experience with the transit service would induce more future uses of the same service (Singleton, 2013).

Additionally, “connectivity” is the factor of perceived service quality which significantly influences the ridership of LMBS. With regards to connectivity, the literature from TCRP Report 88 (2003) mentions that the basic stage of selecting a transit is based upon the availability of service. Availability is directly linked to connectivity. It indicates that connectivity is the primary indicator that requires to be satisfied at the onset in order to receive the acknowledgement from the people that LMBS can be one of choices for their daily travels (Barabino and Deiana, 2013). Therefore, it is consistent with the literature that connectivity is one of the factors to use LMBS.

Another conclusion of this study is that 83% of respondents are inclined towards using LMBS frequently if the transit agency enhances its service quality. This is associated with the research of Anable (2005) which reveals that an intermediation can influence prior behaviour towards the future ridership. For instance, by improving the seating capacity, improving security for women, and increasing the number of buses, the PMA can enhance the number of LMBS users.

In terms of the user characteristic, the research of Eboli and Mazzulla (2011) which states that women, elderly and school goers are most likely user of a transit does not align with the outcomes of this study. Most frequent users of LMBS, as per this research are students and working class who belong to low income group. This finding is supported by Jing and Fan (2018) and Zolnik et al. (2018) who believe that a transit in general and LMBS in particular attracts a low income working class and student ranging from 15-35 years of age. In addition to that, the ridership is inversely proportional to income levels.

Finally, each group of users has a varied view about the service quality which to them is more significant than other. A frequent user rates connectivity/ availability and fare to be the most important factor. Nonetheless for occasional and seldom users, availability of seat and cleanliness are also important in addition to connectivity and fare. This finding demonstrates that every group of users carries a varied viewpoint which needs attention of a transit agency.

This result is in line with the work of De Vos (2019) which elucidated that a betterment in the service quality of a transit based on the inclinations of various groups of users is an imperative for the success of the transit.

### **5.3 Recommendations:**

#### **5.3.1 Policy Recommendation**

Firstly, the GoP and PMA must ensure a systematic and periodic third-party service quality audit of LMBS to ensure a continuous improvement in the quality of transit as per the requirements of its users.

Secondly, PMA is required to improve the user perception of the LMBS. From the results, it is apparent that the perceived service quality is certainly affecting the ridership of LMBS. It is also established that higher the user perception, higher is the likelihood that people will use LMBS more frequently. As per user's perception, few service characteristics indicators that need betterment are the availability of seats in the bus, overall security standards and maintenance of stations of the LMBS. These features have performed poorly as per user's point of view. Likewise, concrete efforts should be made to increase women ridership of LMBS by improving security standards, introducing separate women compartments, priority ticketing, bus boarding lanes and few dedicated buses for women.

Thirdly, PMA and LMBS needs to be adaptive to adjust accordingly in post COVID-19 times. Suspension of service cannot continue for ever because public transport is the basic civic need. PMA shall redesign its bus frequency, adjust operational hours and restart LMBS by introducing strict standard operating procedures. Furthermore, fare is the factor which has a significant impact on the ridership and users are satisfied with the affordability of LMBS. Qualitative data from interviews also substantiate it. A healthy perception regarding fare means that PMA should not increase the fare. However, post corona situation will have financial ramifications and that may lead to a need in fare increase. In case the need arises, it should be thoroughly planned by taking all stake holders on board.

Lastly, the outcome of this study can develop assessment and supervising mechanism for Punjab Mass Transit Authority as the service quality characteristics of this study are relatable to the service quality of LMBS. Therefore, it can be a used as a latest feedback for PMA to gauge the performance of LMBS based on the perspective of its users.

#### **5.3.2 Recommendations for further research**

The emphasis of the study is the opinion of the users. It will be more insightful and detailed if the perceptiveness of the GoP/ PMA as the service provider is also examined for supplementary research. It will help to grasp more comprehensive understanding about the management and system of LMBS. This research is only emphasizing on one aspect of service quality, that is the perceived service quality. Further research may possibly cover other point of views as well, such as expected service quality, delivered service quality, and targeted service quality. In case a further research intends to concentrate on the service provider side, the targeted and delivered service quality shall be the variables of service quality. Finally, further studies must be conducted while LMBS is operational and things are being observed in real time.

#### **5.3.3 Author's Outlook**

Cities in the Global south are expanding speedily, hence, there is an eternal need for mobility. The response to this is a sustainable and well-integrated public transport system. The city of Lahore and its metro bus service are no different. Lahore is growing at a fast pace and LMBS stands at critical

crossroads of its operational life. LMBS must meet the incessant needs of residents of Lahore by remaining technologically relevant, operationally efficient, and economically sustainable. LMBS also faces daunting challenges from emerging Orange Line Train in Lahore in addition to other fast improving public transport modes. It is a tough task, but solution lies in evolving gradually by learning from the best BRT practices from around the globe.

In researcher's opinion, LMBS and similar public transits in developing countries always face funding issues. Car users will not be attracted towards LMBS via low fares only, but via high service quality instead. Similarly, low income user will discontinue using a transit if its unaffordable. Hence, continuous subsidies are required. These subsidies are not required for equitable reasons only, they are required for efficiency reasons too. In addition to this, public sector in developing world lacks capacity and expertise in the field of transit design and operations, therefore private contractors are hired to run the service. This results in poor policy making and regulatory role of transit agencies and dip in the quality of transit. PMA is no different. It needs to be an innovative, self-sufficient, and modern organization.

Future of LMBS is for sure bright yet challenging. Its ridership is bound to increase hence, it must emerge as a most preferred mode of public transport for the people. PMA must be a futuristic organization with a focus on sustainability because as per TCRP (2020) *"only a sustainable transit is a successful transit."*

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## **Annex - I: Research Instruments**

### **A: Semi Structured Interview Guide:**

#### **Questions for the Administration/ Head Office Staff:**

- i) Do you think there are certain service quality characteristics of LMBS that need improvement? If yes, please name them?
- ii) How in your view user attributes (age-gender-income-occupation) influence the ridership of LMBS?
- iii) How in your view the user perception of service quality influence the ridership of LMBS?
- iv) How do you rate safety and security standards of LMBS?
- v) Do you think LMBS and its feeder network offers complete and convenient connectivity to its users?
- vi) Do you think frequency of LMBS is adequate?
- vii) Do you think LMBS is a reliable and adheres to its timetable?
- viii) How do you see the overall security and safety measures of LMBS?
- ix) How has your company ensured pre-boarding and on-board information sharing of LMBS with its users?
- x) Do you believe that LMBS is cheaper as compared to other modes of transport?
- xi) Does your company conduct any service quality assessment? If yes when was it last done? How was it done? What were the results?
- xii) Is there any mechanism for staff training, before and during employment?
- xiii) What kinds of complaints do you receive from your customers and what is the mechanism for their redressal?
- xiv) How do you rate Cleanliness standards of LMBS?
- xv) Do you think trip makers attributes (private vehicles and driving licenses) influence ridership of LMBS?
- xvi) Which quality aspect of LMBS you believe matters the most and encourages to its users?
- xvii) What in your view hampers/ discourages people of Lahore from using LMBS?

## **B: Questionnaire**

### **Influence of perceived service quality and user characteristics on the ridership of Lahore Metro Bus Service (Metro Bus)?**

I am Muhammad Khizer Afzaal Chaudhary, a MSc student of Urban Management and Development at Institute of Housing and Urban Development Studies, Erasmus University Rotterdam, the Netherlands. I intend to see the effects of user's perception and user's characteristics of Lahore Metro Bus Service on its ridership. This questionnaire is designed for the people who have at least travelled once in the Metro Bus. This questionnaire has been divided into 6 sections with 30 questions. It should take 10-15 minutes of your time only.

Kindly be guaranteed that your answers are voluntary, and confidentiality will be ensured. The responses in this survey will be analysed in groups and not individually. Thank you for your time and valued contribution.

**Muhammad Khizer Afzaal Chaudhary** (khizerchaudhary02@gmail.com)

#### **Have you ever used Metro Bus?**

Yes  No (proceed only if answer is a YES)

#### **Section – I: Socio Demographic Characteristics**

<b>1</b>	Gender	<input type="checkbox"/> Male <input type="checkbox"/> Female
<b>2</b>	Age	..... Years
<b>3</b>	What is your Employment Status?	<input type="checkbox"/> Un-employed <input type="checkbox"/> Housewife <input type="checkbox"/> Student <input type="checkbox"/> Private sector employee <input type="checkbox"/> Government employee <input type="checkbox"/> Self-employed <input type="checkbox"/> Others (please specify) .....
<b>4</b>	Marital Status	<input type="checkbox"/> Married <input type="checkbox"/> Single <input type="checkbox"/> Divorced <input type="checkbox"/> Widowed
<b>5</b>	Education	<input type="checkbox"/> Uneducated <input type="checkbox"/> Below Matric <input type="checkbox"/> F.A <input type="checkbox"/> B.A <input type="checkbox"/> M A <input type="checkbox"/> MPhil/ PhD <input type="checkbox"/> Others (Please Specify) .....
<b>6</b>	Indicate your Family Monthly Income range.	<input type="checkbox"/> Less than PKR. 15,000 <input type="checkbox"/> PKR. 15,000 – 30,000 <input type="checkbox"/> PKR. 30,000 – 45,000 <input type="checkbox"/> PKR. 45,000 – 60,000 <input type="checkbox"/> More than PKR. 60,000

**Section - II: Trip Characteristics**

7: How often do you use following mode of transport?

Mode of Transport	Never	Once a Year	Once a Month	Once a Week	Twice a Week	3 to 6 times a week	Every day (7 days a week)
Metro Bus							
Private Car							
Taxi							
Rickshaw							
Feeder Bus							
Public Wagon							
Motorcycle							
Cycle							
Walking							

8: What is your purpose of using those modes of transport?

Mode of Transport	Purpose of mode use				
	Work/ Office	School/ College/ University	Socialising (Family/ Friends/ Functions)	Shopping	Recreational
Metro Bus					
Private Car					
Taxi					
Rickshaw					
Public Wagon					
Motorcycle					
Cycle					
Walking					

9: How far is the nearest Metro Bus station from your home

- Less than 1 km
- 1- 2 km
- 2 - 3 km
- More than 3 kms

10: How do you reach Metro bus stop?

- Walking



- Cycle / Motorcycle
- Rickshaw / Taxi
- Public Wagon
- Feeder Bus

11: Do you combine modes for any of the purpose of travel.

- Yes  No

12: Which combination of modes do you use (If Yes).

Mode of Transport	Metro Bus	Private Car	Taxi	Rickshaw	Feeder Bus	Public Wagon	Motorcycle	Cycle	Walking
Metro Bus									
Private Car									
Taxi									
Rickshaw									
Feeder Bus									
Public Wagon									
Motorcycle									
Cycle									
Walking									

13: Do you think that the stops for Metro bus are conveniently located?

- Yes  No

14: How do you rate the convenience to access the Metro Bus Station?

- Very Convenient
- Convenient
- Neutral
- Not Convenient at all

### Section III: Metro Bus Time and Cost

15: How long does it take you to the nearest Metro Bus stop from your house?

- Less than 5 minutes
- 5 - 10 minutes
- 11 - 15 minutes
- 16 - 20 minutes
- 21 - 25 minutes
- 26 - 30 minutes
- more than 30 minutes

16: How do you consider the time consumed to go to the nearest Metro Bus stop?

- Very long
- Long
- Not long nor short
- Short
- Very short

17: How long do you wait for the bus at the Metro Bus stops?

- Less than 5 minutes
- 5 - 10 minutes
- 11 - 15 minutes
- 16 - 20 minutes
- 21 - 25 minutes
- 26 - 30 minutes
- more than 30 minutes

18: How do you consider the time consumed at the Metro Bus stops?

- Very long
- Long
- Not long nor short
- Short
- Very short

19: How much do you spend on transport for using only the Metro Bus per day?

----- PKR

20: What do you think about the price that you spend for Metro Bus?

- Very expensive
- Expensive
- Moderate
- Affordable
- Very cheap

21: Do you have a driving license?

- Yes
- No

22: Do you or your family own a vehicle which is used as transport purposes for you, at least twice a week?

- Yes
- No

23: If yes, please tick what type of vehicle do you own?

- Car
- Motorcycle
- Bicycle
- Jeep

#### Section IV: Perception of service quality delivery of METRO BUS

24: How would you rate the following service quality attributes of Metro Bus in terms of the following?

No	Indicator	Very Poor	Poor	Fair	Good	Very Good
i.	Cleanliness inside Metro Bus					
ii.	Cleanliness of bus stations					
iii.	Comfort levels of Metro Bus					
iv.	Seat availability situation in the bus					
v.	Adherence to the time schedule					
vi.	Frequency of bus service (arrival/ departure)					
vii.	Security against crime (theft etc.)					
viii.	Safety from traffic accidents					
ix.	Ease of purchasing ticket					
x.	Parking facility at the bus stations					
xi.	Pre-Travel information about METRO BUS (website/ app/ phone)					
xii.	On-board information (announcements)					
xiii.	Accessibility to the bus stop					
xiv.	Convenience of transfer					
xv.	Ticket affordability					

#### Section V: Importance of Service Quality of Metro Bus

25: Which service quality indicators are more important than others for the use of METRO BUS? Please rank the factors that would be the most **important** to you. (Please rank from 1-10. [1] being the highest priority)

Indicators	Ranking
Clear pre-travel and en-route information	
Security from theft of goods/luggage	
Safety from traffic accidents	
Cleanliness of the stop/station	
Cleanliness of vehicle	

Availability of service at my origin and destination	
Adherence to time schedule	
Ease of changing to a different mode of transport	
Affordable public transportation	
Access to seat	

**Section VI:**

26: Are you satisfied with overall service quality of Metro Bus?

- Yes
- No

27: If yes, which of the following factor is the main reason for your satisfaction?

- Access and Connectivity
- Cleanliness and Comfort
- Reliability
- Security and Safety
- Affordability

28: If answer of Q 26 is No, which of the following factor is the main reason for your dissatisfaction:

- Access and Connectivity
- Cleanliness and Comfort
- Reliability,
- Security and Safety
- Affordability

29: Will you choose Metro Bus if it can improve its service quality by improving factor mentioned in Q 28?

- Yes  No

30: Will you recommend Metro Bus to your family/friends/colleagues?

- Yes  No

## Annex – II: Questionnaire in Urdu (Local Language)

1

میرا نام محمد خضر افضل چوہدری ہے۔ میں ہالینڈ کے شہر Erasmus کی Rotterdam یونیورسٹی کے Institute of Housing Development Studies میں شہری انتظام اور ترقی کے مضمون میں M.Sc کا طالب علم ہوں۔ میں شہر لاہور میٹرو بس سروس کے صارفین کے تاثر اور ان کے خواہش کے اثرات جانچنا چاہتا ہوں۔

یہ سوال نامہ ان لوگوں کے لئے ہے جو کہ لاہور میٹرو بس پر کم از کم ایک دفعہ سفر کر چکے ہوں۔ یہ سوال نامہ 6 حصوں اور 30 سوالات پر مشتمل ہے جس کو پُر کرنے کے لئے 15 تا 10 منٹ درکار ہوں گے۔ اس سوال نامہ کو پُر کرنا بالکل رضا کارانہ ہے اور میں اس بات کی مکمل یقین دہانی کروا رہا ہوں کہ آپ کا نام اور کوئی بھی تفصیل سینڈ راز میں رہے گی۔

آپ کے تعاون کا بہت شکریہ۔

کیا آپ نے کبھی لاہور میٹرو بس سروس میں سفر کیا؟ ہاں ، نہیں (صرف ہاں کی صورت میں جواب دیں)

1	جنس	<input type="checkbox"/> مرد <input type="checkbox"/> عورت
2	عمر	سال _____
3	پیشہ	<input type="checkbox"/> بے روزگار <input type="checkbox"/> خانہ داری <input type="checkbox"/> طالب علم <input type="checkbox"/> پرائیویٹ ملازمت <input type="checkbox"/> سرکاری ملازم <input type="checkbox"/> ذاتی کاروبار <input type="checkbox"/> کوئی اور
4	زردانی حیثیت	<input type="checkbox"/> شادی شدہ <input type="checkbox"/> کنوارا <input type="checkbox"/> بیوہ <input type="checkbox"/> طلاق یافتہ
5	تعلیم	<input type="checkbox"/> ان پڑھ <input type="checkbox"/> میٹرک سے کم <input type="checkbox"/> میٹرک <input type="checkbox"/> F.A <input type="checkbox"/> B.A <input type="checkbox"/> M.A <input type="checkbox"/> M.Phil / Ph.D <input type="checkbox"/> کوئی اور (برائے مہربانی واضح کریں)

15,000/- روپے سے کم	<input type="checkbox"/>	ماہانہ نامی آمدن	6
15,000 - 30,000 روپے	<input type="checkbox"/>		
30,000 - 45,000 روپے	<input type="checkbox"/>		
45,000 - 60,000 روپے	<input type="checkbox"/>		
60,000/- روپے سے زائد	<input type="checkbox"/>		

7 آپ درج ذیل نکل و حمل کے طریقوں کو کتنی بار استعمال کرتے ہیں

نقل و حمل کے ذرائع	روزانہ	ہفتہ میں 3-6 بار	ہفتہ میں 2 بار	ہفتہ میں 1 بار	بیسے میں 1 بار	سال میں 1 بار	کبھی نہیں
میٹرو بس							
پرائیویٹ کار							
ٹیکسی							
رکشہ							
فیڈر بس							
پبلک وہیکن							
مولر سائیکل							
سائیکل							
پیدل							

8 آپ درج ذیل ذرائع نقل و حمل کس کام کے لئے استعمال کرتے ہیں

میٹرو بس	دفتر کا روبر	سکول / کالج / یونیورسٹی جانے کیلئے	سہ ماہی صرف / فکشن دوستوں سے ملاقات	خریداری	تفریحی مقاصد
پرائیویٹ کار					
ٹیکسی					
رکشہ					
فیڈر بس					
پبلک وہیکن					
مولر سائیکل					
سائیکل					
پیدل					

9 آپ کے گھر سے میٹرو بس کا قریب ترین سٹاپ کتنی دور ہے۔

1 کوئی میٹر سے کم

1 - 2 کوئی میٹر

2 - 3 کوئی میٹر

3 کوئی میٹر سے زیادہ

- 10<sup>3</sup> آپ میٹرو بس کے سٹاپ تک کیسے پہنچتے ہیں۔
- پیڈل
- سائیکل / موٹر سائیکل
- ریکش / جیسی
- پیبلک وین
- فیڈر بس

11 کیا آپ سڑک کے لیے نقل و حمل کے مختلف ذرائع اکٹھے استعمال کرتے ہیں  ہاں  نہیں

12 اگر آپ کا جواب ہاں میں ہے تو آپ کو نئے ذرائع اکٹھے استعمال کرتے ہیں۔

نقل و حمل کے ذرائع	میٹرو بس	پرائیویٹ کار	جیسی	ریکش	فیڈر بس	پیبلک وین	موٹر سائیکل	سائیکل	پیڈل
میٹرو بس									
پرائیویٹ کار									
جیسی									
ریکش									
فیڈر بس									
پیبلک وین									
موٹر سائیکل									
سائیکل									
پیڈل									

13 کیا آپ سمجھتے ہیں کہ میٹرو بس کے سٹاپ آسانی سے قابل رسائی ہیں۔  ہاں  نہیں

- 14 آپ میٹرو بس کے سٹاپ تک رسائی کی کیسے درج بندی کرتے ہیں۔
1.  بہت آسان
2.  آسان
3.  غیر جانبدار
4.  مشکل
5.  بہت مشکل

- 15 آپ کے گھر سے میٹرو بس کے سٹاپ تک پہنچنے میں کتنا وقت لگتا ہے
- 5 منٹ سے کم
- 5 - 10 منٹ
- 11 - 15 منٹ
- 16 - 20 منٹ
- 21 - 25 منٹ
- 26 - 30 منٹ
- 30 منٹ سے زیادہ

- 16 آپ میٹرو بس سرویس کے سٹاپ تک پہنچنے کے درکار وقت کی وجہ بندی کیسے کرتے ہیں۔
1. بہت لمبا وقت
2. لمبا وقت
3. مناسب وقت
4. کم وقت
5. بہت کم وقت

- 17 آپ میٹرو بس کیلئے کتنا انتظار کرتے ہیں۔
- 5 منٹ سے کم
- 5 - 10 منٹ
- 11 - 15 منٹ
- 16 - 20 منٹ
- 21 - 25 منٹ
- 26 - 30 منٹ
- 30 منٹ سے زیادہ

- 18 آپ میٹرو بس کے انتظار میں درکار وقت کی وجہ بندی کیسے کرتے ہیں۔
1. بہت لمبا وقت
2. لمبا وقت
3. مناسب وقت
4. کم وقت
5. بہت کم وقت

- 19 آپ صرف میٹرو بس کا استعمال کرنے پر رزائن کتنا خرچ کرتے ہیں۔
- روپے \_\_\_\_\_ صرف

- 20 آپ میٹرو بس پر اپنے خرچ کی وجہ بندی کیسے کرتے ہیں۔
- بہت زیادہ / بہت مہنگی
- زیادہ / مہنگی
- مناسب
- کم / سستی
- بہت کم / بہت سستی

- 21 کیا آپ کے پاس ڈرائیجنگ لائسنس ہے؟
- ہاں  نہیں



22 کیا آپ یا آپ کے خاندان اگھر میں سے کسی کے پاس نقل و حمل کے لئے کوئی ایذا رعبے جس کو بندھ میں کم از کم دو دفعہ استعمال کیا جاتا ہے؟

ہاں  
نہیں

23 اگر جواب ہاں میں ہے تو مناسب جواب منتخب کریں۔

- کار
- موٹر سائیکل
- سائیکل
- جیب

24 آپ میٹرو بس سرویس کے درج ذیل خواہش کی وجہ بندی کیسے کرتے ہیں۔

نمبر شمار	مظاہر اشارے	بہت ناقص	ناقص	موزوں	مناسب	بہت موزوں
	بس کی صفائی					
	بس سٹاپ کی صفائی					
	میٹرو بس میں اجتماعی طور پر آرام کون کی سطح					
	بس میں سیٹ کی دستیابی					
	بس کے اوقات کار کی فیمل					
	روت پر بس کا تسلسل (آمد و رفت)					
	بس میں جرم سے تحفظ (چوڑی/ جیب تراشی وغیرہ)					
	حادثے سے بچاؤ					
	تگت خریدنے کی آسانی					
	بس سٹیشن پر پارکنگ کی سہولت					
	سفر کے بارے میں پیشگی معلومات (website / app / phone)					
	دوران سفر معلومات					
	بس سٹاپ تک رسائی					
	بس سے دوسرے ذرائع نقل و حمل میں ٹرانسفر اچھول					
	تگت کی قیمت خرید					

میٹرو بس کے استعمال میں مندرجہ ذیل خدمت کے معیار کے حوال میں کونسا سب سے اہم ہے۔  
سب سے اہم کو "1" اور سب سے غیر اہم کو "10"

25

مطلب / اشارے	درجہ بندی
سز سے پہلے اور سز کے دوران معلومات	
جرم سے بچاؤ (چوری / جیب ڈاچی)	
عاطفیت سے بچاؤ	
بس سٹاپ کی صفائی	
سز کے آغاز اور اختتام پر میٹرو بس سرویس کی سہولت	
اداکت کار کی پاسداری	
بس سے دوسرے ذرائع میں آسانی سے منتقلی	
میٹرو بس کی قیمت	
بس میں خالی سیٹ کی موجودگی	

26 کیا آپ مجموعی طور پر میٹرو بس سرویس کے معیار سے مطمئن ہیں؟  ہاں  نہیں

27 اگر آپ مطمئن ہیں تو مندرجہ ذیل حوال میں سے کونسا آپ کے اطمینان کا باعث ہے۔

- رسائی و رابطہ  
 صفائی و آرام  
 احترام ، سلامتی و تحفظ  
 قیمت

28 اگر سوال نمبر 26 کا جواب نہیں میں ہے تو مندرجہ ذیل حوال میں سے کونسا آپ کے عدم اطمینان کا باعث ہے۔

- رسائی و رابطہ  
 صفائی و آرام  
 احترام ، سلامتی و تحفظ  
 قیمت

29 اگر میٹرو بس اپنے خدمت کے معیار کو بہتر بنانے کیلئے سوال نمبر 28 میں دیے گئے عنصر کو بہتر کر سکتی ہے تو کیا آپ میٹرو بس کا انتخاب کریں گے؟  ہاں  نہیں

30 کیا آپ اپنے دوست ، احباب و خاندان کو میٹرو بس کا مشورہ دیں گے؟  ہاں  نہیں

## **Annex - III: Interview Responses**

**(Interviewee 1) Name: Ozair Shah**

**Designation: General Manager Operations (Senior Level)**

**Work Experience with PMA: 8 Years with PMA + 10 Years with GoP Transport Dept.**

i) Do you think there are certain service quality characteristics of Lahore Metro Bus Service (LMBS) that need improvement? If yes, please name them?

PMA has three Service Quality Parameters: Safety – Efficiency and Comfort  
We are doing well with respect to safety and efficiency. We are working on improving the comfort levels by supplying water to passengers for drinking and washing in the toilets and enhancing overall cleanliness. In addition to that we are trying to maintain operationalization of electric escalators at the metro stations.

ii) How in your view user attributes (age-gender-income-occupation) influence the ridership of LMBS?

PMA as an organization has not conducted any study on determining the influence of user attributes on the ridership of LMBS. However, most of the riders of LMBS they come from middle and lower middle-income class. Our service receives users from all genders and age groups, and it is an acceptable system for majority of working class, student and even women.

iii) How in your view the user perception of service quality influence the ridership of LMBS?

LMBS user needs to find a bus whenever he/ she comes to a metro station. Ours is a headway-based transit operation. Our buses come at a station at every 2 min 15 second in peak hour to 3-4 minutes in off peak hours. It is a high bus operations frequency and we are maintaining a 99 percent frequency level. Users want bus whenever they reach a metro station and we try to satisfy their demand. I imagine if we retain this level of frequency, users will be having a good perception of LMBS service. To me, fare and availability of bus matters the most to a user. Availability of operational escalators and cold drinking water also helps in developing good perception of the service but limited number of users with special needs value these more.

iv) How do you rate safety and security standards of LMBS?

LMBS presents a satisfactory situation with respect to the safety and security standards. PMA has outsourced the security of LMBS (buses-stations) to a well reputed and licensed security agency which is responsible for security of the LMBS track, buses, and stations. Their staff/ guards are well trained, and the company is responsible to pay damages in case of any theft and loss of passenger valuables.

In terms of safety, the stats have been extremely positive. There have been only two deaths in 7 years of LMBS. In comparison, BRT Dehli had 26 deaths in the same period.

v) Do you think LMBS and its feeder network offers complete and convenient connectivity to its users?

Surely its not a complete network. Its an ongoing and continuous process and we have had few feasibility studies to improve the connectivity and LMBS network. LMBS is the first of 4 lines planned in the initial JICA feasibility study. Orange line is almost ready, purple, and blue line are already in the pipeline and work in them will start soon.

Undoubtedly, Lahore has way more demand of routes than what we are offering. Currently green line (LMBS) is supported by 200 feeder buses which is phase 1 on feeder bus feasibility study. With the implementation of phase 2 and 3 of the study and with operationalization of Orange Line (Lite Train Metro) we will be enhancing the feeder routes as well. As a makeshift arrangement Lahore Transport Company is also feeding LMBS on by running their buses on few routes where feeder network is not available.

vi) Do you think frequency of LMBS is adequate?

I think its adequate and well-handled because is passenger demand-based set frequency. Frequency of LMBS is analyzed based on the data of passengers entering the metro stations at various hours of the day. Our frequency is not uniform and varies on different routes from 135 seconds 200 seconds during 16 operational peak and off-peak hours.

vii) Do you think LMBS is reliable and adheres to its timetable?

Yes, absolutely. We have a 99 percent efficiency. Our buses are on time, announcements on stations are made accordingly and that is the best attribute of service quality that we are maintaining. What else can define a successful system.

viii) How do you see the overall security and safety measures of LMBS?

As I have already explained, we have outsourced the security systems and service provision of LMBS to well reputed and licensed companies.

Our (PMA) inspectors visit stations and buses unannounced and observe the overall security arrangements. In case of any lapses, we impose penalties on the security agency. Then we evaluate the overall security maintenance standards before extending the contract of the security company. The service provider is a separate company. A well reputed and experience organization. Their drivers are well trained and are under strict surveillance always. We monitor their speed and in case of violations we impose challans/ penalties on them. We have a rigorously chalked out *service level agreement* with them and recently we imposed a 40m PKR fine on the service provider because the tyres they provided for LMBS buses were of inferior quality. We ensure that the buses are parked properly, and driver adhere to the set parking standards of the level boarding (minimum 10 cm from the platform). PMA staff keeps the service providers on their toes and make strict evaluations in case of any break downs. Initially women were reluctant to use LMBS, now the situation is changing.

ix) How has your company ensured pre-boarding and on-board information sharing of LMBS with its users?

LMBS is a modern BRT system and has many intelligent passenger information systems. Several interns were hired in the early days of LMBS operations to train and guide the passengers regarding how to board the bus and use LMBS systems. Now, passengers are provided with complete pre boarding information on stations via announcements, display screens, maps, signage, and floor

markings. Display screens help passengers in checking schedules/ bus timetables and arrival details of incoming buses. Special arrangements are made to facilitate impaired users. Passengers are well informed during their travels with on board announcements regarding next stop etcetera. Additionally, a display screen in the bus helps them keep a track of their position and next stop. I believe, LMBS has many modern features which keep the passengers informed.

x) Do you believe that LMBS is cheaper as compared to other modes of transport?

Mass Transit Projects are meant to be cheap. That is how they attract masses. LMBS is no different. Its way cheaper than other available modes of transport. Although its fare is calculated based on several factors still it is quite low. LMBS was built at the cost of 30 b PKR and I think it is not financially viable for the same reason that the ticket price is very low. However, its economic benefits are innumerable. It reduces travel time, saves fuel, mitigates pollution, offers a respectable way of public transport, and keeps the city and its citizens in a healthy shape.

xi) Does your company conduct any service quality assessment? If yes when was it last done? How was it done? What were the results?

No, we are not structured to evaluate the service quality through public opinion. There has been no service quality assessment based on the feedback from the users of the LMBS.

We are structured to evaluate it through inspections and monitoring and implementation of service level agreements. There are several contracts running at this moment. Ranging from the security contract to the provision of janitorial services contract etcetera. We evaluate these services monthly through a thorough evaluation, monitoring and inspection procedure and then pay the monthly charges to the companies providing us these services. In case of any lapses and deviations in the provision of service from the given standards, we impose penalties. That is how we maintain quality standards.

xii) Is there any mechanism for staff training before and during employment?

We do train employees after they are hired. We teach our evaluation inspectors, operation supervisors, surveillance officers' etcetera the tasks they are required to do. But PMA has not formal setup for training of its staff.

xiii) What kinds of complaints do you receive from your customers and what is the mechanism for their redressal?

We have a call center to receive complaints and queries. The complaints when received are processed through a well deliberated system of complaint redressal system. A senior PMA official oversees the call center to ensure its smooth functioning.

We hardly get any complaints regarding buses getting late of lack of cleanliness etcetera. Most of the complaints are regarding lost baggage, small theft/ pick pocketing, non-availability of water, dysfunctional toilets etcetera. A few complaints have been registered against drivers and staff of PMA. We conducted inquired and found a few staff members guilty. They were fired from the service. So, we follow and maintain a well-handled complaint management system at PMA.

xiv) How do you rate the cleanliness standards of LMBS?

There are scattered complaints of unclean toilets at the stations. Overall, cleanliness is good as a dedicated janitorial company is looking after the affairs.

- xv) What quality aspects of LMBS in your opinion matters the most to the users and encourages them to use the service?

People need connectivity and then the most important encouraging factor is the low fare of LMBS. In addition to that 16 hours service during 7 days of a week also encourages the people to use it. It means the least to LMBS users if the guards at the stations are armed, walk through gates are there or not.

- xvi) What discourages the people from using LMBS?

I believe it is the low coverage area of LMBS.

- xvii) Do you believe trip makers attribute (vehicle and license ownership) influences the ridership of LMBS?

I think in Pakistan having a license is not as important for people as is in the developed world. However, having a vehicle can adversely impact the ridership.

**(Interviewee 2) Name: Muhammad Adil Mumtaz**

**Designation: Deputy General Manager Operations & Maintenance (Senior Level)**

**Work Experience with PMA: 7 years**

i) Do you think there are certain service quality characteristics of Lahore Metro Bus Service (LMBS) that need improvement? If yes, please name them?

Lahore Metro Bus Service (LMBS) has service quality much better than other bus services operating in Lahore. Buses punctuality, efficiency is 100% and passengers are satisfied with services. But there is also opportunity to improve services some of the are:

1. To improve station facilities like operation of escalators, availability of water etc.
2. During peak hours in Metrobuses it is observed that passenger used alternative modes to avoid rush in metrobuses. So, there is need to improve headways in rush hours.
3. Design of metrobus stations is not user friendly specially for old age people.

ii) How in your view user attributes (age-gender-income-occupation) influence the ridership of LMBS?

Motorcycles are LMBS's competitors. And Yes, user attributes have influence on ridership. For example, in LMBS average ridership is 135,000 and its composition most likely:

1. 70% passengers are from poor background and working class.
2. Ration of male and female is 65:35
3. More than one third are students

iii) How in your view the user perception of service quality influence the ridership of LMBS?

Ridership is directly related to the satisfaction of the users. we should also keep user perception in view for the betterment of service because they are ultimate user of this service.

iv) How do you rate safety and security standards of LMBS?

Safety and Security standards are according to the world practices. For example, fire extinguishers are available at stations and in buses. In last 8 years of operation we have only one major accident which caused causality of one passenger due to negligence of driver.

v) Do you think LMBS and its feeder network offers complete and convenient connectivity to its users?

Yes, passengers are satisfied with connectivity of feeder with metrobuses. there were some issues in start of operation which were rectified accordingly.

vi) Do you think frequency of LMBS is adequate?

Yes, frequency of LMBS is adequate but during peak hours we need to improve its headways to somehow.

vii) Do you think LMBS is reliable and adheres to its timetable?

Yes, we are achieving 100%-time efficiency and 90% adherence

viii) How do you see the overall security and safety measures of LMBS?

For this purpose, security staff is available at station which make sure the safety and security of overall system. Parallel to this security cameras are also installed at stations for surveillance purpose.

ix) How has your company ensured pre-boarding and on-board information sharing of LMBS with its users?

At each station or within the buses passenger's information system and public address system are installed for the guidance of the users. These are in form of display screens and audio.

x) Do you believe that LMBS is cheaper as compared to other modes of transport?

Yes, LMBS is cheaper than other modes.

xi) Does your company conduct any service quality assessment? If yes when was it last done? How was it done? What were the results?

We did not conduct any service quality assessment from users. But we have set our own parameters to check the quality of service.

xii) Is there any mechanism for staff training before and during employment?

No.

xiii) What kinds of complaints do you receive from your customers and what is the mechanism for their redressal?

For redressal of complaint we have a very comprehensive system. We have set our own helpline and software system. Common complaints are:

1. Regarding services at stations like water, escalators, and washroom,
2. Card recharging issues
3. Pick pocketing
4. Misbehavior of staff etc.



xiv) How do you rate the cleanliness standards of LMBS?

Cleanliness on a whole is good. as a dedicated janitorial company is looking after the affairs.

xv) What quality aspects of LMBS in your opinion matters the most to the users and encourages them to use the service?

Convenience to reach the destination, Ticket Price and Operations Timings are the things a user wants the most.

xvi) What discourages the people from using LMBS?

Coverage of service area.

xvii) Do you believe trip makers attribute (vehicle and license ownership) influences the ridership of LMBS?

At times, a user has a family vehicle and it is his son or brother or husband who drives it, so he/she does not have a license but a vehicle. I think license ownership is not directly affecting ridership.

In my view, no if a person has a vehicle or otherwise, he will most probably use LMBS for its low cost.

**(Interviewee 3) Name: Dr Waseem Akram**

**Designation: Director, Transport Planning Unit, Transport Department, GoPb**

**Work Experience with PMA: 08 years with Transport Department (overall experience of 20 years) (Senior Level)**

- i) Do you think there are certain service quality characteristics of Lahore Metro Bus Service (LMBS) that need improvement? If yes, please name them?

Ans Yes, Few Service Quality Characteristics of Lahore Metro Bus Service need improvement such as Cleanliness, Reliability, Ticketing System and Station Infrastructure.

- ii) How in your view user attributes (age-gender-income-occupation) influence the ridership of LMBS?

Ans Income of user is key attribute influencing the ridership of LMBS. The reason is flat fare of Rs30 which is very cheap compared to other transport modes. Therefore, low income group always prefer to travel by Metro to save money in addition to quality service in terms of Air Conditioners, reduced travel time, dedicated route, and integrated feeder services. The influence of gender and age are likely minor other than students travelling during school and college timings.

- iii) How in your view the user perception of service quality influence the ridership of LMBS?

Ans Value for money is the key consideration for user to assess the service quality of Metro Bus.

- iv) How do you rate safety and security standards of LMBS?

Ans Safety and Security standards are far better and well managed through outsourcing model compared to other type of transport mode. Video surveillance through control center is an additional advantage for Metro System.

- v) Do you think LMBS and its feeder network offers complete and convenient connectivity to its users?

Ans No, Feeder routes do not provide connectivity from home to workplaces as feeder service is being operated in radius of 10 to 15 Km only. Most of the city areas are not served by existing feeder service.

- vi) Do you think frequency of LMBS is adequate?

Ans Bus frequency considering the headway seems ok. By further increasing bus frequency, only small numbers of commuters will be added despite heavy cost to government in the form of service charges to operator.

vii) Do you think LMBS is reliable and adheres to its timetable?

Ans Mostly, however delays occur at Ravi Bridge due to mixed traffic and congestion.

viii) How do you see the overall security and safety measures of LMBS?

Ans Satisfactory

ix) How has your company ensured pre-boarding and on-board information sharing of LMBS with its users?

Ans I am not sure, but bus scheduling is shared by PMA with passengers on regular basis. Moreover, operations timings and headway time are other indicators for passenger information.

x) Do you believe that LMBS is cheaper as compared to other modes of transport?

Ans Yes. Rs 30 for 27 Kms

xi) Does your company conduct any service quality assessment? If yes when was it last done? How was it done? What were the results?

Ans No

xii) Is there any mechanism for staff training before and during employment?

Ans Yes, trainings of staff are regular feature of contracts signed by PMA with different service providers.

xiii) What kinds of complaints do you receive from your customers and what is the mechanism for their redressal?

Ans PMA has access to customer complaints. As it is operational matter, therefore Transport Department does not directly intervene into complaints unless it is some emergency, security other any life threatening incident.

xiv) How do you rate the cleanliness standards of LMBS?

Cleanliness is good. It is a continuous process to be carried out with never say die approach

xv) What quality aspects of LMBS in your opinion matters the most to the users and encourages them to use the service?

It is the affordability factor of LMBS.

xvi) What discourages the people from using LMBS?

Coverage area and over corded buses.

- xvii) Do you believe trip makers attribute (vehicle and license ownership) influences the ridership of LMBS?

Vehicle ownership affects the ridership. Motorcyclists prefer using their own vehicle to travel.

**(Interviewee 4) Name: Kamran Ihsan**

**Designation: Transport Demand Modeler (Senior)**

**Work Experience with PMA: 12 Years**

- i) Do you think there are certain service quality characteristics of Lahore Metro Bus Service (LMBS) that need improvement? If yes, please name them?

Increase in number of buses / decreases in headway

- ii) How in your view user attributes (age-gender-income-occupation) influence the ridership of LMBS?

User attributes play vital role in the ridership of LMBS. The socio-economic characteristics of the rider's help determining the fare which in turn influence the ridership. Similarly, the safe and convenient environment attracts female ridership.

- iii) How in your view the user perception of service quality influence the ridership of LMBS?

User perception of service quality plays the most important role in ridership.

- iv) How do you rate safety and security standards of LMBS?

Safety and security standards of LMBS are at par or even better compared to any developing country.

- v) Do you think LMBS and its feeder network offers complete and convenient connectivity to its users?

Since all feeder routes are not operational therefore there are some connectivity gaps

- vi) Do you think frequency of LMBS is adequate?

It needs improvement. LMBS provides adequate number of stops and facilities for parking etc at the stops however, number of buses needs an increase.

- vii) Do you think LMBS is reliable and adheres to its timetable? Yes

- viii) How do you see the overall security and safety measures of LMBS?

Fair amount of safety and security measures are taken by PMA but there is always room for improvement.

- ix) How has your company ensured pre-boarding and on-board information sharing of LMBS with its users?

Through Bus Scheduling System and Passenger Information System

x) Do you believe that LMBS is cheaper as compared to other modes of transport?

Absolutely

xi) Does your company conduct any service quality assessment? If yes when was it last done? How was it done? What were the results?

Service quality assessments are done through user perception surveys that are conducted on regular intervals.

xii) Is there any mechanism for staff training before and during employment?

Yes

xiii) What kinds of complaints do you receive from your customers and what is the mechanism for their redressal?

Complaints regarding frequency of buses, number of buses, ACs during summer.

xiv) How do you rate the cleanliness standards of LMBS?

What I have gathered from my experience with complaints management, I think its satisfactory.

xv) What quality aspects of LMBS in your opinion matters the most to the users and encourages them to use the service?

LMBS is available to people for 16 hours across the week. What else would encourage a user more?

xvi) What discourages the people from using LMBS? A: LMBS is very rusty during peak hours.

xvii) Do you believe trip makers attribute (vehicle and license ownership) influences the ridership of LMBS? A: It depends. Vehicle owners at times prefer LMBS because it save time and money.

**(Interviewee 5) Name: Imran Khan**

**Designation: Ex-Deputy General Manager (Technical) PMA**

**Work Experience with PMA: 6 Years**

- i) Do you think there are certain service quality characteristics of Lahore Metro Bus Service (LMBS) that need improvement? If yes, please name them?
  - a) Wide footpath to ensure accessibility to BRT
  - b) Mobile application to give real time information and fare payment
  - c) Good Station environment
  - d) Escalator contracts needs to revisit for effective services
  - e) Effective integration with feeder routes
- ii) How in your view user attributes (age-gender-income-occupation) influence the ridership of LMBS?
  - a) Due to low fare, the system mostly attracted students and low-income people
  - b) Due to safety in the system, attracted maximum number of females
  - c) Due to punctuality, attracted office holder and time conscious people
- iii) How in your view the user perception of service quality influence the ridership of LMBS?

User perception about service quality spreads information in public over period and influence ridership both positively and negatively. The link is extremely strong, and success of transit is pretty much related to the perception of its users. A drastic increase in LMBS ridership is user perception oriented.
- iv) How do you rate safety and security standards of LMBS?
  - a) High
- v) Do you think LMBS and its feeder network offers complete and convenient connectivity to its users?
  - a) No, its not well connected with LMBS
- vi) Do you think frequency of LMBS is adequate?
  - a) Yes
- vii) Do you think LMBS is reliable and adheres to its timetable?
  - a) Yes
- viii) How do you see the overall security and safety measures of LMBS?

- a) High
- ix) How has your company ensured pre-boarding and on-board information sharing of LMBS with its users?
  - a) Through website and passenger information system at stations and in buses. LMBS offers latest ICT interventions to its users.
- x) Do you believe that LMBS is cheaper as compared to other modes of transport?
  - a) Yes. People do not even bother about its fare. Its users will use it anyhow. It is way cheaper than any other mode, even cheaper than a motorcycle trip. If government stops the subsidy and fare is increases by many fold, then fare might start affecting ridership.
- xi) Does your company conduct any service quality assessment? If yes when was it last done? How was it done? What were the results?
  - a) Conducted in feasibility study report in 2016
- xii) Is there any mechanism for staff training before and during employment?
  - a) Service providers do their own training before and on-job training.
- xiii) What kinds of complaints do you receive from your customers and what is the mechanism for their redressal?
  - a) Help line system and complaints are in various categories.
- xiv) How do you rate the cleanliness standards of LMBS?

Satisfactory. We get complaints which are not of serious nature.

- xv) What quality aspects of LMBS in your opinion matters the most to the users and encourages them to use the service?

System Reliability. Good Station conditions and bus timings etc. They are encouraging factors.

- xvi) What discourages the people from using LMBS?

Over Crowding. Most passenger complaints are from peak hours LMBS operations, such as seat availability and nonfunctioning of air conditioners.

- xvii) Do you believe trip makers attribute (vehicle and license ownership) influences the ridership of LMBS?

It is a subjective question. I will personally use LMBS if its more convenient, although I have a vehicle.



**(Interviewee 6) Name: Sulaiman Majeed**

**Designation: Director (Commercial), Punjab Provincial Transport Authority, Transport Department, Lahore, Punjab, Pakistan. (Middle)**

**Work Experience with PMA: 4 Years**

- i) Do you think there are certain service quality characteristics of Lahore Metro Bus Service (LMBS) that need improvement? If yes, please name them?
  - Poor integration with other modes of transport
  - Most of escalators and elevators are non-functional causing problems for boarding & alighting of disabled persons.
  - Large number of complaints regarding theft in buses and at stations. For women, elderly and children it is a serious concern.
  - Poor ride quality due to lack of maintenance of corridor pavement
- ii) How in your view user attributes (age-gender-income-occupation) influence the ridership of LMBS?
  - Income level is the predominant factor that influence ridership of LMBS because mostly middle and lower middle-income group uses LMBS while those having reasonable income level prefer to use private vehicles (Motorcycle or car etc.) They may like LMBS but to them motorcycles suit more, it saves time. Large families with small kids usually prefer cars.
  - Age is another factor that influence ridership as the track is elevated too, so elder people face difficulty to use stairs because most of the escalators & elevators are out of order. Mostly young people use LMBS.
  - Working persons having origin – destination in line with the LMBS corridor use this service while mostly students prefer to use LMBS.
  - The ridership of males is slightly more than females because in our culture less female population are doing job. While female students prefer LMBS.
- iii) How in your view the user perception of service quality influence the ridership of LMBS?
  - User perception survey is the best way to predict the response of commuters. The best approach to enhance the ridership of LMBS is by providing better service quality for private vehicle users (e.g., motorcyclists). Better service quality will encourage modal shift and result into increase in ridership.
- iv) How do you rate safety and security standards of LMBS?
  - The safety and security services of LMBS have been outsourced and managed in a proper manner. I will rate it as “Good”.
- v) Do you think LMBS and its feeder network offers complete and convenient connectivity to its users?
  - LMBS and its current operation feeder bus routes / network doesn't cover the whole city. The length of feeder route are too short and not planned in a way to attract the maximum ridership. There is a serious need to re-visit the current feeder bus route and also induct more buses to cover the whole city with proper transfer stations. However, PMA have installed mechanized parking systems at Shama Chowk Station and dedicated parking slots at all major LMBS stations
- vi) Do you think frequency of LMBS is adequate?

- The frequency of LMBS in current scenario with low connectivity / integration is adequate but when Orange Line Metro Train & its feeder routes will get operational it will become inadequate.
- vii) Do you think LMBS is reliable and adheres to its timetable?
- Yes
- viii) How do you see the overall security and safety measures of LMBS?
- Pretty good and near to international standards.
- ix) How has your company ensured pre-boarding and on-board information sharing of LMBS with its users?
- Through information boards / signs at LMBS stations and through audio announcements with buses.
- x) Do you believe that LMBS is cheaper as compared to other modes of transport?
- Yes, Rs. 30/- fare of LMBS is still cheaper as compared to other modes of transport for long distance travelers with quality service.
- xi) Does your company conduct any service quality assessment? If yes when was it last done? How was it done? What were the results?
- Transport Department has not conducted such assessment so far. However, PMA conducts these service quality assessments through real time data, user surveys and CCTV cameras regularly.
- xii) Is there any mechanism for staff training before and during employment?
- Operations of LMBS have been outsourced to a private company. They hire professional staff and conduct trainings too.
- xiii) What kinds of complaints do you receive from your customers and what is the mechanism for their redressal?
- Various complaints mechanism is made available to the commuters like complaint boxes at stations, toll free complaint numbers, Pakistan Citizen Portal through mobile app etc.
  - Most complaints are regarding theft.
  - The complaints are properly addressed by the PMA and proper redressal of complaint is carried out. The action taken is also shared with complainant.
- xiv) How do you rate the cleanliness standards of LMBS?
- There is a janitorial company which is responsible to look after the cleanliness matters, it's OK.
- xv) What quality aspects of LMBS in your opinion matters the most to the users and encourages them to use the service?
- Service is reliable and people admire that.
- xvi) What discourages the people from using LMBS?
- Overcrowded buses and nonfunctional air conditions in summers.
- xvii) Do you believe trip makers attribute (vehicle and license ownership) influences the ridership of LMBS?
- Yes. Strongly influence the ridership.

**(Interviewee 7) Name: Usman Hameed**

**Designation: Research Assistant (Middle)**

**Work Experience with PMA: 4.5 Years**

- i) Do you think there are certain service quality characteristics of Lahore Metro Bus Service (LMBS) that need improvement? If yes, please name them?

System Capacity needs to be enhanced

- ii) How in your view user attributes (age-gender-income-occupation) influence the ridership of LMBS?

Income group of commuters help the authority to fix the fare of the commute. Further, separate section for females' buses has increased the ridership.

- iii) How in your view the user perception of service quality influence the ridership of LMBS?

People are satisfied with fare while which is foremost reason of high ridership. However, some attributes need to be improved for further increase in ridership. All user attributes are closely connected to each other. They do influence the overall ridership, yes, their influence can vary from weak to strong.

- iv) How do you rate safety and security standards of LMBS?

Safety and security of the system is good.

- v) Do you think LMBS and its feeder network offers complete and convenient connectivity to its users?

Feeder networks enhance accessibility, however, accessibility will further increase when all the metro lines are operational in the city

- vi) Do you think frequency of LMBS is adequate?

Frequency of the LMBS is ok.

- vii) Do you think LMBS is reliable and adheres to its timetable?

Yes

- viii) How do you see the overall security and safety measures of LMBS?

Safety and security of the system is good

- ix) How has your company ensured pre-boarding and on-board information sharing of LMBS with its users?

Yes, it is ensured through Bus Scheduling System, Passenger Information System and Vehicle Management System.

- x) Do you believe that LMBS is cheaper as compared to other modes of transport?

yes. LMBS charges less than other modes of transport

- xi) Does your company conduct any service quality assessment? If yes when was it last done? How was it done? What were the results?

It is done through LMBS user perception surveys. As per the survey conducted last year, users are very satisfied with the service quality of LMBS

- xii) Is there any mechanism for staff training before and during employment?

Yes

- xiii) What kinds of complaints do you receive from your customers and what is the mechanism for their redressal?

Complaints regarding number of buses, Air conditioners, however, higher management solve the complaints on priority basis

- xiv) How do you rate the cleanliness standards of LMBS?

Cleanliness standards are good.

- xv) What quality aspects of LMBS in your opinion matters the most to the users and encourages them to use the service?

Ticket Price is exceptionally low because of the government subsidy.

- xvi) What discourages the people from using LMBS?

Poor connectivity

- xvii) Do you believe trip makers attribute (vehicle and license ownership) influences the ridership of LMBS?

A vehicle owner will still use LMBS. It is cheap.

**Interviewee 8) Name: Wajeeh Usman**

**Designation: Transport Economist (Expert)**

**Work Experience with PMA: 5 Years**

- i) Do you think there are certain service quality characteristics of Lahore Metro Bus Service (LMBS) that need improvement? If yes, please name them?

Number of buses plying, bus timings.

- ii) How in your view user attributes (age-gender-income-occupation) influence the ridership of LMBS?

User attributes play most important role to attract ridership in LMBS. Separate section for females in LMBS has increased the ridership and income level of riders have significant role in setting up fare.

- iii) How in your view the user perception of service quality influence the ridership of LMBS?

- iv) How do you rate safety and security standards of LMBS?

Very good.

- v) Do you think LMBS and its feeder network offers complete and convenient connectivity to its users?

Feeder network provides around 50% connectivity to LMBS. It will be more effective when all the metro lines are operational in the city.

- vi) Do you think frequency of LMBS is adequate?

No. it may be revisited by the authority to serve more efficiently and cater more people.

- vii) Do you think LMBS is reliable and adheres to its timetable?

Yes.

- viii) How do you see the overall security and safety measures of LMBS?

Authority has taken very good security and safety measures and no passenger feel any sort of safety and security issue while commuting.

- ix) How has your company ensured pre-boarding and on-board information sharing of LMBS with its users?

Through Bus Scheduling System and Passenger Information System and VMS.

- x) Do you believe that LMBS is cheaper as compared to other modes of transport?

Absolutely. LMBS charges Flat Fare of PKR 30/ Trip for 27 KMs, while other mode of transport charges much higher than this.

- xi) Does your company conduct any service quality assessment? If yes when was it last done? How was it done? What were the results?

Through LMBS users' surveys. Last user survey was conducted in last year. Users are very satisfied with the service quality of LMBS

- xii) Is there any mechanism for staff training before and during employment?

Staff training for junior level staff.

- xiii) What kinds of complaints do you receive from your customers and what is the mechanism for their redressal?

Complaints regarding frequency of buses, number of buses, ACs during summers. And higher management solve the complaints.

- xiv) How do you rate the cleanliness standards of LMBS?

Good levels of cleanliness are observed.

- xv) What quality aspects of LMBS in your opinion matters the most to the users and encourages them to use the service?

It's a service for the poor.

- xvi) What discourages the people from using LMBS?

The target area of LMBS covers less than one third of Lahore.

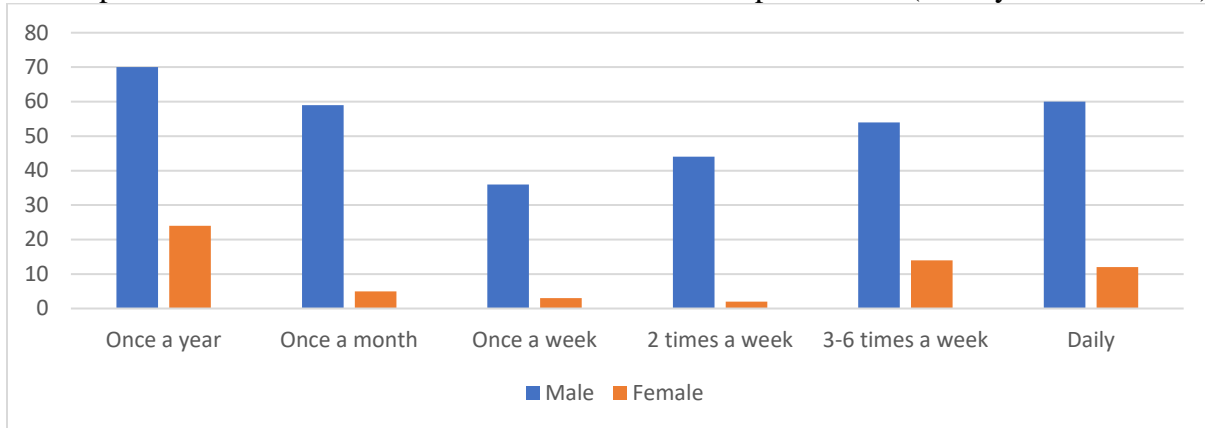
- xvii) Do you believe trip makers attribute (vehicle and license ownership) influences the ridership of LMBS?

It is about the timings of travel and weather which also affects the choice of travel mode. In summers most people will avoid LMBS and prefer their own vehicle. Vehicle ownership is not directly related to license ownership as majority motorcycle owners do not get licenses. That is why we see a police force crack down on motorcycle users on roads etc. It is an issue, a big issue for traffic police but this is how it is.

## Annex - IV: Cross Tabulation Graphs of Socio-Demographic Characteristic of Users

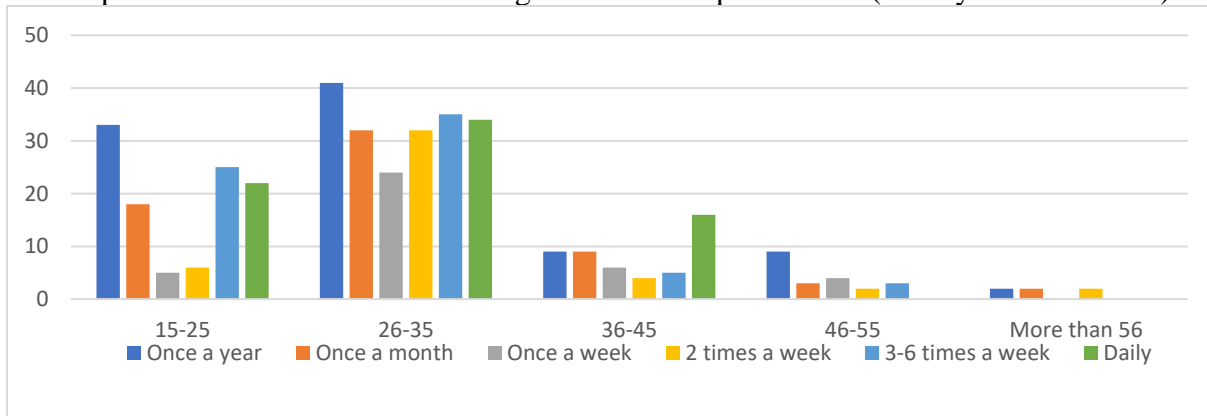
### Gender:

Graph: Cross Tabulation between Gender and Ridership of LMBS (Survey Result: n=383)



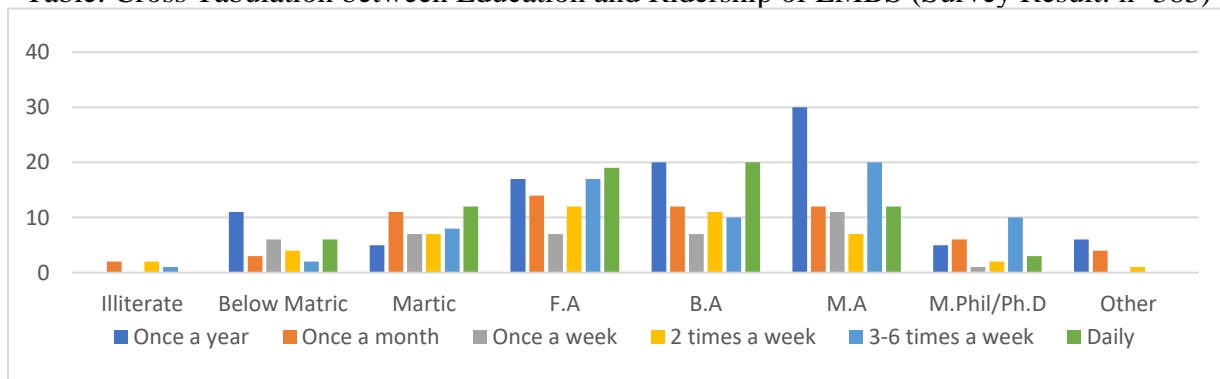
### Age:

Graph: Cross Tabulation between Age and Ridership of LMBS (Survey Result: n=383)



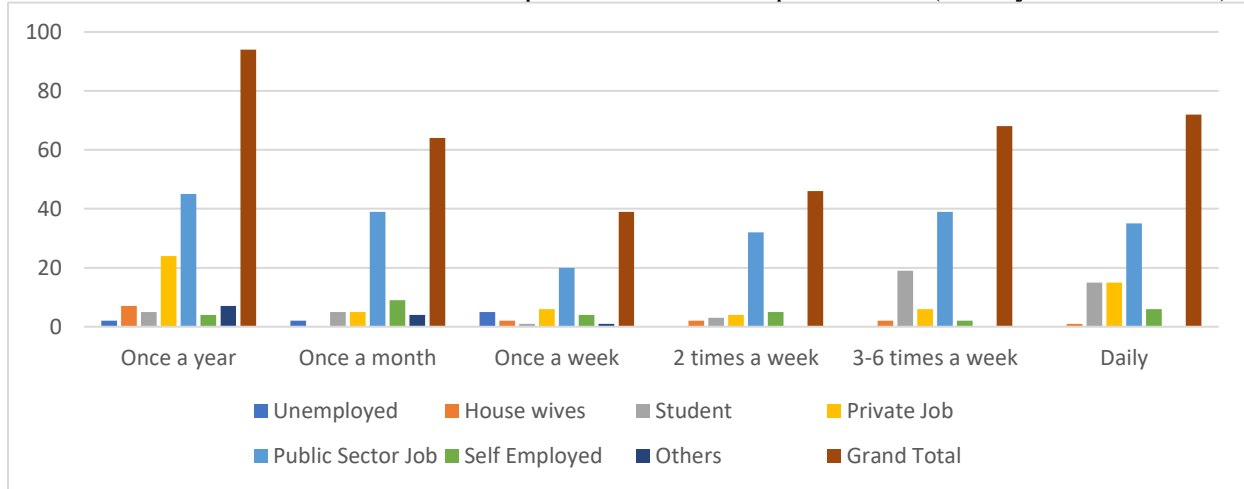
### Education:

Table: Cross Tabulation between Education and Ridership of LMBS (Survey Result: n=383)



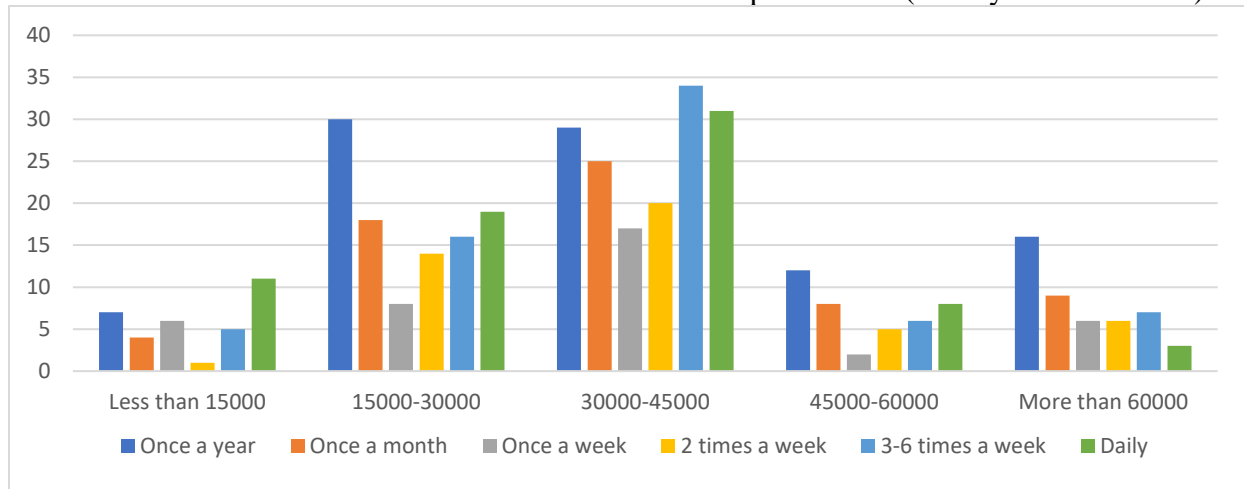
**Occupation:**

Table: Cross Tabulation between Occupation and Ridership of LMBS (Survey Result: n=383)



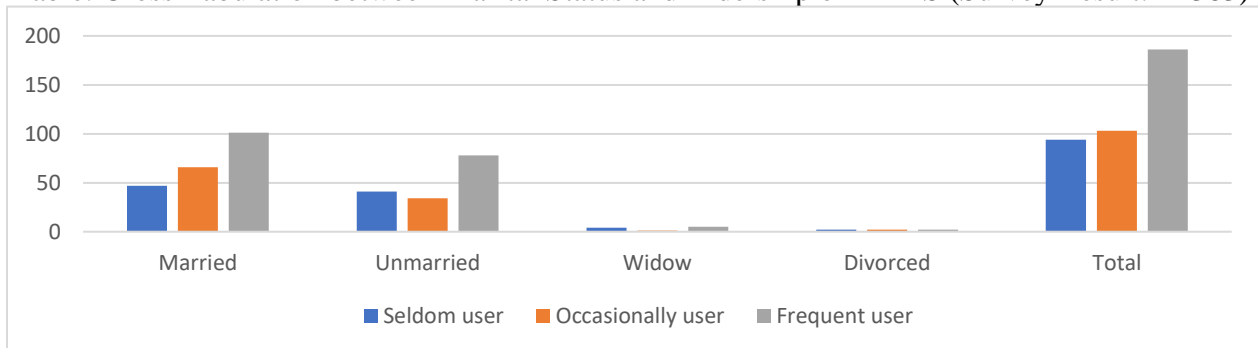
**Income:**

Table: Cross Tabulation between Income and Ridership of LMBS (Survey Result: n=383)



**Marital Status:**

Table: Cross Tabulation between Marital Status and Ridership of LMBS (Survey Result: n=383)





### Vehicle Ownership:

Table: Do you own a family vehicle (Survey Result: n=383)

<b>Ridership</b>	<b>No</b>	<b>Yes</b>	<b>Grand Total</b>
Once a year	24	70	94
Once a month	12	52	64
Once a week	10	29	39
2 times a week	5	41	46
3-6 times a week	9	59	68
Daily	12	60	72
<b>Grand Total</b>	<b>72</b>	<b>311</b>	<b>383</b>

### Driving License:

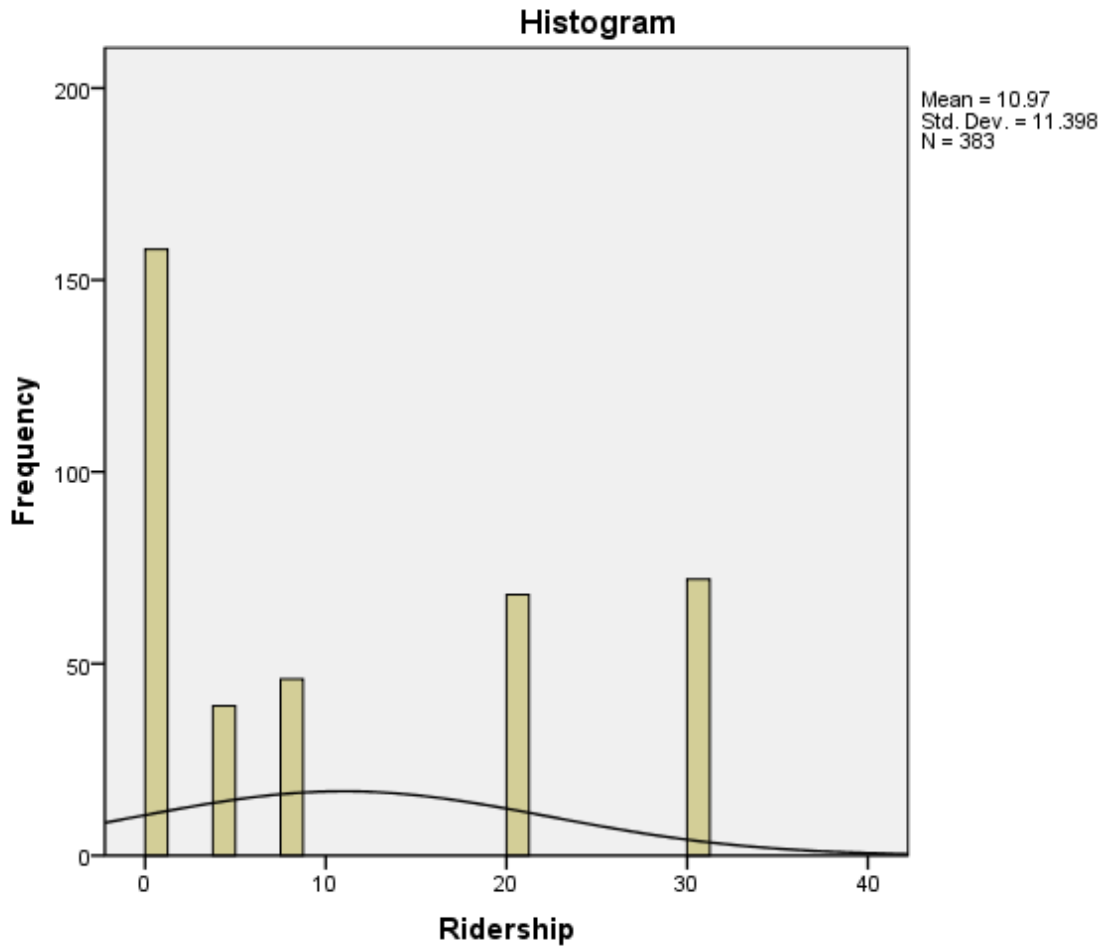
Table: Do you own a driving license (Survey Result: n=383)

<b>Ridership</b>	<b>No</b>	<b>Yes</b>	<b>Grand Total</b>
Once a year	46	48	94
Once a month	24	40	64
Once a week	21	18	39
2 times a week	23	23	46
3-6 times a week	31	37	68
Daily	47	25	72
<b>Grand Total</b>	<b>192</b>	<b>191</b>	<b>383</b>

## Annex – V: Work Plan

<b>Dates</b>	<b>Tasks</b>
<b>8<sup>th</sup> June 2020</b>	Submission of 2 <sup>nd</sup> draft of 1 <sup>st</sup> Proposal
<b>12<sup>th</sup> June 2020</b>	Go or No-Go Decision
<b>12<sup>th</sup> June – 15<sup>th</sup> June 2020</b>	[In case of GO] Work on improving research instruments
<b>17<sup>th</sup> June- 21<sup>st</sup> July 2020</b>	Field Work
<b>23<sup>rd</sup> July – 10<sup>th</sup> August 2020</b>	Data Analysis & Thesis Writing
<b>10<sup>th</sup> August 2020</b>	Submission Draft Thesis
<b>15<sup>th</sup> - 30<sup>th</sup> August 2020</b>	Working on improving thesis based upon feedback
<b>31<sup>st</sup> August 2020</b>	Submission of Final thesis

**Annex – VI: SPSS/ Statistical Results**



Correlation  
 t-Statistic

Probability	RIDERSHIP	AGE	GENDER	MARITAL_S TATUS	BELOW_MA TRIC	INCOME_BE LOW_30K	STUDENT	FORMAL_SE CTOR_EMPL OYED	VEHICLE	LICENSE
RIDERSHIP	1.000000 ----- -----									
AGE	-0.114545 -2.250648 0.0250	1.000000 ----- -----								
GENDER	-0.022411 -0.437551 0.6620	0.126187 2.482929 0.0135	1.000000 ----- -----							
MARITAL_STAT US	-0.065504 -1.281331 0.2009	0.382220 8.073667 0.0000	0.156886 3.100692 0.0021	1.000000 ----- -----						
BELOW_MATRIC	-0.003559 -0.069472 0.9447	0.182933 3.632007 0.0003	0.065672 1.284645 0.1997	0.108067 2.121815 0.0345	1.000000 ----- -----					
INCOME_BELOW _30K	-0.046533 -0.909269 0.3638	-0.212571 -4.246274 0.0000	0.073162 1.431898 0.1530	-0.219934 -4.400688 0.0000	0.265906 5.384115 0.0000	1.000000 ----- -----				
STUDENT	0.236507 4.751223 0.0000	-0.308695 -6.334877 0.0000	-0.180059 -3.573003 0.0004	-0.423705 -9.130480 0.0000	-0.167574 -3.317824 0.0010	0.092796 1.819153 0.0697	1.000000 ----- -----			
FORMAL_SECTO R_EMPLOYED	-0.028792 -0.562228 0.5743	0.097132 1.904940 0.0575	0.219076 4.382647 0.0000	0.297791 6.088903 0.0000	-0.072850 -1.425762 0.1548	-0.088700 -1.738197 0.0830	-0.585115 -14.08345 0.0000	1.000000 ----- -----		
VEHICLE	0.078630	0.046552	0.064515	0.094715	0.053512	-0.089781	0.020658	-0.047518	1.000000	

	1.539565	0.909646	1.261905	1.857118	1.046011	-1.759565	0.403322	-0.928554	-----	
	0.1245	0.3636	0.2078	0.0641	0.2962	0.0793	0.6869	0.3537	-----	
LICENSE	-0.119972	0.143934	0.248597	0.092261	-0.029742	-0.069667	-0.125188	0.129987	0.145764	1.000000
	-2.358791	2.839049	5.009689	1.808568	-0.580802	-1.363165	-2.462951	2.558963	2.875919	-----
	0.0188	0.0048	0.0000	0.0713	0.5617	0.1736	0.0142	0.0109	0.0043	-----

Covariance Analysis: Ordinary

Sample: 1 383

Included observations: 383

Correlation

t-Statistic

Probability	RIDERSHIP	TANGIBLES	CONNECTIVITY	RELIABILITY_ Y SAFETY_AND_	COST_AND_FARE
RIDERSHIP	1.000000				
	-----				
	-----				
TANGIBLES	0.157147	1.000000			
	3.105970	-----			
	0.0020	-----			
CONNECTIVITY	0.177965	0.533863	1.000000		
	3.530095	12.32374	-----		
	0.0005	0.0000	-----		
RELIABILITY_SAFE TY_AND_	0.104445	0.594924	0.729814	1.000000	
	2.049902	14.44728	20.83738	-----	
	0.0411	0.0000	0.0000	-----	
COST_AND_FARE	0.155451	0.497801	0.690053	0.635704	1.000000
	3.071630	11.20349	18.61022	16.07453	-----
	0.0023	0.0000	0.0000	0.0000	-----

## **Tangibles**

### **Variables Include:**

**Case Processing Summary**

		N	%
Cases	Valid	383	100.0
	Excluded <sup>a</sup>	0	.0
	Total	383	100.0

a. Listwise deletion based on all variables in the procedure.

**Reliability Statistics**

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.744	.751	4

**Summary Item Statistics**

	Mean	Minimum	Maximum	Range	Maximum / Minimum	Variance	N of Items
Item Means	3.123	2.815	3.329	.514	1.183	.048	4
Item Variances	1.548	1.373	1.942	.569	1.414	.072	4

## Connectivity and Access

### Variables Include:

**Case Processing Summary**

		N	%
Cases	Valid	383	100.0
	Excluded <sup>a</sup>	0	.0
	Total	383	100.0

a. Listwise deletion based on all variables in the procedure.

**Reliability Statistics**

	Cronbach's Alpha Based on Standardized Items	N of Items
Cronbach's Alpha	.714	3

**Summary Item Statistics**

	Mean	Minimum	Maximum	Range	Maximum / Minimum	Variance	N of Items
Item Means	3.320	3.065	3.457	.392	1.128	.049	3
Item Variances	1.763	1.660	1.894	.233	1.140	.014	3

## Reliability, Safety and Security

### Variables Include:

		N	%
Cases	Valid	383	100.0
	Excluded <sup>a</sup>	0	.0
	Total	383	100.0

a. Listwise deletion based on all variables in the procedure.

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.806	.807	6

	Mean	Minimum	Maximum	Range	Maximum / Minimum	Variance	N of Items
Item Means	3.312	2.950	3.522	.572	1.194	.043	6
Item Variances	1.734	1.508	2.008	.499	1.331	.031	6



## Cost and Fare

### Variables Include:

**Case Processing Summary**

		N	%
Cases	Valid	383	100.0
	Excluded <sup>a</sup>	0	.0
	Total	383	100.0

a. Listwise deletion based on all variables in the procedure.

**Reliability Statistics**

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.555	.548	3

**Summary Item Statistics**

	Mean	Minimum	Maximum	Range	Maximum / Minimum	Variance	N of Items
Item Means	3.326	3.026	3.517	.491	1.162	.069	3
Item Variances	1.377	1.073	1.648	.576	1.537	.084	3

## Dependent Variable: Ridership

Variable	Coefficient	Std. Error	t-Statistic	Sig.
Age	-0.076687	0.071189	-1.077234	0.2821
Gender	0.911712	1.629010	0.559673	0.5760
Marital Status	0.356696	1.328074	0.268581	0.7884
Education	2.561985	1.476288	1.735423	0.0835
Income	-2.389837	1.303391	-1.833554	0.0675
Employment (Status)	11.94949	2.298042	5.199855	<b>0.0000</b>
Employment Type (Formal Sector)	4.656471	1.577974	2.950918	<b>0.0034</b>
License	-2.662132	1.176153	-2.263422	<b>0.0242</b>
Vehicle	2.412915	1.462522	1.649832	0.0998
Constant	7.191799	3.094117	<b>2.324346</b>	0.0206
<b>R-squared</b>				
R-squared	0.106922	<b>Mean dependent var</b>	10.97128	
<b>Adjusted R-squared</b>				
Adjusted R-squared	0.085373	<b>S.D. dependent var</b>	11.39770	
<b>S.E. of regression</b>				
S.E. of regression	10.90032	<b>Akaike info criterion</b>	7.641224	
<b>Sum squared resid</b>				
Sum squared resid	44318.73	<b>Schwarz criterion</b>	7.744306	
<b>Log likelihood</b>				
Log likelihood	-1453.294	<b>Hannan-Quinn criter.</b>	7.682115	
<b>F-statistic</b>				
F-statistic	4.961832	<b>Durbin-Watson stat</b>	1.480607	
<b>Prob(F-statistic)</b>				
Prob(F-statistic)	0.000003			

## Annex – VII: Characteristics of Respondents of Questionnaire

### *Marital Status:*

In terms of the marital status of the respondents there is not a very significant difference between married and unmarried travellers.

**Table: Marital Status of the Respondents** (Survey Result: n=383)

Marital Status	Seldom user	Occasionally user	Frequent user	Total	Total %
Married	47	66	101	214	56%
Unmarried	41	34	78	153	40%
Widow	4	1	5	10	3%
Divorced	2	2	2	6	1%
Total	94	103	186	383	100%

Majority of frequent users are however, married. One of the probable reasons is that married users majorly belong to the working class and they use LMBS to reach their workplaces on daily basis. While unmarried category includes working representation of students as well.

### *Education Level:*

In this study, majority of the respondents are found to be literate and almost half of them are frequent users of LMBS (count = 186/ 383). From the literature we know that LMBS is popular among students (Zolnik et al., 2018).

**Table: Education Level of the Respondents** (Survey Result: n=383)

Education Level	Seldom user	Occasionally user	Frequent user	Total	Total %
Illiterate	0	2	3	5	1%
Under Matric	11	9	12	32	8%
High School	5	18	27	50	13%
High Secondary	17	21	48	86	23%
Bachelors	20	19	41	80	21%
Masters	30	23	39	92	24%
M. Phil/Ph.D.	5	7	15	27	7%
Other	6	4	1	11	3%
Total	94	103	186	383	100%

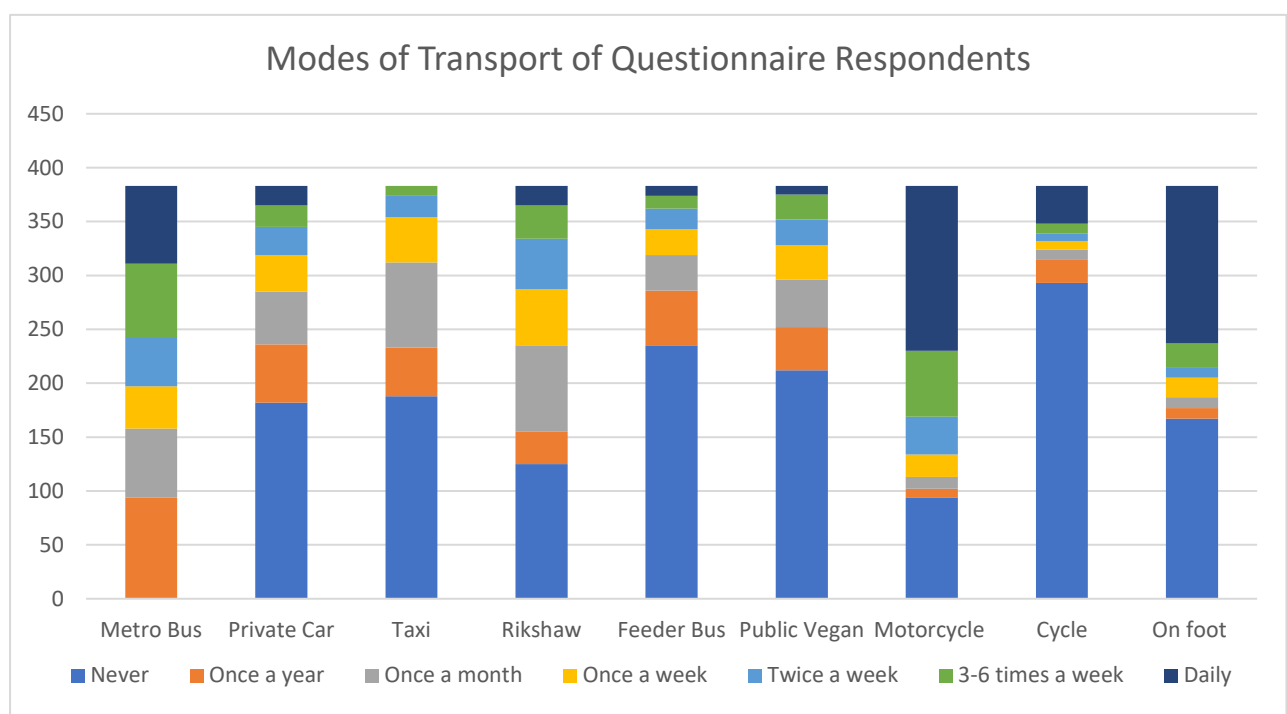
Almost one-third of LMBS users are master's degree holders and have a roughly equal distribution of LMBS usage as seldom and frequent users. Randomly, similar number of users are bachelors and intermediate passed (21% & 23% respectively). Importantly, the most frequent users are students from the higher secondary schools. It is noteworthy that out of overall sample size, there are negligible number of illiterate LMBS users. Probable reasons can be that LMBS is transport for working class and students because its route covers several major educational institutions and public/ private offices and online questionnaires were only responded by educated people.

**Trip Characteristics of Respondents of Questionnaire:**

*Main Mode of Transport of Respondents:*

An investigation (figure below) from the questionnaire, regarding the primary mode of daily transport shows that motorcycle is the major mode of daily transport which is used by respondents (153 respondents). This result is supported with the research of from (Zolnik et al., 2018) which indicated that the most significant motorization in Lahore is the remarkable rise in a motorcycle. The second highest mode of daily conveyance that travelers prefer is LMBS, with 72 respondents. Motorcycle expanded its attractiveness in Lahore because of its small size, convenient handling, and economy of fuel. study revealed that LMBS is seemingly not the leading mode of daily transport by users who have used the service. Travelers prefer to use their motorcycles over LMBS.

*Interviewee # 2: “LMBS has a competitor, motorcycles on the roads of Lahore”.*



**Figure. Main modes of Transport of Respondents (Survey Result: n=383)**

*Purpose of Travel by Mode Type:*

The table below represents the choices the respondents make in selecting their preferred travel mode.

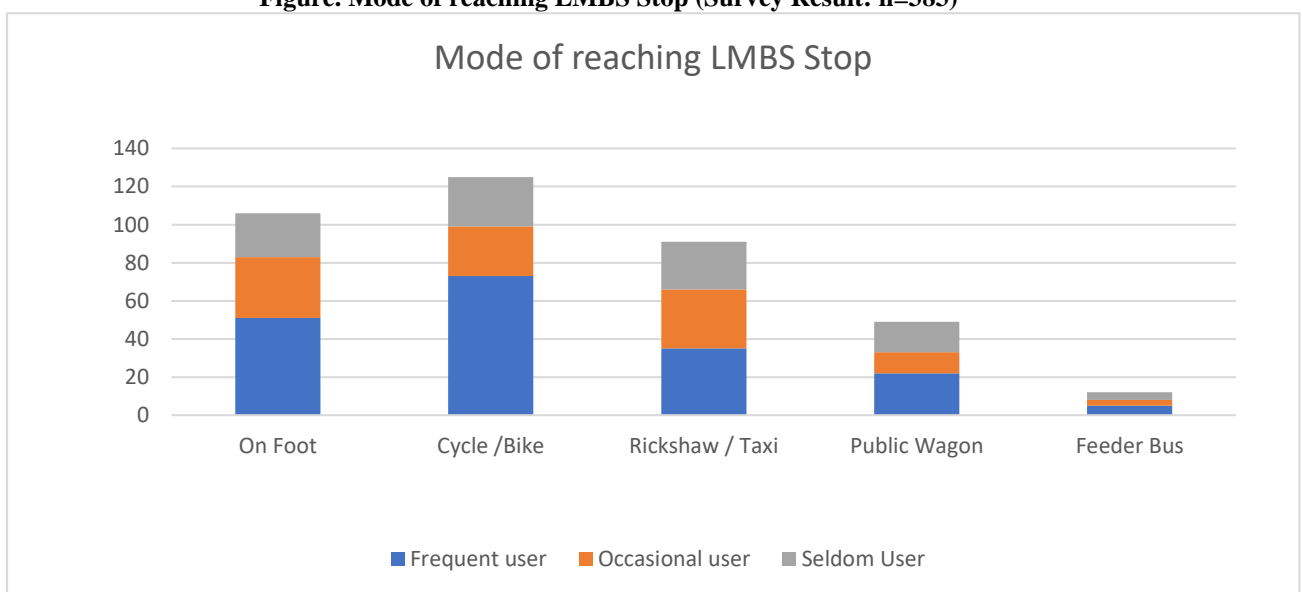
**Table. Purpose of Travel by Transport Mode Type (Survey Result: n=383)**

Purpose of Travel	Mode of Travel								
	Metro Bus	Private Car	Taxi	Rikshaw	Feeder Bus	Public Wagon	Motorcycle	Cycle	On foot
Office	93	58	40	66	38	50	183	21	49
College/University	65	12	16	34	29	44	26	17	22
Function	66	94	64	38	30	37	14	12	23
Shopping	85	11	57	70	17	26	45	23	61
Entertainment	74	75	39	36	30	11	12	22	34

Respondents were asked about selection of a travel mode while making various daily life commutes. In terms of travelling by all type means of transport that are circulated in Lahore City, the respondents selected LMBS as the second most preferred option after motorcycles. However, most office goers who use LMBS are frequent LMBS users. According to respondents they favor LMBS whenever the plan to go for shopping. Car is the most favorite travel mode whenever a family outing is planned, for example leisure outings and family functions. Lastly, LMBS is the most trusted mode of transport among students, followed by public wagons. Like the office goers, students who choose LMBS for their travels to their institutions are majorly the frequent LMBS users. This can be linked back to the allegation against LMBS that it has not attracted car owners as much as it has done in case of motorcycles (Daily Dawn, 2014).

**Mode of Reaching to a LMBS Station:**

**Figure. Mode of reaching LMBS Stop (Survey Result: n=383)**



## Annex – VIII: Compare Mean Analysis (Sub-Research Question One)

### Perception of Tangibles:

Sub-variable Tangibles has several indicators which include, cleanliness inside the bus, cleanliness at metro stations, comfort levels of service and seat availability in the metro bus.

**Table. Perception of Tangibles (Survey Result: n=383)**

How Often People Use LMBS		Mean of Tangibles			
		Cleanliness in the Bus	Cleanliness at Stations	Comfort Level	Seat Availability in the Bus
Seldom User	Once a Year	3.277	3.234	2.957	2.447
Occasional User	Once a Month	3.154	3.338	3.292	3.062
	Once a Week	3.205	3.103	2.615	2.487
Frequent User	Twice a Week	2.913	3.087	2.826	2.652
	3-6 Times a Week	3.118	3.353	3.294	2.897
	Daily	3.403	3.653	3.542	3.236
Total (all scores are out of total = 5)		3.178	3.295	3.088	2.797

With respect to the inner cleanliness, the more frequent the respondent uses the service, the higher they perceived the cleanliness inside the LMBS bus. Even the seldom users gave a good score to the cleanliness standards of LMBS buses (M=3.2). The occasional users also perceived the cleanliness better, about an average score of 3.2. Lastly, the frequent daily user gave the highest score of 3.4. Although, there is a small variation between the group of users, all groups gave a good score for cleanliness inside LMBS.

The pattern of scores for cleanliness at the stations of LMBS is no different from the preceding indicator. It follows the same pattern where the frequent daily user has given the highest score of (M=3.6). Average mean score of the occasional user and the score given by the seldom users is almost the same, that is (M=3.2). All groups of users gave a decent score for the cleanliness at the stations.

Speaking of overall comfort level, the occasional users have given the lowest average score of 2.9. While the maximum average score of 3.3 has been given by the frequent users. The comfort level perceived by the users exhibits a similarity to preceding indicators of under discussion sub-variable.

All respondents of the different user groups identified the access to seat as inequitable with the average mean score of 2.7 among all respondents. Lowest score was given by the seldom users (M=2.4). Hence, users perceive availability of seats as *poor*.

### Perception of Connectivity and Access:

Perception of Connectivity and Access is being examined under several indicators. Starting with the perception of parking spaces at the LMBS stations, it is observed that it increases with the increase in frequency of LMBS use. Maximum average mean value is from frequent users (3.1). With negligible difference all user groups have given a decent score. Connectivity and access are also related to the ease with which users reach their nearest bus stop. Daily users have given an average mean value of 3.6, which means the time taken by them to reach the

nearest metro station is considerably less. The lowest value, which is fair, is given by the seldom user (M=3). Most users perceive the time taken to reach the nearest stop as *short*.

Connectivity is also linked to the time users require to reach the nearest bus stop and the time they need to spend while waiting for the bus at the stop. For both indicators, the scores given by the users reveal that the user perception increases with the increase in frequency of use. The lowest mean values for both indicators are given by the seldom users (M=2.6 & M=3.2) respectively. User perception about the time consumed in reaching to the near stop is lower than the desired value for the seldom users, however the average mean score is 3.0. However, users perceive the waiting time for the bus at the bus stop as *short* with total mean score of 3.1.

**Table. Perception of Connectivity and Access (Survey Result: n=383)**

How Often People Use LMBS		Mean of Connectivity and Access				
		Parking Facility at the Stations	Accessibility to the Bus Stop	Convenience of Transfer	Time to the Nearest Stop	Waiting Time
Seldom User	Once a Year	2.894	3.096	3.128	2.691	3.202
Occasional User	Once a Month	2.754	3.785	3.692	2.938	3.219
	Once a Week	3.051	3.000	2.667	2.974	2.949
Frequent User	Twice a Week	3.152	3.348	3.326	2.913	3.000
	3-6 Times a Week	3.397	3.544	3.662	3.088	3.015
	Daily	3.167	3.819	3.847	3.111	3.389
Total (all scores are out of total = 5)		3.069	3.432	3.387	3.010	3.129

Convenience of Transfer from one mode of transport to LMBS is also an important aspect of connectivity and access. The users just like the case of accessibility to stop perceive this indicator in a relatively good way. The form of increase is like several other indicators where the mean value increases with the increase in user frequency. A high average value of 3.5 by the frequent user and lowest value of (M=3.1) means that users perceive good quality of ease of transfer.

#### **Perception of Reliability, Safety and Security:**

Regarding observance of the schedule, frequent LMBS users perceived that the LMBS provides a good service (Average Mean=3.3). This perception remains constant in case of seldom users and occasional users with a fair mean score (M= 3.1) & average mean of 3.4, respectively. Users perceive scheduling of the service as fair.

**Table. Perception of Reliability, Safety and Security (Survey Result: n=383)**

How Often People Use LMBS		Mean of Reliability, Safety and Security					
		Adherence to Schedule	Service Frequency	Security against Crimes	Safety from Accidents	Pre-Travel Info.	On-Board Info.
Seldom User	Once a Year	3.106	3.383	2.755	3.564	2.819	3.319
Occasional User	Once a Month	3.415	3.554	3.031	3.538	3.138	3.585
	Once a Week	3.462	3.436	3.077	3.359	2.846	3.026

Frequent User	Twice a Week	3.065	3.152	2.826	3.391	3.326	2.935
	3-6 Times a Week	3.324	3.426	3.118	3.559	3.559	3.676
	Daily	3.667	3.528	2.944	3.542	3.472	3.681
Total (all scores are out of total=5)		3.340	3.413	2.959	3.492	3.193	3.370

Safety and Security contribute towards enhancing the reliability of the service. Seldom users have given the lowest mean score for security against crime (M=2.7). Whereas, the highest score comes from occasional users, with an average score of 3.0. The frequent users have given a fair score to security as well, with an average mean score of 3.

In contrast to the security aspect, the frequent users, occasional and seldom users have given a relatively fair score to the safety standards of LMBS. The lowest score has been given by users who use the LMBS twice a week (M=3.3).

LMBS is a reliable service or otherwise rests on the availability of on and off board information as well. Seldom users have not shown complete trust in the pre travel information of LMBS and have given a somewhat low score (M=2.8). However, occasional, and frequent users have shown trust with average mean scores of 3 and 3.5, respectively.

Speaking of on-board information all groups of users have perceived the quality of this indicator to be very good with an overall average mean of 3.3.

One of the reasons for users of LMBS to perceive the quality of information as good is that LMBS has several hi-tech Information Technology and Communications interventions incorporated in its operations and services. This finding gets justified from the literature as well.

### Perception of Cost and Fare:

The fare of LMBS is flat. The fare remains the same regardless of the distance. As for the perception of the fare of LMBS, there are no significant difference. All respondents believed the ticket price to be affordable with 3.4 mean score.

**Table. Perception of Cost and Fare (Survey Result: n=383)**

How Often People Use LMBS		Perception of Cost and Fare	
		Ease of Purchasing Ticket	Ticket Affordability
Seldom User	Once a Year	3.234	3.213
Occasional User	Once a Month	3.462	3.785
	Once a Week	3.282	2.974
Frequent User	Twice a Week	3.391	3.457
	3-6 Times a Week	3.500	3.485
	Daily	3.681	4.001
Total (all scores are out of total = 5)		3.425	3.483

Likewise, users from all groups perceived the ease of purchasing ticket to be good with a similar mean score to the preceding indicator, 3.4. These outcomes are consistent with the interview findings. Succinctly, the users perceive LMBS as a cheap mode of transport.



## Overall user Satisfaction:

**Table. Overall user Satisfaction (Survey Result: n=383)**

Are you satisfied with overall quality of LMBS?	Seldom user	Occasional user	Frequent user	Total	%
Yes	75	85	176	336	88%
No	19	18	10	47	12%
Total	94	103	186	383	100%

**Annex – IX: Indicator Perception Tables (Sub Research Question - I)**

**Perception about Tangibles:**

**Table. Survey Result in Percentage (Survey Result: n=383)**

	Frequent User					Occasional User					Seldom User				
	Very Good	Good	Neutral	Poor	Very Poor	Very Good	Good	Neutral	Poor	Very Poor	Very Good	Good	Neutral	Poor	Very Poor
<b>Cleanliness in the Bus</b>															
<b>% Total</b>	18.23	19.89	36.46	20.99	4.42	10.31	38.14	35.05	14.43	2.06	1.11	55.56	30.00	11.11	2.22
<b>Cleanliness at the Stations</b>															
<b>% Total</b>	19.67	28.96	34.97	10.38	6.01	5.10	52.04	30.61	7.14	5.10	5.68	50.00	30.68	11.36	2.27
<b>Overall Comfort Levels</b>															
<b>% Total</b>	18.54	25.84	37.08	16.29	2.25	6.19	40.21	35.05	10.31	8.25	1.10	42.86	27.47	17.58	10.99
<b>Seat Availability</b>															
<b>% Total</b>	16.20	24.58	26.26	17.32	15.64	8.08	38.38	18.18	15.15	20.20	7.78	17.78	17.78	35.56	21.11

**Perception about Connectivity and Access:**

**Table. Survey Result in Percentage (Survey Result: n=383)**

	Frequent User					Occasional User					Seldom User				
	Very Good	Good	Neutral	Poor	Very Poor	Very Good	Good	Neutral	Poor	Very Poor	Very Good	Good	Neutral	Poor	Very Poor
<b>Parking Facility at the Stations</b>															
<b>% Total</b>	14.12	42.37	22.60	12.43	8.47	15.79	27.37	25.26	17.89	13.68	10.99	24.18	32.97	16.48	15.38
<b>Accessibility to the Bus Stop</b>															
<b>% Total</b>	21.67	38.89	30.56	7.78	1.11	30.43	41.30	22.83	3.26	2.17	11.49	40.23	29.89	8.05	10.34
<b>Convenience of Transfer</b>															
<b>% Total</b>	21.98	42.31	24.18	9.89	1.65	26.37	37.36	27.47	5.49	3.30	6.90	45.98	27.59	17.24	2.30

**Perception about Reliability, Safety and Security:**

**Table. Survey Result in Percentage (Survey Result: n=383)**

	Frequent User					Occasional User					Seldom User				
	Very Good	Good	Neutral	Poor	Very Poor	Very Good	Good	Neutral	Poor	Very Poor	Very Good	Good	Neutral	Poor	Very Poor
<b>Service Frequency</b>															
<b>% Total</b>	18.39	40.80	29.31	8.62	2.87	19.79	52.08	19.79	5.21	3.13	14.77	42.05	35.23	5.68	2.27
<b>Adherence to the Schedule</b>															
<b>% Total</b>	18.39	39.66	31.61	6.90	3.45	14.14	41.41	38.38	3.03	3.03	4.60	40.23	44.83	6.90	3.45
<b>Security against Crimes</b>															
<b>% Total</b>	11.56	36.42	21.97	20.81	9.25	16.67	23.96	39.58	12.50	7.29	5.62	25.84	37.08	16.85	14.61
<b>Safety from Accidents</b>															
<b>% Total</b>	28.33	26.67	25.00	19.44	0.56	28.13	34.38	27.08	6.25	4.17	19.78	42.86	25.27	9.89	2.20
<b>Pre-Travel Information</b>															
<b>% Total</b>	25.28	29.21	32.58	8.43	4.49	23.66	25.81	22.58	21.51	6.45	7.06	36.47	27.06	20.00	9.41
<b>On Board Information</b>															
<b>% Total</b>	21.71	40.00	29.14	6.29	2.86	28.42	28.42	30.53	9.47	3.16	20.22	26.97	40.45	7.87	4.49

**Perception about Cost and Fare:**

**Table. Survey Result in Percentage (Survey Result: n=383)**

	Frequent User					Occasional User					Seldom User				
	Very Good	Good	Neutral	Poor	Very Poor	Very Good	Good	Neutral	Poor	Very Poor	Very Good	Good	Neutral	Poor	Very Poor
<b>Ease of Purchasing Ticket</b>															
<b>% Total</b>	22.65	34.81	28.73	11.60	2.21	17.35	41.84	28.57	8.16	4.08	6.67	43.33	35.56	10.00	4.44
<b>Ticket Affordability</b>															
<b>% Total</b>	22.65	41.99	28.73	3.31	3.31	31.91	37.23	20.21	5.32	5.32	11.24	41.57	29.21	11.24	6.74

**Perception about time to reach the nearest LMBS stop and waiting time for the bus at the stop:**

**Legends for the table below: (VLT= Very long time / LT =Long time / ST= Suitable time / LitT= Little time / VLitT= Very little time)**

**Table. Survey Result in Percentage (Survey Result: n=383)**

	Frequent User					Occasional User					Seldom User				
	VLT	LT	ST	LitT	VLitT	VLT	LT	ST	LitT	VLitT	VLT	LT	ST	LitT	VLitT
<b>How do you perceive the time to reach the nearest LMBS stop?</b>															
<b>% Total</b>	4.32	8.64	66.48	16.75	3.78	0.98	15.68	69.60	11.76	1.96	11.70	21.27	54.25	11.70	1.06
<b>How do you perceive the time to wait for a bus at the stop?</b>															
<b>% Total</b>	2.70	9.72	59.45	23.78	4.32	0	10.78	65.68	21.56	1.96	2.12	13.82	54.25	21.27	8.51

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