

# Assessment of Service Quality And Efficiency of Bus Rapid Transit System

Original Article

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Transportation is an indistinguishable component of any society. Provision of luxury transportation at favorable rates to general public is the need of the day for societal comfort. Research has been done to assess the service and efficiency level of (Bus Rapid Transit) BRT system by evaluating initial parameters including passenger's attitudes towards quality, safety, security, and service provided by Metro bus Lahore as well as identifying problems encountered by passengers. In Pakistan, local transportation play significant role for travelers to commute whereas the vast transportation system of Lahore and construction of Metro Bus Transit System with consideration to balance demands of traffic has provided safer, economical and secure public transport system to the people. This research has been carried out from Shahdara to Gujumat. The questionnaire-based survey was conducted. which was comprised of questions according to problems, needs of passengers and indicators which were set to identify the service quality of Metro Bus. It is revealed from analysis that majority of people are satisfied from service quality, punctuality, accessibility and efficiency provided by BRT system. It is also observed that this service is user-friendly for physically impaired persons. Dissatisfaction level was also observed on low seating capacity in buses, security, safety of users on board. This research suggests concerned authority to improve, enhance current passenger services and provide better services so that current users can enjoy services and attract new passengers to use Metro bus as well as imply international best practices in Pakistan urban transport.

**Keywords:** Bus Rapid Transit (BRT), Passenger satisfaction, Metro Bus

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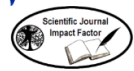
**Author's Contribution**

I did this work by my own.

**Conflict of interest**

Authors has no conflict of interest

**Project details.** NIL



**Introduction**

Transportation is important part of any society. Buses, LRT (Light Rail Transit), BRT (Metro Buses), wagon, mini-vans, auto-rickshaws and taxis are the types of urban transport. Public transport is to satisfy the passengers, by providing the high-quality services [1]. The passenger’s perception is an important measure in evaluating the level of the quality of bus service [2]. Both the developed and developing countries, have faced many problems in urban transportation such as poor quality infrastructures, mismatch between demand and supply, crowd of passengers and congestion on roads that lead to increase travel time due to improper segregation of bus lanes [3]. Urbanization and increased number of vehicles are responsible for environmental degradation [4]. Burning of fuels by vehicles add a considerable amount of CO<sub>2</sub> in the atmosphere which is ozone precursor. The main sources of Ozone precursors are petrol pumps, industries, residual smoke from factories, automobile emissions, water desalination plants and gas-based power stations [5]. Public transport is an alternative source for reduction of environmental pollution. To overcome such problems, BRT bus service was introduced which is a city-based, high speed transport travel framework in which buses travel on dedicated routes [6][7]. BRT is now a days broadly executed in both the developed and developing world [8]. Deng and Nelson (2012) [9] found that 75.4% people were diverted from previous bus system to BRT [9][10]. Nugroho et al. (2010) [11] studied almost 14% private car users altered their transportation mode to BRT within four months in the city. Echeverry et al.(2004)[12] studied the travel time for users of the city reduced by 32%. Gutierrez (2010)[13] mentioned that BRT showed better performance, user satisfaction, travel time, reliability and improved urban environment than the previous bus system [14,15, 16, 17].

The aim of this study was to assess the current public bus services in the city and to suggest a sustainable and suitable rural-urban bus system. This study includes identification of research problem, research questions formulation, formulation of research objectives, reviewing the literature of developed countries, and to suggest measures for improvement in current metro system in local context. A questionnaire was designed by considering the research questions and objectives which helped in data collection and in analysis of collected data.

The main objective of this research was to review the literature regarding quality of BRT (Metro bus), its efficiency and passenger’s satisfaction level in international and national context. Other objectives include the establishment of the performance indicators, assessment of the service quality and efficiency of BRT (Metro Bus) using that criteria. To improve quality of bus service conclusions and recommendations are drawn upon analysis.

**Material and Methods**

Metrobus is operating in various cities of Pakistan but here we are specifically concerned with metro bus working in Lahore Punjab, Pakistan which is one of the biggest rapid bus (transit services). Lahore Metrobus service is coordinated with Lahore Transport Company's (LTC) local bus service to function as an urban transport system, which provide transit benefits across Lahore with association to neighboring suburban communities. Till May 01, 2017 the system had transported 210 million passengers supported by 64 buses. Metro bus infrastructure was developed in Lahore covering a distance of 27 km on Ferozpur Road corridor comprising of 27 stations with an average distance of 1.04 km from station to station. The terminal stations are Shahdara, in the North west side and Gajjumata, in the South-East side of Lahore. Metro bus stations are showing in Figure 1.



Figure 1. Route map of metro bus stations.

Seating capacity of buses utilized in BRT Lahore is 160 which create a normal directional capacity of 3906 travelers per hour. Normal everyday ridership of Metro transport Lahore is nearly 125,000. Working hours of metro bus service are 16, from 6am to 10pm. Peak hours starts from 7am to 10am and from 4pm to 8pm. The frequency of Metro bus Lahore is 20 buses per hour in off-peak hours and 27 buses per hour in peak hours. In off-peak hours, the time headway is 3 minutes. From terminal to terminal the maximum time required is 63 minutes which is achieved mostly but sometimes, when peaking takes place at stations, dwell time is increased.

**Material:**

Primary data was comprised of questionnaires designed to achieve the real-time information about the passengers’ perceptions. In this research, secondary data sources were Government or Metro bus offices, books, magazines and daily papers, reports arranged by researchers, open records and measurements.

Thus, a total of 125000 daily ridership came into calculations when sample size was known. The sample size is determined from the Solve in sample size formula (1960) [18]:  $n = N/1 + Ne2$  The calculated sample size was 2400, the sample was determined through random sampling from different stops. The collected data was further processed by the chi-square test, t-test, and regression analysis on SPSS to draw the best results. After applying these analyses, the best method was a correlation to support the defined variables.

Table 1: Evaluation criteria of performance indicators

<u>Performance Indicators</u>	<u>Evaluation Criteria</u>
<b>Headway</b>	Bus on Time / Punctuality
	Easy Access to Bus
	Easy to Switch Buses
	Restroom Availability
	Sufficient Benches Available
<b>Station Services</b>	Guidance About Services (Availability of Maps, Timetables And Information On Delays)
	Card/ Ticketing System
	Enough Shelters for Bus Stops
	Provision of Ramps/ Escalators for Disabled Persons
	Enough Seating Capacity in Buses
<b>Bus Comfort</b>	Bus Level Boarding
	Enough Leg -Space in Buses
	Easy to Carry Items on Board
	Security (Not Afraid of Being Pickpocketed on Bus)
	Safety of Passengers on Board
	Ceiling Heights of Buses Are Convenient
	Convenience for Elderly, Disabled
	Enough Widened Door for Wheelchair
	Enough Space for Wheelchair Inside Bus
	Staff Behavior
<b>Bus Condition</b>	Cleanliness
	Comfortable Seats
	Proper Maintenance of Buses
<b>Facilities Inside Buses</b>	Ventilation
	Air Conditioning Service

A closer cross examination reveals that passengers were divided in different satisfaction levels towards the bus service-quality. These divisions were used to examine the level of disagreements and agreements in term of their perceptions. The satisfaction levels were categories as 0% 20% 40% 60% and dissatisfied levels as 47% 36% 17%.

Table 2 Summary Of Public Response To Various Quality Attribute

Performance Indicators	Evaluation Criteria	Performance Grades		
		Satisfied	Indifferent	Dissatisfied
<b>Headway</b>	Bus on Time / Punctuality	69%	19%	12%
	Easy access to Bus	53%	38%	9%
	Easy to switch buses	41%	31%	28%
	Restroom Availability	51%	36%	13%

<b>Station Services</b>	Sufficient Benches Available	11%	37%	52%
	Guidance about services (availability of maps, timetables and information on delays)	69%	29%	2%
	Card/ Ticketing System	71%	24%	5%
	Enough shelters for bus stops	38%	20%	42%
	Provision of Ramps/ Escalators For Disabled Persons	50%	31%	19%
<b>Bus Comfort</b>	Enough Seating Capacity in buses	20%	25%	55%
	Space availability at Level Boarding	40%	42%	16%
	Enough leg-space in buses	70%	25%	5%
	Easy to carry items on board	60%	30%	10%
	Security (Not afraid of being pickpocketed on bus)	11%	20%	69%
	Safety of Passengers on Board	33%	18%	49%
	Ceiling Heights of Buses are Convenient	78%	13%	9%
	Convenience for Elderly, Disabled	26%	29%	45%
	Enough Widened door for wheelchair	65%	25%	10%
	Enough space for wheelchair inside bus	50%	20%	30%
<b>Bus Condition</b>	Staff Behavior	71%	22%	7%
	Cleanliness	56%	33%	11%
	Comfortable seats	65%	30%	5%
	Proper Maintenance of buses	30%	44%	26%
<b>Facilities Inside Buses</b>	Ventilation	53%	29%	18%
	Air Conditioning Service	47%	36%	17%

### Discussion

In Pakistan, Metro bus was the first bus rapid transit project and the aim to implement this project was to provide high efficiency and better service quality through fast, reliable and comfortable BRT system that fulfills the demand of passengers for achieving high satisfaction level. By evaluating service quality, attributes such as station services, bus comfort, bus condition, facilities inside buses are ensured which reveals that Metro Bus is solving many problems in term of mass transportation e.g., reduced travel time, easy accessible to long distance users and the cost-efficient as compared to other public transport. Analysis on service quality and efficiency of Metro bus service were drawn on the basis of passenger's perception. The result regarding the performance of headway shows that mostly passengers are satisfied from the punctuality and accessibility of buses.

As per analysis, predominant satisfaction level was observed on efficiency of Metro bus service like the guidance availability (maps, timetable, information on delays, etc.), provision of ramps/ escalators for disabled persons, availability of enough space at bus level boarding, enough leg space in buses, space for wheelchair inside bus, widened door for wheelchair and carrying items. Bus conditions like ventilation, comfortability of seats and cleanliness were also observed

satisfied by users. Analysis show that most of users show dissatisfaction level on sitting area at Metro stations because of inadequacy of benches, in adequate seating capacity in buses, security, safety of users on board and in adequate seating capacity for elderly people inside buses. Majority of the users showed ordinary behavior on regular monitoring and maintenance of Metro bus services as BRT system of Lahore is confronting numerous maintenance issues with respect to BRT hallway, lifts, washrooms, water coolers and sewerage framework. Escalators were observed collapsed due to maintenance work. We assessed the quality of the service, efficiency and passenger's satisfaction using quality indicators of bus transport service. By assessing quality attributes, it was found that respondents showed positive attitude toward most of the indicators while least of the indicators revealed negative attitude. Some recommendations have been given below to overcoming the problems that cause the dissatisfaction level.

Installations of up to date framework to get the arrangements for economical transport system in future, which is the reason to extend customer satisfaction. Recurrence, punctuality, and travel time are vital factors observed during survey that are responsible for bringing a higher level of satisfaction. Adequate seating capacity should be increased at each bus stop so that passengers can wait for buses patiently and their comfort level can be improved.

Availability of seats in a bus is linked with crowd condition when there will no crowd, passengers will get more chances to get a seat. So, the schedule of buses should be designed to accommodate crowding, and everyone should have access to a seat in buses. Ease for elder people should be improvised by making seats reserved for them and allow them to board the bus easily by taking as much time as they want.

Lahore BRT corridor needs maintenance as corridor is damaged badly at various points. Buses should be monitored and maintained properly after specific time periods to ensure the quality. For improving service quality, passenger security is very important. To keep customers safe and secure inside buses and at boarding, buses should have good lighting system, security cameras and should keep an eye on the pickpockets and other criminal activities and should also be monitored in cooperation with the police especially at high demand routes and terminals. Quality and management of Metro Buses should be improved by cleaning the environment onboard, running on schedule, providing pleasant environment at stations and maintaining air-conditioning onboard, are prerequisites to obtain passenger satisfaction

#### **Social and Environmental impacts of metro bus:**

Socially, BRT is economical, affordable, time saving as well as health promoting, environment protecting, discipline instilling, a source to create social homogeneity, and community acceptance or satisfaction. It has reduced traffic congestion, air pollution, noise pollution, and road accidents to some extent. According to the survey, respondents wanted that the fares must be less than 20 rupees. About 90% people were very optimistic and hopeful for the BRT with positive opinions. Almost 50% people were agreed with opinion that MBT has reduced the unemployment rate. Most of the people thought BRT has reduced traffic on roads. People used motor bikes within the city but by the advent of BRT most people left their own vehicles and shifted on this service. Some people shifted from conventional buses to BRT because of poor services and inconvenience of old transport system. Poor were not able to afford the high fares of reasonable public transport like Daewoo, meanwhile, rich people did not agree to leave their own vehicles.

MBT has reduced the commuting time and increased the accessibility towards work. Accessibility to other establishments such as hospitals, schools and colleges also improved since these are situated along BRT route.

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**Annexures- 1****SURVEY QUESTIONNAIRE DESIGNED FOR THE ASSESSMENT OF SERVICE QUALITY, EFFICIENCY & PASSENGERS SATISFACTION LEVEL TOWARDS BUS RAPID TRANSIT (METRO BUS LAHORE)  
DEPARTMENT OF CITY AND REGIONAL PLANNING  
LAHORE COLLEGE FOR WOMEN UNIVERSITY,  
LAHORE**

1. Name of Respodent:

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2. Gender:

Male

Female

3. Age Group:

<25 Years

26-35

Years

36-45 Years

>45 Years

4. Occupation:

Student

Business

Private Employee

Govt. /

Semi- govt Employee

Other (please specify) \_\_\_\_\_

5. Frequent access mode to metro bus station

Foot

Car/bicycle

Rickshaw/ Qingchi

local bus/ Wagon

other (please Specify) \_\_\_\_\_

6. How often do you take metro bus as a transport measure?



Daily  Once a week  Once a month

Rarely  First experience

7. What is your trip purpose?

Work  Education

Medical

Shopping  Social

Other

8. Total No. of trips per day

1  2

3  More than 3

Not Applicable

9. Total travel time from Residence to metro station

5-10 min  10-20 min

21-30 min  >30 min

10. Satisfaction on Travel time reduction by metrobus as compared to other public transport

Satisfied  Indifferent

Dissatisfied

11. Satisfaction level on effective cost by metrobus as compared to other public transport

Satisfied  Indifferent

Dissatisfied

12. Do you use Park n Ride? If Yes, then are you satisfied with the facility of Park n Ride?

Yes

No

Do you feel buses are overcrowded at peak hours of travel?

Always

Sometimes

Rarely

13. Are you satisfied with Metro bus service schedule?

Satisfied

Indifferent

Dissatisfied

14. Are you satisfied with Metro bus service routes?

Satisfied

Indifferent

Dissatisfied

15. Are you satisfied with frequency and reliability of bus service?

Satisfied

Indifferent

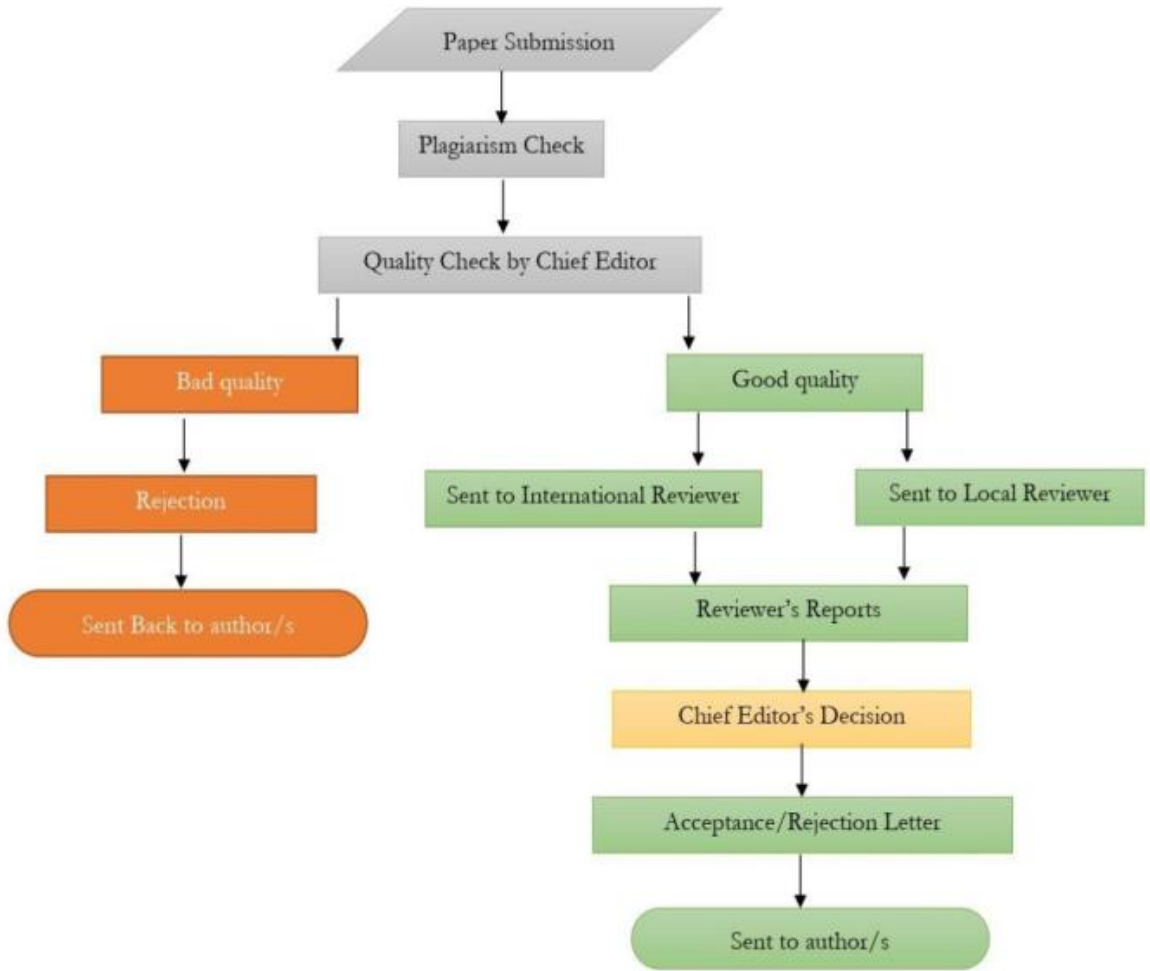
Dissatisfied

16. Will you recommend Metro bus service to others?

Yes

No

**Peer Review Process**



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