SOCIO-ECONOMIC COST AND BENEFIT ANALYSIS OF BUS RAPID TRANSIT (BRT) PESHAWAR

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CERTIFICATE

This is to certify that this thesis entitled: **"Socio-economic Cost and Benefit Analysis of Bus Rapid Transit (BRT) Peshawar"."** submitted by **Mr. Uzair Ali** is accepted in its present form by the School of Economics, Pakistan Institute of Development Economics (PIDE), Islamabad as satisfying the requirements for partial fulfillment of the degree in Master of Philosophy in Economics and Finance.

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Author's Declaration

I, **Uzair Ali** hereby state that my MPhil thesis titled **Socio-Economic Cost and Benefit Analysis of Bus Rapid Transit (BRT) Peshawar** is my own work and has not been submitted previously by me for taking any degree from this University **Pakistan Institute of Development Economics** or anywhere else in the country/world.

At any time if my statement is found to be incorrect even after my Graduation the university has the right to withdraw my MPhil degree.

Date: _____ Signature of Student: _____

Name of Student: _____Uzair Ali ____

Dedication

I dedicate this Research to my beloved parents, who have been a great source of inspiration and support; their love encouraged me at every step in life, particularly during my studies at PIDE. I dedicate my little effort to my brothers and sister, whose love, trust, and prayers are unforgettable for me.

(Uzair Ali)

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Abstract

There is an increasing trend of development of transport infrastructure in Pakistan to cope with the issues regarding the mobility within the city. To handle the transport issue, most countries in Asia, Europe, and Africa have developed Bus Rapid Transit (BRT) solutions. Traffic congestion in Peshawar has become a major issue. Besides the ill-planned traffic system, various other elements are contributing to it, such as inappropriate car parking due to unavailability of parking lots and roadside encroachments.

This Study analyzed the BRT Peshawar through a mixed approach through socio economic cost benefit analysis. We used both primary and secondary data in the analysis while in methodology we use Cost and Benefit Analysis, Mixed Method Approach and multinomial logistic regression. From Primary data, we summarized that the respondents are using public transportation. The mostly respondents said that they took the bus for the vehicle. 36 percent of respondents travel the bus less than once a week, 24 percent who ride the bus 1 to 3 days a week, and 40 percent who ride the bus 4 to 7 days a week. We also analyzed Socio-Economic Cost-Benefit Analysis found through Asian Development Bank data and all the BRT system's costs and benefits are calculated by comparing them to the base. Evaluate the project's economic stability using a 9% discount rate and the project's economic income rate (EIRR) and net present value. Started in 2017, the evaluation expected a two-year project implementation time. After then, there will be a 20-year life cycle of economics (2019 to 2039). The cost data for 2017 is based on a study of constant pricing. This estimate is based on domestic costs.

Keywords: Socio-Economic, Cost-Benefit; Bus Rapid Transit (BRT) Peshawar

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CHAPTER 1

INTRODUCTION

1.1. Background of the study

The Issues of Transport are emerging with high growth rate of population worldwide in the big cities. To handle the transport issue, most countries in Asia, Europe, and Africa come up with Bus Rapid Transit (BRT) solutions. The Rapid Transit mode of Transport is faster, time saving, convenient, safe, and cost-effective compared to other transport modes. For example, Rapid Transport in North America, Latin America, and Europe reported 25-30 percent saving in travel time (Levinsonet al., 2003).

Traffic congestion in Peshawar has become a major issue besides the ill-planned traffic system, various other elements are contributing to it, such as inappropriate car parking's due to unavailability of parking lots, roadside encroachments, and about 229 % increase in private cars in about a decade (Ali, 2020). Usage of too many Rickshaws in the city most often had made traffic jams and caused accidents. It has estimated that only 20,000 out of 70,000 rickshaws are registered with the transport department. Such usage is the main factor of environmental pollution in the region.

Pakistan is also facing traffic congestion, especially in big and populated cities, due to a lack of infrastructure increase in vehicles in urban areas. According to World Health Organization (WHO) data published in 2014, deaths due to traffic accidents reached 30,310 annually, which is 2.69 percent of total deaths in that year. Use of wrong ways, sharp curves on

roads, little use of indicators by motorists and helmets by riders are a few reasons that lead to fatalities.

Khyber Pakhtunkhwa Government took the initiative and came up with the idea of Bus Rapid Transit to solve the Issue of Transport in Peshawar. According to a 2016 report, there were 43,759 registered vehicles in Peshawar.

The Peshawar city population of 1.8 million, has a proper BRT public transportation structure. As an alternative, an informal system of minivans, wagons, vans, and different means of transportation offer public transport. This lack of ratification has influenced inefficiency and safety, and environmental concerns. Many modes of transport have regular directions, but there are no timetables, stops, or fixed stations. As a result, the frequency of service is irregular. Drivers stop when they want to pick up passengers, and they can wait for the vehicles to be full. Passengers are compelled to hail cars from the roadside, endangering their protection. Getting into vehicles can be difficult for the elderly, children, and those with limited mobility, and it is even more complicated when traveling on a congested road. During rush hour, passengers are often known to sit on the road or hang from the side of moving vehicles. Finally, automobiles in this informal network are frequently overlooked, resulting in inefficient fuel consumption, higher emissions, and higher operating expenses (Assessment, 2017).

Bottlenecks have formed in Peshawar and other fast-growing Asian cities, limiting travel times to less than 10 km/h on certain major roadways. As citizens gradually buy private vehicles and motorcycles and the simple transportation system expands to meet demand, demographic stability and economic expansion have exacerbated the difficulty. In addition to the difficulties described above, neglected construction contributes to urban congestion by forcing automobiles

to stop for passenger lanes. Peshawar's Sustainable Bus Rapid Transport Corridor (BRT) program intends to provide high-frequency transportation over many corridors. BRT buses would ride in a dedicated lane in the city's busiest regions and may also travel outside of the lane. This strategy, called the "direct service" paradigm, broadens the system's reach while reducing passengers' transitions. On both sides of the corridor, the BRT Route would be segregated from ordinary transportation, and each location was large enough to accommodate three to 4 buses at the moment. The route is mainly on the ground floor, and the plan also includes cycling paths and pedestrian services to upgrade the BRT station's entrance (Ahmad, 2019).

1.1.1 Economic Prospective

The Economic analysis described here focuses on variations in transportation expenses, reserves for vehicle operating costs (VOC), or reduced trip travel. Passenger security and the environment have also been taken into account. The expenses and remunerations of the scheme situation are measured beside a baseline situation which assumed sustained supremacy of the simple transport structure. The income generated by BRT services was examined to see if it would be sufficient to meet the structure's operating and management (O&M) costs (Ahmad, 2019).

The speedy increasing ultimatum for public transportation in urban cities has seriously disturbed the metropolitan socio-economic structure. As the 6th biggest city of Pakistan and a major in KP province, Peshawar, the city of flowers is no exception. The city's air quality index has been in the 'unhealthy zone' for years. According to a report published by WHO, the capital

city of Peshawar has the second most polluted air out of 3,000 cities in the world[1]. Similarly, a large portion of the air pollution comes from carbon emissions from vehicles wandering on roads. However, an abundant number of transportations exist, but which are not informal networking, which creates a hurdle to the public (Ali, 2020).

Peshawar Rapid Transit (BRT) is solely the public transport system of the Khyber Pakhtunkhwa (KPK) started in 2017 with the collaboration of the Asian development bank. It was initially projected to cost Rs41 billion (US$260 million), but its final estimated cost is approximately Rs71 billion (US$440 million), and its expected revenue is $80 million per year and functional in 2020. It operates a total of around 450 buses with a capacity of 95 passenger per bus and carries an expected passenger of more than two lacs daily. There are 31 stations and a route covering a 26 km distance (ABD, 2017). All the Buses are hybrid means it have diesel and electric. This allows for better overall energy efficiency and lower emissions and charging facilities to recharge the battery (Ahmad, 2019).

Despite this, the current elected government reached out to Asian Development Bank for a sustainable mass transit project to resolve the existing problem. As a result, in 2017, the Peshawar Bus Rapid Transit (Peshawar BRT) project was launched. It was divided into two sections: the first connect an east-west bus route from Chamkani to Karkhano bazaar in the west of Peshawar. At the same time, the 2nd part consists of the routes of the feeder, which is used for entering/exit of the metro buses to travel on city streets with diverse traffic. On the other side, the BRT route operates from Chamkani to Hayatabad, and a total distance is 26 kilometers; among them additional 31 stations exist between them.

[1] Ahtisham Khan (2020,March 25) Covid-19 Leads To A Drop In K-P Pollution , The Express Tribune https://tribune.com.pk/story/2183447/1-covid-19-leads-drop-k-p-pollution

On the other hand, the underlying system is mostly elevated (around 49%), with 38% at ground level and 17% under underpasses. The entire bus route is fenced to prevent illegal pedestrian crossings and vehicular traffic from entering. Likewise, the BRT system has around 450 buses with a maximum capacity of 95 people, and BRT vehicles are operating 6 AM to 10 PM with additional buses at peak times. The cheapest ticket costs 10 rupees, while the most expensive ticket costs 50 rupees (ABD, 2017).

1.2. Research Problem

Peshawar is the capital city of Khyber-Pakhtunkhwa, Pakistan, and one of the main hubs for the educational, industrial, public, and private sectors. As the city's population is overgrowing due to the rapid migration of people from rural areas and other cities to get a better education and new job opportunities, it also affected traffic-related problems. The daily traveling percentage of people has rapidly increased with the increase in private cars, which resulted in an adverse effect on the already sensitive state of the Peshawar transportation system. To improve the current transportation network and mobility of people in the city, this study provided solutions regarding the traffic issues and helped improve the situation.

1.3.Research Gap

This study considered the socio-economic and cost-benefit analysis of Bus Rapid Transit Peshawar. The study's objective is to evaluate the cost and benefit analysis of bus rapid transit, BRT Peshawar. For formal networking, reduction cost and timing saving BRT Peshawar are established while there is no single study regarding cost and benefit analysis. Therefore, the study is based on the cost and benefit of BRT, whether the project is significant or not for the

country. Finally, as the above discussion indicated, vans in this familiar system are directed to be maintained poorly, useless fuel consumption primary, enhanced emissions of carbons, and higher operating cost is included. Moreover, the deteriorating environment is only one fact of devastating the transport system.

1.4. Objectives of the study

The study investigates unexplored variables like investment in the metro, public buses, private buses, saving in travel time, personal vehicles, reduction in accidents, the revenue of metro, investment cost, government revenue, saving in fuel, saving in infrastructure investment, O & M cost of metro and reduction in pollution. This study used both primary and secondary data, with primary data being collected through a questionnaire among BRT beneficiaries/Passengers. At the same time, secondary data is obtained from the official sites of ADB and Trans Peshawar. The study targeted the passengers and employees of BRT for the survey, while we followed a random sampling technique following (Vitter, 1985).

We also calculate the net economic benefit for each stakeholder, including the government, passengers, transporters, unskilled labor, and the general public, following the methodology (M N Murty, 2006). We employ (Morana, J., Gonzalez-Feliu, J., & Semet, F, 2014) methodology to estimate the Classical Cost-Benefit Analysis (CBA). The study shall undertake the project's Social Cost-Benefit Analysis (SCBA), which accounts for the social cost and benefits along with the economic cost.

The following are the main objectives.

- To investigate the cost-benefit analysis of Peshawar Bus Rapid Transit (BRT)

- To examine the preferences of Passengers using BRT as a mode of transport.
- How BRT a time-saving, Cheap, Convenient, and safe mode of Transportation.
- To evaluate the socio-economic development of Bus Rapid Transit (BRT).

1.5. Research Questions

Each stakeholder's cost and benefits are separately calculated along with other positive externalities. Based on the objectives, we aim to answer the following research questions:

- The Cost-benefit analysis of Peshawar Bus Rapid Transit (BRT)?
- How is socio-economic development affected by Bus Rapid Transit (BRT) Peshawar?
- Is BRT a time-saving, Cheap, Convenient, and safe mode of Transportation?

1.6. Significance of the study

The Study has profound policy implications and aligns with the management's vision of policy-oriented research. Public transport across the country has been revived. Bus Rapid Transit System is one of the major candidates in this regard. A total of 4 BRTs has initiated in the country, and more are in the pipeline. A comprehensive study of the underlying cost and benefits of a rapid mass transit system can help us formulate a better project next time. The analysis of the study helps out the authority of Bus Rapid Transit (BRT), especially the provincial government, investigate the causes of initiating this type of project at a considerable cost and recommend a possible solution to the investigated problem.

CHAPTER 2

LITERATURE REVIEW

2.1. Introduction

This chapter reviews the literature to explore all the possible factors determining the Socio-Economic Benefit and Cost-benefit analysis. So, this chapter briefly explains the factors reconnoiter by different studies on the main factors of Rapid Transport. The literature review helps us identify the research gap and explain in brief the objectives of the study discussed in previous studies. The current literature review comprises the previous studies conducted on the social cost and benefits analysis of Metro (BRT). There are very few studies found in Pakistan on Metro BRT.

2.2. Literature Review

The Growing demand for public transport in big cities has been affected for decades due to increasing population and changes like land. (Hidalgo, 2013) investigated the BRT and Bus of High level of Service (BHLS). They concluded that significant encouraging externalities and some fascinating trends such as implementing a cohesive citywide system of the bus, increasing funds from national governments, and development in bus technology. (Enrst, 2013) evaluated that the Trans Jakarta BRT delivers a clear vision for a sound, sustainable municipal transportation system in Jakarta and the solid public acceptance of the Bus Rapid transit. However, (Ahmed, H. U., & Azeem, A, 2015), investigate the evaluation of system performance of metro bus Lahore. Their Results of investigation provide components like utilization,

productivity, and reliability of the system, and consequently, appraisal of system performance is measured.

M N Murty (2006) evaluated the cost-benefit analysis of the metro in Delhi; his estimation indicated that a 17 percent financial interest rate of return on investment and economic rate of return is 24 percent estimated. Described further, they find significant for socio-economic and environment and provide numerous assistances, including a decrease in air, saving time, reduction an accident, and high traffic load. It is imperative to know the potential impacts when modernizing public transportation networks.

According to (Shah, 2020), the sustainability of recent urban transport and its role in the failure of greenhouse gas emissions through a case study of a metro bus system (MBS) in Lahore, in which they collected data on vehicle range, fuel type, and regular seats. Ability to estimate greenhouse gas emission levels. The MBS project achieved the total annual reduction of greenhouse gases by 15034.38 metric tons of CO2-e (59.25%). (Zolnik, 2018) studied the benefits of bus rapid transit in Lahore, Pakistan, where the usage patterns show that women are more customary to use and benefited more from the fare subsidy. It helped ease the monetary and temporal expenses of the metro usage, which affected more females. Another studied is conducted by (Malik, 2021) investigated users, travel behaviors, and the experiences of single corridor Bus rapid transit in Lahore, Pakistan; they found out that single corridor BRT has been a crucial means of mass transit for employees, students, both male and female of different ages of groups, and more important for younger to a middle-age segment of the society. They also found out that service quality evaluation of BRT corridors provides valuable input regarding the critical factors from which users are happiest and satisfied.

The demand for Bus Rapid transit is predominantly increasing in developing countries of the world. In big cities, the projection of transportation aims to enhance economic development and change the view of the city for residents of that city and outsiders. (Shah, 2020) investigated the performance evaluation of the Bus Rapid Transit (BRT) and Eco-friendly public transport system for the Multan city of Pakistan. The analysis findings indicate that the hybrid bus system is not only replacing the conventional bus transportation system but also helping an eco-friendly and energy-efficient economical solution. Although, the forthcoming Bus Rapid Transit (BRT) is cheerful. Bus Rapid Transit (BRT) has grown its popularity worldwide cost successful replacement compared to (Cervero, 2013) investigated that fast motorization, and the worse traffic circumstances in many speedily emerging countries and the cities which are growing very fast can invest high-size, high routine transportation systems more important than ever. (Hensher, D. A., & Golob, T. F., 2008) Evaluated 44 BRT system operations worldwide, and they concluded that, once the current lifespan cost is taken to account, the price of giving high-quality unified BRT systems is an attractive option from many perspectives.

Modern transport systems are being put in place in cities worldwide to increase social mobility in overcrowded urban areas. In addition, communities worldwide are looking for the most cost-effective approach to modernizing their public transport networks. (Ingvardson, J. B., & Nielsen, O. A., 2018) Studied the impact of 86 transportation systems worldwide, including Bus Rapid Transit (BRT), Light Rail (LRT), and Subway. They concluded that BRT could attract more and more passengers if the traveling period is considerably high. And this is led to an increase in the value of properties near the transit line, and these effects are usually connected with desirable rail base public transportation systems. (Flyvbjerg, 2004) concluded that Rail is riskier than the BRT in relation of cost strikes and investment forecasts.

(Venter, 2018) evaluated the equity impact of the operational bus of Bus Rapid Transit (BRT) systems in the Global South. This study emphasizes vertical equity, whether BRT structures achieve the objective for the deprived parts of the population. They found that, in Africa, Latin America, and Asia that in, the accurate term BRT is giving advantages to the poor in terms of time traveling, price saving, health aids, and safety. (Munoz-Raskin, 2010) examined that those properties which were near to the BRT systems, their property values were high with walking distances. In contrast, there were contradictory results for small income housing societies. (Hidalgo, D., & Gutiérrez, L, 2013) Studied the costs and impacts of Trans Milano, Bogota's bus-built mass transportation system, using feeder services and BRT corridors. The effects on crime, tax revenue, employment services, and land value are also presented. Their results showed that, besides travel time and cost, BRT also reduced health illness, injuries, and mortalities due to road protection and development in the air quality and assessing the adverse traffic effects during construction. (Vincent, W., & Jerram, L. C, 2006) investigates the Bus Rapid Transit (BRT) as a near time approach to reduce CO^2 discharges in predictable medium size US Metropolis. Their study finds that, the Bus Rapid Transit (BRT) suggests the most significant possibility for a green-house gas reduction since the BRT buses usually offer lower CO^2 reduction.

While Bus Rapid Transit (BRT) has appeared to be a cost-efficient transportation approach for inner-city mobility globally. (Deng, T., & Nelson, J. D, 2010) the land-development effect due to Bus Rapid Transit (BRT) in Beijing (China). The pragmatic study suggests that easy access to BRT is causing higher property prices. The average land price near BRT stations is relatively higher than those far away from BRT stations.

2.3. **Cost-Benefit Analysis**

The emergence of demand responsive transport (DRT) services is restructuring mobility in the urban universe. They provide a high level of service and compete with public transportation modes in many cases. However, in more minor dense areas, where conventional public transit (CPT) services such as buses are inefficient and costly, DRT services could be an alternative that is both profitable and provides passenger satisfaction (Berrada, 2021).

This paper investigates the economic and socioeconomic potential of replacing CPT with DRT services. It focuses on the development and combination of two models. The first is an agent-based model, which describes the movements of vehicles and assigns them to passengers according to a utility function. The assignment equilibrium problem is solved for elastic demand to generalized cost alone. The second is an economic optimization model based on a simulated annealing algorithm, which aims to determine supply conditions that maximize the benefit for the operator, the user, the environment, and society. Four economic problems are discussed and formulated accordingly. In addition, supply optimization is carried out in particular concerning fleet size, trip fare, and vehicle capacity. Finally, these models are applied to a real case in the Paris metropolitan area where a DRT system has replaced a bus service. The results show that though this shift is not beneficial from a societal point of view, bus demand is attracted by a DRT service consisting of 30 vehicles and charging a fare of €0.5. The operator would aim to propose a taxi service with small-sized vehicles and higher fares to increase their profitability.

On the other hand, user utility would suggest that public authorities should regulate fares and vehicle capacity (more than six seats). Fare regulation, in particular, will depend on the fleet size, ranging linearly from €0 for 25 vehicles to €4 for 70 vehicles. Finally, through the

sensitivity analysis, we find that thresholds exist for demand and fixed costs (respectively 85% and 90% of reference values) beyond which the bus line is more beneficial to society than the DRT service (Berrada, 2021).

Cost-benefit analysis (CBA) is a tool used to evaluate the potential socio-economic impact of public investment choices. In many countries, particularly France, this tool is used to support decision-making related to transportation infrastructure. Taking the multiple effects of the different choices into account in complex budgetary arbitrations makes choosing among transport infrastructure investments a two-fold problem. On the one hand, public decision-makers have limited resources that they must use in the best way possible. On the other hand, when choosing among alternative investment projects, the decision-makers reveal their priorities (based on the importance they assign to the different projects), which must be perceived as legitimate. Based on a case study of how French institutions use the CBA method, this paper examines how cost-benefit analysis interacts with the use of public debate and stakeholder participation in France today. This French case illustrates the difficulty of striking the right balance between the expert knowledge produced by CBA methods and the knowledge produced by the participation of various stakeholders in the decision-making process (Damart, 2009).

CHAPTER 3

DATA AND METHODOLOGY

3.1. Introduction

In this chapter, we briefly discussed the theoretical framework behind the objective—the study based on BRT's Socio-Economic cost and benefit. The methodology comprises on cost and benefit. Primary Data was collected through structured questionnaires from a sample of respondents from the residents of Peshawar, and secondary data was collected from The Asian Development Bank (ADB). Moreover, Peshawar residents were selected for this study and targeted units of the inquiry.

3.2. Theoretical Framework

The study survey questions were planned to collect the info from the Peshawar residents, and this was used in the econometrics model. The secondary data used in cost-benefit analysis, the evaluation methodologies, and cost-benefit analysis (CBA) is the most common approach for transport policy impact assessments in the national project appraisal guidelines and in scientific analysis and research. Considering its extensive usage in the appraisal work, the main focus will be on the evaluation tools used within the CBA approach (Ustaoglu, E., & Williams, B. , 2019). and their findings were collected through various methods, and often a researcher used the following while conducting a quantitative study.

3.3 Data

The Data was collected through structured questionnaires from a sample of the respondents from the residents of Peshawar and secondary data from The Asian Development Bank (ADB). Moreover, those Peshawar residents were selected for this study and targeted units of the inquiry. The questions are collected from the Peshawar residents, which is used in the econometrics model. The secondary data used in quantitative analysis, the researcher, used it for cost-benefit analysis. Their findings were collected through a variety of methods, and often a researcher used the following while conducting a quantitative study.

3.4. Sampling

The target population of the study are commuters of Peshawar city, and in population we have three types of strata, 1st stratum is the people who are using BRT as a mode of transportation, in the 2nd stratum people are commuting through public transport and in the 3rd stratum basically people are using their own vehicles to commute. Every stratum is homogenous, so if we take any sample from here, even if we take systematic sampling or random sampling or if we take sample of convenience, so it will have no effect on our results because our stratums are homogenous. A sample of 240 passengers were taken from the Passengers of BRT. BRT project, Peshawar, has an east-to-west track with 31 stations along the way, being interconnected to an extensive network of feeder buses[2].

[2] https://www.zameen.com/blog/peshawar-brt-project-updates.html

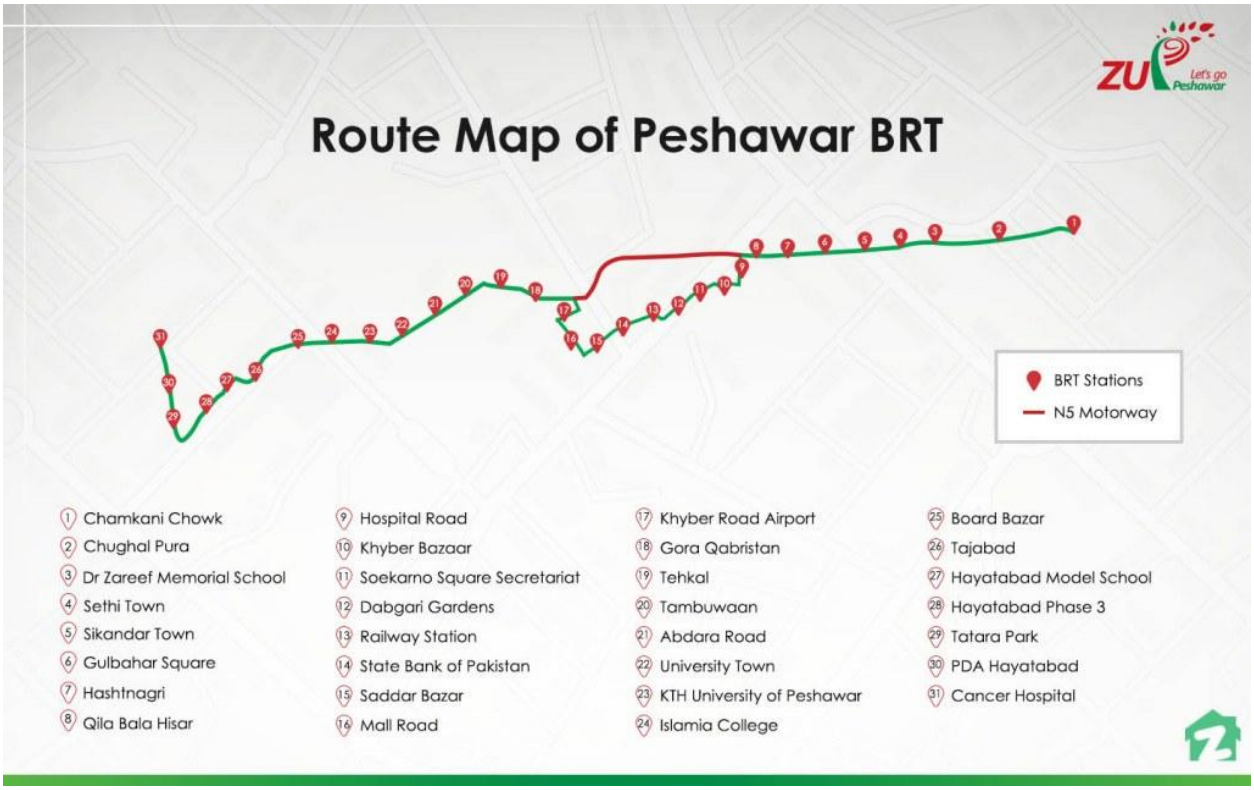


Figure 1: The Peshawar BRT Route Map

Table 1: No of the Peoples interviewed at BRT Station or Routes

S. No	BRT Station or Routes	No of Peoples interviewed
1	Chamkani Chowk	24
2	Hayatabad Phase 3	24
3	Chughal Pura	24
4	Dr Zareef Memorial School	24
5	Hashtnagri	24
6	Qila Bala Hisar	24
7	Hospital Road	24
8	University Town	24
9	State Bank of Pakistan	24
10	Saddar Bazar	24
	Total	**240**

We have an unknown population or beneficiaries of BRT Peshawar, and an equal number of respondents or interviewers selected at the BRT station or route. And different type of peoples

was interviewed like businessmen, the government employed, and public section employed and students.

3.4. Econometric Model

The study's main interest is to define and estimate a basic functional model of cost and benefit analysis of bus rapid transit BRT Peshawar. By estimating equation 1 below. Equation 1 is a non-linear equation used to measure the change.

$$\mathbf{BRT} = \boldsymbol{\alpha_0} + \boldsymbol{\beta_1}\mathbf{G} + \boldsymbol{\beta_2}\mathbf{A} + \boldsymbol{\beta_3}\mathbf{E} + \boldsymbol{\beta_4}\mathbf{MI} + \boldsymbol{\beta_5}\mathbf{O} + \boldsymbol{\beta_6}\mathbf{H} + \varepsilon \qquad (\mathbf{1})$$

Where:

BRT = Best transport BRT

G = Gender

A = Age

E = Education

MI = Monthly Income

O = Occupation

H = Home

ε = Error term

3.5. Variables

3.5.1. Bus Rapid Transit

Trans Peshawar or Peshawar BRT is a bus rapid transit system in Peshawar, capital of Khyber Pakhtunkhwa (KP) province. Trans Peshawar BRT system consists of two parts: the first encompasses an east-west corridor served by 32 stations on a dedicated lane for exclusive use by buses. In contrast, the second part consists of a network of feeder routes in which buses can enter and exit the system to travel on city streets. The system was inaugurated on August 13, 2020, and is the fourth BRT system in Pakistan.

3.5.2. Gender

Both of the two sexes (male and female), especially when considering social and cultural differences rather than biological ones. The term is also used more broadly to denote a range of identities that do not correspond to established ideas of male and female. "a condition that affects people of both genders."

3.5.3. Age

The amount of time during which someone or something has lived or existed.

3.5.4. Education

The education system in Pakistan is generally divided into six levels: preschool (for the age from 3 to 5 years), primary (grades one through five), middle (grades six through eight), high (grades nine and ten, leading to the Secondary School Certificate or SSC), intermediate (grades eleven and twelve, leading to a Higher Secondary School Certificate or HSSC), and university programs leading to undergraduate and graduate degrees. The Higher Education Commission, established in 2002, is responsible for all universities and degree awarding institutes. It was established in 2002 with Prof. Atta-ur-Rahman FRS as its Founding Chairman.

3.5.5. Household Monthly average income

Pakistan Average Monthly Income: Household data was reported at 41,545.000 PKR in 2019. This records an increase from the previous number of 35,662.000 PKR for 2016. Pakistan Average Monthly Income: Household data is updated yearly, averaging 23,732.135 PKR from Jun 2005 to 2019, with 8 observations. The data reached an all-time high of 41,545.000 PKR in 2019 and a record low of 9,685.000 PKR in 2005. Pakistan Average Monthly Income: Household data remains active status in CEIC and is reported by the Pakistan Bureau of

Statistics. The data is categorized under Global Database's Pakistan – Table PK.H006: Household Integrated Economic Survey: Average Monthly Income: Household.

3.5.6. Occupation

A person's usual or principal work or business, especially to earn a living; vocation: Her occupation was dentistry. Any activity in which a person is engaged.

3.6. Cost and Benefit Analysis

The cost-benefit analysis is a systemic approach to estimating the strengths and weaknesses of alternatives used; because of that, we can select the best approach to achieving benefits while preserving savings.

The flow of net economic benefit can be calculated as:

Demand of the Passengers before and after mode = $(\boldsymbol{Motorcycles} + \boldsymbol{Bicycle} + \boldsymbol{Car} + \boldsymbol{Suzuki\ pickup\ truck} + \boldsymbol{Large\ bus} + \boldsymbol{Rickshaw} + \boldsymbol{Taxi} + \boldsymbol{Minibus} + \boldsymbol{Station\ wagon} + \boldsymbol{Datsun\ pickup\ truck} + \boldsymbol{Mixed\ Traffic\ Total})$

Passengers = $(\boldsymbol{Yearly\ Bus\ Rapid\ Transit\ Passenger\ Numbers\ Estimates})$

Vehicles Km: $\boldsymbol{Base\ case\ of\ VKT} + \boldsymbol{Project\ case\ of\ VKT}$)

Vehicle Operating Cost = **(VOC without BRT + VOC with BRT + VOC savings)**

General public = ($\boldsymbol{Passengers\ of\ BR} + \boldsymbol{Passenger\ on\ a\ private\ plane}$ ($\boldsymbol{mixed\ traffic}$) + $\boldsymbol{Passengers\ on\ public\ transportation}$ ($\boldsymbol{mixed\ traffic}$))

This study borrows the abovementioned methodology from Murty et al. (2006). The annual economic benefit of Peshawar Metro can be calculated by summing up the individual economic

benefits accrued to each economic agent. Further, we can also calculate the social benefits of Peshawar Metro by applying the estimates of income distributional weights to the incomes accruing to various economic agents from the Metro.

Moreover, we can also use the basis of classic Cost and benefit analysis (CBA), which comprises primarily listing on one side all economic benefits and on the other side all monetary costs (operational & investment), which can be done one year after another for a provided period/time horizon (Gonzalez, 2014). Therefore, benefits are tackled to costs year by year for attaining a ratio of gains or losses at the end of every year of the given period, and the difference will be updated by using a revised rate for accounting for the money revising rate year after year. Therefore, the money value is not remaining the same one year after another. It is essential to define an updating rate α, which will allow us to compare two quantities of money during two distinct periods.

3.7. Mixed Method Approach

Mixed Methods Research is defined as a type of user research that combines qualitative and quantitative methods into a single study. We applied the design of integrated research, the initial to the analysis and discussion of results, with a mixed methodology. The design of mixed methods in research (Figure 2) included qualitative data and quantitative analysis of socio-economic cost and benefit analysis of bus rapid transit (BRT) Peshawar, which enabled the first research questions to be answered and the second phase under development, which integrated the analysis the socio-economic cost and benefit analysis of bus rapid transit (BRT) Peshawar.

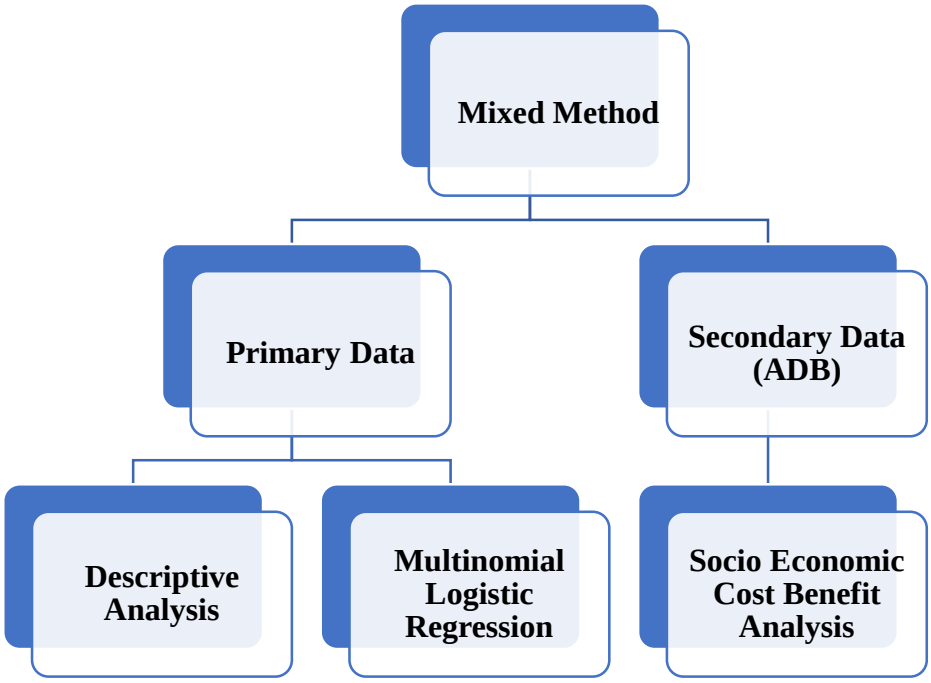


Figure 2: Mixed Method Approach

CHAPTER 4

EMPERICAL RESULTS AND DISCUSSION

4.1. Introduction

In this section the results of the survey questionnaire and secondary data of ABD were analyzed. By means of IT technology numerous types of statistics associated with social and scientifically research can be done very easily and quickly. However, this study used Stata and SPSS.

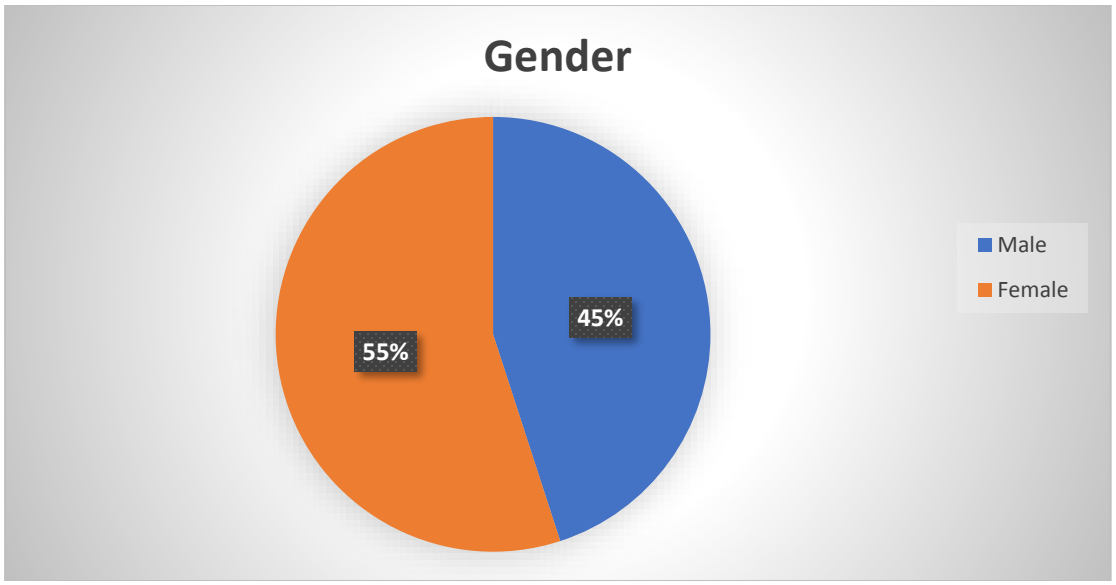
4.2. Descriptive Statistics

This section deals with the descriptive statistic of data. The Descriptive statistics of the variable taken into consideration are presented below.

4.2.1. The Profile Analysis of the Respondents

The own features and specific appearances of the participants play an energetic role in survey questionnaire data analysis. (Robson, 2002) called it profile analysis and indorsed that previously the actual survey analysis, the comprehensive description of the features of the participants could give an enhanced presentation of the collected data. This tool is known as descriptive statistical analysis as it transmits to the procedures of forming, summarizing, and presenting data in a helpful and practical way (Keller, 2003). In the subsequent section, a comprehensive description of the special characteristics of the participants has been given. Though stated before, the researcher used the SPSS program to attain all these results.

Figure 2: Respondents Gender



The Figure 2 shows the respondents and the gender wise participation. Out of total participants of the survey 55% of the respondents are females and 45% of them are male.

Figure 3: Age Group

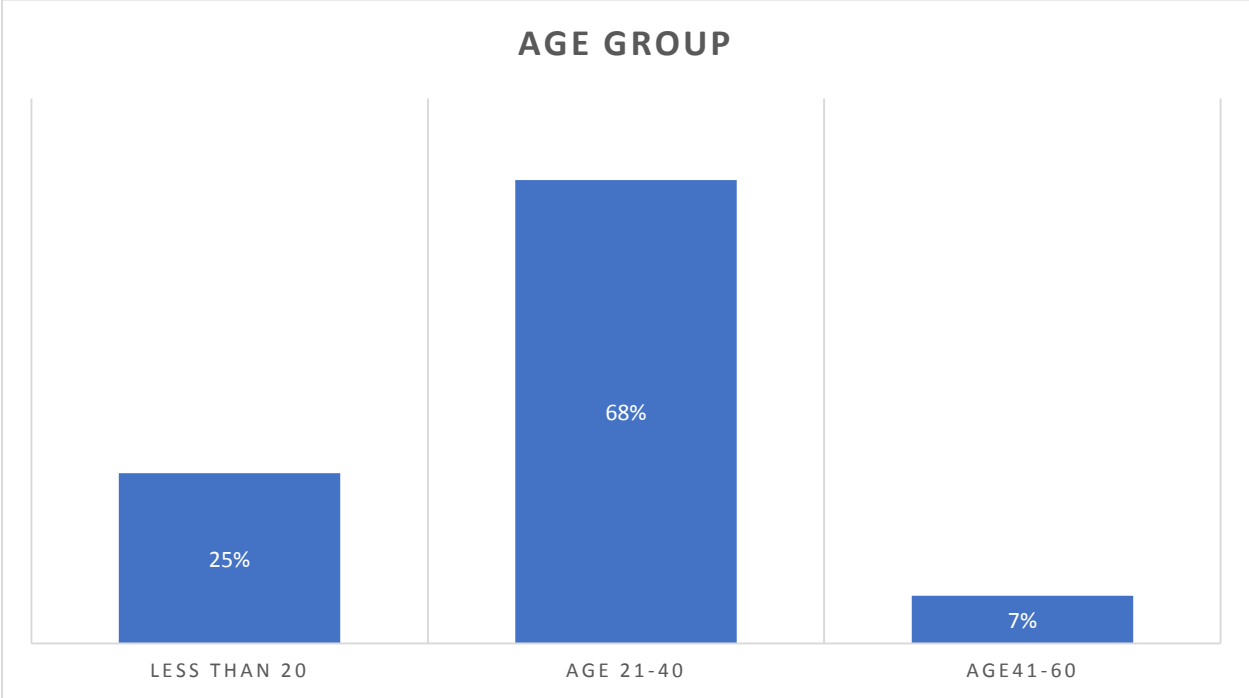


Figure 3 depicts the age of the respondents as per the reported data majority of the respondents that commute using BRT are of 21 to 40 years of age. Which is followed by

commuters that are less than 20 years of age. The percentage of commuters that are above the age of 40 and below 60 is 7%.

Figure 4: Education Status of respondents

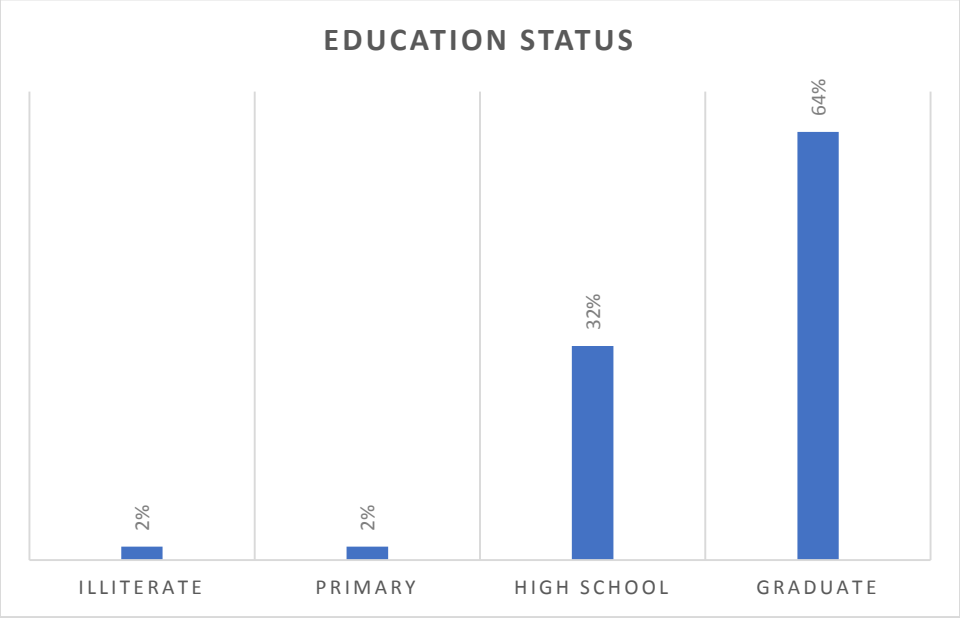


Figure shows the educational status of the respondents. Majority of the respondents that participated in the survey are graduates i.e., 64 % of the respondents. Which is followed by respondents that have attained the education level of high school. Only 2 % of the respondents were illiterate and 2% of them had primary level of education. As per the statistics the commuters of BRT are educated individuals with majority of them having education level of high school or graduates.

Figure 5: Monthly Average Income of respondents

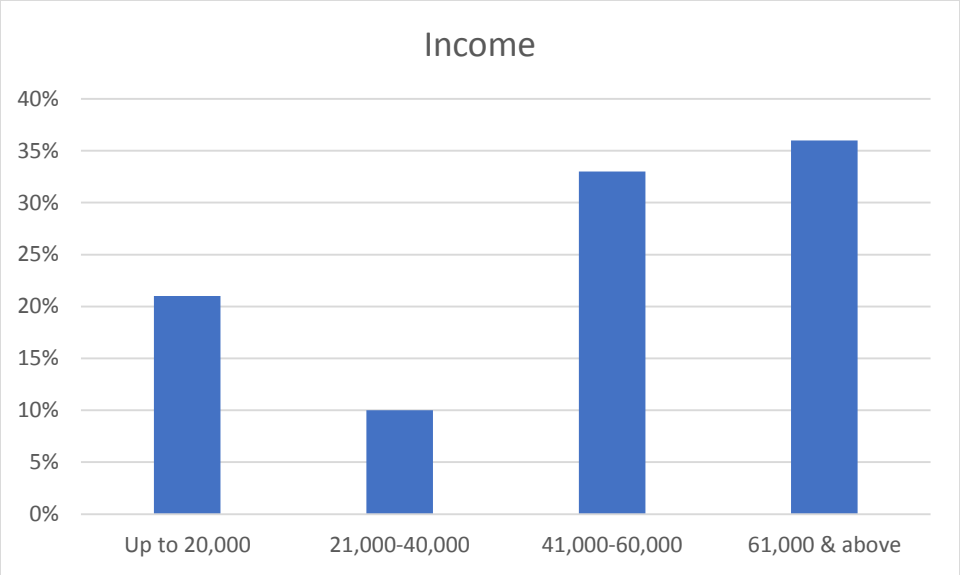


Figure depicts the average monthly income of the commuters of BRT Peshawar. This data is collected in order to have an estimate regarding the economic status of the beneficiaries of BRT.

As per the collected data majority of the respondents have average monthly income of Rupees 61000 and above which us followed by respondents with monthly income of 41000 rupee to 60000 rupee. Only 21 % of the beneficiaries were have average monthly income that was 20,000 or below. The respondents with average monthly income of 21000 to 40 000 are 10 %

Table 6: Occupation of the Respondents

Occupation	Percent
Public sector	12%
Private sector	8%
Self-employee	2%
Students	78%

The above table shows the occupation of the respondents that commute via BRT Peshawar. Majority of the respondents that commute through BRT are students i.e. 78% of the total respondents. Followed by public sector employees i.e 12%. The percentage of the

commuters thata are self-employed is 2% and those that work in the private sector is 8%. Hence the majority of the beneficiaries of the BRT are the students. Among these students as per the interaction with the respondents students were also working part time or full time in the private sector.

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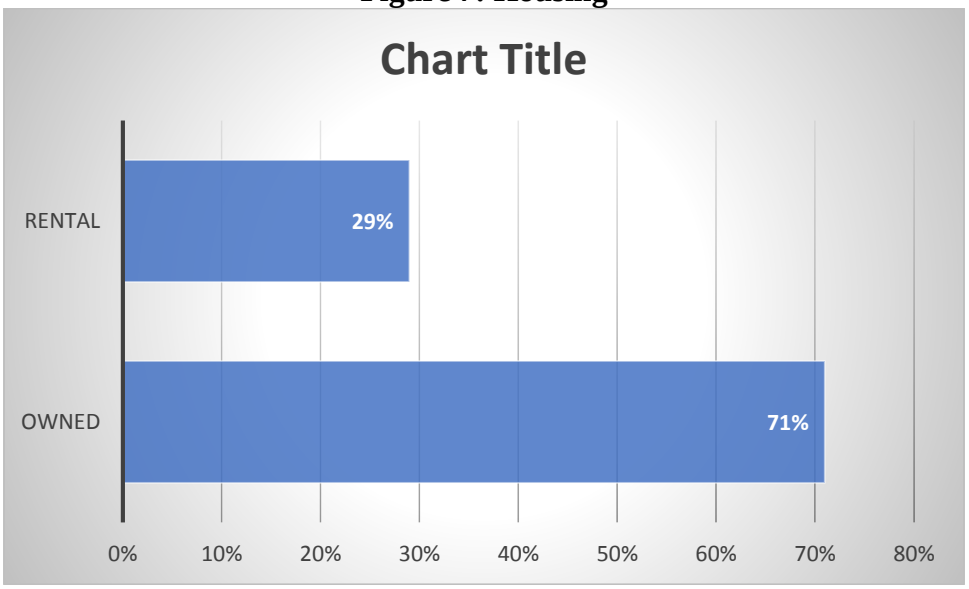
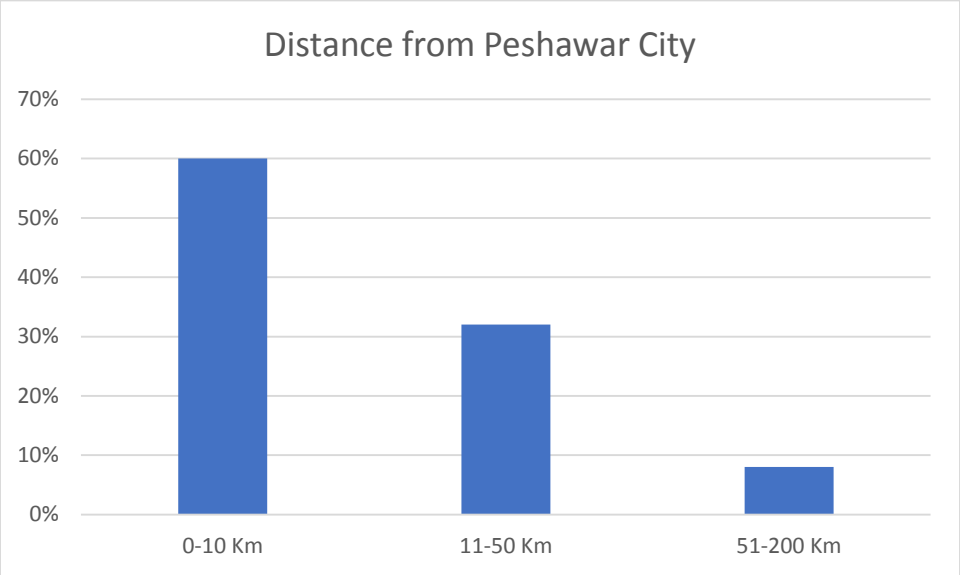
Figure 7: Housing



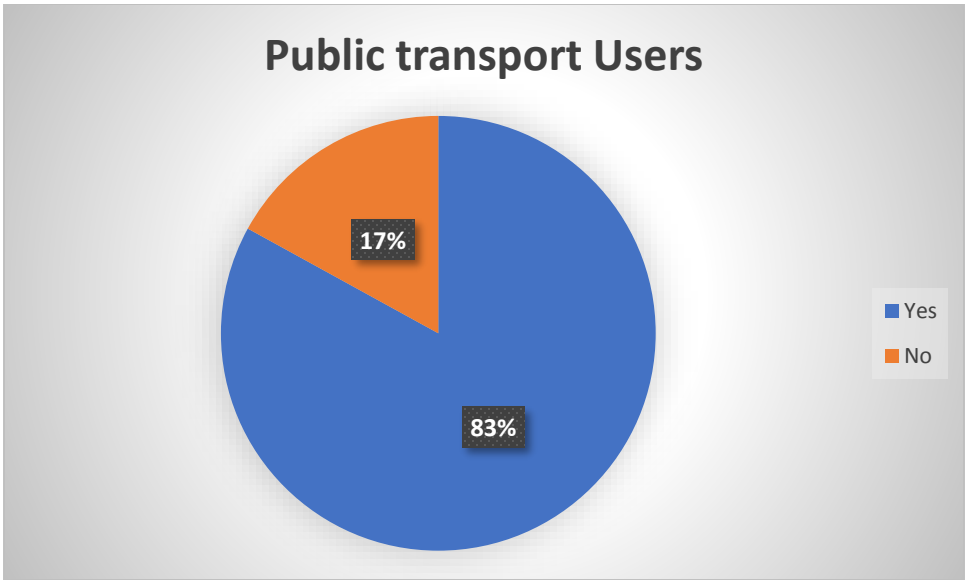
The above figure shows the type of housing respondents of the survey are residing in. majority of the respondents lived in the houses were not rented i.e. 71%. The respondents that lived in rented houses are 29%. The daily commuters of the BRT were the residents of Peshawar with majority living in rent free houses.

Table 8: Distance from Peshawar City



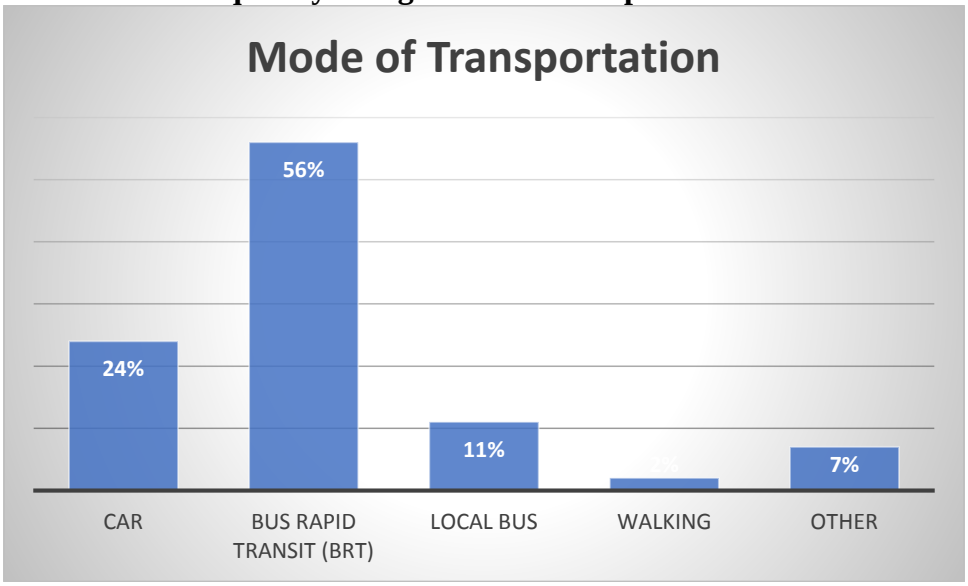
The above figure shows the distance of the respondent's residence from the Peshawar city. As per the statistics majority of the respondents were either living within the city or are living within the distance of 10 Km or less than 10 km from the Peshawar city, the percentage of such respondents is 60%. Which is followed by the those that travel a distance of 11-50 Km to reach Peshawar city i.e. 32 %. The percentage of respondents that were commuting 51- 200km to reach Peshawar city are 8 %. .

Figure 9: Public Transport User



The above figure shows the percentage of people that commute using public transport in Peshawar. As per the statistics 83% of the respondents commute via public transport other than BRT and 17 % of the respondent commute in private vehicles.

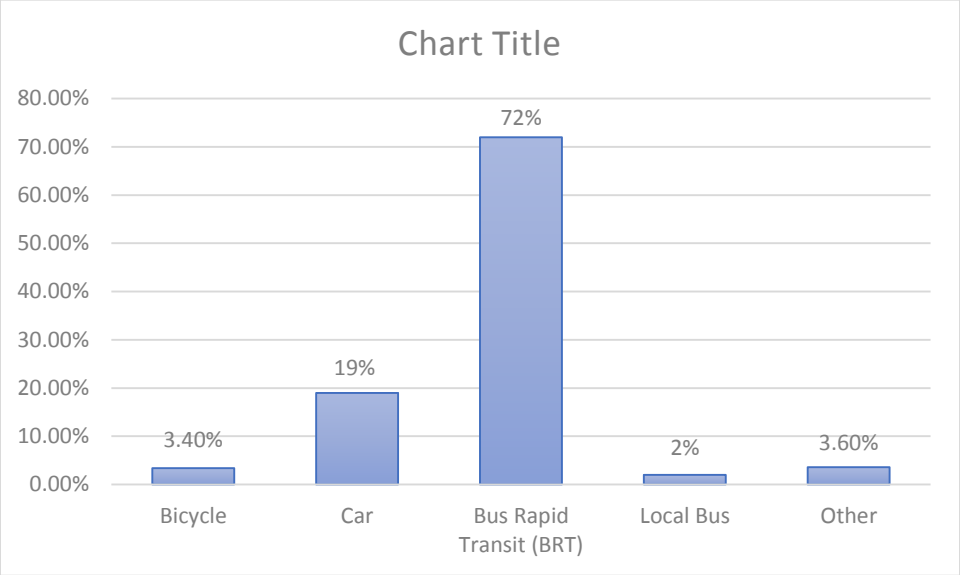
Table 10: Frequently Using Mode of Transportation in Peshawar



The figure depicts the most frequently used mode of transportation used by the respondents to travel in Peshawar. Majority of the respondents that is 56 % uses BRT to commute within

Peshawar which is followed by user that travel using cars. Only 11 % of the respondents uses local bus for traveling and 2 percent of them resort to walking for reaching their destination. As per the statistics majority of the respondents preferred BRT over other modes of transportations.

Table 11: Best Public Transport in the Peshawar



The above figure shows the percentage of the respondents regarding best public transport for commuting in Peshawar. As per the data reported majority of the respondents think of BRT as the best mode of public transport i.e 72 % and only 2% of the weighted in favor of local bus. 19% of the respondent reported car as best mode of transportations. The bicycle that are reported here are the one provided by Transpeshawar (BRT) for commuting within the station premises.

Table 12: Best Transport

	Percent

Public transport	51%
Private transport	49%

The respondents are asked to define the transportation system that is good in Peshawar among public or private. Private transport also includes the transport provided in shape of local buses, wagons etc. The above table shows the percentage of respondent that termed public and private transport as good. 51 percent of the respondents responded in the favor of public transport while only 49% preferred private transport over public transport.

Table 13: Affordable mode of transportation

	Percent
Bicycle	8%
Bus Rapid Transit (BRT)	78%
Local Bus	2%
Walking	12%

In order to observe the affordability of the transport cost respondents are asked to select the mode of transportation that cost the least and is affordable to them. As per the responses as reported in the above table majority of the respondent's termed BRT as the most affordable mode of transportation The table of frequency consist of 2 major columns of summary measure. The column of the frequency shows categorical measure which comes in the same table. Total number of participants were 232 which are the residents of the Peshawar. The Percentage column shows the percentage of all observations fall in this category. There are 8% respondents that Bicycle are easily cost for transport, 78% respondents that Bus Rapid Transit (BRT) easily

cost for transport, 2% respondents that local bus easily cost for transport and 12% respondent that using walking usually

Table 14: Travel through BRT

	Percent
once a week	36%
1-3 days a week	24%
4-7 days a week	40%

The above table shows the response of the respondents when asked how often they ride BRT majority of the respondents travel using BRT 4-7 days a week which is 40 %. 24 % of the respondents said that they travel through BRT 1-3 days a week. 36 % of the respondents said that they travel via BRT once a week.

Table 15: BRT buses reach in every 10 minutes or more regularly

	Percent
Yes	81%
No	12%
Not Important	7%

In order to know about the efficiency of the BRT in terms of if they arrive at the platform on time respondents were ask to state their perception about it. The above table shows the response of the respondents. Majority of the participants of the survey responded in the favor of the consistent time pattern of the BRT and only 12% of the respondents said that bus arrives late than its regular time. For 7 % of the respondents, it doesn't matter if bus arrives on time or is late, as at per the interaction they don't put much weight in the consistency of the BRT arrival at platforms

Table 16: Perception regarding distance between stops

	Percent
Like	76%
Dislike	17%
Not Important	7%

BRT facilitates its consumer through various types of buses which basically differ due to the number of stations a bus will stop at. Firstly, there are buses which stop at every station for taking and dropping the passenger and then there are those which stops at few stations so that those who have to reach at destinations can reach in less time. Respondents were asked regarding their perception about the buses categorization and the services they provide. Majority of the respondents i.e., 76 % stated that they like the way the buses are differentiated as it helps them in reaching to their destination on time. With only 17% against the way the BRT operate in terms of buses mobility.

Table 17: BRT pick and drop of passengers

	Percent
Like	74%
Dislike	16%
Not Important	10%
Total	100

The table of frequency consist of 2 major columns of summary measure. The column of the frequency shows categorical measure which comes in the same table. Total number of participants were 232 which are the residents of the Peshawar. The Percentage column shows the percentage of all observations fall in this category. There are significantly 74% respondents have Like the BRT station reducing time for required to pick and drop of passengers, 16% respondents have disliked the BRT station reducing time for required to pick and drop of passengers and 10%

respondents are not giving importance the BRT station reducing time for required to pick and drop of passengers.

Table 178: BRT Buses operating

	Percent
Like	77%
Dislike	14%
Not Important	9%
Total	100

The table of frequency consist of 2 major columns of summary measure. The column of the frequency shows categorical measure which comes in the same table. Total number of participants were 232 which are the residents of the Peshawar. The Percentage column shows the percentage of all observations fall in this category. There are significantly 77% respondents have Like the BRT Buses operating in separate line and that they can bypass the traffic congestion, 14% respondents have disliked the BRT Buses operating in separate line and that they can bypass the traffic congestion and 9% respondents are not giving importance the BRT Buses operating in separate line and that they can bypass the traffic congestion.

Table 1918: Three elements of BRT

	Frequency	Percent
Enhanced Stations: BRT Passengers wait at attractive shelters with seating, lighting,	100	49%
BRT Vehicles: High ridership BRT corridors use three-door low-floor articulated buses	48	24%
Real-time bus arrival Information: Real-time bus arrival information is displayed at monitors at BRT stations	56	27%
Total	204	100

The respondents were asked regarding their perception about the facilities that are provided at BRT stations and they are to select which is the most important of them all according to them. Majority of the participants of the survey which is 49 % considered the shelter at the

BRT stations for the passengers as important followed real time arrival information of buses which is 27 %. Only 24 % of the respondents considered the three-door low-floor articulated buses as important.

Table 20: Off-Set Bus Lane

	Percent
Like	47%
Dislike	18%
Others	35%

The Percentage column shows the percentage of all observations fall in this category. There are 47% participants have like the Off-Set Bus Lane, 18% participants have disliked the Off-Set Bus Lane and 35% participants have other options.

Table 21: Physically Separated Busway

	Percent
Like	88%
Dislike	9%
Others	3%

The participants of the survey are asked about their view and experience regarding separate bus way for BRT. The above table shows the statistics of the respondents. 88% of the respondents liked the separate bus ways as it reduces travel time plus the bus avoids congestion that it had to face on normal routes that are their for other types of vehicles. Only 9 % of the respondents didn't like the separate busways.

Table 22: Feel about BRT as a solution to transportation

	Percent
I support more BRT routes.	81%
I do not support more BRT routes.	10%

I support more BRT routes but have some concerns.	9%

The Respondents were asked regarding BRT as an alternative to other transit modes and the expansion of BRT routes. The above table shows the response of the participants of the survey in this regard. 81 % of the respondent's support BRT expansion with more routes to cover more area of the city, as according to them it provides a service that should be used as an alternative for all other transit modes for the public. Only 10% of the respondents responded against it. With 9% supporting the expansion of BRT to more route but they had some concerned with the BRT.

Table 2319: Monthly Average Income and Gender

Monthly Average Income	Gender		Total
	Male	Female	
Up to 20,000	16	16	32
21,000-40,000	8	8	16
41,000-60,000	32	20	52
61,000 & above	8	48	56
Total	64	92	156

Contingency tables, which describe the interaction between two category variables, are created using the Crosstabs process. There are 45% respondents were Male and 55% were female and females have more Monthly Average Income from males.

Table24: Monthly Average Income and Age Group

Monthly Average Income	Age Group			Total
	01-20	21-40	41-60	
Up to 20,000	8	24	0	32
21,000-40,000	4	4	8	16
41,000-60,000	12	36	4	52
61,000 & above	20	32	4	56
Total	44	96	16	156

Contingency tables, which describe the interaction between two category variables, are created using the Crosstabs process. There are 25% respondents were zero to 20 aged, 68% respondents are 21-40 aged and 7% respondents are 41-60 aged and Age Group 21-40 have more Monthly Average Income from other groups.

Table25: Monthly Average Income and Occupation

Monthly Average Income	Occupation				Total
	Public sector	Private sector	Self-employee	Students	
Up to 20,000	0	8	0	16	24
21,000-40,000	0	0	0	16	16
41,000-60,000	16	8	0	24	48
61,000 & above	0	0	4	52	56
Total	16	16	4	108	144

Contingency tables, which describe the interaction between two category variables, are created using the Crosstabs process. There are 12% respondents were public sector occupation, 8% respondents were private sector occupation, 2% respondents were self-employee, and significantly 78% respondents were belonging from students. And students have more Monthly Average Income from others Occupation Public sector, Private sector and Self-employee.

Table26: Monthly Average Income and Residing type

Monthly Average Income	Residing type		Total
	Owned	Rental	
Up to 20,000	12	8	20
21,000-40,000	8	8	16
41,000-60,000	48	4	52
61,000 & above	44	4	48
Total	112	24	136

Contingency tables, which describe the interaction between two category variables, are created using the Crosstabs process. There are 71% respondents were owned home in Peshawar, 29% respondents were rental homes in Peshawar. And Owned Residence have more Monthly Average Income from Rental homes.

4.3. Correlations

A correlation (Pearson) is a number between -1 and +1 that represents the degree to which two quantitative variables are linear. The strength of a linear relationship between two (and only two) variables is estimated using correlations. The correlation coefficients range from -1.0 (perfect negative correlation) to 1.0 positive correlation (perfect positive correlation) (perfect positive correlation). The higher the connection, the closer the correlation coefficients are to -1.0 or 1.0. The weaker the link between the two variables, the closer the correlation coefficient is to zero. Ordinal or relative (or group) data should be used. Nominal data is not used in the types of relationships we are examining.

BPT: Best Public Transport
G: Gender
AG: Age Group
ES: Education Status
MAI: Monthly Average Income
O: Occupation

RT: Residing type

Residing type Table 2720: Correlations

Pearson Correlation	BPT	G	AG	ES	MAI	O	RT
BRT	1.000	-.005	-.123	-.025	-.301	.188	.235
G	-.005	1.000	-.229	-.006	.076	.535	-.067
AG	-.123	-.229	1.000	-.243	.035	-.185	.000
ES	-.025	-.006	-.243	1.000	.282	-.211	-.023
MAI	-.301	.076	.035	.282	1.000	-.066	-.384
O	.188	.535	-.185	-.211	-.066	1.000	.031
RT	.235	-.067	.000	-.023	-.384	.031	1.000

If the value is close to 1, the relationship is perfect: when one variable is increased, the other variable tends to increase (if it is positive) or to decrease (if it is negative) (if it is negative).
High degree: if the value of the coefficient is between 0.50 and 1, it is considered a strong link.

The analysis of the correlation matrix clearly shows that BPT, G, AG, ES, MAI, O and RT are negatively and positively correlated, however if the value of the coefficient is between 0.50 and 1 then the correlation is high.

4.4. Primary Data Analysis

4.4.1. Model Summary

The model summary table shows the strength of the association of the model with the dependent variable. The linear correlation between the values seen and predicted by the model of the dependent variable is known as R, or multiple correlation coefficient. Its high value suggests a strong connection.

Table 28: Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.596[a]	.357	.312	.46898	.157	3.496	6	113	.003	2.110

a. Predictors: (Constant), Residing type, Age Group, Occupation, Education Status, Monthly Average Income, Gender
b. Dependent Variable: 6. What are the best public transport in the Peshawar?

R Square, the coefficient of determination, is the squared value of the multiple correlation coefficient. It shows that 35.7% of the variation over time is explained by the model. R Square Adjusted 31.2% is a "corrected" R Square statistic that penalizes models with many parameters. These statistics, along with the standard error of the estimate, are very useful as comparative measures in choosing between two or more models. The Durbin Watson (DW) statistic is an autocorrelation test in the output of a regression model. The DW statistic ranges from zero to four, with a value of 2.0 indicating zero autocorrelation. Values less than 2.0 mean there is positive autocorrelation and above 2.0 indicate negative autocorrelation and Durbin-Watson 2.110 indicates negative autocorrelation.

4.4.2. ANOVA Test

Using the P (Sig) value in the ANOVA output to determine if the differences between any of the means are statistically significant. If the p-value is less than or equal to the significance level, you reject the null hypothesis and conclude that all population means are not equal.

Table 29: ANOVA Test

Model	Sum of Squares	Df	Mean Square	F	Sig.
Regression	4.613	6	.769	3.496	.003[b]
Residual	24.853	113	.220		
Total	29.467	119			
a. Dependent Variable: Best Public Transport (BRT)					
b. Predictors: (Constant), Residing type, Age Group, Occupation, Education Status, Monthly Average Income, Gender					

"The *, **, and * asterisks indicate the level of significance at 1%, 5%, and 10% respectively".**

The ANOVA result indicating the value of F that appears in the Between Groups row (see above) and whether it is significant (next column). The value of F is 3.496, which reaches significance with a p-value of 0.003 (which is less than the alpha level of 0.05). This means that there is a statistically significant difference between the means of the different levels of the variable.

4.4.3. Model Fitting Information

Table 3021: Model Fitting Information

Model	Model Fitting Criteria	Likelihood Ratio Tests		
	-2 Log Likelihood	Chi-Square	df	Sig.
Intercept Only	101.892			
Final	8.716	93.176	24	.000

This is a test of the likelihood ratio of the model (Final) against a model in which all the coefficients of the parameters are 0 (Null). The chi-square statistic is the difference between the -2 log-likelihoods of the Null and Final models. Since the significance level of the test is less than 0.05, this concludes that the final model outperforms the Null model.

Table 3122: Likelihood Ratio Tests

Effect	Model Fitting Criteria	Likelihood Ratio Tests		
	-2 Log Likelihood of Reduced Model	Chi-Square	df	Sig.
Intercept	8.716a	0.000	0.000	.
Gander	21.971b	13.255	2.000	0.001
Age	8.716b	.	4.000	.
Education	34.103	25.387	4.000	0.000
Monthly Income	17.642b	8.926	6.000	0.178
Occupation	35.083b	26.367	4.000	0.000
Type of Home	31.325	22.609	2.000	0.000

The chi-square statistic is the -2 log-likelihood difference between the final model and a reduced model. The scale model is formed by omitting an effect from the final model. The null hypothesis is that all the parameters of this effect are 0.

a. This reduced model is equivalent to the final model because omitting the effect does not increase the degrees of freedom.

b. unexpected singularities in the Hessian matrix are encountered. This indicates that either certain predictor variables should be excluded, or certain categories should be merged.

4.4.4. Multinomial Logistic Regression

Multinomial logistic regression is used based on several independent variables to estimate categorical placement or possibility of group inclusion on a dependent variable. The independentvariables can be either dichotomous, continuous (i.e., binary) or (i.e., interval or scale ratio). Multinomial logistic regression is a basic extension of binary logistic regression that requires the dependent or outcome variable to have more than two types. Multinomial logistic regression, like binary logistic regression, uses a full probability estimate to determine the likelihood of categorical inclusion (Starkweather, 2011).

Table 3223: Multinomial Logistic Regression

Variables	Coef.	Std. Err.	z	P>z
Male	-17.07669	1968.515	-0.01	0.093
Female	-14.85991	1968.515	-0.01	0.094
Age group 01-20	16.06644	1968.515	0.01	0.993
Age group 21-40	18.02255	1968.515	0.01	0.093
Age group 41-60	.8711903	.043093	-2.79	0.005
Age group Above 61	104.7766	168.387	2.89	0.004
Education - Illiterate	34.00754	4027.621	0.01	0.993
Education - Primary	0.4547291	3420.527	0	1.000
Education - High	-2.755122	0.908198	-3.03	0.002
Education - Graduate	-1.914129	0.78878	-2.43	0.015

Monthly Income Upto20000	0.1617385	0.605331	0.27	0.789
Monthly Income 21000-40000	213.8498	353.2461	3.25	0.001
Monthly Income 41000-60000	-0.056631	0.646707	-0.09	0.030
Monthly Income 61000 Above	-0.893292	0.577639	-1.55	0.122
Occupation - Public Sector	0.3164663	0.818404	0.39	0.099
Occupation – Private Sector	0.6130035	0.867074	0.71	0.080
Occupation – Self-Employee	.8336694	.77145	1.08	0.280
Occupation - Students	-0.098028	0.658907	-0.15	0.082
Home - Owned	0.1540567	0.62536	0.25	0.005
Home - Rental	0.4948519	0.713613	0.69	0.488
Home - Shacks	.1177131	1.12463	0.10	0.917
R square	33%			

"The *, **, and * asterisks indicate the level of significance at 1%, 5%, and 10% respectively".**

The table results of regression show that, Male, Female, Age group 21-40, Age group 41-60, Age group Above 61, Education – High, Education – Graduate, Monthly Income 21000-40000, Monthly Income 41000-60000, Occupation - Public Sector, Occupation – Private Sector, Occupation – Students and Home – Owned were contacted and to discuss that they have recommended and significantly correlated with dependent variables best transport BRT in Peshawar. The summary table of the model R represents the relationship between the variables, R squared explains the variance of the dependent variable because of the variance of the independent variable and which are 33% the variance of the dependent variable is explained by the variation independent variables and that statistical models represent.

The table of coefficients represents the coefficient values which means percentage change in the dependent variable because of one unit increase in the independent variable. The t value enables the researcher to decide upon the acceptance or rejection of hypotheses with significance value less than .05. the Coefficient values representing the percentage of each

variable in the dependent variable with the increase and decrease by one unit in the independent variable. The P>z value for Age group 41-60 is p = 0.005 shows that Age group 41-60 had significant impact on best transport and positively correlated with coefficient value .8711903. The P>z value for Age group Above 61 is p = 0.004 shows that Age group Above 61 had significant impact on best transport and positively correlated with coefficient value 104.7766. The P>z value for Education - High is p = 0.002 shows that Education - High had significant impact on best transport and negatively correlated with coefficient value -2.755122. The P>z value for Education - Graduate is p = 0.015 shows that Education - Graduate had significant impact on best transport and negatively correlated with coefficient value -1.914129. The P>z value for Monthly Income 21000-40000 is p = 0.015 shows that Monthly Income 21000-40000 had significant impact on best transport and positively correlated with coefficient value 213.8498. The P>z value for Monthly Income 41000-60000 is p = 0.030 shows that Monthly Income 41000-60000 had significant impact on best transport and negatively correlated with coefficient value -0.056631. The P>z value for Home - Owned is p = 0.005 shows that Home - Owned had significant impact on best transport and positively correlated with coefficient value 0.1540567.

4.5. **Socio-Economic Cost Benefit Analysis**

In Peshawar, Pakistan, the Asian Development Bank helps provide safe and contemporary urban transport systems. The project featured the development of the city 1st bus rapid transit route, which comprised 31 stops, as well as cycling pathways and child and women's safety features. The technology is expected to benefit 500,000 people by improving air quality and reducing congestion.

Table 3324: Source of Funding / Amount

Ordinary capital resources for Corridor Project loan	USD $ 335 Million
AFD Corridor Project Loan	USD $ 150 Million
European investment bank Corridor Project Loan	USD $ 75 Million

The project supports the development of a sustainable urban transport system in Peshawar by supporting the city's first integrated BRT corridor, which are directly benefit 0.5 million people. The project is successful in two areas: 1) the development of a 26 km BRT route and related infrastructure, including 2) the long work operation and management of the BRT including structural adjustment. The construction is financially rationalized by considerable time savings for upcoming passengers of BRT, transportation operational cost savings, healthier environment, as well as reduce carbon emissions, all of these are beneficial to passengers' health. Consider the effects of climate change in the Peshawar city.

4.5.1. Importance of the Project Rationale with Country and Regional Strategy

Peshawar is capital of Khyber Pakhtunkhwa province in the northwestern part of the country. Peshawar is located in the Indus Valley, near the Afghan border, a 2-hour drive from the national capital Islamabad. While the last collection of information in 1998, about the population of the city of Peshawar was estimated at 1.8 million in 2016 and is expected to reach 3.0 million until 2030 as the current high growth rate. Due to the domestic displacement of Afghans from Afghanistan to Pakistan as refugees, it is also a major reason for population growth, which is very difficult to provide food, shelter and transportation services. Ownership of cars and motorcycles remains low but is increasing as the number of middle-class people increases. Together with additional aspects, for example unproductive public transport and controlling deprived traffic to form difficult modes of transport, the increasing number of vehicles harms

overcrowding and increases air and noise pollution. The worst traffic system is now very difficult to manage and now the speed has dropped to an average speed of 11 km per hour in major cities like Peshawar. The public transport budget has been insufficient for years. On the other hand, the current large investments in various overflights are a reminder of the importance given to private transportation. The city urban transportation structure does not give flexibility for everyone related to limited infrastructures.

Poverty is particularly common in Peshawar, with 40% of the population living in poverty. In comparison to men, who have a 10% unemployment rate, women have a 90% jobless rate. Women have fewer job prospects than men. Low-income people still travel on foot or with small and large vehicles for the transport service of the 80s and 90s, even though such cars only meet 70% of passenger volume and account for just 43% of overall traffic, they account for 70% of total traffic.

Due to the high demand for vehicles for transportation, many operators operate without a license and use the major city corridors unproductively. There is a lack of omission of public transport demand, ignoring the quality of transport vehicles, the bus station is not well maintained, the ticket system is worse and there are no safety measures. Traffic problems are increasing, affecting pedestrians. 84% of the participants indicate that during office and school hours the traffic system is uncontrollable or unmanageable and the behavior of drivers and drivers is not good. An accessible and well-classified public transport structure bring relief and benefit to the poor of the city of Peshawar, especially women.

The Preparation of the project and pre-feasibility study to modernize the urban transport infrastructure was completed in May 2014, the Asia Cities Development Initiative completed a pre-feasibility study to improve Peshawar's urban transport system. Following that, the Asian

Development Bank (ADB) gave technical support city of Peshawar in the preparation of the BRT corridor. The ADB also approved a $10 million Project Design Advance Loan (PDA) from ADB Regular Capital Resources (OCR) in November 2016 to prepare the detailed engineering design, facilitate operative development and pre-purchase for public works and apparatus. The tender for the first civil works lots started in May 2017. The preparation of the project is evidenced by the need to sign contracts and mobilize contractors on the way to start out production as soon as the credit is offered. was approved and entered into force, probably in the fourth quarter of 2017.

Agreement with the country's plan. The plan is in keeping with Pakistan's 2030 vision, growth of the economy frameworks, and global climate policy. It would be in keeping with both the ADB Development Cooperation Strategy and the Sustainable Transportation Initiatives, and it complements the objectives stated throughout the KPK Sustainable Development Model 2014-2018. The implementation plan considers insights learnt with previous aid, such as the importance of political agreement and then a governance framework. Collaboration between development agencies, particularly potential co-financiers including such ADB and the European Investment Bank, has been ensured. The finance sector is expected to participate in BRT activities (section 20), and not in development, because so few public transportation services in the world recoup its investments only from fares, and costs should be reasonable and acceptable.

The following ADB support value added in the BRT Project:

i) Changes in institutional and organizational frameworks. Its ADB supported pass legislation for (a) the Khyber Pakhtunkhwa Public Transit Law, which formed the Khyber Pakhtunkhwa Urban Mobility Authority (KPUMA) and (b) a specialized vehicles named TransPeshawar, which has been established in December 2016. KPUMA oversees creating rules and procedures, as well as planning, coordinating, and funding regional urban transportation. at

the provincial level. TransPeshawar was in management of the BRT's infrastructures, as well as the BRT's operation and maintenance continuous performance.

(ii) Development of project design and innovation. ADB intervention resulted in innovative design features such as (a) promotion of non-motorized transport through universal accessibility, inclusion of bicycle lanes along the BRT corridor and a bicycle sharing system at the University of Peshawar; (b) _lane sidewalk for BRT lanes reserved; (c) a modern fare collection system that uses smart cards to enable distance-based fares; and (d) the use of satellite imagery to map the corridor and facilitate engineering design.

(iii) Operational planning and financial sustainability. ADB has pushed for a 3rd generation BRT project that uses a _service immediate operation strategy, which allows BRT buses to have been along the BRT route into congested regions and depart in the less crowded areas. That approach increases the passengers and capability of the system, reduces the number of passengers, and increases the number of passengers and financial viability. The project's major goal was to lower the amount of operational subsidy required and to generate income from parking and commercial development.

(iv) Shareholder participation and, transition of bus operation. ADB places a strong emphasis on meeting the current bus industry and has proven to have a collaborative process through which current operators can contribute to the new structure of BRT. A vehicle rasps program and a recompense tool of non-participating hands are also included in the project's structure. To validate the membership of organizations impacted by the project, a major shareholder involvement and contribution strategy is already in the works.

The effect of the project on a safe, reasonable, convenient and environmentally friendly transport structure in Peshawar has been achieved and the superiority of life in Peshawar has been improved.

4.5.2. Demand Estimate

The analysis assumed that most passengers would come from the existing informal public transport system operating on BRT routes, with 50% to 100% of passengers in buses, station wagons and vans being transferred to BRT. Based on the examples observed in previous projects, a moderate modal shift of 7% over private vehicles. Table 34 shows current passenger demand on the project's route, based on information gathered by that of the Asian Development Bank's (ADB) Projects Preparatory Technical Assistance Team (PPTA). 476,838 passengers from various forms of transportation are anticipated to have converted to the BRT.

Table 3425: Demand of the Passengers before and after mode

Mode	Passengers demand on daily basis (base case)	BRT % shift to modal	Passengers demand on daily basis (project)
Motorcycles	26915	7%	25031
Bicycle	1165	0%	1165
Car	87923	7%	81768
Suzuki pickup truck	203639	50%	101820
Large bus	44601	50%	22301
Rickshaw	82211	50%	41106
Taxi	49902	25%	37427
Minibus	236483	100%	
Station wagon	50006	100%	
Datsun pickup truck	9219	50%	4610
Mixed Traffic Total	792064		315226
BRT			476838

Source: Estimates from the ADB

In Table 35 Future BRT trip progress is estimated at 3.5% per year after seeing population growing forecasts, earliest trends in travel growth, and the evolution of car tenure and travel costs by approach. The projected annual BRT ridership.

Table 3526: Yearly Bus Rapid Transit Passenger Numbers Estimates

	2020	2025	2030	2035
Yearly Bus Rapid Transit Passenger Numbers Estimates	158870438	188688244	224102443	266163403

Source: Estimates from the ADB.

Alternative Peshawar mobility solutions, like as formalizing the current informally infrastructure, a first-generation "trunk only" BRT structure, and rail line, were all explored throughout the decision-making process. Although these alternatives did not have a sound cost-benefit analysis, they were excluded for other reasons. The formalization of the informal system appears to have no effect on increasing vehicles speed or reducing VOCs. Because a single trunk BRT system only services a small portion the Peshawar's transportation needs but also requires many transfers, it was deemed impossible to just be economically sustainable. Because of the long implementation period and relatively expensive investment costs, rail service was ruled out. As shown in the table below, the BRT design used for the project meets the needs of Peshawar demands better efficiently and economically than with the alternative.

4.5.3. Cost–Benefit Analysis

The introduction of BRT as just a modern means of transportation improves Peshawar in both directly and indirectly. The immediate benefits of the BRT system include lower operating costs for the urban transport system, shorter travel time for transit users switching from existing modes to BRT, and shorter travel times. displacement for users of other modes of transport due

to road congestion. network. Indirect benefits include lower costs related to greenhouse gas emissions and road accidents.

Based on ADB's Guidelines, the project's economic viability was assessed by examining the project's economic internal rate of return (EIRR) and net present value with a discount rate of 9%. Starting in 2017, the evaluation expected a two-year project implementation time, after then, there will be a 20-year life cycle of economics (2019 to 2039). The cost data for 2017 is based on a study of constant pricing. This estimate is based on domestic costs.

4.5.4. Project Costs

Capital Costs. The economic assessment included the following investment costs: (i) investment costs, including civil works, rolling stock and equipment; (ii) project engineer services; and (iii) structural constraints; (iv) expenses of mitigating social and environmental consequences, including compensating for relocation and the costs of supporting a vehicle scrapping programme for informal provider.

Operation costs. Its mentioned operational costs were included in the analysis: (i) cost borne by TransPeshawar, a newly established state-owned enterprise responsible for the management of a public transport and maintenance of the BRT transportation system (construction servicing approximated at 2% of infrastructure projects each year); and (ii) costs borne by vehicle drivers, including vehicle operation and maintenance costs. (iii) the costs of operating the ticketing system, stations service (such as cleanliness, beautification, and payment collecting), a transportation infrastructure, and revenues distribution systems; and (iv) the cost of vehicles maintenance and replacements (calculated based mostly on vehicle's rated life).

Tax & levies, as well as finance expenses incurred throughout development and price variations, are not included in the socioeconomic cost calculations. According to ADB rules,

economic costs have been changed to economic consequences. A differentiation has been drawn among trade and non-traded items, with the traded goods receiving a notional currency exchange component of 1.039. For unskilled jobs, a dummy salary component of 0.85 was calculated and used.

4.5.5. Vehicle Operating Cost

The mean VOC/km across transportation systems, including fuel, maintenance, and driver expenditures, was 71.7 PRs/km, according to the PPTA research. The cost of the BRT vehicles was determined using the following factors: the vehicles' actual fuel usage (km per travelled); the cost of replacement materials (hydrocarbon, filter, and Tyr, at 3.7 PRs/km); different vehicles maintenance charges (PRs3.5/km); and driver and mechanic costs.

The basic transport scenario's vehicles kms travelled (VKT) are targeted based on data collected either by PPTA staff in 2016. In 2020, the VKT of mass transit along the BRT corridor is expected to be 33,306,284 per year. In 2020, the VKT for the BRT fleet will be 28,736,264 per year. The two VKT statistics had been rising at a rate of 3.5 percent each year on average, in line with the expansion in ridership. In 33, the annual VKT estimate in the base scenario and the project are shown. The low VKT inside the projects example is due to the BRT vehicles' greater capacity and the increased efficiency gained by moving them. the total passengers expected to use the development section.

Table 3627: Vehicles Km Estimated and the Bus Rapid Transit Corridor for public transportation

	2020	2025	2030	2035
Base case of VKT	33306284	39,557,417	46,981,803	55,799,644
Project case of VKT	28736264	34,129,668	40,535,339	48,143,267

VKT = vehicle kilometers travelled.

Source: Estimates from the ADB.

The reference VCT was divided mostly by mean VOC of a current equipment (PRs71.7 / km) to compute the VOC savings. The BRT service's operational costs (46.98 PRs / km) were divided by the system's estimated VKT. To calculate overall VOC savings, the service's cost has been removed from the cost of the existing system. Table 37 summarizes the findings.

Table 37: Saving on the vehicles operating cost in million

	2020		2025		2030		2035	
	PRs	$	PRs	$	PRs	$	PRs	$
VOC without BRT	2388	22.8	2837	27.1	3369	32.1	4001	38.2
VOC with BRT	1350	12.9	1603	15.3	1904	18.2	2262	21.6
VOC savings	1038	9.9	1233	11.8	1465	14	1740	16.6

BRT = bus rapid transit, PRs = Pakistan rupees, VOC = vehicle operating cost. Source: Asian Development Bank estimates.

4.5.6. Travel Time

Peshawar current transportation infrastructure is congested and inefficient, resulting into difficult and long travels of urban residents. Users of the BRT system have benefited from the project's quick and simple services, which has reduced travel time. On the BRT route, dedicated bus lanes allow for traffic-free travel, and while traffic outside the corridor can still affect buses, bus lanes have been built on the city's main arteries, where the majority of traffic jams occur. The project cut driving time all non-BRT passengers by helping to streamline the remainder of the traffic.

The transportation reductions have been calculated to use a demanding method to forecast that expected time gain because of the project after conducting origin-destination studies to get insight into current travelling time. The average time savings for individuals changing to BRT is expected to be 9.3 minute each passenger’s ride. Road users who do not use the BRT

should just save 2.6 mins each passenger travel for private carriers and 5.8 mins each passenger travel for public transportation users due to the decongestion impact (section 18).

Table 3828: Mixed Traffic and Bus Rapid Transit Passenger Travel Time Savings

Travel without BRT		Traveling by BRT takes less time (minutes)	Saving on travel time (total minutes)	Savings on travel time (percent)
Passengers of BRT	43.3	34	9.3	21
Passenger on a private plane (mixed traffic)	28.6	26	2.6	9
Passengers on public transportation (mixed traffic)	43.3	37.6	5.8	13

BRT = bus rapid transit.
Source: Estimates from the ADB.

Overall values of time (VOT) for such average road users were assessed to transform those obvious example saves towards economic benefits. The VOT for worktime was estimated as 84 PRs per hour depending on Pakistan's terms of per capita incomes of US $ 1,260.01 in 2020 (World Bank 2020) and considering that incomes are greater in metropolitan areas. The VOT was determined at 227 PRs per hour for higher-income taxi and vehicle riders. 4 Its VOT for time spent not operating were calculated to be twice that of time spent operating. Furthermore, it was anticipated that 50% of the journeys in the corridor were for business and 50% were for pleasure.

By calculating the physically efficiency gains described in Table 38 mostly by VOT, total travel savings were determined for both projected BRT riders and non-BRT users who would benefit from the congestion on the roads. Table 39 shows the value of transport costs for mixed traffic and BRT riders.

Table 3929: Travel Time Cost Savings for Bus Rapid Transit Passengers and Mixed Traffic (million)

	2020		2025		2030		2035	
	PRs	$	PRs	$	PRs	$	PRs	$
BRT passenger travel time savings	1551	14.8	1843	17.6	2188	20.9	2599	24.8
Mixed traffic travel time savings	8296	79.2	8296	79.2	8296	79.2	8296	79.2
Total Travel Time Cost Savings	9847	94	10139	96.7	10484	100	10895	104

BRT = bus rapid transit, PRs = Pakistan rupees. Source: Estimates from the ADB.

4.5.7. Road Safety

Road accidents cost society a lot of money, including productivity losses for those who are involved. The average yearly number of crashes is related positively to VKT, according to studies. As a result, when the VKT is lower, the rate of road accidents and the associated with social costs were decreased.

Accident data for Khyber Pakhtunkhwa was gathered from of the Bureau of Statistics to calculate the worth of a reduced expenses of road crashes. To avoid an exceptional event from changing the results, the average value from 2004 to 2013 was determined. The rate of road accidents in Peshawar was calculated on the basis on the city's population in relation to the provinces. The overall cost of anticipated collisions was calculated by using the following: 27.7 million RP ($ 264,000) for fatalities and 1.4 million RP ($ 13,000) for severe injuries. In the analysis, 5 numbers have been changed to 2017 values.

Even though the pace of accident development fluctuates year to year, as the VKT rises, the estimated yearly number of accidents is predicted to rise or fall. Because of program sought to decrease VKT public transit by around 3 million kilometers per year and replace unsafe forms of transportation with safer options, deaths and serious injuries are projected to be 17.5 percent reduced than they would have been if the project had not been implemented. Using the data and

methodology outlined below, the cost of the security saving was estimated by setting the baseline road accident cost then deducting overall projected road collision costs for the project. -above.

4.5.8. Carbon Emissions

The Transportation Emissions Assessment Model for Projects was used to calculate the carbon emission reductions (TEEMP), the industry standard developed by Clean Air Asia, ADB and other partners. Data on VKT, ridership and modal split with and without the project are entered into the model, which then produces an estimate of reduced tones per year. The carbon emission reductions were then multiplied by a social cost of carbon of $ 36.30, in accordance with ADB guidelines.

Results and Sensitivity

The project's EIRR was determined to be 15.4 percent, well exceeding the minimal economic benefit of 9.0 percent necessary for a Factors that are important project, as shown in Table 35. Sensitivity tests are used to determine how sensitive a product is. To obtain a valid outcome, the analysis includes sensitive testing. The following scenarios were explored in such tests: a 20% increase in construction expenses, a 20% fall in passenger traffic, and two years wait in system launch. All situations meet the ADB criteria, as illustrated in Table 40.

Table 4030: The Economic Analysis' Findings (Including Sensitivity Tests)

Test Parameter/Result	Base	Scenario A	Scenario B	Scenario C
EIRR	0.15	0.12	0.14	0.12
Net current income values in $ million	201	120	172	261
Cost benefit ration	1.29	1.15	1.25	1.39
Value of switching	N/A	0.55	–26%	N/A

EIRR = economic internal rate of return, N/A = not applicable.
Net present value discounted at 9%. Source: Estimates from the ADB.

Table 41: Results of the Economic Analysis ($ million, 2017 prices, undiscounted)

Year	VOC Saving	Time Saving	Safety Saving	Carbon Saving	Total Econ. Benefit	OPEX	CAPEX	Total Econ. Costs	Net Econ. Benefit
2017	-	-	-	-	-	-	240.7	240.7	–240.7
2018	-	-	-	-	-	-	216.1	216.1	–216.1
2019	9.6	93.5	2.5	1.4	106.9	28.1	-	28.1	78.8
2020	9.9	94	2.5	1.5	107.9	31.1	-	31.1	76.8
2021	10.3	94.5	2.5	1.6	108.9	31.5	-	31.5	77.4
2022	10.6	95	2.5	1.7	109.9	31.9	-	31.9	78
2023	11	95.6	2.5	1.9	111	32.4	-	32.4	78.6
2024	11.4	96.1	2.5	2	112	32.9	-	32.9	79.2
2025	11.8	96.7	2.6	2.1	113.2	33.4	-	33.4	79.8
2026	12.2	97.3	2.6	2.2	114.3	33.9	-	33.9	80.3
2027	12.6	98	2.6	2.2	115.4	34.6	-	34.6	80.8
2028	13	98.6	2.8	2.3	116.8	35.2	-	35.2	81.6
2029	13.5	99.3	2.9	2.3	118	35.9	-	35.9	82.1
2030	14	100	2.9	2.4	119.3	36.7	-	36.7	82.6
2031	14.5	100.8	2.9	2.4	120.5	113	-	113	7.5
2032	15	101.5	2.9	2.5	121.9	41	-	41	80.9
2033	15.5	102.3	2.9	2.6	123.2	42	-	42	81.2
2034	16	103.1	2.9	2.6	124.7	43.1	-	43.1	81.5
2035	16.6	104	3.2	2.7	126.4	44.3	-	44.3	82
2036	17.2	104.8	3.2	2.7	127.9	45.6	-	45.6	82.3
2037	17.8	105.7	3.2	2.8	129.4	47	-	47	82.5
2038	18.4	106.6	3.2	2.8	131.1	48.5	-	48.5	82.6
2039	19	107.6	3.2	2.9	132.7	50.1	-	50.1	82.7

CAPEX = capital expenditures, Econ. = economic, OPEX = operational expenditures, VOC = vehicle operating costs. Source: Estimates from the ADB.

4.5.9. Analysis of Financial

The estimated financial analysis was conducted in accordance with the ADB's finance reporting and planning guidelines. The construction and its operating plan were designed to ensure that now the BRT system's earnings match its operating and maintenance expenditures,

which are expected to be $ 32 million in 2020. Operating and maintenance expenditures, as well as civil engineering works, technology, consultants, and environmental and social offset expenses, such as the acquisition of all vehicles with such a 12-year projected life. The management business, TransPeshawar, is not liable for repaying the loan amount initial investment.

Tariffs, advertising, leases for refreshments and stores in stations or depot, and car park income are all governed by the BRT system. Most significant source of income, fare revenue, was estimated to use an estimated mean price of $ 0.23 (PR25) per travel. Ad revenue is projected to be 3% of price income, with restaurant and parking income determined by utilization. In 2020, those sectors are expected to produce $ 40 million in income.

These funds will be used to pay for all operational and maintenance expenditures and the procurement of additional vehicles to satisfy anticipated demand and fleet replacement costs. The tariff funds were collected and dispersed by a financial compensation firm. The cost of operating a vehicle was calculated per kilometer. Sanitation, safety, and staffing services at the station were also farmed outsourced. Experts from the African Construction Bank are now assisting in the investment of a comprehensive operating and economic strategy, which includes assessing the proper each km payment for commercial bus drivers.

The government of Khyber Pakhtunkhwa has opted to regard the capital cost (which includes the BRT facilities and the first vehicle) as a subsidy and would not recoup this investment from the system's operational earnings. The government plans to maintain the system's financial viability by limiting or perhaps eliminating the requirement for operating subsidies, which would disrupt other BRT system in Pakistan, like those in Lahore and Islamabad-Rawalpindi. A traditional financial assessment based on a cash flow analysis leading

to the computation of an internal financial rate of return is not regarded adequate in the absence of a cost recovery tariff.

Rather, the operational accounting ratios has been used to guarantee that revenues were sufficient to meet operational expenses. Table 43 summarizes overall findings of the study. Alternative scenarios have been investigated in addition to the original scenario. Scenario A implies that operational cost is 20% more than expected inside the base case, whereas scenario B predicts the tariff revenues were 20% lower than usual. Throughout every case, the proportion is less than 100%, showing that the project is economically sustainable.

Table 42: Operational Ratio Analysis ($ million) produced the following results

	2020				2025				2030			
	Costs	Rev.	Ratio	Net Cash Flow	Costs	Rev.	Ratio	Net Cash Flow	Costs	Rev.	Ratio	Net Cash Flow
Base Case	34	49	0.7	10	37	76	0.48	26	40	118	0.34	52
Scenario A	41	49	0.84	5	44	76	0.58	21	48	118	0.41	47
Scenario B	34	40	0.86	4	37	61	0.6	17	40	95	0.42	37

Rev. = revenue.
Source: Estimates from the ADB.

The taxes upon advantages of 33 percent have been used to calculate the net working capital. Trans Peshawar projected economic status demonstrates high cash flow and the corporation's economic capabilities to fund recurrent costs associated with the project's facilities. Furthermore, as passenger and GDP rise and function is to ensure improves, the organization could be able to raise rates and charge more now for marketing, ticketing, and refreshments, strengthening its capacity to meet operational and maintenance cost.

CHAPTER 5

CONCLUSION AND POLICY RECOMMENDATIONS

In this chapter, the study is briefly discussed and concluded behind the objective. The study based on Socio-Economic cost and benefit of BRT, the methodology comprises on cost and benefit. Data was collected through structured questionnaires from a sample of the respondents from the residents of Peshawar and secondary data from The Asian Development Bank (ADB) (ABD, 2017). The secondary data was used in quantitative analysis, the researcher was used it for cost benefit analysis and their findings were collected through a variety of methods, and often a researcher was used of the following while conducting a quantitative study.

Significantly received a response from the respondents which are used public transportation. The mostly respondents said that they took the bus for transportation. 36 percent of respondents travel the bus less than once a week, 24 percent who ride the bus 1 to 3 days a week, and 40 percent who ride the bus 4 to 7 days a week. There are substantial differences 81 percent of respondents prefer that high-traffic BRT bus routes arrive every five to ten minutes or more frequently, while 12 percent dismiss the fact that high-traffic BRT bus routes arrive every five to ten minutes or more frequently, and 7 percent dislike the fact that BRT bus lanes arrive every five to ten minutes or more frequently.

We concluded by using the multinomial logistic regression model that we can be able to define accurately the relationship between the group of explanatory variables and the response variable, identify the effect of each of the variables, and we can predict the classification of any individual case. The summary of the model R represents the relationship between the variables.

R squared explains the variance of the dependent variable because of the variance of the independent variable and which are 33% the variance of the dependent variable is explained by the variation independent variables which the models represent statistically. The Durbin Watson (DW) statistic is a test for autocorrelation in a regression model's output. The DW statistic ranges from zero to four, with a value of 2.0 indicating zero autocorrelation. The Values below 2.0 mean there is positive autocorrelation and above 2.0 indicates negative autocorrelation and that Durbin-Watson 2.110 indicates negative autocorrelation.

The analysis of financial was conducted in accordance with the ADB's finance reporting and planning guidelines. The construction and its operating plan were designed to ensure that now the BRT system's earnings match its operating and maintenance expenditures, which are expected to be $ 32 million in 2020. Operating and maintenance expenditures, as well as civil engineering works, technology, consultants, and environmental and social offset expenses, such as the acquisition of all vehicles with such a 12-year projected life. The management business, TransPeshawar, is not liable for repaying the loan amount initial investment.

Tariffs, advertising, leases for refreshments and stores in stations or depot, and car park income are all governed by the BRT system. Most significant source of income, fare revenue, was estimated to use an estimated mean price of $ 0.23 (PR25) per travel. Ad revenue is projected to be 3% of price income, with restaurant and parking income determined by utilization. In 2020, those sectors are expected to produce $ 40 million in income.

These funds will be used to pay for all operational and maintenance expenditures, as well as the procurement of additional vehicles to satisfy anticipated demand and fleet replacement costs. The tariff funds were collected and dispersed by a financial compensation firm. The cost of operating a vehicle was calculated per kilometer. Sanitation, safety, and staffing services at

the station were also farmed outsourced. Experts from the African Construction Bank are now assisting in the investment of a comprehensive operating and economic strategy, which includes assessing the proper each km payment for commercial bus drivers.

The government of Khyber Pakhtunkhwa has opted to regard the capital cost (which includes the BRT facilities and the first vehicle) as a subsidy and would not recoup this investment from the system's operational earnings. The government plans to maintain the system's financial viability by limiting or perhaps eliminating the requirement for operating subsidies, which would disrupt other BRT system in Pakistan, like those in Lahore and Islamabad-Rawalpindi. A traditional financial assessment based on a cash flow analysis leading to the computation of an internal financial rate of return is not regarded as adequate in the absence of a cost-recovery tariff.

Rather, the operational accounting ratios has been used to guarantee that revenues were sufficient to meet operational expenses. It the summarizes overall findings of the study. Alternative scenarios have been investigated in addition to the original scenario. Scenario A implies that operational cost is 20% more than expected inside the base case, whereas scenario B predicts the tariff revenues were 20% lower than usual. The proportion is less than 100% throughout every case, showing that the project is economically sustainable.

5.1. Recommendations

- The government should increase physical separation of dedicated bus lanes and more BRT Routs to connect the near cities.
- The provision of wheelchairs at stations, especially at elevated and underground stations, and trained helpers may increase passengers' trust on the system.

- Elevating station platforms and pre-payment of tickets should boost the speed of on/off boarding; express bus services should have passing lines to offer flexibility and speed to the system.
- To Enhance of public spaces and sidewalks in the area of BRT and bus terminals
- To Complete integration with other modes of transportation
- A marketing strategy for the entire system to attract users and increase access to route and service information.
- Rationalization of bus routes to improve efficiency and save fuel
- Quality improvements in the level of bus service (speed, schedules, and cleanliness) to enhance passenger security
- Invest in newer bus technologies, e.g., hybrids and electric, and fuels e.g., ethanol and sugarcane diesel.
- Each station at the BRT route should have a significant number of female security and assistance staff for the appropriate guidance of the female passengers to increase the number of passengers.
- The entry and exit points at stations need proper care to keep the unwanted vendors and beggars significantly away from the stations.

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Appendices

Survey Questionnaire (English)

Survey Questionnaire
Socio-Economic Cost and Benefit Analysis of Bus Rapid Transit (BRT) Peshawar

This questionnaire is aimed at collecting information about Socio-Economic Cost and Benefit Analysis of Bus Rapid Transit (BRT) Peshawar. It is a part of the research for a MPhil program at Pakistan Institute of Development Economics (PIDE), Islamabad to study the Socio-Economic Cost and Benefit Analysis of Bus Rapid Transit (BRT) Peshawar. If there is any part irrelevant to you then leave it blank. The personal information in the questionnaire will be treated with extreme confidentiality. Your participation in the questionnaire will be highly appreciated.

1. Demographic Information

Gender	***Age Group***	***Education Status***	***Monthly Average Income***
1. Male	*1. 01-20*	*1. Illiterate*	*1. Up to 20,000*
2. Female	*2. 21-40*	*2. Primary*	*2. 21,000-40,000*
3. Other	*3. 41-60*	*3. High*	*3. 41,000-60,000*
	4. Above 61	*4. Graduate*	*4. 61,000 & above*

Occupation	***Nationality***	***Residing type***
1. Public sector	*1. Pakistani*	*1. Owned*
2. Private sector	*2. Foreigner*	*2. Rental*
3. Self-employee		*3. Shacks*
4. Student		

2. Bus Rapid Transit (BRT)

1. Where you currently live in Peshawar city?

_____

2. How long have you lived in your current home?

Months_____ OR Years_____

3. How far do you live from Peshawar city?

_____ (Km)

4. Are you using public transport?

a) Yes b) No

5. What mode of transportation that you use most frequently in Peshawar? Please choose one:

a) Bicycle b) Car c) Bus Rapid Transit (BRT) d) Local Bus e) Walking f) Other

6. What is the best public transport in Peshawar?

a) Bicycle b) Car c) Bus Rapid Transit (BRT) d) Local Bus e) Walking f) Other

7. Which one of the following is better transportation in Peshawar?

a) Public transport
b) Private transport

8. Whose transport are easily cost?

a) Bicycle b) Car c) Bus Rapid Transit (BRT) d) Local Bus e) Walking f) Other

9. How often do you ride the bus?

a) Less than once a week
b) 1-3 days a week
c) 4-7 days a week

3. Bus Rapid Transit features

10. The five BRT features listed below are designed to increase the speed and reliability of bus service. For each feature, please indicate if you like the feature, dislike the feature, or feel the feature is not important.

		Like	Dislike	Not Important
i.	**Frequent service: On high ridership corridors BRT buses arrive every 5 to 10 minutes or more frequently.**	1	2	3
ii.	**Subway-like station spacing: Like subway stops, BRT stops are spaced about every half a mile or more, so that buses spend less time stopping and starting.**	1	2	3
iii.	**Traffic signal priority: BRT buses get an extended green light at intersections, reducing stop time at red lights.**	1	2	3
iv.	**Off-board fare payment: Customers pay their fares at the BRT station, reducing the time required to pick up and drop off passengers.**	1	2	3
v.	**Bus lane/Busways: BRT buses operate in bus lanes or physically separated busways so that they can bypass traffic congestion.**	1	2	3

11. The three BRT features listed below are designed to improve the comfort and convenience of bus service. Please select the one comfort and convenience BRT feature you feel is most important.

a) Enhanced Stations: BRT Passengers wait at attractive shelters with seating, lighting, and passenger information displays.

b) BRT Vehicles: High ridership BRT corridors use three-door low-floor articulated buses, which are easier to board and exit.
c) Real-time bus arrival Information: Real-time bus arrival information is displayed at monitors at BRT stations and available on the web, cell phones, and smart phones.

4. Bus Lanes and Busways

12. Off-Set Bus Lane

a) Like
b) Dislike
c) Other

13. Physically Separated Busway

d) Like
e) Dislike
f) Other

14. How do you feel about BRT as a solution to transit needs in Peshawar City? Please check one of the following:

a) I support more BRT routes.
b) I do not support more BRT routes.
c) I support more BRT routes but have some concerns. Please describe:

_____

15. Would you like to give feedback on these potential BRT corridors in the Peshawar?

a) Yes

_____

_____

_

b) No

Thank you for your time and cooperation.

Survey Questionnaire (Urdu)

سروے سوالنامہ
بس ریپڈ ٹرانزٹ (بی آر ٹی) پشاور کا سماجی و اقتصادی لاگت اور فوائد کا تجزیہ

اس سوالنامے کا مقصد سماجی و اقتصادی لاگت اور بس ریپڈ ٹرانزٹ (بی آر ٹی) پشاور کے فوائد تجزیہ کے بارے میں معلومات اکٹھا کرنا ہے۔ یہ بس ریپڈ ٹرانزٹ (بی آر ٹی) پشاور کے سماجی و اقتصادی لاگت اور فوائد کے تجزیے کا مطالعہ کرنے کے لئے ، (Pakistan Institute of Development Economics, Islamabd (PIDE ، اسلام آباد میں ایم فل(M.PHIL) پروگرام کے لئے تحقیق کا ایک حصہ ہے۔ اگر آپ کے لئے کوئی حصہ غیر متعلق ہے تو اسے خالی چھوڑ دیں۔ سوالنامے میں موجود ذاتی معلومات کے ساتھ انتہائی رازداری کا سلوک کیا جائے گا۔ سوالنامے میں آپ کی شرکت کو سراہا جائے گا۔

1. آباد یا تی معلومات

ماہانہ اوسط آمدنی		تعلیم کی حیثیت		عمر گروپ		صنف	
20,000 تک	1	ناخواندہ	1	20-0	1	مرد	1
40,000-21,000	2	پرائمری	2	40-21	2	تروع	2
60,000-41,000	3	ہائی اسکول	3	60-41	3	دیگر	3
61،000 سے اوپر	4	گریجویٹ	4	61 سے اوپر	4		

رہا ئش		قومیت		ہشیپ /رابوراک	
مالک ہے	1	پاکستانی	1	عوامی شعبہ	1
کرایہ پر لیا ہے	2	غیر ملکی	2	نجی شعبہ	2
ےڑپنوھج	3			رابوراک انپا	3
				طلباء	4

2. بس ریپڈ ٹرانزٹ (بی آر ٹی)

1 آپ اس وقت پشاور شہر میں کہاں رہتے ہیں؟

_____

2 آپ اپنے موجودہ گھر میں کتنے عرصے سے رہ رہے ہیں؟

مہینے _____ یا سال _____

3 آپ پشاور کے شہر سے کتنی دور رہتے ہیں؟

_____ (کلومیٹر)s

4 کیا آپ پبلک ٹرانسپورٹ استعمال کررہے ہیں؟

A) ہاں
B) نہیں

5 آپ پشاور میں نقل و حر کت (Transport) کا کون سا طریقہ استعمال کرتے ہیں؟ براہ کرم ایک منتخب کریں:

A) بائیسکل B) کار C) بس ریپڈ ٹرانزٹ (بی آر ٹی) D) لوکل بس E) ل دیپچلنا F) دیگر

6 پشاور میں بہترین پبلک ٹرانسپورٹ کیا ہیں؟

A)بائیسکل B) کار C) بس ریپڈ ٹرانزٹ (بی آر ٹی) D) لوکل بس E) ل دیپچلنا F) دیگر

7 پبلک ٹرانسپورٹ بہتر ہے یا نجی ٹرانسپورٹ ؟

A) پبلک ٹرانسپورٹ

B) نجی ٹرانسپورٹ

8 لیز مجرد ےئل ےک پآ ےس ںیم ےہ یتسد ٹروپسنارڈ یسنوک؟

A)بائیسکل B) کار C) بس ریپڈ ٹرانزٹ (بی آر ٹی) D) لوکل بس E) **لدیپچلنا** F) دیگر

9 آپ کتنی بار بس میں سفر کرتے ہیں؟

C) ہفتے میں ایک بار سے بھی کم

B) ہفتے میں 1-3 دن

C) ہفتے میں 4-7 دن

3. بس ریپڈ ٹرانزٹ کی خصوصیات

10. ذیل میں درج پانچ بی آر ٹی خصوصیات بس سروس کی رفتار اور دامتعا لباقی کو بڑھانے کے لئے بنائی گئی ہیں۔ ہر ایک خصوصیت کے لیے ، براہ کرم اس بات کی نشاندہی کریں کہ کیا آپ کو خصوصیت پسند ہے ، خصوصیت ناپسند ہے ، یا خصوصیت اہم نہیں ہے۔

		پسند ہے	نا پسند ہے	ضروری نہیں
vi.	بار بار سروس: تیز سوار راہداریوں پر بی آر ٹی بسیں ہر پانچ سے 10 منٹ یا اس سے زیادہ کثرت سے آتی ہیں۔	1	2	3
vii.	سب وے جیسے اسٹیشن کا فاصلہ: سب وے اسٹاپ کی طرح ، بی آر ٹی اسٹاپ ہر آدھے میل یا اس سے زیادہ فاصلے پر جگہ پائے جاتے ہیں ، تاکہ بسیں رکنے اور شروع ہونے میں کم وقت گزاریں۔	1	2	3
viii.	ٹریفک سگنل کی ترجیح: بی آر ٹی بسوں کو چوراہوں پر توسیع شدہ گرین لائٹ ملتی ہے ، جس سے لال بتیوں پر اسٹاپ ٹائم کم ہوتا ہے۔	1	2	3
ix.	آف بورڈ کرایہ ادائیگی: صارفین بی آر ٹی اسٹیشن پر کرایہ ادا کرتے ہیں ، جس سے مسافروں کو لینے اور چھوڑنے کے لئے درکار وقت کم ہوجاتا ہے۔	1	2	3
x.	بس لین / بس ویز: بی آر ٹی بسیں بس لین یا جسمانی طور پر الگ بس ویز میں چلتی ہیں تاکہ وہ ٹریفک کی بھیڑ کو عبور کرسکیں۔	1	2	3

11. ذیل میں درج بی آر ٹی کی تین خصوصیات بس سروس کی راحت اور سہولت کو بہتر بنانے کے ےلئ تیار کی گئیں ہیں۔ براہ کرم ایک ایسی راحت اور سہولت کا انتخاب کریں جو آپ کو لگتا ہے کہ بی آر ٹی خصوصیات ںیمسب سے اہم ہے۔

d) بہتر اسٹیشنز(Stations): بی آر ٹی مسافر بیٹھنے ، مسافروں سے متعلق معلومات کے ڈسپلے کے ساتھ پرکشش پناہ گاہوں میں انتظار کرتے ہیں۔

e) بی آر ٹی گاڑیاں: تیز سوار بی آر ٹی کوریڈورز میں تین دروازوں سے کم منزل کے لئے مخصوص بسوں کا استعمال کیا گیا ہے ، جن میں سوار اور باہر جانے میں آسانی ہوتی ہے۔

f) ریئل ٹائم بس آمد کی معلومات: بی آر ٹی اسٹیشنوں پر نظر رکھنے والے اور ویب ، سیل فونز ، اور سمارٹ فونز پر دستیاب وقتی بس کی آمد کی معلومات۔

4. بس لین اور بس ویز

12. آف سیٹ بس لین

g) پسند ہے
h) ناپسند کرنا
i) دیگر

13. جسمانی طور پر الگ بس وے

A) پسند ہے
B) ناپسند کرنا
C) دیگر

14. آپ پشاور شہر میں نقل و حر کت کی ضروریات کے حل کے طور پر بی آر ٹی کے بارے میں کیسے محسوس کرتے ہیں؟ براہ کرم مندرجہ ذیل میں سے ایک چیک کریں:

d) میں بی آر ٹی کے مزید راستوں کی حمایت کرتا ہوں۔

e) میں بی آر ٹی کے مزید راستوں کی حمایت نہیں کرتا ہوں۔

f) میں بی آر ٹی کے مزید راستوں کی حمایت کرتا ہوں لیکن مجھے کچھ خد شات لاحق ہیں۔ براہ کرم بیان کریں:

_____

15. کیا آپ پشاور میں بی آر ٹی کے ان ممکنہ راہداریوں پر رائے دینا چاہیں گے؟

c) جی ہاں

_____

_____

$\bar{d}$) نہیں

آپ کے تعاون کا شکریہ