COST BENEFIT ANALYSIS OF PAKISTAN METRO BUS SYSTEM (RAWALPINDI-ISLAMABAD)

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CERTIFICATE

This is to certify that this thesis entitled: **"Cost Benefit Analysis of Pakistan Metrobus System (Rawalpindi- Islamabad)"** submitted by **Mr. Adnan Saqib** 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 Econometrics.

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I Adnan Saqib hereby state that my MPhil thesis titled Cost Benefit Analysis of Pakistan Metrobus System (Islamabad-Rawalpindi) 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.

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Abstract

With rapid urbanization worldwide, cities are struggling to provide sustainable public transportation and are heavily investing in mass transit services like Bus Rapid Transit. This research aims to estimate the cost and benefits of the Pakistan Metrobus Service (PMS) (Rawalpindi-Islamabad). A mixed-method methodology is applied to analyze the cost and benefits of PMS. The study is descriptive, exploratory, and qualitative in nature. Financial data was collected from PMS, and for Pedestrian Shed concept data was collected from Google Maps, and the interview was conducted from government experts to dig deep down the policy context.

Pakistan Metrobus System (PMS) is a state-of-the-art mass transit service operating in Islamabad and Rawalpindi, jointly known as twin cities. The PMS aimed to ease commuting in the twin cities, uplift the poor's and provide a sustainable transit system to the residents of Islamabad. However, the cost-benefit analysis shows a different picture of the PMS. According to the international benchmarks, the cost of PMS is 65 percent higher than the normal transit system. The project's payback period shows that it cannot cover its investment cost and requires an additional PKR 71 billion to keep the project running till 2035. The project relies heavily on subsidies and cannot cover half of its operating cost. The biggest problem with the PMS is that it is not accessible to the general public. The pedestrian shed concept was applied to the PMS, and the results show that it is merely accessible to 50 percent of the population residing in a close circle of 5 minutes.

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List of Abbreviations

CDA	Capital Development Authority
ICTA	Islamabad Capital Administration
NESPAK	National Engineering Services of Pakistan
SUPARCO	Pakistan Space & Upper Atmosphere Research Commission
RIMA	Rawalpindi Islamabad Metropolitan Area
PMS	Pakistan Metrobus Service
IBS	Islamabad Bus Service
ITDP	International Transport Development Authority
PSDP	Public Sector Development Program
CBA	Cost Benefit Analysis
BRT	Bus Rapid Transit
PBS	Pakistan Bureau of Statistics

Chapter 1

Introduction

1.1 Introduction:

Transportation and mobility are fundamental components of cities that must be managed in a sustainable manner because it helps in the exchange of people and goods. Mobility is a result of economic and social activities, geographical and residential arrangements, and individual behavior patterns (Masood & Khan, 2011).

Mobility is important for cities and their inhabitants (Batten , 2017), in fact cities were built on the provision of mobility (Wegener, 2013). Transport and mobility are recognized as key to sustainable development as it stimulates economic growth, increases connectivity, and improves economic integration. In mobility, public transportation is most important without which any city can't prosper (Wegener, 2013).

In terms of mobility, there are three basic categories: personal/individual, collective, and freight movement. Individual mobility include movement through car, riding motorcycle, biking or even walk or any form of mobility in which movement is the result of a personal preference. Majority of people take a walk to get round and meet their basic mobility needs, given the kind of urban setting is in consideration. Person versatility may be preferred in some cases, although it may be hindered in others. Walking, for example, accounts for only 3 percent of all activities in Los Angeles, compared to whopping 88 percent in Tokyo's central district. It's because the density and architecture of LA is not as conducive to human pedestrian movement as Tokyo (Rodrigue D. J.-P., 2017).

Collective mobility services include public transportation, buses, and taxis, the majority of which are regulated and administered by government entities with the goal of making particular regions

of the city more accessible to the general public. It is termed public transportation because anyone can use it as long as they pay a fare. Its quality is usually determined by its ability to move large groups of people while achieving economies of scale (Rodrigue D. J.-P., 2017).

Cities, in essence, are marketplaces and dominating consumption centres. As a result, extensive freight movement is required daily to meet the city's many needs. Delivery trucks generally move around huge docks, railyards, and depots, as well as to and from major businesses, manufacturing centres, factories, and retail establishments. The progress in package delivery to customers' doorstops has considerably boosted the e-commerce industry. Freight mobility within cities is sometimes overlooked, although it is a critical component of a developing sector of city logistics. At the dawn of automobiles, city planners divided the city into separate segments like housing here, jobs there, shopping somewhere else to increase the demand for cars. Second, the population density of cities was segregated to increase travel time. Third, make sure there is plenty of off-street parking available everywhere so that vehicles are the most convenient and least expensive mode of transportation. As a result of such policies, our cities have become car-oriented and reduced the concept of walking (Rodrigue D. J.-P., 2017).

As cities expand, the cost of travelling around the city increased with distance, so people need affordable and efficient modes of transport (Tahir & Butt, 2021). Moreover, with the concept of urbanization, a new ideology of modernism was introduced in 1960. Modernists have contradicted city and city space and have introduced their emphasis on individual buildings, while at the same time burgeoning cities with automobile traffic, resulting in an increase in city space (Gehl, 2013). From year to year, elements of urban life and pedestrians have become less and less dignified. The overall number of cars owned by urban residents grew at a different rate around the world: in developed cities, there was an average annual rise of 2.9% between 1995 and 2001 and just 1.5%

per year since 2001. In the developing cities considered, the total number of cars almost quadrupled between 1995 and 2012 (at an average growth rate of 8.3 per cent) creating tremendous stress on urban transport infrastructure. Although population growth plays a role in the growth of the number of vehicles, the comparison of the rate of motorization reveals different patterns for cities in developed and developing countries (UITP, 2015).

To overcome the problem of congestion and ensure side and clean mobility to all citizens, mobility experts have come up with a plan to build Bus Rapid Transit system (BRT). In some countries BRT is also known as metro bus service. The Metrobus system is the name of a bus transport system that operates on a dedicated fenced lane, independent of the traffic on the adjacent road. The cost of path, fence, new buses and the requisite facilities carries a lot of costs in the final bill (Hussain, The Express Tribune, 2015). New research shows that BRT has the ability to minimize travel time by millions of hours for commuters worldwide. For example, users of BRT in Istanbul, Turkey, can save 28 days per year by switching from other modes of transport to BRT (King, 2012). Presently, BRT is operational in 165 cities globally, expanding in 55 cities, and planned/under construction in 121 cities (BRT Centre of Excellence, 2018a).

Currently, Pakistan provincial government is highly investing into mass transit system. Pakistan has currently 4 operational mass transit projects operating in Lahore, Multan, Rawalpindi & Islamabad, Peshawar, and one is planned in the Karachi.

Rawalpindi Islamabad metro is the second mass transit project operating in the third largest metropolitan of Pakistan. Both cities are jointly known as twin cities. When it comes to the dynamics of the twin cities, Rawalpindi is an example of a mixed-use, high-density, while Islamabad, is the projected national capital in the 1960’s, is a medium-density administrative and residential city. The Rawalpindi Islamabad Metropolitan Area (RIMA) is frequently referred to as

a single metropolitan agglomeration. Islamabad and Rawalpindi have merged into a single urban entity with a significant influence on one another. Economic activity, housing development, urban transportation planning, utility service, job possibilities, and environmental preservation are incompatible with two distinct cities. For example, Rawalpindi must meet demand that Islamabad's development cannot meet, particularly for lower income people. This increased the pressure on Rawalpindi's urban area. Indeed, Islamabad's development has come at the expense of Rawalpindi. Currently, the population of Islamabad is 2.0 million, while the population of Rawalpindi is 3.2 million. The Rawalpindi Islamabad Metropolitan Area (RIMA) is frequently referred to as a single metropolitan agglomeration. The RIMA transportation network was designed in 1980 and is operational till date. Total 89 public transport routes were planned in RIMA out of which 52 are inactive due to low ridership and 37 are operational. It is estimated that there are approximately 700,000 daily trips within Islamabad that start and end within the city, and up to a further 500,000 daily trips which move either to or from the city to neighboring urban areas. Public transport in Islamabad is dominated by the private sector, which operates small wagons and minibuses in a largely unregulated and uncontrolled setting. They contribute about 35% of the average share of total traffic, a share that is on the decline due to a relatively low level of quality and widespread consumer dissatisfaction with services (CDA, 2012). In addition to the private sector, private busses/coasters also operate or hired by various government agencies, private businesses, schools and other organizations (Shaikh, 2017) solely to serve the needs of their staff and students. While Islamabad is the capital of the country, it lacks a comprehensive public transportation framework that complies with industry standards of operation best practices. Services are not delivered on a consistent and predictable schedule and frequency basis. As a result, waiting times are unpredictable and sometimes time-consuming, and when services do arrive, they are often

recorded to result in opportunistic fare and harassment of passengers. Passenger demand is on the rise, but the standard of service is declining compared to that of private transport. The experience of public transport for women, the elderly and school children are especially bad. A social survey showed substantial (over 90%) public discontent with current public transport systems and a high degree of support for better, higher quality services (CDA, 2012).

On May 5, 2013, Pakistan Muslim League Nawaz (PMLN) Leader Nawaz Sharif announced that he will gift the residents of twin cities with mass transit system like Lahore Metro service if his party is elected to power (Hussain, The Express Tribune, 2015). As the PMLN was elected to power, the construction work began in February 2014 and the mass transit became operational in June 2015. The total cost of metro was PKR 42.04 billion. The mass transit was named as Pakistan Metro Bus System (PBS), commonly known as Rawalpindi-Islamabad metro (AFP, 2015). The metro service in Islamabad and Rawalpindi was planned to be built in 4 phases: Redline (from Saddar to Pakistan Secretariat) in 2014-15, Green Line (from Sawan Adda to Pakistan Secretariat) in 2016, Orange Line (from G-11 to D Chowk) in 2018, and Blue Line (from Katchery to 9th Avenue) in 2020. So far, only the red line metro has been operational, and the rest of the metro lines are only available in the paper. Redline metro was established first because of its highest travel demand of 135,000 (NESPAK, 2015).

The total track length of the metro is 23 km, at which 8.6 km is elevated, 10 km is at grid and 4 km is at trench. The metro bus includes 68 air-conditioned buses carrying an estimated 135,000 passengers a day (Hussain, The Express Tribune, 2015). The Pakistan Metro Bus is operated by the Punjab Metrobus Authority (PMA) and according to PMA, metro bus has the highest ridership of 151,000 in a day. Till May 01, 2017, the system has transported 76 Million passengers. The fare

was set Rs 20 irrespective of the travel length and the idea of lower fare was that everyone can avail the metro facility.

As the metro became operational the revenue generated in financial year 2015-16 through fares was Rs 774 million, against the expenditure of Rs 2.6 billion. In the first year the metro was in deficit of Rs 1.8 billion which the government accounted for as subsidy. In the next financial year 2016-17 the subsidy increased by 5% amounting Rs 1.9 billion. So, from 2015 to 2017 total subsidy given to metro comes out to be about Rs. 3.7 billion. This means the service gave an average of nearly Rs. 5 million in subsidy every day (Abbas, 2018). In the year 2017-18 the metro system was deficit of Rs 2.03 billion, which again the government covered up the amount by subsidy.

The increasing rate of subsidies each year raises the concern about the overall significance of the system. According to the government stance the metro was designed in a way that 150,000 people will use it, while the actual daily ridership is far less than the government expectation. The daily average number of commuters was just 80,000 in 2016. Even so, these estimates recognize only one side of travel. If we're to presume that every individual who has used the Metro Bus to move from home to his/her workplace or other destination also used it to travel back, that would mean an average of just 40,000 travellers per day with a maximum capacity of 75,000 (150,000 divided by 2) travellers per day (Abid, 2020). Furthermore, to end the subsidy the Pakistan Tehreek Insaaf government increased the metro fare price from Rs 20 to Rs 30 in 2019, while the actual cost of the fare is Rs 80 (APP, 2019).

It is important for a project to measure its costs and benefits. Cost-benefit analysis (CBA) is the most objectively feasible approach for evaluating a decision. It includes combining the value of a project, an investment or action, and then comparing it with the costs associated with it.

1.2 Statement of Problem:

This research will try to study cost benefits analysis of the Pakistan Metro bus and try to figure out what benefits so far it has delivered and what cost it bears. If the government is paying the subsidy what economic benefits are gained so far and is the really the poor getting benefit from as the government claims? This research will try to address the decreasing amount of ridership by evaluating the design feature of the metro bus, which means is the metro built in a way that maximum people can have access?

1.3 Research Objective:

The proposed research will have following objectives:

1. To analyze the cost benefits of the Pakistan Metro Bus (Islamabad-Rawalpindi). Cost benefit analysis is a systemic approach to estimating strengths and weaknesses of alternative uses, on the basis that we can select the best approach to achieving benefits while preserving saving.

1.4 Research Question:

1. Is Pakistan Metro Bus really worth the massive investment spent on it?

2. Can the project be converted to a sustainable or the metro was a move to drown the taxpayer money?

1.5 Significance of the Study:

The Public Sector Development Program (PSDP) is an important part of public sector investment which transmit domestic and foreign capital to implement federal, provincial and local government development programs and projects. Before implementing a project, there are several procedures which needs to follow in order to gain maximum efficiency from the project. Among the procedures, Cost Benefit Analysis (CBA) is an important part of the standard procedure before implementing a mega project, which explains the gains and losses (environmental degradation) from a project, but unfortunately CBA is not consider while preparing feasibility of any mega projects. This research will show how important role, CBA plays in any project by considering the social and economic benefits.

1.6 Limitations of Research

The extensive literature stressed to first analyses the travel patterns of the city residents before planning or designing Bus Rapid Transit or metro system through Origin Destination (OD) Matrix. Origin Destination Matrix was first introduced by the National Cooperative Highway Research Program (NCHRP) and during that time (OD) was calculated through Census data. With the advancement of technology, the OD is calculated through different techniques. Currently OD can be calculated through Cellular Network Record Data, Ride Hailing apps (Careem & UBER), and Remote Sensing. For all these mentioned points additional shape file[1] of city demarcation is required which should be embedded in to google maps.

Cellular networks have towers which transmits signal for communication. One cell site has a range of 20 to 80 km. During this range the cell tower not only transmits signal for communication but

[1] Shape file is a geospatial file representing city boundaries with its sectors and sub-sectors demarcation.

also records the position of the user. For such purpose Jazz Pakistan leading mobile operator was contacted for the provision of data but the request was denied because of no such policy for sharing data.

Ride hailing apps like Careem, and UBER are high on demand for mobility as a service. Careem and UBER also collects data of an individual origins and destination points, but they refused to provide data because it is a privacy breach of their customers. Lastly, the OD matrix can also be calculated through remote sensing technique. For remote sensing, Pakistan Space & Upper Atmosphere Research Commission was requested for data provision but woefully they don't collect such type of data.

For all the above-mentioned technique, shape file of the city is required which demarcates city inner regions which helps researchers to measures the travel demand for each region. In Pakistan, Pakistan Bureau of Statistics (PBS) has the digital prints of the cities but there is no clause in PBS to provide such data.

Chapter 2

Literature Review

2.1 Literature Review:

The literature review is of narrative type in which the author reads other researchers and literature and narrates in fashion to build arguments out of it. For easy understanding the literature review, it would be divided into multiple themes which are central to this research. The themes are cities and their role in economies, local government, transport infrastructure and their role in economic growth, role of GIS in helping the best stubble design for transport, bus rapid transit system and their cost benefit analysis.

2.1.1 Cities & its history:

Just as matter in the solar system is clustered in a small number of bodies (planets and their satellites), economic activity is contained in a relatively small number of human settlements known as cities (Fujita & Thisse, 2002). (Jacob, The Economy of Cities, 1969) defined cities as "A settlement where much new work is added to older work and this new work multiplies and diversifies a city's division of labor or a settlement where this process has happened in the past." Cities are places where a lot of human activity occurs regularly in a small piece of land. Life without towns would be worse than it is now not just for urban residents, but also for everyone who consumes the goods and services created and manufactured in cities. One beautiful aspect of cities is that people gather from all forms of life. The more frequently different types of people with different talents and backgrounds come together in a smaller space, the better the town functions as a place to work and play (O'Flaherty, 2005).

The civilization and history that has developed around cities. All significant scientific, political, social, economic and technological developments have occurred in human agglomerations called cities. In the past, the reigning empires had the most creative, supreme, and wealthy city of their time. The most sophisticated cities have become centers for higher learning and the development of ideas. Most of the output in every country is produced in cities. All classes live in cities, particularly the poor and middle classes. Economic activity, innovation and entrepreneurship tend to cluster and feed each other, preferring density (Haque, 2020).

An important feature of a city is mobility, in fact cities were built on the provision of mobility, which is not often present in rural areas(Wegener, 2013). Mobility is enhancing our economies. It is important for prosperous economies, good governance, a stable climate, vibrant communities and our individual prosperity. Mobility means access to work, services and ideas. Mobility is important for cities and their inhabitants, and it is particularly important for people with lower incomes (Batten , 2017). Mobility demonstrates the willingness and ability to move, as well as the motion itself. In simple words, it includes walking, cycling, vehicle sharing, public transportation, and much more. In mobility, public transportation is most important without which any city can't prosper. Transport and mobility are recognized as key to sustainable development as it stimulates economic growth, increases connectivity and improves economic integration. In mobility, public transportation is most important without which any city can't prosper (Wegener, 2013).

Public transport offers people mobility and connectivity in communities. It provides employment, community services, medical care, and leisure opportunities. It helps both those who opt for driving and those who have no choice: more than 90 percent of recipients of public assistance don't have a vehicle and must rely on public transport. For those people and all others without access to a vehicle, public transportation offers a basic mobility service (Popuri & Proussaloglou, 2011).

2.1.2 Local Government and Its Revenue:

(WUF, 2018) highlights the importance of the Local government and its financing importance. Increasingly the municipal finance sector recognizes the important role that the informal economy can play in the local economy. Income from its own source is seen as a key ingredient of municipal finance. To achieve the SDG agenda, local governments can take advantage of large- and small-scale infrastructure investments. Municipal financing projects in the realm of urban planning and design should be integrated. A working governance structure and an enabling legal framework remain essential prerequisites. Increase revenue from own sources by alternate types of municipal financing such as land-based funding. Leverage the informal sector's potential to contribute to funding and improved financial services delivery. Improve good governance and basic municipal financial accounting. Attracting capital from the private sector by increasing the value of investing in delivering public service. In order to achieve sustainable urbanization, interventions should feature urban planning and environmental components.

2.1.3 Transportation infrastructure and its role in economic development:

The first significant civilian transit is believed to have been the exchange of goods. The exchange occurred when there was an excess of output, allowing producers to trade surplus goods for other goods, or when specific resources became scarce in other places. The growth of product trade has necessitated the construction of new commercial channels and marketplaces. Thus, it can be demonstrated that transportation has played an important role in shaping urban settings (such as ports and harbours on seacoasts, lakes, and rivers), even if it has not always remained a prominent activity during the city's later phases of growth. Growth in support services has resulted in activity diversification and, as a result, significant growth in the tertiary sector in all major cities

(administrative, cultural, financial activities, etc.). Throughout history, transportation technology and organisation have significantly influenced the growth and population of cities. Transportation began to bolster urban growth by enabling convenient access from a variety of areas and in a variety of modes, hence relocating numerous cities. Their growth has also been accelerated by increased urban mobility. This was the case in a number of cities when the construction of a bridge or tunnel resulted in the development of new industrial, manufacturing, and residential sectors, resulting in economic growth and population growth throughout the metropolitan area (Vuchic, 2007).

The occupancy of more and more lands by cities everywhere today is the direct product of urbanization, clearly described as the steady accumulation of human population in cities, cities and metropolitan areas (Angel, 2012). Urbanization represents a growing proportion of the population living in urban settlements, mainly through net rural to urban migration (Rodrigue & Comtois , 2009). World is becoming urban, and economic growth and urbanization are becoming inextricably linked, so much so that (Scott & Storper, 2003) have declared urbanization a "necessary condition for sustainable development."

Today cities are tomorrow's future economies, and they act as drivers of generating wealth. In 2009, the five most powerful economical cities were Tokyo, New York, Los Angeles, London, and Paris. Tokyo generated USD 2.99 trillion; New York produced USD 2.63 trillion; Los Angeles produced USD 1.79 trillion; London produced USD 695.6 billion; and Paris produced USD 658.1 billion. The economy of Tokyo or New York is greater than that of individual national economies such as Italy, Spain, Canada, Russia, South Korea, Brazil, and India (UN Habitat, 2011).

Between 1960 and 2017, the worldwide urban population tripled, rising from more than one billion to over four billion people. Today, cities house more than 55 percent of the world's population, a

ratio that is expected to rise to nearly two-thirds by 2050, with an extra 2.5 billion people. Urbanization, on the other hand, has a number of benefits and drawbacks. It enables people to work together to benefit from agglomeration economies. Higher productivity as a result of economic density, rapid knowledge spillover innovation, and enhanced mobility and access to jobs and services all contribute to this. It also creates a significant strain on land and natural resources, but the resulting urban environment has a variety of negative repercussions, such a lack of housing and availability, insufficient basic services, increased pollution, and congestion (Kaw & Lee, 2020).

As cities expand, the cost of travelling around the city increases with distance, so people need affordable and efficient modes of transport (Tahir & Butt, 2021). Moreover, in particular with the concept of urbanization, a new ideology of modernism was introduced in 1960. Modernists have contradicted city and city space and have introduced their emphasis on individual buildings, while at the same time burgeoning cities with automobile traffic, resulting in an increase in city space (Gehl, 2013). From year to year, elements of urban life and pedestrians have become less and less dignified. Globally, the aggregate number of cars owned by urban people increased at a variable rate: in major cities, the average annual rise was 2.9 percent between 1995 and 2001, but has slowed to 1.5 percent since 2001. Between 1995 and 2012, the total number of automobiles in developing cities nearly quadrupled (at an average annual rate of 8.3 percent), putting enormous demand on urban transportation infrastructure. While population growth contributes to the rise in vehicle ownership, a study of motorization rates in developed and developing countries indicates radically different trends (UITP, 2015).

Global annual car sales are projected to reach 125 million by 2025. The city dwellers will buy half of these cars. The global fleet of vehicles is expected to grow from 1.2 billion today to 2 billion by

2030. It is clear that human reliance on the car is expected to remain. However, it is the evolving nature of this dependence that is interesting, particularly when considering the challenges of sustainable urban mobility. When we think of vehicles in towns, we have a vision of overcrowded highways, roads lined by parked delivery vans and traffic pollution. How does this image fit into a sustainable future (Batten , 2017)? Traffic congestion is the clustering of vehicles on the road in a traffic network that decreases the throughput and significantly slows the speed of traffic flow (Lizbetin & Bartuska, 2017). Congestion is a bad thing for our economy. The analogue is cardiovascular. If the arteries (arterials) of our bodies are clogged, we have two choices: we can die, or we can surgically reconstruct a new way. Our cities are in the process of dying as their arteries clogged with congestion. If we proceed down this route, properties will devalue, people and jobs will abandon cities, and cultural structures will decline. When cities die, their economic efficiency vanishes, weakening our national economy (Balaker & Staley, 2006).

Automobile ownership is ingrained in modern life, and traffic congestion is an unavoidable annoyance. Western nations have a much great grasp on the speed and volume of vehicular traffic, as well as infrastructure spending. On the other hand, developing countries face infrastructure deficiencies and a scarcity of major highways, which are exacerbated by soft-car loans, leases, and other discounts. As a result, many growing economies have been burdened by peripheral issues such as pollution and congestion, which have harmed their economy and caused havoc through high energy prices. Pakistan is a case in point. (Syeda & Yasar, 2014).

Transport infrastructure and economic development goes beyond the basic purpose of building and serves a wider social need related to the movement of people and goods between locations. Transport networks are the cornerstone of national supply chains and national economies. They serve the efficient supply of goods and the transport of people by providing access to various

destinations and by contributing to the development of the standard of living. The intra-regional transport system contributes to the improvement of mobility, to the reduction of intra-regional transport costs and to regional development. Transport infrastructures have an impact on the strength of spatial interdependence, economic cooperation and regional spatial rivalry. Many economic activities are redistributed between regions where some regions benefit from this distribution and others do not. In the longer term, these changes may have an effect on business locations, urban sprawl, land-use change, tourist flows, the climate and other aspects of intra-regional and inter-regional economies (Mohmand, 2017).

The initial impacts on transport times and prices of investment, the impact on labor markets, conurbation and transmission networks also affects the long-term impact of transportation investment on economic growth and on urban/regional development. Each of these larger impacts has a spatial dimension due to its effect on location and geography of economic and social activity. These spatial impacts have a range of sizes. The first is that the economic consequences cannot be distributed evenly. This will result in a redistribution of economic consequences for transportation expenditure between (and within) regions. Analysts should be cautious when measuring benefits such as new jobs created in one region to ensure that redistribution does not favor miscount. The capacity for redistribution is particularly relevant in the case of inter-regional transportation links. Another consideration is that in an urban setting, local transit investment has a direct effect on the aesthetics and amenity of a neighborhood. Transportation infrastructure and facilities may have a direct impact on a city's attractiveness as a place to live, function, and visit by enhancing or detracting from its urban type. This, in turn, would have an effect on the city's cultural and economic vitality. As a result, transportation spending has the potential to have long-term impacts on economic growth and development, in addition to the immediate benefits of shorter travel times

and lower vehicle operating costs (Ministry of Transport, 2016). The Global Information System (GIS) can used to find the best optimal route for transitive services. GIS can be used for any service that relies on the network, such as water supply, power supply, sewage, etc. It may also be of great assistance to Transportation Engineering and Planning. The digital data on the road network map of the Bhavnagar district was compiled via the GIS system and the length of 49 different routes taken from the GIS was compared with the length data obtained from the S.T. Bhavnagar Department. Out of 49 routes, 45 routes are configured, and 4 routes are therefore shorter than the routes suggested by the GIS network tool (Advani, Srirama , & Pathan , 2005). (Gahlot & Kalla , 2012) model's a bus rapid transit corridor based on the spatial distribution of transit trips in the area for the horizon year. Based on the city's demographic, transit trip, and land use characteristics, the model defines the high-ridership oriented BRT corridor. The strategy consists of two models: the first is responsible for predicting BRT transit demand, while the second is in charge of choosing a BRT corridor based on pre-determined parameters. As a result of the model's output, urban planners can better understand transit demand trends and make policy decisions using graphical GIS-based maps.

2.1.4 Public Transportation, Mass Transit System and Travel Time:

(Javid, 2015) analyzed the patterns in travel behavior and identified the nature of the relationship between socio-economic demographics (SEDs) and travel demand management (TDM) interventions. A survey of the questionnaire was conducted in Lahore, Pakistan, and 631 samples were collected. Initially, a cross-analysis of vehicle ownership and modal share was carried out in order to classify the sample into four categories, i.e., automotive, motorcycle focused, public transport routing and non-motorized modes oriented, and the respondents also asked a variety of

other questions, such as gender, age, income, education, occupation, vehicle ownership, travel frequency with different modes and for different reasons. The results of the cross-examination showed that the use of cars increased with an increase in the level of education and decreased with the size of households. People with private cars prefer to use them instead of using public transport. The results of the cross-analysis showed that the use of cars increased with an increase in the level of education and decreased with the size of households. People who have private cars tend to use them instead of using public transport. However, most private car users have a favorable assessment of the plan for enhancing public transport. Ordinal regression analysis was performed using the Logit model and the relationship between different SED variables and TDM measurements was calculated. Modeling results showed that wages, schooling, gender and current travel habits are major determinants of commuter attitudes towards selected TDM steps. Of all factors, the level of education of the respondent was found to be the most important factor. However, various SED variables have a different effect on the consideration of TDM interventions. The results of this study may help transport planners and policy makers to develop effective TDM measures for specific segments of the travel market. (Majid , Malik , & Vyborny, 2018) estimated impacts on commuting of mass transit. In many cities in the developing world, public transport infrastructure has not kept up with dramatic urban developments. Car ownership is growing among richer families, increasing congestion and emissions, and potentially leading to patterns of land use that make access difficult for the poor. More than a hundred cities in the developing world have recently developed rapid transit systems to solve these issues, and many more are considering doing so. Areas have been planned for transit routes that have not yet been established as a reference category for areas connected to the proposed Bus Rapid Transit line. The results indicate that access to the new transit line decreased both the time and the switching costs. The result has

shown that the line has caused workers to move from private to public transport. It is estimated that the introduction of this transit line has led to a 24 per cent increase in the use of public transport by commuters in nearby areas, with some 35.000 commuters switching to city-wide public transit. The study also states that the mass transit route attracts a significantly higher proportion of highly educated passengers than those who travelled by public transport prior to its introduction, suggesting that its high quality and reliability make public transport options attractive to a greater part of the population. The construction cost of the transit line was substantial and the fare is subsidized. However, the majority of riders are willing to pay a much higher fare, suggesting that it could be made more financially feasible by better targeting the grant. The results reflect the potential of mass transit investment to make urbanization more sustainable in the developing world.

One of the most important criteria for transportation planning, management, and service is travel time, which is affected by a variety of factors such as driver behavior, traffic, and the physical characteristics of urban corridors. Physical characteristics are concerned with road width, geometry, and intersection controls, while traffic characteristics are concerned with traffic flow and density under heterogeneous conditions. (Wang & Fu, 2016) recognizes that lane width and traffic stream numbers have a huge effect on travel time and traffic flow. In their analysis of travel time prediction in Adelaide, Australia, (Lin, Zito, & Taylor, 2005) looked at the impact of signalized systems on travel time. They discovered that the signal system has a major impact on travel time. Certain incidents, such as collisions, processions, maintenance work, and environmental conditions, may also be known as non-recurring conditions.

The pedestrian shed concept is evolving to make cities compact and free from individual mobility like cars and motorbikes. The charter on new urbanism states coins pedestrian Shed concept if

cities are designed in a manner that if an individual has access to goods and services within 5 minutes of radius circle, he will prefer to walk rather than using a motorized form of transport. The same is the case with transit services. If he/she can access transit service in 5 to 10 minutes, he will use public transport, and if that is distance is greater, he/she will prefer an individual form of transport.

2.1.5 Cost Benefit Analysis:

Governments often use bus rapid transit (BRT) to invest in public infrastructure, particularly in developing countries with limited capital resources. Exuberant evaluations of BRT systems around the world may be premature, given that the vast majority of these systems have only been operational for a short time. Furthermore, there is no research in the literature on BRT systems from the user's perspective. This is problematic because one of the reasons for the government's participation in BRT is the social value it provides to communities that have previously been denied access to private modes of transportation. To examine the alleged social benefits of a BRT system, two sets of multiple logistic regression models are fitted. The first uses disaggregated data from within a BRT service area, while the second uses data from both within and outside. The passenger and commuter data sources help determine who and how the new Lahore Metro Bus System (MBS) will assist. Women make up a smaller percentage of riders and commuters than men, but inferential findings indicate that women are more likely to use the MBS. Females are also more frequent users and benefit the most from the fare subsidy, according to consumption patterns. Finally, integrating the MBS with Lahore's broader public transportation network will help to reduce the monetary and temporal costs of MBS use, which disproportionately affect women (Zolnika & Malik, 2018).

The rapid growth of the Madison metropolitan area's population has resulted in a deterioration of transportation facilities, placing a strain on the region's public transportation system. In order to prevent the region's transportation problems from reaching crisis proportions, a study called Transport 2020 was commissioned to assess various transportation improvement options for the city. One of the alternatives discussed in this study was bus rapid transit, but it was rejected without a thorough review (BRT). This research compares two BRT options: one studied by Transport 2020 (BRT 2020) and a modified version of the Transport 2020 option (BRT Plus). When all US citizens are granted voting rights, the results show that BRT 2020 will have a negative net benefit of $261 million over the course of the project's 30-year existence, while BRT Plus will have a negative net benefit of $153 million. According to our findings, implementing a BRT framework in the greater Madison metropolitan area is not justified solely on the basis of results, and that further research is required in a number of areas. The net present value of each BRT option was found to be highly dependent on standing. Each BRT choice has a major negative net impact when all residents of the United States are granted voting rights. When only residents of the Madison metropolitan area are considered, each BRT choice provides substantial net benefits. Since the federal and state governments must pay the majority of the BRT system's capital and operating costs, these differences remain (Blonn & Carlson, 2006).

2.2 Literature Gap:

The Public Sector Development Program (PSDP) is an important part of public sector investment which transmit domestic and foreign capital to implement federal, provincial and local government development programmes and projects. Before implementing a project, there are several procedures which needs to follow in order to gain maximum efficiency from the project. Among the procedures, Cost Benefit analysis is an important part of the standard procedure before

implementing a mega project, which explains the gains and losses (environmental degradation) from a project, but unfortunately CBA is not consider while preparing feasibilities of any mega projects. This research will show how important role, CBA plays in any project by considering the social and economic benefit.

Chapter 3

Methodology

3.1 Research Design:

This research is exploratory in nature. Exploration sometimes or frequently occurs, its recognition as an important procedure and personal orientation are generally missing in the modern world. In the social sciences, including even qualitative research circles, the idea of exploration is usually mentioned (Stebbins, 2001).

In this study, the author used applied quantitative research to address practical mobility problems of Islamabad and Rawalpindi by using real-ground data. This study evaluates the cost benefit analysis of the Islamabad Rawalpindi Metro Bus (Pakistan Metro Bus System (PMS)). Islamabad and Rawalpindi are the locale of this study and metro operates in these cities also known as twin cities.

The data is collected from Pakistan Metrobus System in which all the details of ridership per month and per year, revenue and operational expenses per year, overall ridership on every stations was taken for the year 2015-2021 (till April). Due to the COVID-19 data from 2015 to 2019 is being analyzed. Data regarding project cost and estimated ridership is collected from National Engineering Services Pakistan (NESPAK) report.

3.1.1 Structure

The methodology is divided into two parts, first, exploring the infrastructure cost of the PMS, the cost benefit analysis and Pay Back Period of the PMS, and second breaking down the PMS in to twin cities separately to analyse the performance in both cities. The PMS infrastructure cost is compared with the International Transport and Development Policy (ITDP) to assess the cost justification of PMS. For the infrastructure cost comparison data is taken from National

Engineering Services Pakistan (NESPAK) report and the International Transit Development Policy (ITDP). NESPAK is Pakistan consultation agency while ITDP is a non-governmental, non-profit organization dedicated to the development of bus rapid transit networks, the promotion of biking, walking, and other non-motorized modes of transportation, and the enhancement of private bus operator margins.

3.2 Cost Benefit Analysis:

The cost benefit analysis is a systemic approach to estimating strengths and weaknesses of alternative uses, on the basis that we can select the best approach to achieving benefits while preserving saving. The general method for the project, in one this method one side has all the monetary cost (both monetary and operational) and other hand all economic benefits which is mostly for one year. (Vigren & Ljungberg , 2017)

There are two types of CBA's:

1. Financial Cost-Benefit Analysis (FCBA)
2. Social Cost-Benefit Analysis (SCBA)

3.2.1 Financial Cost-Benefit Analysis (FCBA):

FCBA answers the issue of whether the project would result in sufficient financial returns, taking into account its entire life cycle, to justify the costs incurred by the investor/operator (Eijgenraam, Koopmans, & Tang, 2000).

3.2.2 Social Cost-Benefit Analysis (SCBA):

Social cost-benefit analysis (SCBA) answers the question of whether an intervention will contribute to social welfare. From the perspective of society as a whole, SCBA describes both possible positive and negative results of a given action (Eijgenraam, Koopmans, & Tang, 2000).

3.3 Benefit Cost Ratio:

The benefit-cost ratio (BCR) is a profitability metric used in cost-benefit analysis to assess the feasibility of cash flows provided by a particular asset or project. The present value of all benefits provided by a project/asset is compared to the present value of all costs in the BCR. If the BCR is greater than one, the asset/project is supposed to produce additional value.

Formula:

$$\boldsymbol{Benefit - Cost\ Ratio} = \left[\sum_{\boldsymbol{t=0}}^{\boldsymbol{n}} \quad \boldsymbol{CFt}[\boldsymbol{Benfits}]/(\mathbf{1}+\boldsymbol{r})^{\boldsymbol{t}}\right] / \left[\sum_{\boldsymbol{t=0}}^{\boldsymbol{n}} \quad \boldsymbol{CFt}[\boldsymbol{Costs}]/(\mathbf{1}+\boldsymbol{r})^{\boldsymbol{t}}\right]$$

- CF = Cash flow
- i = Discount rate
- n = Number of periods
- t = Period that the cash flow occurs

All the above points will be calculated through data collected from the Pakistan Metrobus System Command centre, which keep the detail record of PMS.

3.4 Discounted Pay Back Period:

The discounted pay period is a method used to calculate the amount of time required for a project to reach the break-even point or to get to the point where the net cash flow generated covers the initial cost of the project. In short, discounted payback period is used to evaluate the profitability

and timing of cash inflows of a project or investment. If the payback period is quicker the project is beneficial.

3.4.1 Calculation of discounted Payback Period:

There are two steps for calculating discounted payback period. First the initial investment is discounted (i.e., bring to the "Present Value") the net cash flows that will occur during each year of the project.

$$Discounted\ Cash\ Inflow\ =\ [Actual\ Cash\ Inflow/(1+i)^n]$$

Where:

- i is the discount rate
- n is number of period cash inflow relates

Second, the discounted payback period is calculated by subtracting the discounted cash flows from the initial cost. When the discounted cash flows for the project's various phases have been computed, the original cost can be deducted until it equals zero.

$$Discounted\ Payback\ Period\ =\ A\ +(\frac{B}{C})$$

Where,

- A = Last period with a negative discounted cumulative cash flow.
- B = Absolute value of discounted cumulative cash flow at the end of the period A; and
- C = Discounted cash flow during the period after A.

For the cost benefit study, PMS financial data was analysed on a year-by-year basis.

3.5 Social Cost Benefit Analysis (SCBA)

In the social cost benefits, following points of PMS will be studied:

- Ridership patterns in twin cities
- Actual Cost of Fare comparison with charged fare cost
- Subsidies
- Checking accessibility of twin cities residents to PMS station through Pedestrians Shed concept

The ridership pattern will be used to determine the PMS's use in the twin cities. The ridership assessments will be expanded to determine which cities have the most utilisation capacity and which stations have the highest check-in and check-out dates. Additionally, the SCBA will compare the year-to-year fare cost to the real cost and how much the commuter spends. Accessibility is a critical aspect of any transportation network. The PMS accessibility will be compared to the "Character of New Urbanism," which states that an individual will choose to walk if the city structure is designed in such a way that he or she can obtain goods or services within a quarter-mile radius or within a five-minute walkable distance. The accessibility will be determined using Google Maps by drawing a quarter-mile radius circle around the metro stations and calculating the population density within the orbit of each station. Digital maps of the population are sourced from the Pakistan Bureau of Statistics (PBS).

Chapter 4

Results and Discussion

This Section states and discusses all the results we gathered from the NESPAK reports, Right to Information Act and Pakistan Metrobus System command center. All the details like project cost, life cycle, estimated ridership about PMS was collected from NESPAK report and the data regarding ridership yearly, monthly, daily and average daily, plus the revenue and operational expenses are taken from Pakistan Metrobus System command Center.

Major findings of this research are divided into 4 parts:

- Pakistan Metrobus Service Infrastructure Cost and cost comparison with International Transport Development Policy Standards
- Cost Benefit Analysis
- Discounted Payback Period
- PMS ridership Patterns of twin cities, fare comparison, Subsidies, and the Pedestrian Shed Concept

4.1 Construction cost of Pakistan Metrobus System (PMS):

The construction work on Pakistan Metro Bus (PMS) was started in February 2014 and completed in June 2015, with PKR 4,204 million cost. The PMS infrastructure cost was PKR 4,000 million, and the cost of 68 buses was 2,040 PKR million (NESPAK, 2015). Some sources claim that the cost of PMS has escalated to PKR 50 billion due to prolong protest of Pakistan Tehreek Insaaf and additional redesigning of bus corridors and land accusations for bus depot (DAWN, 2014). The finance of PMS is overlooked jointly by the Punjab and Federal Government, while the operations and maintenance responsibilities are handed over to the Punjab Mass Transit Authority.

The capital cost of PMS infrastructure was PKR 40,000 million. The capital cost includes dedicated signal-free lanes, stations corridors, right of way, bus depot, command and control centre. Table 1 represents the total capital cost and per kilometre cost, compared with the international standards.

Table 1: **Infrastructure Cost**

	Infrastructure Cost in PKR Millions	**Infrastructure Cost in Dollars Millions (Bronze Category)**
Capital Cost	PKR 40,000	$ 395,985,499.01 [2]
Per Kilometre Cost	PKR 1,666	$ 15,873,016

As shown in the above table, the capital cost in US dollars is $396.99 million, and per kilometre, the cost is $15 million.

Let us compare the PMS infrastructure cost with the international BRT standard to see whether the cost is justifiable or not?

4.1.1 Cost Comparison with International Benchmarks:

According to the Institute for Transportation and Development Policy (ITDP), a non-profit organization dedicated to developing bus rapid transit systems, there are four types of bus rapid transit (BRT). ITDP classifies that the cost of capital for developing bus rapid transit in both developed and developing countries is determined by the type of BRT service. The cost of each BRT service is shown in table 2, which divides the service into four groups.

[2] Exchange Rate of 2014 is taken, which was average 101.0138 in 2014.

Table 2: BRT Category Cost Comparison

Category	Lower Income Countries (2013 $/Km)	Higher Income Countries (2013 $/Km)
BRT Gold	$16,312,504	N.A.
BRT Average	$11,504,575	$10,054,824
BRT Silver	$9,528,467	$9,729,605
BRT Bronze	$9,612,943	$10,380,042

A BRT system is categorized into gold, average, silver, and bronze on the following benchmarks: BRT Basics, Service Planning, Infrastructure, Stations, Communications, Access and Integration and its subcategories.

The benchmarks mentioned above have several categories, and the total points are 100, with PMS scoring 64 out of 100, putting it in the bronze category. Bronze is the least expensive category of BRT construction. When comparing the cost of PMS infrastructure to the international standard, the cost is 65.12 percent higher. According to the 2013 standard, the bronze category should cost around $9.6 million per kilometer, while the PMS category should cost around $15.8 million per kilometer. The higher construction cost begs the question, "Why PMS is so expensive?"

4.1.2 Why PMS development is so expensive?

The answer for the expensive metro is the inexperience and lack of research of the consultancy. (Iftikhar, Muller, & Ahola, 2021) investigated the crises in the PMS megaproject. In the study, Director generals, chief engineers, Deputy Directors, Contractors and Subcontractors were interviewed. In the interview, Deputy Director and Contractors claimed that the consultant gave us drawings of the projects. All the approvals were verbal (verbal approvals are called shop drawings), and after some time, the consultant changed the design drawings into officially approved drawings, so the contactors had to dismantle the already constructed material.

Moreover, the underground conditions were not studied clearly. The biggest problem was the underground water. The general idea was that the underground water table is 5 to 10 meters deep, but sometimes the water arises before the constructors reach the desired water level, making the construction task more difficult.

A deputy project manager of PMS mentioned that the communication gap was another big challenge. The consultant company engineers were working on PMS. They were also busy on thousands of other projects due to a communication gap between the site and office. The consultant office was in Lahore, and timely communication was not possible. As the head of division was in Lahore, they could not give time to everyone during their visit to the site.

Several other challenges to cite here include shifting utilities, land acquisitions, and security concerns. Shifting of utilities was a dilemma. City concerned departments had no service plans; even more alarming was that they did not know which utility service they owned and who looked after it. Land acquisition was one of the biggest challenges the contractors faced. In Rawalpindi, the acquisition of Murree Road was a serious issue because it was the lifeline of the Rawalpindi commercial center.

Similarly, a graveyard land came into the project track, and the graveyard organization took the matter into court, due to which work construction work was halted. Lastly, the PMS receives a blow from the security departments. On their main events, the contractors had to stop their activities, which all adds up to the delay of the projects.

To sum up all the above discussion, the main reason for the hike in PMS construction cost is the inexperience of all the acting bodies in the project. The project was big, and they had never worked on a project like that.

4.2 Cost Benefit Analysis:

In the next section the main aim of research is being research is discussed which are:

- To investigate the cost and benefits of the PMS.
- Over the years how did PMS perform?
- Is the metro being utilized at its full potential or not?

4.2.1 Cost-Benefit Analysis:

The cost benefit analysis is a systemic approach to estimating strengths and weaknesses of alternative uses, on the basis that we can select the best approach to achieving benefits while preserving savings. The general method for the project, in one this method one side has all the monetary cost (both monetary and operational) and other hand all economic benefits which is mostly for one year. (Vigren & Ljungberg, 2017)

There are two types of CBA's:

1. Financial Cost-Benefit Analysis (FCBA)
2. Social Cost-Benefit Analysis (SCBA)

The scope of this research is limited to financial cost benefit analysis.

4.2.2 Financial Cost-Benefit Analysis (FCBA):

FCBA answers the issue of whether the project would result in sufficient financial returns, considering its entire life cycle, to justify the costs incurred by the investor or operator (Eijgenraam, Koopmans, & Tang, 2000). To look deep into the Financial Cost-Benefit Analysis, there are different methods, we chose the one below:

Benefit Cost Ratio:

The benefit-cost ratio (BCR) is a profitability metric used in cost-benefit analysis to assess the feasibility of cash flows provided by a particular asset or project. The present value of all benefits provided by a project/asset is compared to the present value of all costs in the BCR. If the BCR is greater than 1, the asset/project is supposed to produce additional value, and if the value is less than 1 the project is not beneficial.

The cost benefit ratio formula is as follow:

$$\boldsymbol{Benefit - Cost\ Ratio} = \left[\sum_{t=0}^{n} \quad \boldsymbol{CFt}[\boldsymbol{Benfits}]/(\mathbf{1}+\boldsymbol{r})^{t}\right] / \left[\sum_{t=0}^{n} \quad \boldsymbol{CFt}[\boldsymbol{Costs}]/(\mathbf{1}+\boldsymbol{r})^{t}\right]$$

CF is the cash in and out flows during the project life cycle in monetary terms. Here the cash inflow is the amount generated through the fare collection and termed as benefits, and cash outflow is the expense incurred through operational expense.

i is the discount rate or the interest rate which represent capital cost or the target rate of return which the project will incur.

r is the discount rate

t Period that the cash flow occurs

Table 3: Calculation of Cost Benefit Analysis

Year	Operational Expenses	Revenue	Time Period (t)	Discount Rate ®	1+r	Benfits	Cost	B/C Ratio
2015	2,623M	447M	1	0.058	0.075	5,964M	34,974M	0.170516
2016	2,752M	787M	2	0.083	0.057	13,802M	48,288M	0.285824

2017	2,833M	795M	3	0.0403	0.075	10,604M	37,778M	0.280701
2018	3,089M	1,079M	4	0.0592	0.077	14,014M	40,114M	0.349347
2019	3,042M	1,121M	5	0.0333	0.116	9,647M	26,164M	0.368707
	Total					**54,030M**	**187,317M**	**0.288442**

Over the course of 5 years the benefits (revenue) are PKR 54,030 million and the cost (operational expenses) are PKR 187,317. The benefit cost ratio is 0.289 which is less than 1 means that the project is not beneficial.

4.2.3 Additional Cost:

PMS uses Al-Barak company buses, which are on an 8-year lease that expires in 2022. In 2015, the cost of one bus was PKR 300 million, with a total cost of PKR 2,040 million for 68 buses. As the contract expires, new buses will be purchased, and the cost of new buses will serve as fuel to the fire, pushing the expenses curve upward. The cost of new buses can be estimated based on the purchase of new buses by the Lahore Metro. The Punjab Mass Transit Authority is also in charge of the Lahore metro. The same type of contract was signed between Lahore Metro and Al-Bayrak company for the buses for an 8-year period, and Lahore Metro now purchases 64 new buses after the contract expires. The cost of 64 new buses in 2021 is PKR 2,600 million, compared to PKR 1,290 million in 2013. The cost of a single new bus for Lahore Metro is 40.6 million, and if the same cost is estimated for PMS 68 buses, the total cost will be PKR 2,762 million, and this additional burden will skyrocket the project cost.

4.3 Discounted Payback Period:

As the project operation cost is way much higher than the revenue the next thing we wanted to calculate is the payback period. Payback period is the amount of time the project will incur to recover its cost.

The life cycle of this project is twenty years with initial investment of 42 billion rupees. To find the cost benefit ratio, the inflow of cash and outflow of cash will be discounted to its project year which is 2015. Net Present Value (NPV) is the most widely used method for discounting to cashflows.

The data for Operational Expense and revenue generated through ridership is taken from Pakistan Metrobus System command center and is available from 2015 to 2021. Due to Covid-19, the PMS services were closed for 4 months in 2021 and in 2021 the due to smart lockdown the PMS services were affected in some part of the month also the ridership didn't reach to its full potential as in the previous years, due to which the data of 2020 and 2021 is dropped from analyses. To vanish the effect of Covid 19 in data, we had found the growth rate in operational expense (OE), which is mainly due to inflation in the country, and then we have calculated OE for year 2020, 2021 onward to 2035. Same techniques were applied for finding revenues from 2020 to onward 2035 with one percent increase in ridership. This justification for one percent increase in ridership is the increase in the population growth in consideration which will contribute ridership increase. Revenue is discounted to base year of project. For discounting inflow and outflow of cash, we have taken average of interest rate from 2015 to 2021 and applied on remaining year up to 2035.

Table 4: PMS Discounting Pay Back Period

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Year	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**	**2034**	**2035**
Initial Cost	-42,040M																					
Revenue		447M	787M	795M	1,079M	1,177M	1,188M	1,200M	1,212M	1,224M	1,237M	1,249M	1,261M	1,274M	1,287M	1,300M	1,313M	1,326M	1,339M	1,352M	1,366M	1,380M
Subsidies		1,834M	1,924M	1,879M	2,263M	0M	2,176M															
Operational Expenses		2,623M	2,752M	2,833M	3,089M	3,042M	3,780M	4,082M	4,409M	4,761M	5,142M	5,554M	5,998M	6,478M	6,996M	7,556M	8,160M	8,813M	9,518M	10,279M	11,102M	11,990M
Net Cash Flow	-42,040M	-342M	-42M	-159M	253M	-1,865M	-416M	-2,882M	-3,197M	-3,537M	-3,906M	-4,305M	-4,737M	-5,204M	-5,709M	-6,256M	-6,848M	-7,487M	-8,179M	-8,927M	-9,736M	-10,610M
Discount Factor at 8.22%	1.0000	0.9924	0.8544	0.7889	0.7299	0.6744	0.6233	0.5755	0.5332	0.4941	0.4544	0.4199	0.3888	0.3588	0.3331	0.3066	0.2833	0.2611	0.2411	0.2223	0.2066	0.1910
Present Value	-42,040M	-316M	-36M	-126M	185M	-1,256M	-259M	-1,658M	-1,699M	-1,737M	-1,773M	-1,805M	-1,836M	-1,863M	-1,889M	-1,913M	-1,935M	-1,955M	-1,973M	-1,990M	-2,006M	-2,020M
Net Present Value	-71,899M																					
Net Present Value is negative, so we cannot calculate Payback period.																						

From the aforementioned computation the net present value is negative which suggests that the project will not reap any advantages. Instead, the PMS will require additional -71,899 million to keep its operations going through 2035.

4.4 Social Cost Benefit Analysis:

4.4.1 PMS Ridership:

Pakistan Metro Bus (PMS) construction began in February 2014 and was finished in June 2015. The goal of PMS was to make it easier to travel between the twin cities and reduce dependency on personal transport and traffic congestion. National Engineering Services prepared the feasibility report, and it anticipated a daily ridership of 135,000. Table 2 shows the details of total ridership, average ridership, and revenue:

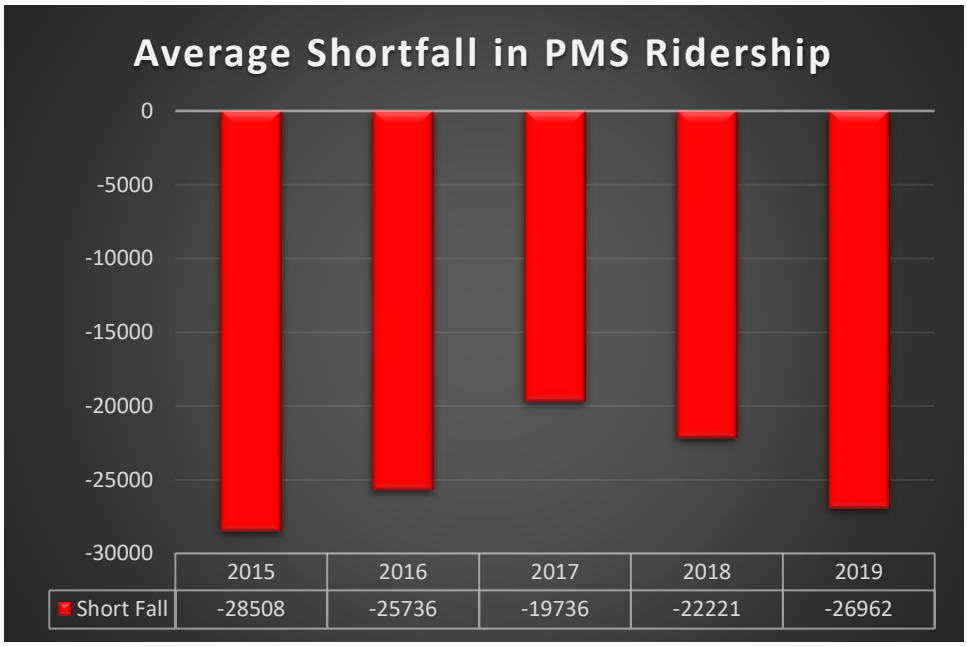
Table 5: Total Ridership and Average Ridership from 2015-2019

Year	Total (Passengers) in Year	Operating Days	Average Ridership (Per Day)
2015	22,363,321	210	106,492.00
2016	39,335,133	360	109,264.00
2017	39,766,064	345	115,264.00
2018	40,938,787	363	112,779.00
2019	37,381,198	346	108,038.00
Total	**179,784,503**	**1,624**	**551,837.00**

The total amount of ridership from 2015 to 2019 is 179 million. From the table we can see the highest ridership recorder was in 2018 and lowest in 2019. Year 2015 is not included in the comparison become of the project inception in June 2015.

In the NESPAK feasibility report it was estimated that the average daily ridership would be around 135,000, but from the table 2 we can that there is shortfall in the average ridership. The shortfall in ridership is shown in figure 1:

Figure 1: Average Shortfall in Ridership



Between 2015 and 2019, the PMS ridership has been short by an average of 24,633. The question is, why is there a significant ridership gap? Is it the fare being charged too high than the private transportation, or are the PMS station not accessible?

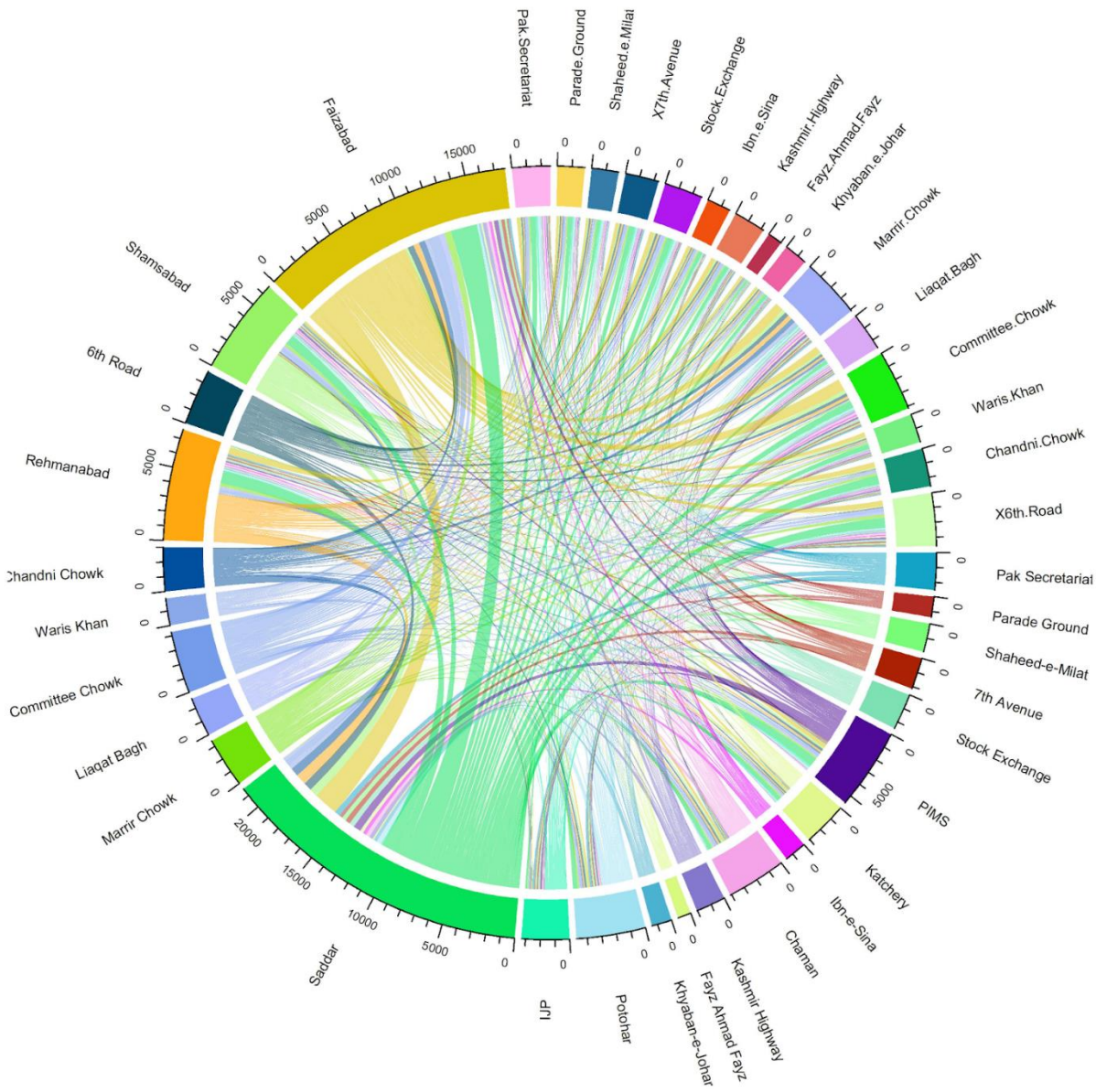
Are Both questions examined independently to answer the issue of shortfalls? Nevertheless, first, let us compare the ridership of Islamabad and Rawalpindi separately.

4.4.2 Ridership patterns of Twin Cities:

As the PMS is operating in twin cities, ridership of both cities is analyzed separately to find the commuting patterns and useability of PMS. Daily inflow and out flow of PMS ridership at each station is depicted through chord diagram in figure 2. A Chord diagram helps to investigate flows

between a set of things. Entities (nodes) are displayed all around a circle and connected by arcs (links).

Figure 2: Chord Diagram representing Inflows and Outflows of Each Stations



The above chord diagram depicts a complete picture of metro ridership on 06 July 2021. A total of 87,694 commuters used the metro bus station that day. Lines in the chord diagram show the check-in and check-out of each station. The highest number of in and out is between Saddar and Faizabad. Saddar and Faizabad have the biggest chunk of ridership in the figure, followed by

Rehmanabad, Shamasabad, Marrir Chowk, Committee Chowk, 6th road. The interesting factor to note here is that almost all the stations in the Rawalpindi region are performing better or have the highest ridership, and it is just not one day; if we analyse year-wise ridership, we get the same picture. The useability of PMS in twin cities from 2015 to 2019 is shown in figure 3 & 4.

Figure 3: Daily Average Ridership of Rawalpindi from 2015-19

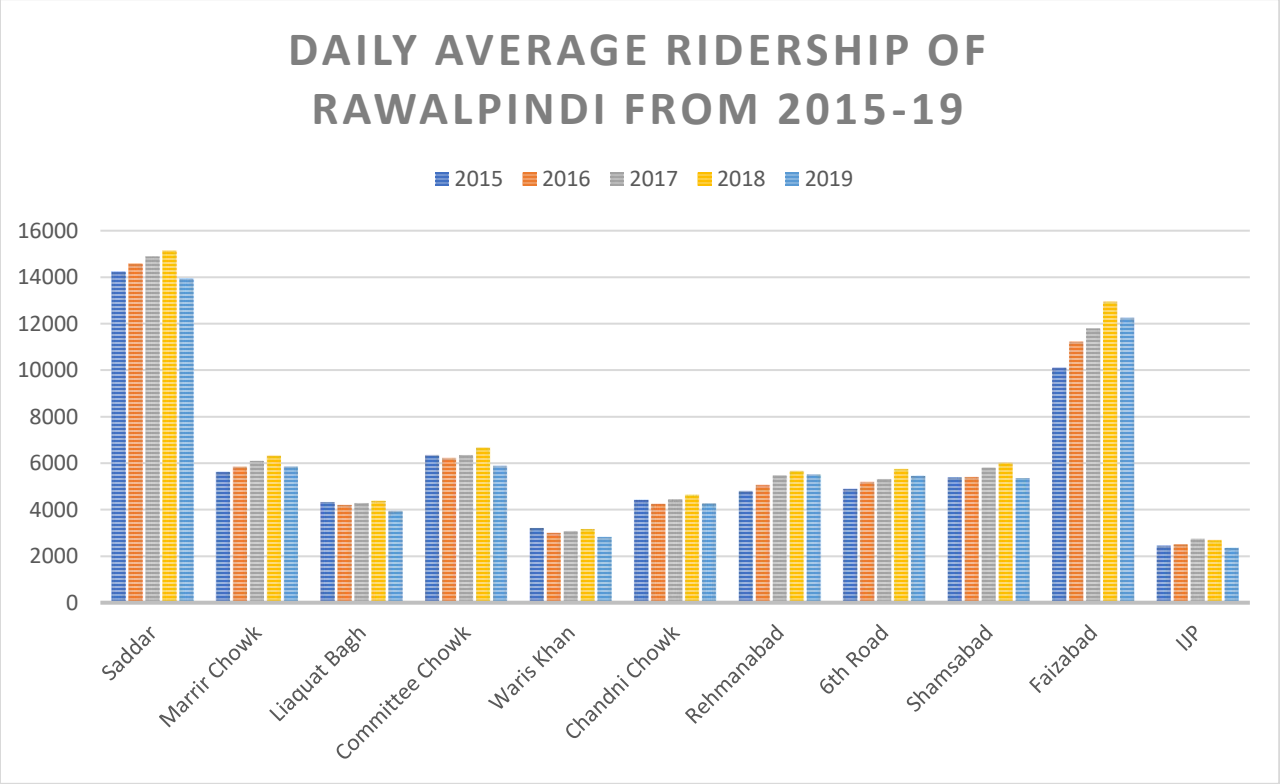
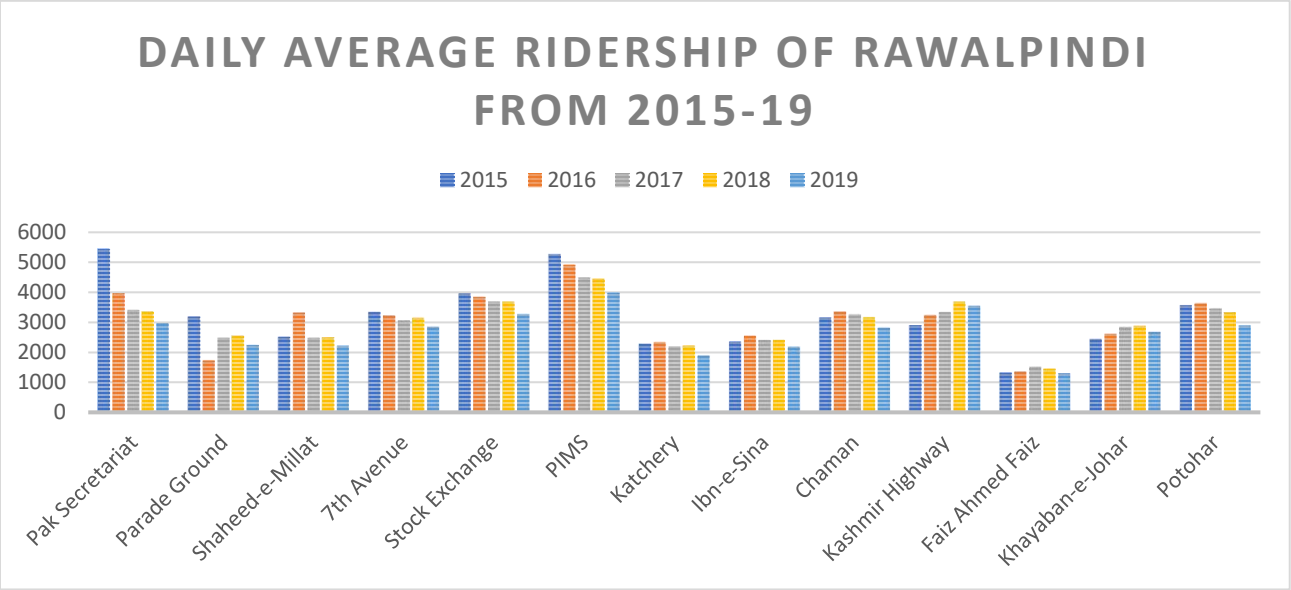


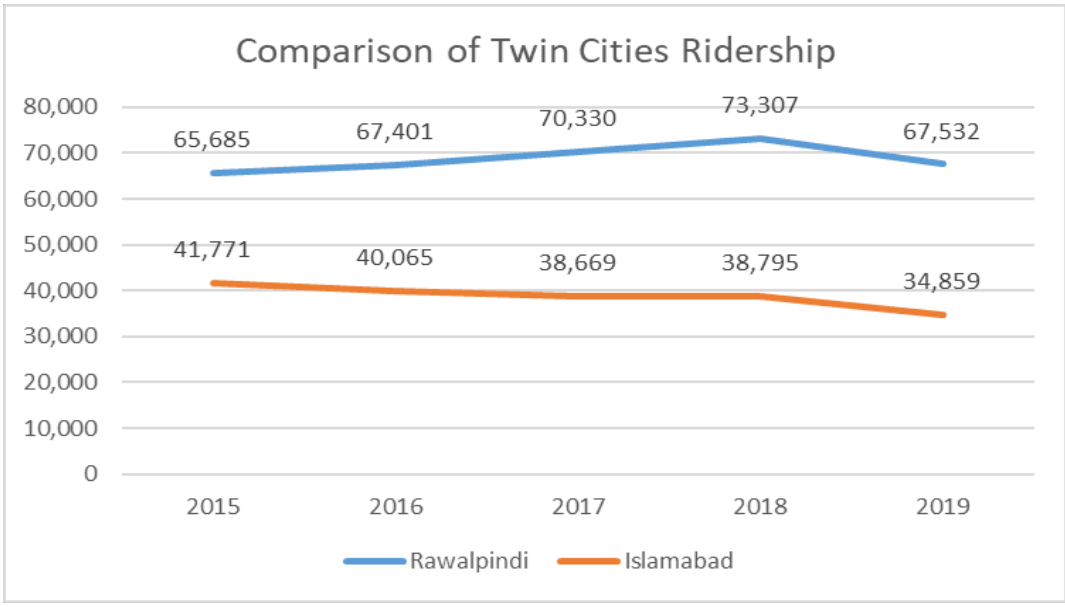
Figure 4: Daily Average Ridership of Islamabad from 2015-19



The above figure 3 & 4 shows the average ridership per year from 2015-2019. The Rawalpindi portion of metro is highly active or have highest useability as compared to Islamabad.

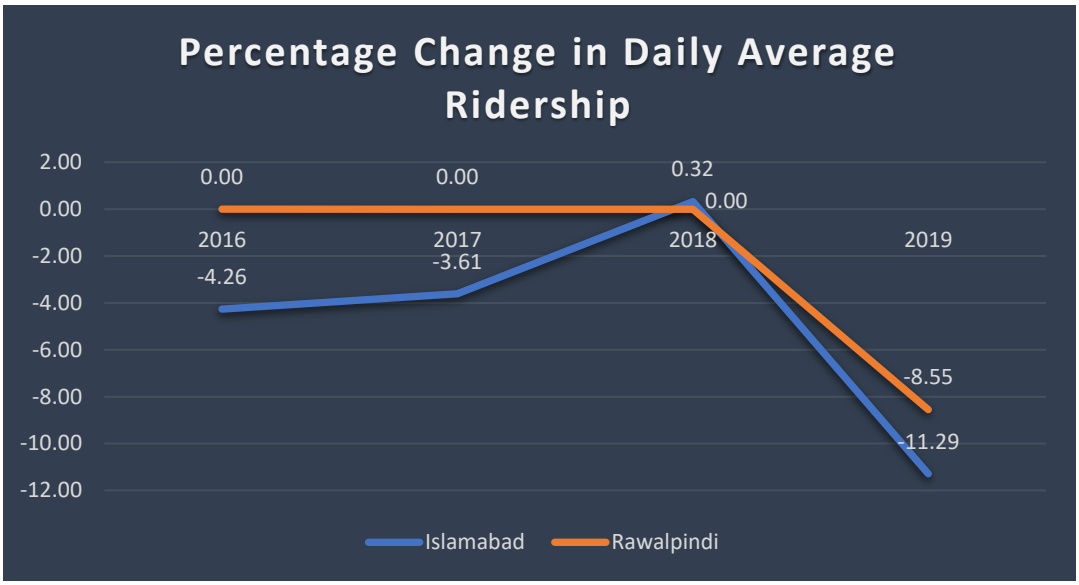
If we look at the average increase in the ridership per year the picture is depicted in figure 5:

Figure 5: Average Comparison of Twin cities Ridership



Percentage Growth in Ridership:

Figure 6: Percentage Growth in Ridership

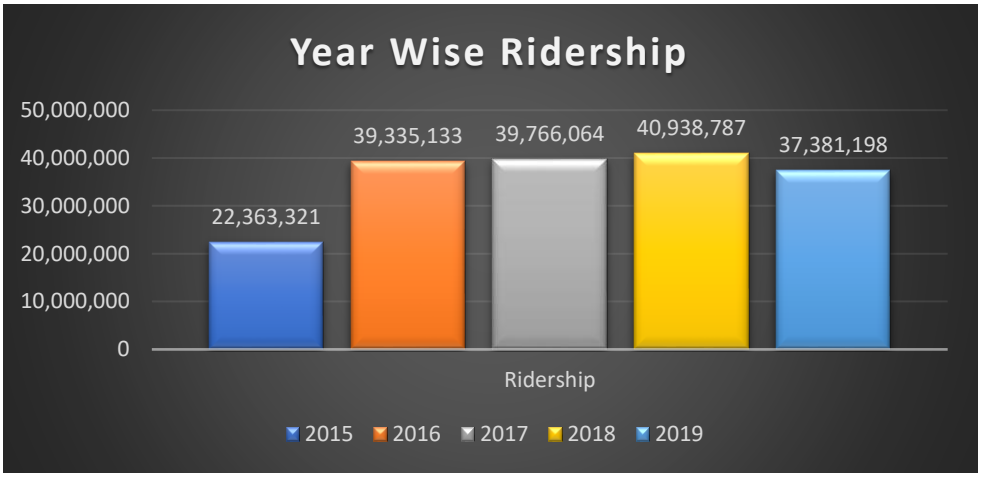


Another interesting point about the PMS ridership patterns is that the average useability in Rawalpindi show a minute increase till 2018, while the Islamabad region is showing a negative trend throughout its course. The average daily ridership showed a little recover from -4.26 percent in 2016 to 0.32 percent

4.4.3 Is the fare to high?

From the inception of PMS, the fare was charged around Rs. 20 for single trip. During that time the private transport had the same fare for the 23-kilometre route. Due to growing number of subsidies the federal government, increased the fare from Rs. 20 to Rs.30.

Figure 7: Total ridership from 2015-2019



The ridership increased by 43.14 percent between 2015 and 2016. The number of operating days was the cause of this tremendous growth. As previously stated, the PMS commenced operations in June 2015 for 210 days, whereas in 2016, the PMS was operational for 363 days. From 2016 to 2017, ridership increased by 1.08 percent, whereas in 2018, ridership increased by 2.8 percent, and in 2019, ridership decreased by 9.5 percent. One of the primary causes for the drop in ridership was an Rs.10 fare increase. The federal government increased the fare due to the increasing number of subsidies.

4.4.4 Subsidies:

The PMS is experiencing a high number of deficits, which are being covered by massive amounts of subsidies. Table 5 depicts the subsidies received by PMS from 2015 to 2019:

Table 6: Subsidies given to PMS

Year	**Subsidies**	**Percentage Increase**
2015	1,833,986,825	
2016	1,923,866,727	4.671836
2017	2,020,060,063	4.761905
2018	2,263,112,661	10.73975

2019	2,376,268,294	4.761905
Total	**10,417,294,570**	**6.72 (Average)**

Subsidies totaled PKR 10.41 billion in the first five years of PMS, with an average annual growth rate of 6.72 percent. If the average increasing rate of subsidies is used for the entire life cycle of 20 years, a total of PKR 69.45 billion in subsidies will be put into PMS to keep it functioning for the entire life cycle.

Table 7: Subsidy Per Head from 2015 to 2019

Year	Total Ridership	Subsidy	Total Cost of Fare	Cost Paid by Passenger	Subsidy Per Head
2015	22,363,321	1,833,986,825	102.01	20	82.01
2016	39,335,133	1,923,866,727	68.91	20	48.91
2017	39,766,064	2,020,060,063	70.80	20	50.80
2018	40,938,787	2,263,112,661	80.28	20/30[3]	55.28
2019	37,381,198	2,376,268,294	93.57	30	63.57

PMS is heavily subsidized in terms of fare. The federal and Punjab provincial governments are paying a significant chunk of the one-way fare cost.

4.4.5 Pedestrian Shed Concept and the PMS Stations:

According to the Charter of the New Urbanism, "Neighborhood's should be compact, pedestrian-friendly, and mixed-use," and "many activities of daily living should be within walking distance." The solution for making the neighborhood compact was the "pedestrian shed," "a distance that can be covered in five minutes at a normal walking pace, typically shown on a plan as a circle with a

[3] PMS fare rate was changed from PKR 20 to 30 in May 2018.

quarter-mile radius." If cities' physical environments appeal to people's sense of scale, they will walk for at least five minutes rather than using a motorized form of transportation.

When the "Pedestrian Shed" concept was applied to PMS stations to check whether the metro boarding stations were in the range of 5 minutes walkable distance, the results were quite different in twin cities.

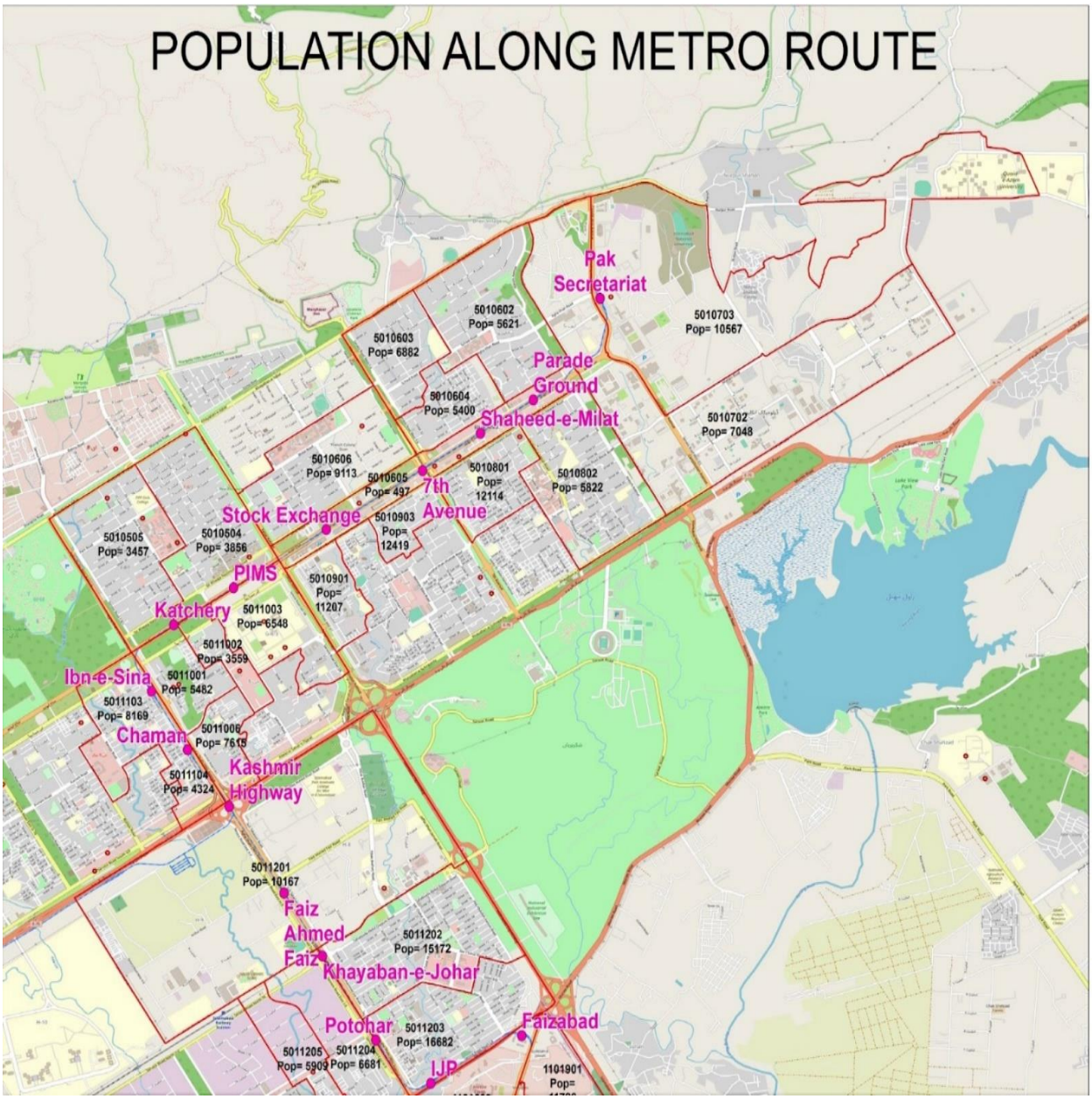
For the pedestrian shed concept, "Shape File" with charge, circle and block-wise was requested from the Bureau of Statistics, Pakistan. But the request was denied due to security reasons. Instead, the PBS provided us with a limited amount of data in "PNG" (image) files. Only circle boundaries data along the PMS route was provided with the residing population in that circle. For simplification, the twin cities are analyzed separately.

4.4.6 What is Charge and Circles?

Charge and Circle are the two measuring boundaries of a city. At the granular level, we have a block, which includes 200-250 households. When 5-7 blocks are combined, a circle is made. Similarly, when 5-7 circles are combined, it is represented by a charge. A charge is represented with a physical address, while Circle has a unique set of codes. The number of charges in Islamabad is seven, and the number of circles is 77, while the number of charges in Rawalpindi is 192.

The reason for analyzing charge and circle is to find out how much population is residing around the PMS route. It will guide us how much population is using the service. Unfortunately, due to limited provision of data from PBS we can only make assumptions. Figure 8 represents Islamabad population residing along the PMS route in Islamabad.

Figure 8: Population along PMS route of Islamabad



In the next step, a quarter mile radius circle was drawn along the PMS route to see how much circle population have access to their respective station. The results are depicted figure 4:

Figure 9: Quarter Mile Radius Circle from Pakistan Secretariat to Katchery Station

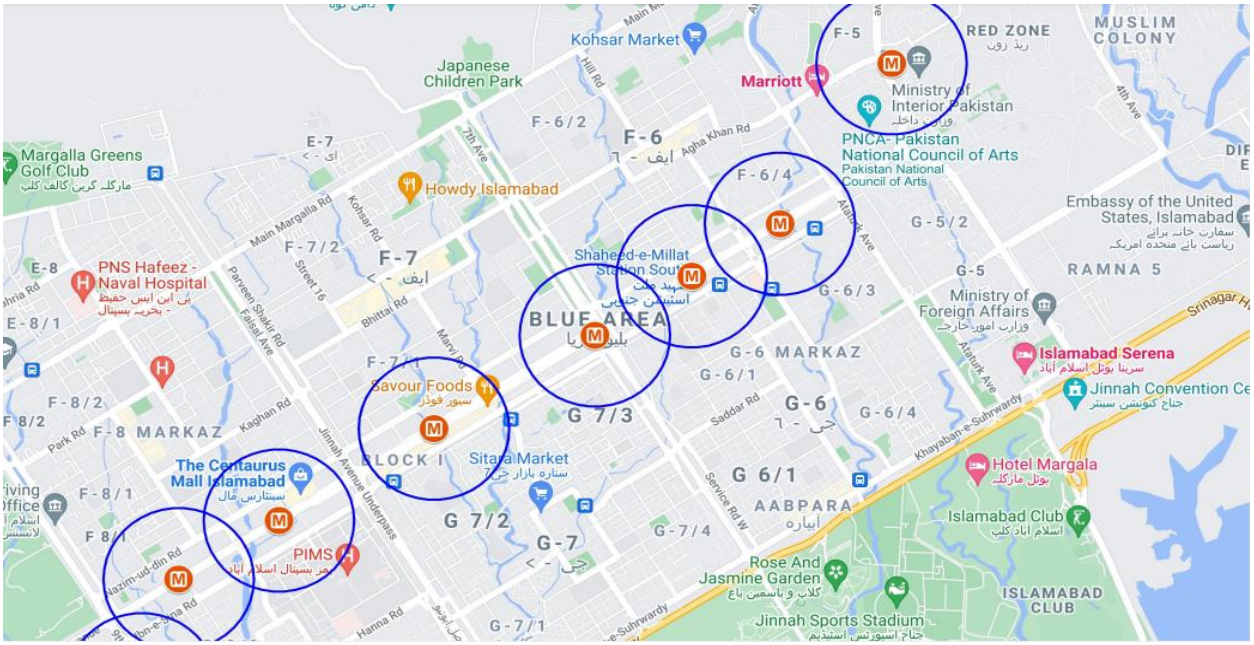
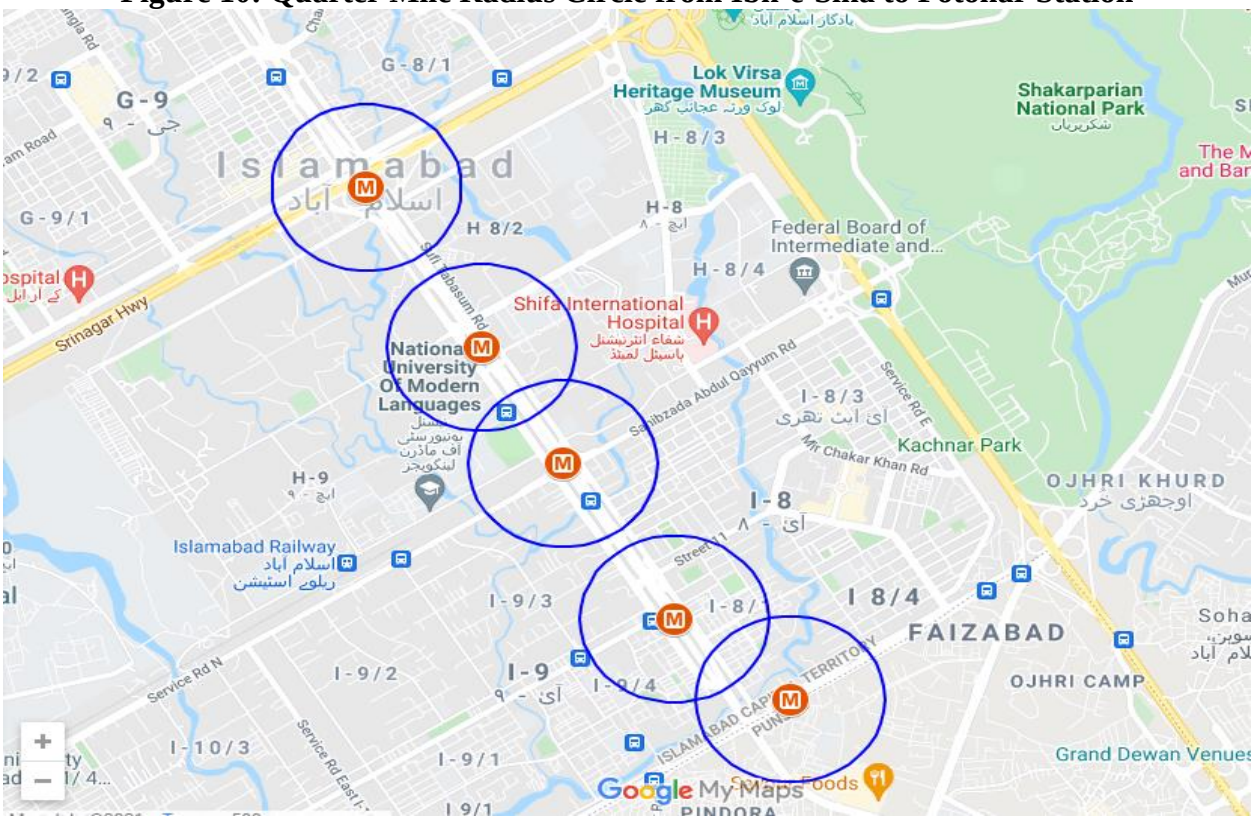


Figure 10: Quarter Mile Radius Circle from Ibn-e-Sina to Potohar Station



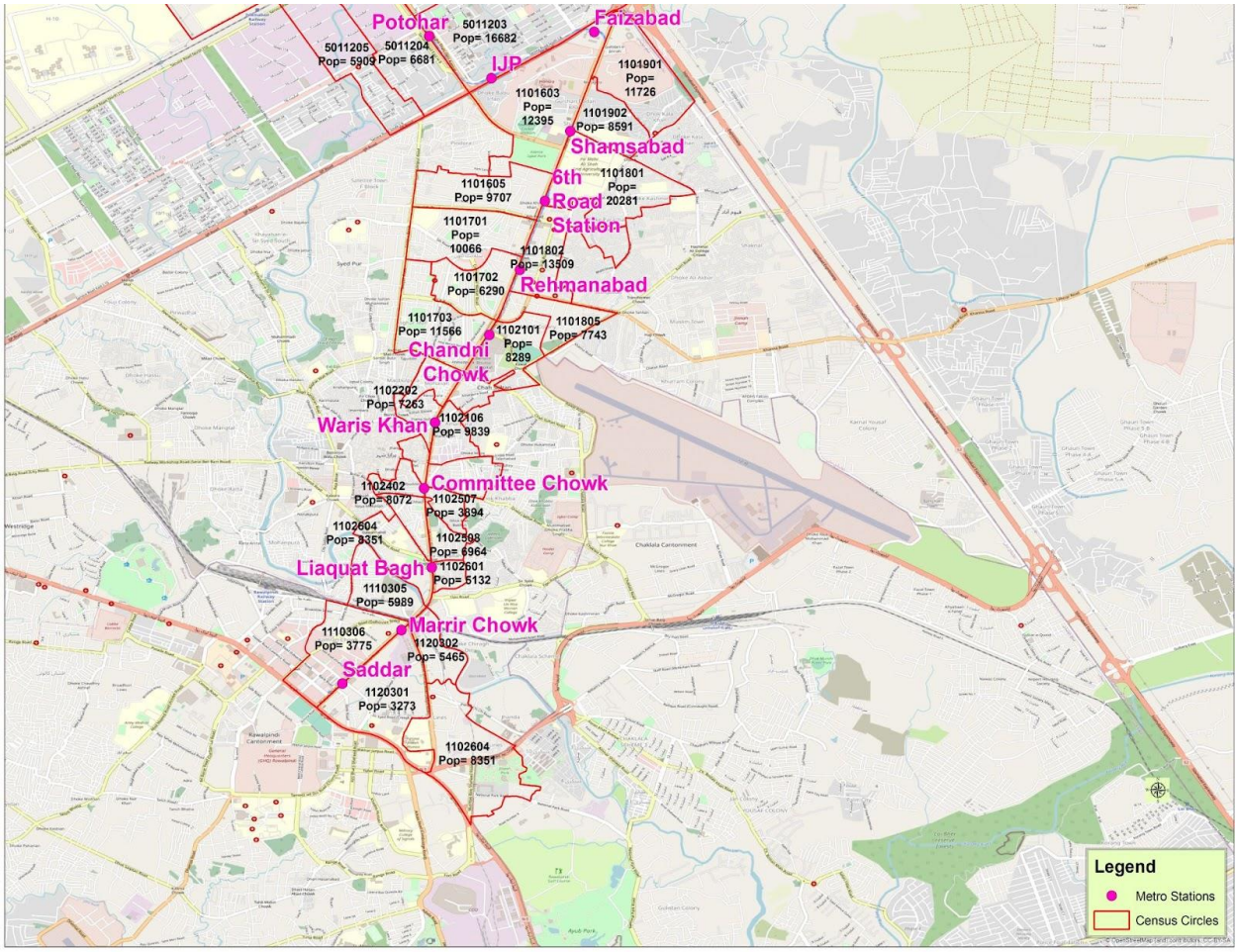
When the quarter mile circle is drawn that the along the PMS station, half of the population along the metro have access to the PMS station, while most of the population didn't have access to the

nearby PMS station in 5 minutes. When people didn't have access nearby stations within 5 minutes walkable distance people will prefer individual mobility rather than opting for collective mobility.

Rawalpindi Circle wise population along PMS route:

The population of Rawalpindi along PMS route is depicted in figure 5:

Figure 11: Population along PMS route of Islamabad



When we draw the quarter mile circle along the Rawalpindi population, most of the residents have access to boarding station within 5 minutes of walkable distance which is why the Rawalpindi region PMS have higher ridership as compared to Islamabad.

Figure 12: Quarter Mile Radius Circle from Faizabad to Chandni Chowk

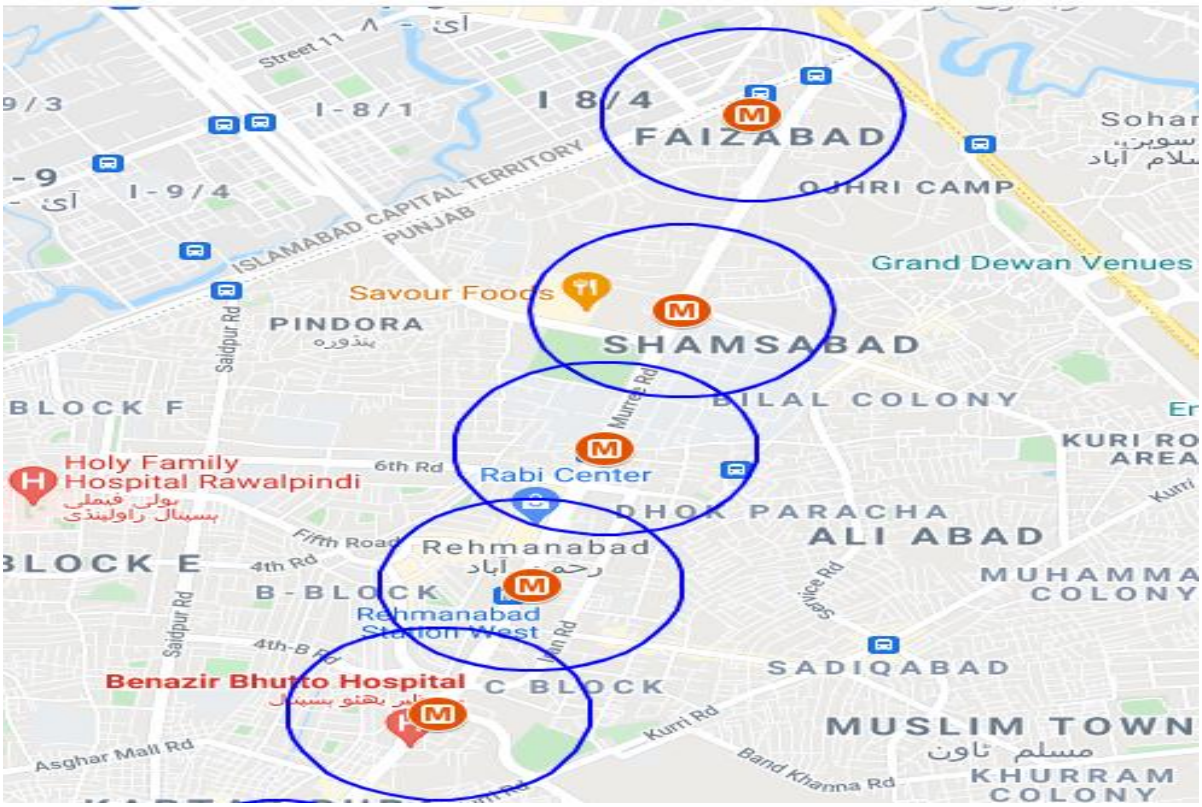


Figure 13: Quarter Mile Radius Circle from Waris Khan to Saddar

When the population (figure 5) is compared with the (figure 6) quatre mile radius we can clearly see that almost all of the population have access to PMS station at a five minute of walkable distance.

(Khan & Shiki, 2018) investigated the PMS's accessibility and revealed that three-quarters of the population lives outside walking distance of the PMS. 41, 61, and 81 percent of the twin city population, cannot reach the PMS service within 5, 10, and 20 minutes of the walking distance. Another point worth noticing is that Hiace coaches are accessible to 80 percent of the population within 5 minutes of walking distance, whereas PMS is only accessible to 8 percent of the combined population of the twin cities, who live within 10 minutes of walkable distance.

Chapter 5

Qualitative Assessment

To conduct scholarly research, qualitative methods differ from quantitative ones. Inquiry strategies, data collection, analysis, and interpretation methods all play a role in qualitative research. Qualitative procedures use text and image data, have distinct steps in data analysis, and employ a variety of investigation strategies despite the processes being similar. However, even within a single strategy, the methods used are not always the same due to the fact that qualitative projects use a variety of inquiry strategies from social justice thinking to ideology perspective to philosophical stances, the landscape of qualitative methods reveals a variety of viewpoints (Creswell, 2008).

Many different types of data are collected by qualitative researchers rather than just one, such as interview transcripts, field notes and other documents. Qualitative research is based on the idea that the best way to learn about a problem or issue is to speak with people who have firsthand experience with it.

In this chapter discussion is mainly focused on qualitative assessment of the research and the underlying objective of this study by interacting with relevant stakeholders and experts from the industry. Moreover, different policy documents and regulations were also put to a review. This helped the author in broadening his policy horizon by understanding the real situation on the ground, policy dynamics if the problem and view of different stake holders.

To carry out these interactions the author developed an interview guide based on the objectives of the study and the underlying problem. Two interview guide was prepared for the qualitative assessment. Interviews arrangements were kept as semi structured and unstructured in nature, to better reflect on the situation. Two separate interview (structured and unstructured) interviews

were conducted because of the different approach level of the interviewers. One interview was conducted from government officials which was structured in nature and the other was conducted at ground level from the Bus Stand Manger. The guide can be found in the appendix A. Moreover, the interviews weren't conducted on a specific time during the research, rather interviewee were reached out on different stages of the thesis.

Summary

It's quite ironic that Pakistan third biggest metropolitan has no public transport system, and there are two reasons for that. One, in the rule book of Capital Development Authority (CDA) it has nothing to do with the provision or regulating the public transport network. Second, the Islamabad Capital Territory Administration (ICTA) only provides licenses to private transporters and incase of regulation they don't have any jurisdiction. In the light of above cases, when one institution has nothing to do with regulation and second only providing license who is regulating them no one knows". In case of public transport provision, governments throughout the world does not provide transportation channels to public, they just regulate them**.**

Pakistan Metrobus System project is good, but it is extremely expensive, and heavily subsidized. There was no need of such lavish spending and building such a state-of-the-art bus. Are we in a position to afford such an expensive project? Is our commuter in a position to afford a high price tag ticket. A single increase in PKR 10 hike in PMS fare dropped 9 percent in ridership which clearly means that we exceeded our consumer price cape. There was no need for building elevators, escalators and air-conditioned buses which escalated the overall cost. Mass transit system are post graduate phases of transportation, and we haven't graduated yet. Normal buses would have been a much better option.

It was quite odd that PMS project construction work began in 2014 completed in 2015 and the feasibility report was published in 2015. Why was feasibility report published a year later? It was necessary for the PMS project to first analyze all the components of mass transit system and then execute the project, but the case here is opposite**"**

Mass transportation services is our dire need at the moment, but not expensive project like PMS. Instead of building such an expensive project, the best option was to buy 300 to 400 buses and operate them according to the needs of people.

Metro is fenced or have dedicated routes when congestion is there, so that it can attract riders who are using individual mobility. Islamabad is not facing severe congestion so there was no need of fenced or dedicated route, also the main avenues of Islamabad is signal free and metro route passes from there. On the other hand, Rawalpindi is facing from sever congestion so dedicated route is justifiable there**.**

For locally empowered project, the question is who will do it? In CDA rule book there is no section about public transport, and everyone thinks CDA is all in all but it's not. First, CDA has to be given mandate which will allow it to initiate, execute and regulate the project. In PMS two bodies were involved in the project initiation. From Punjab side Pakistan Public Work Department (PWD) Rawalpindi and from Federal government Executive Committee of The National Economic Council (ECNEC) had the mandate to initiate and execute the project. A letter has been forwarded to the Ministry for the establishment of Capital Mass Transit Authority (CMTA) which will empower CDA in public transport matter.

On flat surface i.e., 20 rupees the cost should be 50-50. Half of the cost of one-way fare should be borne by the consumer/commuter and half should be barred by the government. Another discriminating thing about the subsidy is that the ridership of Rawalpindi metro is quite high as

compared to the Islamabad so the subsidy should be in that manner, i.e., Rawalpindi region has the highest ridership so they should pay more subsidy, vice versa. But no both the parties are spending the same amount irrespective of the PMS useability.

Interviewer:

List of the interviewee for this exercise include the following name: **Nasir Javed**, Urban Planner; **Nadeem Khurshid**, Urban Planner; **Qazi Omar**, Director BRT CDA; **Route Clerk**, ITA

Interview 2 Summary:

Islamabad's public transportation system is in disrepair for a variety of reasons:

- To begin, Islamabad has more than 42 public transportation routes, 15 of which are operational. Twenty-five routes are inoperable because the population density along those routes is low, which is not economically beneficial to transporters. This makes access within Islamabad more difficult and increases reliance on personal transportation.
- Second, there is no regulatory body in charge of monitoring the transportation network. The Islamabad Capital Territory Administration (ICTA) only assigns route permits after inspecting the vehicle's condition and seating capacity; otherwise, no body monitors whether the drivers follow the route or not. The drivers, on the other hand, take full advantage of the monitoring system's shortcomings.
- Drivers do not adhere to the transportation route that has been assigned to them. They usually take the route that is more economical and has a higher passenger load. They easily deceive traffic enforcement agencies by changing their assigned route number, which most of the time results in an excess supply of vehicles in some areas and vice versa.

Interviewer:

Naveed Ahmad, Local Bus Stand Manager Abpara

Chapter 6
Conclusion and Policy Recommendation

Cities are the engine of economic growth. People move to cities for better jobs, education, health, and lifestyle opportunities. For such reasons, a high influx of people has moved to cities to avail such opportunities.

One of the prominent features of cities is mobility. Mobility in general sense means "the ability to move." Mobility includes walking, cycling, running, individual motorized mobility (cars and motorbikes). At the dawn of automobiles, city planners divided cities into different parts, like housing here, jobs there, shopping somewhere else, etc., to increase the travel time so that demand for cars rises. This concept had a drastic effect on people's mobility patterns. Cities were dependent and dominated by cars everywhere, the concept of walking was killed, and cities' arteries were choked with cars.

The collective mobility concept was on the rise to revert city life to normal and reduce car congestion. For collective mobility, the Urban Light Rail (ULR) system evolved, which effectively addressed the issues of mass mobility. However, there were two problems with ULR, it was costly, and the second, its non-flexibility. Due to scarce resources, a high amount of investment was required for the ULR, making it difficult for the government to invest. Second, ULR operates on fixed dedicated lanes, which means it could not operate without its track. Due to its non-flexibility, it was costly to redesign the track if the travel demand was slightly miscalculated.

With time, ULR was swapped with Bus Rapid Transit (BRT), also known as the metro bus system/service. BRT was the least expensive and more flexible, which is the reason governments around the globe have heavily invested in the BRT projects. Latin America and Europe have the highest BRT operating systems, followed by Asia.

Pakistan is also heavily investing in the BRT system. Lahore was the first city to have a BRT system (most commonly known as metro), followed by the Twin Cities of Pakistan, Islamabad, and Rawalpindi. Islamabad and Rawalpindi are the third biggest metropolitan of Pakistan, with a combined urban population of 5.2 million. The evolution of both cities is quite different from both cities. Islamabad is the only planned city of Pakistan, and its foundation was laid in 1960, while Rawalpindi was conquered by the British in 1844 and is home to Pakistan Army Headquarters. Both quite rely on each other. Due to the development of Islamabad, Rawalpindi infrastructure saw a boom.

The twin cities transportation plan was developed in 1980, and the plan has not seen any modification to date, and the private sector runs the public transport network. In 2012 a survey by the Capital Development Authority Islamabad revealed that more than 80 percent of the people are dissatisfied with public transport. Out-dated vehicles, increased travel time, and fear of harassment were major reasons for dissatisfaction with public transport. In 2013 Pakistan Muslim League Nawaz (PMLN), in an election campaign, announced that if his government came into, he would gift the residents of twin cities with state-of-the-art metro bus service. The PMLN government won the 2013 election, and the promise was fulfilled.

The construction work on the project started in 2014 and was completed in 2015. The project was named Pakistan Metrobus Service (PMS) and is a 23-kilometer-long route connecting Rawalpindi from Saddar to Islamabad from Pak Secretariat. The total project cost was PKR 4204 million and is jointly operated by the Capital Development Authority and Punjab Mass Transit Authority. The feasibility report of PMS was prepared by National Engineering Services Pakistan (NESPAK). Since its development, the PMS has been in a heating debate between the ruling party and the opposition.

The metro service in Islamabad and Rawalpindi was planned to be built in 4 phases: Redline (from Saddar to Pakistan Secretariat) in 2014-15, Green Line (from Sawan Adda to Pakistan Secretariat) in 2016, Orange Line (from G-11 to D Chowk) in 2018, and Blue Line (from Katchery to 9th Avenue) in 2020. So far, only the red line metro has been operational, and the rest of the metro lines are only available in the paper. Redline metro was established first because of its highest travel demand of 135,000. Nevertheless, it has not achieved its targeted ridership to date after the operations.

To make the metro affordable, the one-way ticket fare was priced at PKR 20. So far, 17.9 million commuters have used the PMS service from 2015-2019. The revenue generated through fare in these years is 54,030 million, while the operational cost in this period stands at 187,317 million, which means that the project is in a huge amount of loss. There are two reasons for this loss in revenue: one shortfall in ridership and the second high operating cost.

NESPAK feasibility estimated that 135,000 commuters would use the ridership daily, but the highest ridership PMS achieved was 115,000 in 2018. Moreover, in 2018 an increase in PKR 10 caused a significant drop of 24,000 ridership daily. Second, the PMS is state of the art mass-transit service like air-conditioned buses, elevators, escalators, etc., which makes the operating cost of PMS high, and on the other hand, commuters cannot pay the high cost of the fare. The one-way fare cost from 2015-2019 was 102, 69, 71, 81, and 94 for each year, respectively, while the commuters paid PKR 20 from 2015 to 2019 and PKR 30 in 2019. The federal and Punjab provincial governments are paying the subsidies to fill the revenue and operational expenses gap. So far, 10,417 million has been paid in terms of subsidies.

The cost-benefits ratio of PMS is 0.2 for the first 5 years, which means that the project is not beneficial at all. If we look at the project payback period, the net present value is negative, which

means the project cannot recover its cost over the life cycle of 20 years. Additionally, there will be extra expenses for the PMS operations. PMS has outsourced all the operations. PMS uses Al-Barak company buses on an 8-year lease that expires in 2022. In 2015, the cost of one bus was PKR 300 million, with a total cost of PKR 2,040 million for 68 buses. As the contract expires, new buses will be purchased, and the cost of new buses will serve as fuel to the fire, pushing the expenses curve upward. The cost of new buses can be estimated based on the purchase of new buses by the Lahore Metro. The Punjab Mass Transit Authority is also in charge of the Lahore metro. The same contract was signed between Lahore Metro and Al-Bayrak company for the buses for eight years, and Lahore Metro now purchases 64 new buses after the contract expires. The cost of 64 new buses in 2021 is PKR 2,600 million, compared to PKR 1,290 million in 2013. The cost of a single new bus for Lahore Metro is 40.6 million, and if the same cost is estimated for PMS 68 buses, the total cost will be PKR 2,762 million, and this additional burden will skyrocket the overall project cost.

Despite the heavy investment, the project is not used at its full potential mainly because of one reason, and it is accessibility. The PMS is merely accessible to 8 percent of the total population of Islamabad and Rawalpindi. Through the pedestrian shed concept, the PMS is hardly accessible to half of the population living in the close circle of PMS. The pedestrian shed concept states that if the city design is built in a way people can fulfill their needs in 5 minutes' walk (quarter-mile radius), they will most likely walk, but if that is not the situation, people will be oriented towards the motorized mode of transport, i.e., individual mobility (like cars and motorbikes).

There is a dire need for feeder buses to operate the PMS at its full potential; otherwise, the PMS is just a waste of taxpayers' money and a politically implanted project keeping the cost and benefits completely out of the book.

6.1 Policy Recommendations

Our cities desperately need a comprehensive public transportation policy. Our current transport policies are outdated and their formulation dates to the 90's era, and Rawalpindi-Islamabad is a classic example. Islamabad the national capital, and the only planned city have no clear-cut policy for public transportation. The only transportation plan was made in the 1980 and still implemented which no one follows, and no government body is playing the role of regulator.

- For efficient transportation plan first city dimension must be studied, like where the population resides, what are there commuting patterns and what is the urban sprawl pattern? How much population is using cars and how much uses public transport? This calculation is easy because of the internet age. Cellular Network Record data, Global Positioning System and Remote Sensing can easily help the planners to where the population resides, what are there commuting patterns and what is the urban sprawl pattern. Based on these points' transportation network should be designed, keeping in mind the accessibility, peak and trough hours and most importantly affordability.
- One biggest problem with the Pakistan Metrobus System (PMS) is the cost. A state-of-the-art mass transit system was built, but on the other hand, people don't have much of the purchasing power to pay the cost of the actual fare. The development should be divided into different phases. First, the old transport system should be replaced with improved mass transit buses. A dedicated lane should be provided to the buses, buses should be aligned with a strict schedule, and accessibility should be at the forefront of designing any transit service. The second contributing factor in PMS downfall is the accessibility; people do not have access to the PMS. To make the PMS, an efficient transport system of feeder routes must be provided to keep the demand for feeder routes.

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Appendix A

Interview Guide 1

Questions:

1. What do you think about the Islamabad public transportation network? Is it adequate?
    a. If yes, how?
    b. If no, why?
2. Who regulates the public transport and what are the guidelines for regulation?
3. Is providing public transportation to the general public government responsibility or private bodies?
    a. If its government responsibility, then how much should the government invest?
4. What are your views about the Islamabad-Rawalpindi metro service?
5. Should the metro be fenced or not?
6. The metro is heavily subsidized and over the years the PKR 71 billion will be required to cover up its expenses your views about it?
7. Metro is a centralized project why not a locally empowered project?
8. Cost of one-way vs the subsidy provided by the government

Year	Total Ridership	Subsidy	Total Cost of Fare	Cost Paid by Passenger	Subsidy Per Head
2015	22,363,321	1,833,986,825	102.01	20	82.01

2016	39,335,133	1,923,866,727	68.91	20	48.91
2017	39,766,064	2,020,060,063	70.80	20	50.80
2018	40,938,787	2,263,112,661	80.28	20/30[4]	55.28
2019	37,381,198	2,376,268,294	93.57	30	63.57

Should the cost solely barred by the passenger or by there should be 50/50 partnership?

Interview Guide 2

Questions:

1. How do you view the public transportation network? Is it good?
2. Why only 15 routes are operational out 42 proposed routes by the Islamabad Capital Territory Administration (ICTA)?
3. What is the route allocation and how effective is the system?
4. Who regulates the transport system and what are the challenges?

[4] PMS fare rate was changed from PKR 20 to 30 in May 2018.