Behavioral Intentions of using Paratransit Services for Enhancing Accessibility at Metro Bus Stations

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THESIS ACCEPTANCE CERTIFICATE

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CERTIFICATE OF APPROVAL

This is to certify that the research work presented in this thesis, entitled "Behavioral Intentions of using Paratransit Services for Enhancing Accessibility at Metro Bus Stations" was conducted by Mr. Abdul Moeed Bin Khalid under the supervision of Dr. Sameer-ud-Din. No part of this thesis has been submitted anywhere else for any other degree. This thesis is submitted to the School of Civil and Environmental Engineering in partial fulfilment of the requirements for the degree of Master of Science in Field of Transportation Engineering, Department of Transportation Engineering, National University of Sciences and Technology Islamabad.

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I, Abdul Moeed Bin Khalid, hereby state that my MS thesis titled "Behavioral Intentions of using Paratransit Services for Enhancing Accessibility at Metro Bus Stations" is my own work and has not been submitted previously by me for taking any degree from this University, National University of Science and Technology, Islamabad or anywhere else in the country/ world.

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DEDICATION

To my parents and siblings, who encouraged and supported me in every aspect of life.

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ABSTRACT

Behavior plays an important role in developing individual perception and attitude, which assist in making decisions, and especially in selecting transportation modes. Among various theories, the theory of planned behavior (TPB) and interpersonal behavior (TIB) are used to determine users' intentions in using paratransit service in an area with conservative social norms, status-conscious and Asian culture as compared to developed nations. In this study, various contextual factors were investigated to determine the behavior of people. These factors are processed through the structural equation modeling technique to determine the effects of all considered constructs. It is revealed that attitude and perceived behavioral control were significant predictors of intentions. Additionally, it is further influenced by positive emotions indirectly through attitude and perceived behavioral control. Unlike other studies, negative emotions have not been found to be significant across all paths. This indicates that positive emotions play a significant role in shaping behavior to choose travel mode. However, affect remains insignificant, although it has found a significant impact on intentions through attitude. Therefore, experiences from travel patterns are fruitful in developing their cognition, based on which they will be able to decide whether to choose or not. The findings also revealed that females are more inclined towards using paratransit than males. The implications of the discussed matters would impact the shaping of transit policies and strategies for attaining sustainability.

Keywords: Human Behavior, Theory of Planned Behavior (TPB), Theory of Interpersonal Behavior (TIB), Structural Equation Modelling (SEM), and Mode Choice.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF ABBREVIATIONS

Abb.	Description
TPB	Theory of Planned Behavior
TIB	Theory of Interpersonal Behavior
SEM	Structural Equation Modelling
EFA	Exploratory Factor Analysis
CFA	Confirmatory Factor Analysis
BRT	Bus Rapid Transit
CBD	Central Business District
PMA	Punjab Mass Authority
CDA	Capital Development Authority
TRA	Theory of Reasoned Action
PBC	Perceived Behavioral Control
MGB	Model of Goal-Directed Behavior
ELM	Elaboration-Likelihood Model
KMO	Kaiser-Mayer-Olkin
GFI	Goodness of Fit Index
AGFI	Adjusted Goodness of Fit Index
CFI	Comparative Fit Index
NFI	Normed-Fit Index
RMSEA	Root Mean Square Error of Approximation
SRMR	Standardized Root Mean Squared Residual
AVE	Average Variance Extracted
VIF	Variance Inflation Factor
LOS	Level of Service

CHAPTER 1: INTRODUCTION

The population has abruptly increased by 27 percent over the last couple of decades globally [1]. It has resulted in an increase in the growth of car ownership because people need to travel based on utilities. Currently, the increase has reached a level where road infrastructure been faced a problem of congestion at peak hours in cities. It has been associated with economic and non-economic damages incurred in gridlock [2, p. 3365]. It has not just been confined to the transportation systems but also impacted heavily on transportation services as well. Thus, there is a need to have better transport connectivity in cities to facilitate people's mobility. Usually, long distances travel has encouraged the use of private cars [3], [4, p. 463]. Another aspect of the private car is the symbol of status in society, a feeling of independence, and manifesting one's higher socioeconomic standing [5], [6].

1.1 Demand for Mass Transit

Governments are trying to introduce schemes rather than continuing to focus and invest in road infrastructure to mitigate congestion and carbon footprints. Currently, they have focused more on different kinds of mass transit projects (e.g. Bus Rapid Transit (BRT), Commuter Rail, Metro, etc.) as observed in most of the developed nations. It is a present need to have a better transport mode choice that encourages private car users to shift to public transport by providing flexibility in transport in transportation mode. Government agencies can play an important role by implementing efficient policies to enhance the ridership of Bus Rapid Transit (BRT)/Metro. The ridership can be enhanced by shifting non-mass transit users to use BRT [7], [8]. There is a need of better transport network connectivity between users and the BRT line. To access BRT, demand-responsive vehicles (paratransit) can help in better facilitation of service due to its flexibility in routing and scheduling.

Among various mass transit projects, the most commonly adopted is the Bus Rapid Transit (BRT). It is considered an efficient system for the cities to improve mobility. However, it cannot produce fruitful results by itself until and unless other public transport modes would be integrated with this system. It is said so because such a massive service be introduced to capture the area of the Central Business District (CBD) based on the market segment. Therefore, its' accessibility from other urban areas and urban fringes would be challenging. This will encompass involving various types of services (e.g., feeder routes and paratransit) to enhance its' accessibility.

1.2 Factors Influencing Transportation Demand

Currently, a matter of most concern is integration within different modes of transport [9, pp. 3129–3146], [10, pp. 1341–1356]. The system would be considered successful if more people were shifted towards the public mode of travel rather than choosing or adapting private mode for trips. This would only be feasible if public transport has offered affordability and efficiency to its users and is the most challenging task. It is said so because the demand for transport has been influenced by socio-economic characteristics (e.g. income, trip purpose) [11, p. 2]. Additionally, the demand is directly affected by the population of the area as well [12, p. 181,182]. The income attribute for determining the transportation demand is more inclined towards people purchasing power and population so a per capita income makes it more appealing than considering the GDP [13, p. 88].

Several factors that influence public transportation demand are quality, comfort, and the most contributing among them is the area of population. People's behavior plays a significant role in the adaption of different transportation modes. People living in a certain area will prefer certain modes of transport based on factors like comfort, convenience, and accessibility to a specific mode. An understanding of people's behavior plays a significant role

in determining factors that are involved in decision-making regarding the travel experience [14, p. 318].

People's beliefs vary from region to region and can be affected in different ways. Mostly, the influence of culture in different regions plays a role in justifying people's behavior [15, pp. 1–2]. However, important factors like availability of transport, fare, and time affect the decision-making of people's preferences. Additionally, taxi costs and parking availability were found to have an impact on public transit utilization as indirect effects [16], [17, p. 484].

1.3 Pakistan's Challenges towards Transportation Network

The challenges of the developing country, like Pakistan, are far different compared to those of developed nations. Users are forced to pay high transportation prices based on their income value. Additionally, the government agencies have borne additional congestion and safety cost from the road network. An increase in the transportation cost of services and modes whether it is parking, fuel or buses, taxis, uber, careem has enforced an extra burden on users. Thus, transport accessibility and affordability are becoming critical issues for citizens who are heavily relying on public transport [18].

The purpose of paratransit is in line with a definition of sustainability, which is defined as "meeting the needs of the present without compromising the ability of future generations to meet their own needs" [19]. It assists in providing accessibility to various areas of urban units. [9, p. 3137] has mentioned the paratransit as the most preferred mode after walking in Lahore city. Pakistan, being a developing country, has more influence on paratransit which is a famous and most operated service for a long time in Lahore. An increase in the number of private cars on the road network with the passage of time has raised concerns in urban areas [20] and it has become a challenging task to mitigate it by providing better alternative public transportation modes. There is a need to have a better environment and structure that will encourage people to have a paratransit service as their priority to travel [9, p. 3130]. The company's involvement

with the inclusion of the government can help in managing the paratransit service operations in a more efficient way [21].

Additionally, it would assist in the modal shift from private to public transport. This has offered users an opportunity to enjoy travel rides in a private car and public mode both at a reasonable cost. However, unlicensed vehicles (e.g. rickshaws) are difficult to regulate by the authorities [11, p. 2], and its' workers face a variety of challenges, including lower wages, fewer job possibilities, and diminished decision-making power [22]. However, these challenges could be addressed through a user's feedback unit that would assist in justifying the performance of the system [23, p. 44].

1.4 Accessibility Concerns of Metro Bus Network

The urbanization of Islamabad, Pakistan's capital city, has increased 426.21 percent in the last 3 decades [24]. The Metro area population of Islamabad is increased by 3.1% in 2021 from the last year [25]. Currently, this city is facing challenges of the increase in congestion, safety, and accident issues [18, p. 11]. It is vital to consider the traffic of Rawalpindi in connection to Islamabad because they both are considered twin cities of Pakistan. According to statistics, the population of Rawalpindi city reached over 2.3 million in February 2022 [26].

As far as Metro is concerned, it provides to-and-fro services between Islamabad and Rawalpindi. Additionally, this metro has the following two routes: first, connecting Rawalpindi (Saddar) to Islamabad (Pak-Secretariat), which is currently functional. Whereas, the second route is within Islamabad Capital connecting Kashmir Highway (Peshawar Mor) to Islamabad International Airport. Both cities have different demographic cultures, norms, and traffic patterns. Additionally, the metro route covering Rawalpindi areas is from CBD and downtown areas. While it is far away from centralized Markaz (business) areas of Islamabad. It would be not wrong to say that the route lies towards the outer fringe of Islamabad city wherein covering some government institutions and educational sectors. Currently, the feeder routes of

Islamabad city are centric towards markaz areas that lie in mid of the residential housing area as shown in **Figure 1-1** below [27].

1.5 Study Area

Islamabad, being the capital of Pakistan, has covered an area of 906.50 sq. km., where each sector consists of a 2 x 2 km area [28]. The survey was conducted at Islamabad Metro stations, educational and commercial institutes. A total of 13 stations are operating on the first route of Islamabad from Pak Secretariat to Potohar and entering into IJP Metro bus station towards Rawalpindi stations. Seven stations were selected for the survey in Islamabad [PIMS, Kashmir Highway (Peshawar Morr), Stock Exchange, Pak Secretariat, Potohar, Chaman and 7th Avenue]. These seven (7) stations were selected based on a large number of ridership as compared to the remaining six (6) stations in Islamabad. The demand for Metro passengers is much greater at these selected stations. International Islamic (H-10) and FAST (H-11) University in Islamabad were selected in Institutions category. A survey was conducted through questionnaires from passengers/travelers at these Metro stations. The questions are comprised of covering two types of information pertaining to demographic information and willingness to travel on paratransit. The demographic information covers gender, age, income, education, and car ownership. Whereas, the survey about the paratransit has detailed discussed in the Chapter 3 Methodology section, which has based on a literature review.

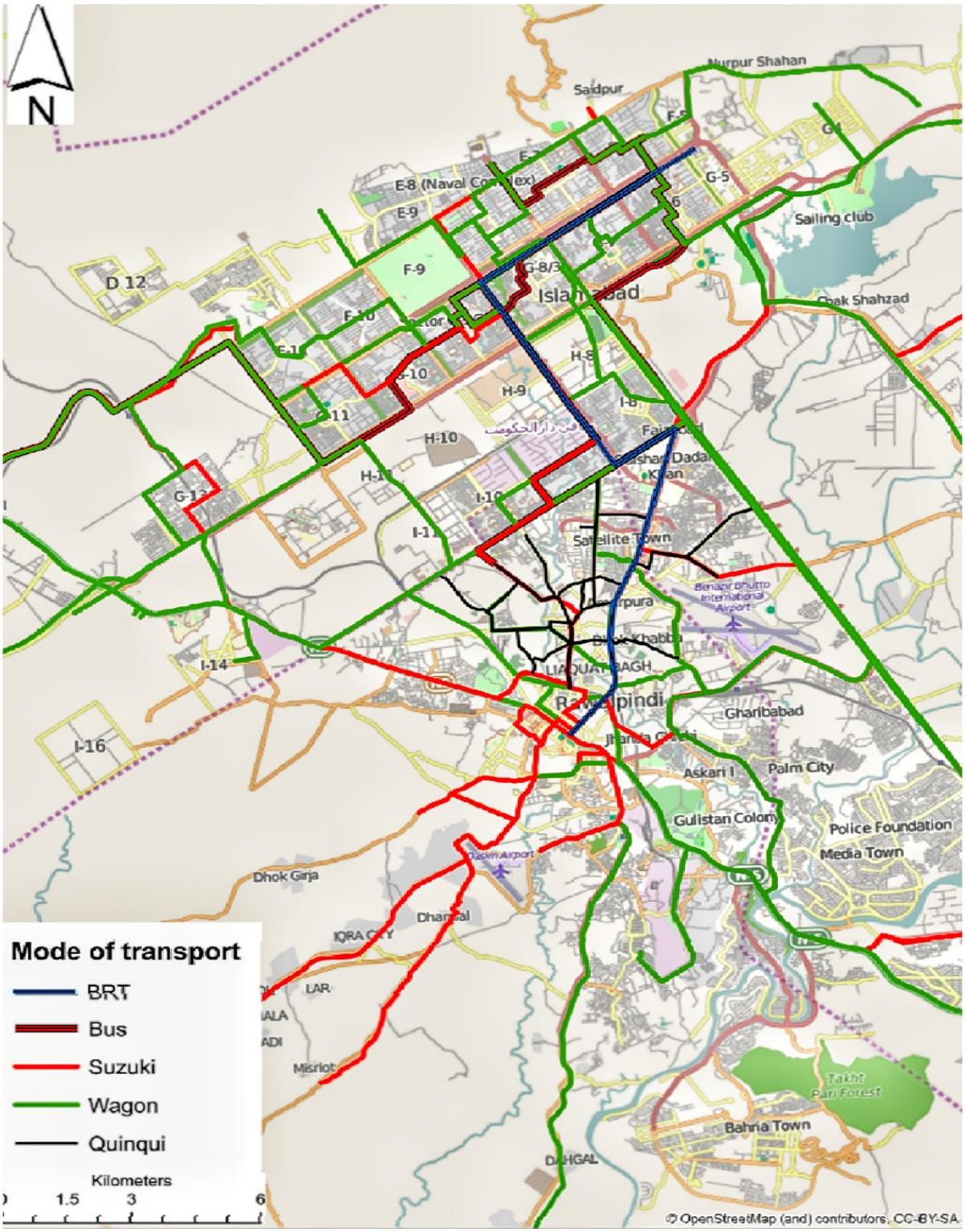

Figure 1-1. Islamabad and Rawalpindi Public Transport Routes

The overall study plan area is shown in the above figure showing various routes as per the legend. In this area, metro lines are highlighted in the following **Figure 1-2**. Access and

egress information gives an idea of the people's patterns and choices for traveling. Currently operated metro stations are being well-served in connectivity of movement in nearby sectors.

However, a problem, that the metro lines stations located in Islamabad differ from Rawalpindi, is the ridership. There is a large ridership in a limited number of Metro stations (i.e., PIMS, Kashmir Highway, and Pak Secretariat) of the first route in Islamabad. It is due to the presence of a Medical Center (e.g. Pakistan Institute of Medical Sciences -PIMS), markets (e.g. Itwar Bazaar near Peshawar Mor Interchange on Kashmir Highway), and government administrative structures (e.g. Pak Secretariat area). However, the second route is not-centric on CBD areas apart from connecting Islamabad International Airport and mostly covers university areas located on the outer fringes of Islamabad sectors.

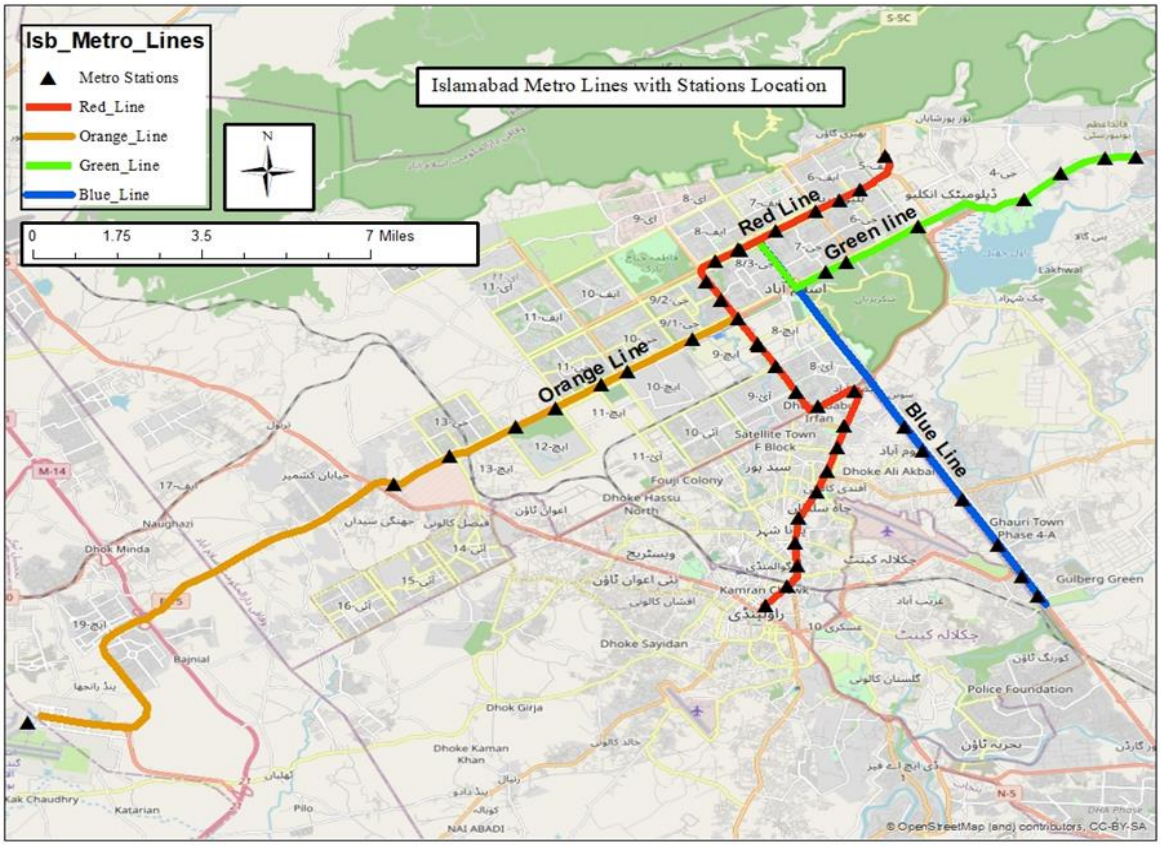

Figure 1-2. Islamabad and Rawalpindi Metro Lines

It could be estimated that the ridership would not be the same as it is predicted. Additionally, it is less accessible from the residential units which would be a hindrance to

commute the airport. Currently, the road network at peak times faces a severe level of congestion. This problem cannot be resolved with the provision of building more roads. Thus, the second route was built while considering that it will be a well-suited and preferred choice for road users to commute purposes. Hence, it implies in investing schemes (like paratransit) that would offer road users to enjoy a car ride service connected to the metro line instead of making a private mode of a trip to commute. Else, running a metro line scheme with fewer benefits would not serve a value to money.

Currently, the mode of transport in Islamabad city are public vans, bus rapid transit (BRT), private cars, and motorbikes. Whereas, informal transport (e.g. auto-rickshaws, etc.) is not allowed in a city to operate [18, p. 4,5]. This has reduced the option for commuters to enjoy a low-cost ride. This gap could be sustainably filled with a paratransit service scheme to be considered as it has the potential to produce a fruitful contribution by providing a better and affordable service.

Having a background as aforementioned, this study has modeled the behavior of users and commuters to determine whether the scheme of paratransit could be acceptable to them. Additionally, the factors on which government agencies/departments (e.g. Punjab Mass Authority (PMA), and Capital Development Authority (CDA) would need to focus. It will assist them in better understanding users' behavior while implementing such schemes in the future. Islamabad, being the capital city, has different characteristics as compared to the rest of all urban units and metropolitan cities of the country. Therefore, the nature of the travel and user behavior is most important to model and could not be judged based on past studies of developed and developing countries.

According to the Theory of Planned Behavior (TPB), behavioral intentions serve to motivate future actions [14], [29]. Many studies on commuting have focused almost entirely on individual-level psychosocial variables in order to investigate non-coercive methods of

changing behavior [15, p. 1], [30], [31]. Past behavior is thought to be the best predictor of future behavior [32]–[34]. Theory of Interpersonal Behavior (TIB) comprises of Theory of Planned Behavior (TPB) and Theory of Reasoned Action (TRA) [35, p. 322]. The TRA and TPB do not account for the emotional components of conduct since they only focus on the cognitive parts of behavior. Therefore, Ajzen's Theory of Planned Behavior (TPB) and Triandis' interpersonal behavior theory (TIB) has been adopted to model people's behavior consideration in model shifting towards paratransit. It will assist in elaborating intentions based on emotions and control of commuters. As abovementioned, we have listed the study objectives as follows:

- Determining the intentions to use paratransit service as transfer mode to/from Metro stations?
- Determine the commuters perceive the paratransit service for the accessibility of the Metro bus service?
- What is the acceptability of paratransit service based on income and trip purpose?
- Whether personal car users will show a willingness to use paratransit services in the future or not?

CHAPTER 2: LITERATURE REVIEW

Travel experiences play an important role in selecting a travel mode for making a trip, which is eventually recognized as a behavior. It has resulted in developing certain attributes that influence the behavior of an individual based on convenience [36, p. 176]. Among various transportation modes, motorcycles and three-wheeler modes are considered the most vulnerable to safety aspects. The risk involved in the occurrence of accidents and the severity of their impacts for these modes is likely higher as compared to other modes. However, the individual preferences of liking and disliking would vary based on the circumstances, either socially or culturally, which further rely on locations. Irrespective of their vulnerability, these modes are most common and popular in developing countries because of the non-availability of efficient, reliable, and time-bound public transportation facilities. Additionally, the economic condition plays an important role in choosing a travel mode. These are considered as the cheap in capital cost as well as operational and maintenance cost which attracts masses having low GDP ratio.

Currently, the safety and security issues involving harassment on a gender basis, especially females, have forced us to choose these vulnerable modes as the most preferred alternative option, and their numbers and presence on the road network are on the increase. In light of the aforesaid statements, government agencies need to ensure the safety of road users through enhancing schemes for improving public transport. We have incorporated literature based on behavioral theories and studies to develop a model for this study to estimate the willingness and acceptance of commuters to use schemes like paratransit services. It is stated as such because there may be future intentions to use public transportation services or facilities by improving their accessibility without compromising system mobility when measured in

terms of efficiency [10, p. 12]. It would further highlight weak areas to be addressed based on our case study area, which is the capital city of the developing country.

2.1 Behavior towards Travel Mode Choice

Psychological theories were developed to understand the behavior of people. Different theories have evolved with the passage of time. These theories have been shown to be more effective than infrastructure facilitation in determining people's mode choices [37]. Various policies are being adopted in order to limit car use by improving public transport on the basis of people's psychology [38]. These theories have helped in understanding human behavior in terms of understanding their preferences for particular trip/journey modes. The past experiences of users play an important role in making further decisions while facing future uncertainties that later on converge into their behavior [39, p. 20].

Mode choice differs according to the nature and purpose of travel. An increase in the number of private cars on the road network with the passage of time has raised concerns in urban areas [20] and it has become a challenging task to mitigate it by providing better alternative public transportation modes. The important factors that play a key role in mode shift are travel time and convenience [40]. There are certain instrumental (i.e., affordability, satisfaction) and affective (i.e., emotions and moods) factors that can be helpful in travel mode choice [41], [42]. These factors need to be better explored and understood through incorporating theory of planned behavior and interpersonal behavior. We have utilized the same for estimating users' intent about the usefulness of paratransit.

2.2 Theory of Planned Behavior

The theory of planned behavior (TPB) is based on psychological behavior which is widely adopted for modal choice research focusing on predicting and explaining intended behavior across various disciplines [34, p. 128], [43]. TPB is derived from the theory of

reasoned action (TRA) [29]. However, the TRA is comprised of volitional control components only, and it has a limitation in addressing non-volitional parameters. The decision, once made, is based on both volitional and non-volitional parameters. Additionally, there is another determinant parameter which is called "perceived behavioral control," and that needs to be taken into consideration. It deals with certain resources (e.g., money and time constraints) that control their actions and are discussed later in detail.

Behavioral intentions are based on the motivation for which people would like to take an action. Therefore, it is the probability that an individual will engage in a particular behavior [36]. These intentions further stimulate the formation of future behaviors [29]. It is behavior that plays an important role in decision making, apart from factors like travel experiences. It is a natural and common behavioral response that people always give preference to a better mode of conforming towards convenience and affordability, which influences them to shift modes. As an example, more people would prefer to choose public transport for making their trips through adopting approaches that focus on enhancing services and convincing marketing tactics. A primary purpose of public transportation systems is to attract both users traveling in either private or public modes [17, p. 484], [44], [45]. Various researchers in the past have utilized TPB to evaluate behavior pertaining to mode choice [32], [33].

2.2.1 Perceived Behavioral Control

Perceived behavioral control (PBC) is defined as "the perceived ease or difficulty of performing the behavior, and it is assumed to reflect past experience as well as anticipated impediments and obstacles" [46]. There are various external and internal resources that help in performing a certain behavior [47]. The internal resources are mainly focused on certain conditions like knowledge and skills, while money, time, and physical condition are incorporated as external resources. The combination of above two will help in developing a certain behavior that an individual will act or not [48, p. 103]. In the case of ample resources,

people will have more control over their actions on which they make decisions towards performing a certain action. Therefore, individual performing any behavior does not just depends on resources only but to surpass their interferences [49], [50].

The resources assist in making people's mind up to carry out particular actions. A study [34] found its influence significantly impacted on motorcycle users as compared to car users. It indicated that individuals with enough resources have given preference when making decisions for better alternative modes of transport. However, people will be able to establish more control over their decisions if they are provided with equally good public transportation in comparison to private modes. The resources will motivate people towards taking any action, called "intentions". In a study, these intentions for public transportation mode were found to be significantly influenced by perceived behavioral control [51].

2.2.2 Attitude

Attitude is defined as "the degree to which a person has a favorable or unfavorable evaluation or appraisal of the behavior in question" [46]. The assessment of an attitude does not clearly indicate a coalition between evaluation and specific behavior [52], [53]. Ajzen's theory of planned behavior [46] affirms that attitudes have a significant influence on behavioral intention that switches cognitive signal into specific behavior [54]. An individual's attitude does not always lead them to act or perform a specific action. Therefore, attitude towards behavior is usually based on cognition and requires greater processing time in making decisions [55]. In transportation, attitudes can also alter future intentions in making a perception of using services. Attitude can help in determining travel mode choice [56]. However, there are two types of attitudes that normally considered, and these are positive and negative. A positive attitude is an indication towards the utilization of certain modes of transport. People prefer to travel more when they have a favorable attitude toward particular forms of transportation,

which will eventually improve their desire to travel [53]. The study [51] has revealed that attitude plays a significant role in the context of public transportation usage.

People control over their actions can be influenced by their cognitive ability, as attitude and PBC were proved to be important predictors in risky behavior [57]. Thus, the attitude can be helpful in developing the cognitive ability to better understand resource utilization among transport users. In this way, a positive attitude can be helpful in better control over the actions towards their behavior and vice versa for the negative attitude.

2.3 Theory of Interpersonal Behavior

The theory of interpersonal behavior (TIB) has contributed significantly, in addition to theory of planned behavior (TPB) and theory of reasoned action (TRA), by introducing emotions and feelings. Most of the studies that have previously been conducted have limitations in addressing TIB. Therefore, there is a gap that needs to be incorporated through conducting investigations into other factors involving decision making. The reactions and feelings are based on the events that have happened in the past. It may result in a change in their dynamic thinking, which forces them to act accordingly. However, it is not always a single reason for adopting or changing a certain behavior because people can also make decisions based on their mood states.

2.3.1 Emotions

Emotions can play an important role in decision making [58]. They are also being studied together with other psychological theories to understand more about actions influencing behavior. It can be characterized in terms of its valence (positive or negative) [59]–[61]. These are further categorized into two dimensions of emotions, which were characterized based on valence (positive/negative) and arousal (high/low) [62]. Negative emotions and bad

experiences were observed in users of public transportation as compared to users of the other forms of transportation[63], [64].

A study conducted by [65] incorporating TPB and a model of goal-directed behavior (MGB) was carried out to determine users' preference to choose public transport over private cars for work trips, subjected to assessing anticipated emotions. The findings of this study show that negative emotions have prevailed in people's preferences towards the use of public transportation. In the past, anticipated emotions were investigated in the context of climate change [66]. The findings have revealed that both positive and negative emotions have played a significant role towards perceived behavioral control. The positive emotions were found to be significant in recent marine studies (e.g., cruise) [67] and bicycle [68] travel. This shows that people with positive emotions have more control over their actions [69] and tend to abstain from negative emotions [70]. We have focused on examining the contributions of positive deactivating (comfortable/relaxed) and negative activating (frustrated/irritated) emotions in decision making for a travel mode choice.

Positive emotions will aid in the exploration of new ideas and approaches and lead towards problem-solving situations [71], [72]. People with positive emotions are flexible in moulding their decisions based on uncertain situations they will experience in future and afterwards [72]. Emotions can help in generating a distributive attitude among people's behaviors whether positive or negative. Usually, attitude constructs are recognized in terms of eagerness and willingness, and these are mediated to develop a relationship for emotional aspects towards knowledge-sharing intentions [73]. It has been revealed that emotions can directly influence judgment if they are experienced as a response to the object of assessment [74]. It has been proposed that the negative emotions reduce cognitive processing capability [74], [75]. Therefore, it can be concluded from the above discussion that the emotions can assist in producing a cognitive stimulus according to the adaptation of people's decisions.

2.3.2 Affect

"Affect" refers to an individual's natural, automatic, and sometimes even unconscious emotional reaction to various situations [35, p. 325], [58]. There is growing evidence that people also evaluate a desire by monitoring their subjective affective reactions (feelings and moods). Therefore, decisions are not merely based on cognitive but also affective components, which can play an important role. Affect influences attitude based on two characteristics of learning, such as semantic and procedural knowledge. Semantic knowledge refers to obtaining information about things as an evaluation, whereas receiving it in response to a specific object is referred to as "procedural knowledge" [74, p. 440]. However, affective states can have an impact on judgmental appraisal in a variety of ways [55, p. 478]. A study on heuristic-systematic model [76] and the Elaboration-Likelihood Model (ELM) [77] determined a coherent relationship between attitude and affect. Several studies have found agreement with the affect-as-information theory's assertion that attitude is influenced by affect [78], [79]. A study focusing on paratransit has revealed affection as a stronger predictor in comparison to cognition towards loyalty [80]. Feelings can also induce a change in attitude and assessment [81]. However, vacillation or mixed feelings may cause people to hesitate when making decisions [82]. Thus, it would lead to more hassle in decision making and ultimately result in being less judgmental. Therefore, there is a greater chance that negative affection can impair cognitive processing [83], while positive affection serves to strengthen an existing positive cognitive evaluation [84].

In this study, the model has been developed to investigate the relationship between the constructs by integrating theory of planned behavior (TPB) and interpersonal behavior (TIB). We have hypothesized, based on the literature findings, as follows.

H1: "Negative emotions" will have a negative and significant impact on "affect".

H2: "Positive emotions" will have a positive and significant impact on "affect".

H3: “Affect” will have a positive and significant impact on “attitude towards paratransit”.

H4: “Negative emotions” will have a negative and significant impact on “attitude towards paratransit”.

H5: “Positive emotions” will have a positive and significant impact on “attitude towards paratransit”.

H6: “Negative emotions” will have a negative and significant impact on “perceived behavioral control”.

H7: “Positive emotions” will have a positive and significant impact on “perceived behavioral control”.

H8: “Attitude towards paratransit” will have a positive and significant impact on “perceived behavioral control”.

H9: “Attitude towards paratransit” will have a positive and significant impact on “intentions to use paratransit”.

H10: “Affect” will have a positive and significant impact on “intentions to use paratransit”.

H11: “Perceived behavioral control” will have a positive and significant impact on “intentions to use paratransit”.

CHAPTER 3: METHODOLOGY

The following framework has been adopted and shown in **Figure 3-1**.

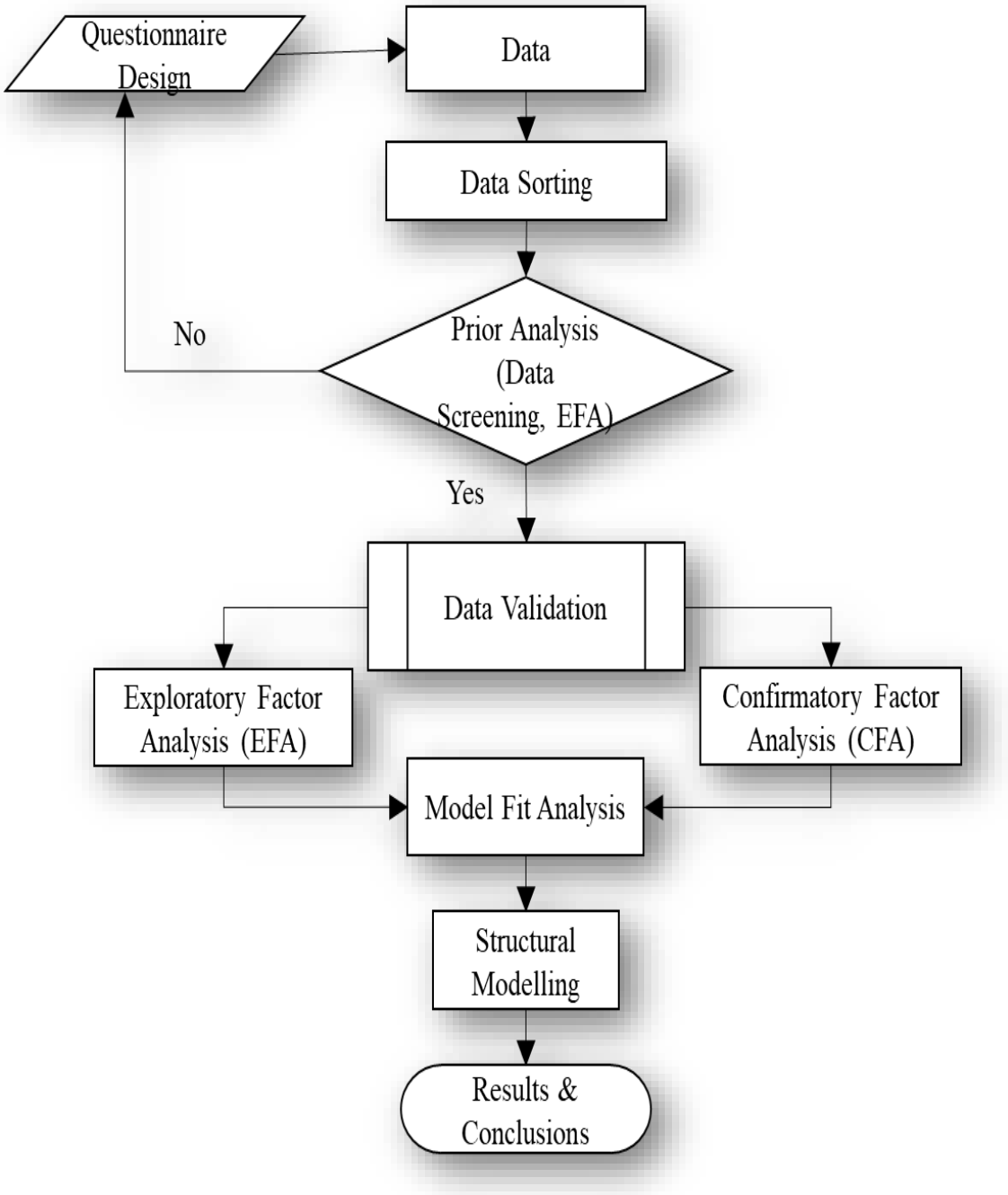

Figure 3-1. Methodology Framework

3.1 Data

A questionnaire-based survey was conducted to achieve our objectives to evaluate users' intentions. The data screening was done based on the responses (i.e., unengaged responses, and outliers) indicating variables as recommended by Kurtosis and Skewness test [85]. The variables used are based on the literature review discussed earlier shown in **Table 3-1** below. The questionnaire inspected the items related to the Theory of Planned Behavior (Attitude towards Paratransit, Perceived Behavioral Control and Intentions towards use of Paratransit); and Theory of Interpersonal Behavior (Emotions and Affect). The intention to use paratransit was mapped into 3 items, such as My intention is to take the paratransit (uber/taxi) to get to the Metro station next time. Subsequently, the attitude towards paratransit behavior consisted of 3 items (e.g. Using paratransit (uber/taxi) services is good/satisfying/affordable). The questionnaire based on the perceived behavioral control (PBC) consisted of 3 items focusing on the resources (e.g. My money/time/physical condition allows me to use the paratransit (uber/taxi) service). In the PBC, the further two dimensions we considered are perceived difficulty and perceived control. The perceived difficulty would relate to us in determining users' ease or difficulty in it to use the paratransit (uber/taxi) service next time. Whereas, the perceived control would highlight the ability of users to control either full or partially over the use of paratransit (uber/taxi) service next time. Additionally, we have tried to model the user's experience by considering three types of input: affects (e.g. I felt that using paratransit (uber/taxi) service is ____), and emotions. The emotions were constructed by categorizing them into positive (2 items i.e. During traveling on paratransit (uber/taxi), I felt comfortable), and negative (2 items i.e. During traveling on paratransit (uber/taxi), I was frustrated) aspects. All aforesaid variables were simultaneously examined to get an overall users' intentions towards paratransit service, and measured on a seven-point Likert scale.

3.1.1 Data Analysis

Initially, a pilot-based survey was conducted to check the validity of the constructs based on the model developed. It would not proceed further to analysis without normalization being done. It represents the distribution of the collected sample data and Skewness and Kurtosis was adopted as it is widely used. The recommended values for Skewness are in the range of ±3 and Kurtosis is ±7 [86, p. 224]. However, the non-normality in the dataset can occur due to limited sampling size or scaling of the variables [87, p. 28].

Table 3-1. Questionnaire Items regarding the Constructs

Construct	**Items (7 point scale)**	**Ref**[1]
Intention to use Paratransit	• My intention is to take the paratransit (uber/taxi) to get to the Metro station next time *(Very Weak, Weak, Slightly Weak, Neither Strong nor Weak, Slightly Strong, Strong, Very Strong)* **[INT1]** • I intend to take the paratransit (uber/taxi) to get to the Metro station next time *(Very Unlikely-Very Likely)* **[INT2]** • I intend to use the paratransit (uber/taxi) service in future *(Very Unlikely-Very Likely)* **[INT3]**	[33]
Attitude towards Paratransit	• Using paratransit (uber/taxi) services is good *(Strongly Disagree, Disagree, Somewhat Disagree, Neither Agree nor Disagree, Somewhat Agree, Agree, Strongly Agree)* **[ATT1]** • Using paratransit (uber/taxi) services is affordable *(Strongly Disagree-Strongly Agree)* **[ATT2]** • Using paratransit (uber/taxi) services is satisfying *(Strongly Disagree-Strongly Agree)* **[ATT3]**	[2], [34]

[1] References

Perceived Behavioral Control (PBC)	• My money allows me to use the paratransit (uber/taxi) service *(Strongly Disagree-Strongly Agree)* **[PBC1]** • My time allows me to use the paratransit (uber/taxi) service *(Strongly Disagree-Strongly Agree)* **[PBC2]** • My physical condition allows me to use the paratransit (uber/taxi) service *(Strongly Disagree-Strongly Agree)* **[PBC3]**	[2]
Perceived Behavioral Control (PBC)	• How easy or difficult would it be for you to use the paratransit (uber/taxi) service next time *(Very Difficult, Difficult, Somewhat Difficult, Moderate, Somewhat Easy, Easy, Very Easy)* **[PD1]**	[88]
Perceived Behavioral Control (PBC)	• I have full control over to use paratransit (uber/taxi) service next time *(Completely Disagree-Completely Agree)* **[PC1]** • How much control do you feel over using paratransit (uber/taxi) service next time *(No Control at all, No Control, Somewhat No Control, Moderate, Somewhat Control, Control, Completely Control)* **[PC2]**	[88]
Affect	• I felt that using paratransit (uber/taxi) service is *(Extremely Unpleasant-Extremely Pleasant)* **[AFF1]** • I felt that using paratransit (uber/taxi) service is *(Extremely Boring-Extremely Exciting)* **[AFF2]** • I felt that using paratransit (uber/taxi) service is *(Extremely Displeasing-Extremely Gratifying)* **[AFF3]**	[35]
Emotions	• During traveling on paratransit (uber/taxi), I felt comfortable *(Completely Disagree-Completely Agree)* **[EMO1]** • During traveling on paratransit (uber/taxi), I felt relaxed *(Completely Disagree-Completely Agree)* **[EMO2]**	[66], [89]

	• During traveling on paratransit (uber/taxi), I was frustrated *(Completely Disagree-Completely Agree)* **[EMO3]** • During traveling on paratransit (uber/taxi), I was irritated *(Completely Disagree-Completely Agree)* **[EMO4]**	

The prior analysis validated the data to be able to use the data for exploratory factor analysis. The sample adequacy was determined by Kaiser-Meyer-Olkin (KMO) test. The item reliabilities were analyzed by the Reliabilities test of items. The behavior of variables was studied through the "Dimension Reduction" technique, and factors were extracted based on the item characteristics. Subsequently, confirmatory factor analysis was conducted later to determine the outcomes according to the hypothesized diagram. The model fit was determined by examining certain fit indices involved in confirmatory factor analysis. The causal model was developed through structural equation modeling wherein identifying and elaborates the relationship among various variables.

3.2 Exploratory Factor Analysis (EFA)

Once the data has proceeded, it is ready to undergo validated checks that we have conducted using an initial exploratory factor analysis approach. The recommended Kaiser-Meyer-Olkin (KMO) values should be greater than 0.7 for the adequacy of the sample [86], [90]. Moreover, a value less than 0.5 is not acceptable [86], [91], [92]. [93] has suggested that the observed variables within each construct should have reliabilities greater than 0.7 for Exploratory Factor Analysis (EFA). However, the reliability of items in the range between 0.6 and 0.7 can be considered acceptable [94, p. 681]. A statistical approach is used to reduce data into a smaller collection of summary variables and to investigate the theoretical structure of the phenomenon.

3.3 Confirmatory Factor Analysis (CFA)

The unknown parameters cannot exceed the sum of a number of variances and covariances. The model should be just identified or over-identified for performing a confirmatory factor analysis [95, p. 171]. The parameters (q) to be estimated can be determined by the equation:

$$q = p(p+1)/2 \quad \text{(Eq. 1)}$$

where:

- p : number of observable indicators

3.3.1 Model Fit

The model will be analyzed by performing a Goodness of Fit indices. Different fit indices were analyzed. i.e., χ^2/df < 5, RMSEA < 0.08, GFI > 0.9, AGFI > 0.9 [36, p. 183]. The sample size has an impact on the chi-square statistic [87, p. 86].

The chi-square equation is represented as:

$$\chi^2 = (n-1)F_{ML} \quad \text{(Eq. 2)}$$

where:

- x^2 : Chi-Square value
- n: Sample Size
- F_{ML}: Maximum Likelihood Fit Function

The goodness of Fit Index (GFI) can be used to account for the scale of the observed and recreated matrices [87, p. 86,87]. It is represented as:

$$GFI = 1 - [\chi^2_{Model} / \chi^2_{Null}] \quad \text{(Eq. 3)}$$

where:

- GFI: Goodness of Fit Index
- χ^2_{Null}: Chi-Square for Independence Model at 15 d.f.

Adjusted goodness-of-fit index (AGFI) is based on degree of freedom and the number of variables in a model. It is computed as:

$$AGFI = 1 - [\left(\frac{k}{df}\right)(1 - GFI)] \quad \text{(Eq. 4)}$$

where:

- AGFI: Adjusted Goodness of Fit Index
- k: Number of Unique Distinct Values in Observed Model
- df: Degree of Freedom of Model

3.4 Structural Equation Modeling (SEM)

The basic structural equation model is represented as:

$$\eta = \beta\eta + \gamma\xi + \zeta \quad \text{(Eq. 5)}$$

where:

- η: endogenous (latent) variables
- β: coefficient of endogenous variables
- γ: coefficient of exogenous variables
- ξ: exogenous (latent) variables
- ζ : error among endogenous variables

Structural equation modeling depicts a relationship between latent variables using observed variables and will help in testing different hypothesized models based on theoretical concepts. After conforming exploratory and confirmatory factor analysis among the observed variables, we will proceed to a final structural model, which will testify the model based on the

results. It is the amalgamation of independent and dependent constructs in order to develop a path model.

This study determined the intentions toward the paratransit by including the factors based on the interpersonal behavior theory (TIB) and theory of planned behavior (TPB). This will help in diversifying our approach toward the acceptability of the interventions. The diagram will give you the idea related to the constructs that are developed for further analysis as shown in **Figure 3-2**.

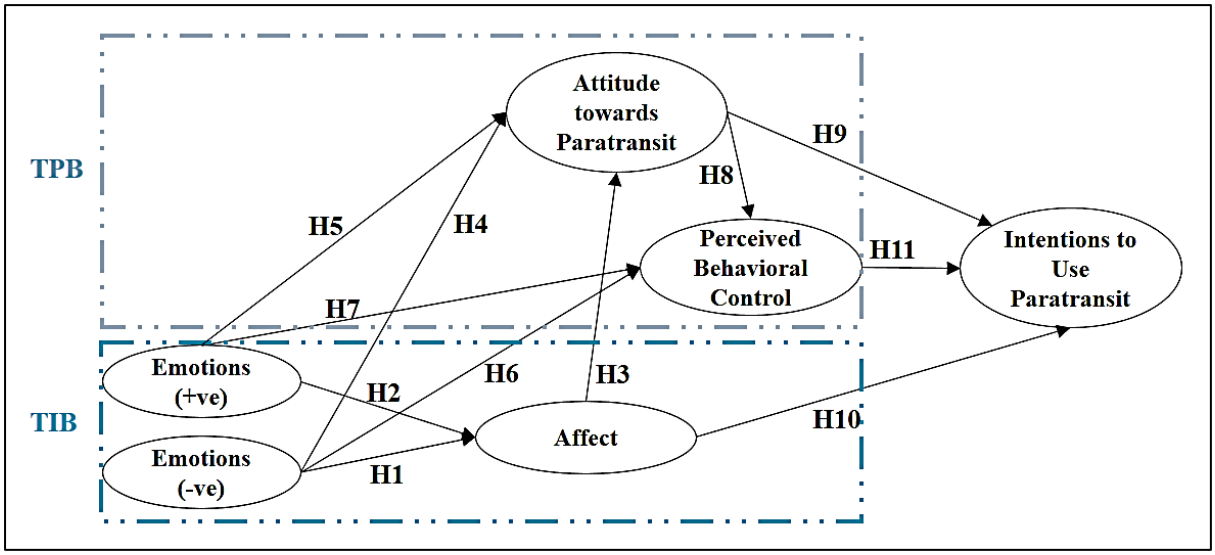

Figure 3-2. Conceptual Framework

CHAPTER 4: RESULTS AND DISCUSSIONS

4.1 Demographics

A total of 472 respondents, participated in the survey, were scrutinized (i.e. based on missing information, incomplete survey and etc.) into 437 unique entities. The preliminary outcome in terms in the **Table 4-1**.

Table 4-1. Descriptive Statistics

Ser.	**Items**	**All users (N = 437)**
1.	Gender	
a)	*Male*	62.24 %
b)	*Female*	37.76 %
2.	Age Group	
a)	*15-24 years old*	70.94 %
b)	*25-64 years old*	29.06 %
3.	Income Level (Monthly)	
a)	*No Income*	34.10 %
b)	*<= 20,000 Rs*	22.20 %
c)	*20,000-40,000 Rs*	21.05 %
d)	*40,000-60,000 Rs*	14.19 %
	> 60,000 Rs	8.47 %
4.	Education	
a)	*Secondary Education*	2.52 %
b)	*Higher Education*	15.56 %
c)	*Graduate*	53.78 %
d)	*Post-Graduate*	28.15 %
5.	Trip Purpose	
a)	*Educational*	51.95 %
b)	*Work*	21.97 %
c)	*Business*	10.98 %
d)	*Recreational/Leisure*	15.10 %
6.	Car Ownership	
a)	*Yes*	25.86 %
b)	*No*	74.14 %

Among the respondents, 272 (62.24%) were male and 165 (37.76%) were female. There were 310 (70.94%) respondents aged 15 to 24 years old and 127 (29.06%) between 25 and 64 years old. There were 149 (34.10%) respondents with 'No Income' followed by 97 (22.20%) with an income of less than 20,000 Rs. There were 92 (21.05%) reported incomes between 20,000 and 40,000 Rs; 62 (14.19%) between 40,000 and 60,000 Rs. Finally, respondents with an income greater than 60,000 Rs were 37 (8.47%). Additionally, there were 11 (2.52%) with secondary education, higher education with 68 (15.56%), 235 (53.78%) graduate respondents, and 123 (28.15%) with post-graduate education level. The respondents recorded their trip purpose, with 227 (51.95%) for education, followed by 96 (21.97%) for work, 66 (15.10%) for recreational/leisure purposes, and 48 (10.98%) respondents traveling for business purposes. The respondents having car ownership were 113 (25.86%) and 324 (74.14%) did not own a car.

The research findings show that there were 188 (69.12%) males as compared to 122 (73.94%) females with age 15-24 years old. Mostly the people with age 15-24 years old participated in the survey. Most of the males 75 (27.57%) and females 74 (44.85%) reported with 'no income' as they were pursuing the education and were parents dependent. There were 29 (10.66%) males and 8 (4.85%) females who reported income greater than Rs. 60,000. We also observed that most of the people are depending on the public transport services. It is said so because 206 (75.74%) males and 118 (71.52%) females were having "no car ownership". As far as trip purpose is concern, most of the trips were made for educational and work purposes.

Respondents were asked for the travel modes used for access and egress from Metro stations. Motorcycles (27.23%) and uber/careem (24.48%) were the most preferred modes for

the access of stations. The other modes preferred for the access were private cars (16.70%), public transportation (14.87%), walking (10.98%), bicycles (4.35%), and taxis (1.37%)).

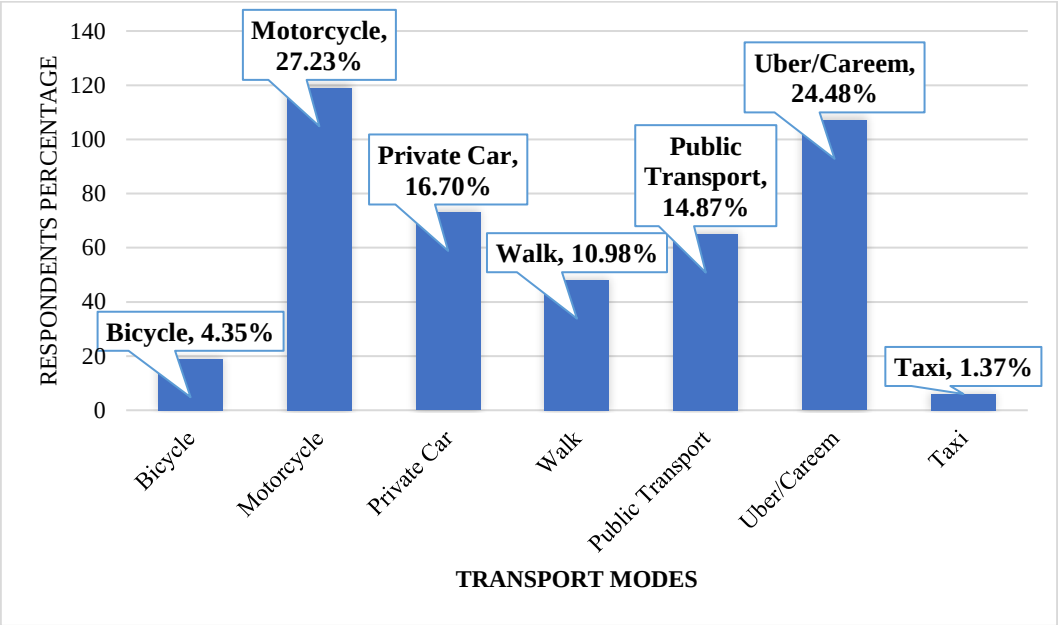

Figure 4-1. Preferred Mode for the Access to Metro Stations

Uber/Careem (27.92%) and motorcycle (24.03%) were the most preferred modes of egress from Metro stations followed by public transportation (16.25%), walking (13.27%), private car (11.90%), bicycle (4.12%), and taxi (2.52%).

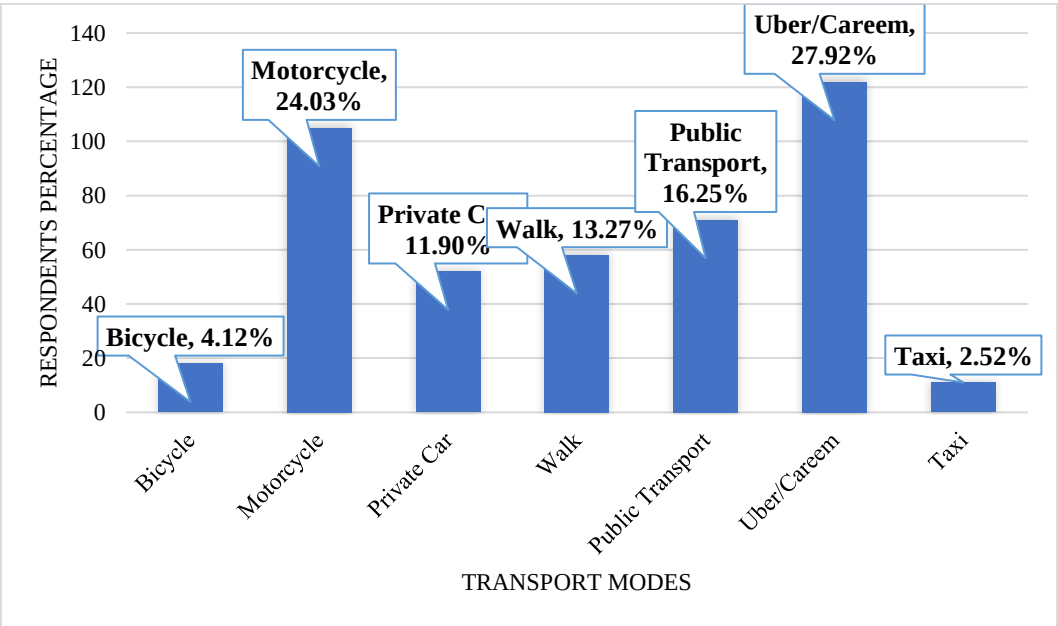

Figure 4-2. Preferred Mode for the Egress from Metro Stations

4.2 Dimensionalities of Model Constructs

Based on the model as discussed in the methodology, the reliability check on the statistics and different construct has analyzed through Cronbach's alpha. In order to proceed it, we have first get through by applying Kaiser-Mayer-Olkin (KMO) and Bartlett's test of sphericity for sample adequacy and significance, and the results are shown in the **Table 4-2**. The results has shown value of 0.835, which is within the acceptable range of 0.7 to 1.0 [86], [90]. Moreover, the Bartlett test has shown a significance value of ($p<0.05$) respectively.

Table 4-2. KMO and Bartlett's Test (Sample Adequacy)

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.835
Bartlett's Test of Sphericity	Approx. Chi-Square	3943.995
	df	171
	Sig.	0.000

The reliability for study parameters are checked through Cronbach's alpha as shown in the **Table 4-3**. It assist in determining internal consistency of items as it plays a significant role in classifying the latent variables. The results has found to be reasonable: intentions (α) = **0.827**, attitude (α) = **0.797**, perceived behavior control (resources + difficulty + control) (α) = **0.806**, affect (α) = **0.926,** and emotions (α) = **0.812** for positive and (α) = **0.803** for negative. Our all parameters are satisfied because the Cronbach's alpha recommends values should be greater than 0.7 [93] and should not be less than 0.6 [94].

Table 4-3. Reliability Measures of Items

Measures	**No. of Items**	**Cronbach's alpha**
Intentions to use Paratransit **(INT)**	3	0.827
Attitude towards Paratransit **(ATT)**	3	0.797
Perceived Behavioral Control (Resources+Difficulty+Control) **(PBC)**	6	0.806
Affect **(AFF)**	3	0.926
Positive Emotions **(PosEMO)**	2	0.812
Negative Emotions **(NegEMO)**	2	0.803

Additionally, the mean and standard deviation of the individual items of each parameters (latent construct) were obtained and shown in the **Table 4-4**.

Table 4-4. Mean and S.Ds of Item constructs

Construct	**Items**	**Mean**	**S.D**
Intention to use Paratransit	• My intention is to take the paratransit (uber/taxi) to get to the Metro station next time.	3.81	1.678
	• I intend to take the paratransit (uber/taxi) to get to the Metro station next time.	4.00	1.825
	• I intend to use the paratransit service if there will be good transport service available in the future.	4.21	1.762
Attitude towards Paratransit behavior	• Using paratransit (uber/taxi) services is good.	4.94	1.615
	• Using paratransit (uber/taxi) services is affordable.	4.63	1.559
	• Using paratransit (uber/taxi) services is satisfying.	4.90	1.685

Perceived Behavioral Control	• My money allows me to use the paratransit (uber/taxi) service. • My time allows me to use the paratransit (uber/taxi) service. • My physical condition allows me to use the paratransit (uber/taxi) service. • How easy or difficult would it be for you to use the paratransit (uber/taxi) service next time?	4.51 4.70 4.95 4.82 4.90	1.716 1.677 1.626 1.570 1.707
	• I have full control over to use paratransit (uber/taxi) service next time. • How much control do you feel over using paratransit (uber/taxi) service next time?	4.56	1.713
Affect	• I felt that using paratransit (uber/taxi) service is _____ (Unpleasant-Pleasant) • I felt that using paratransit (uber/taxi) service is _____ (Boring-Exciting) • I felt that using paratransit (uber/taxi) service is _____ (Displeasing-Gratifying)	4.73 4.37 4.60	1.664 1.707 1.812
Emotions	• During traveling on paratransit (uber/taxi), I felt comfortable. • During traveling on paratransit (uber/taxi), I felt relaxed. • During traveling on paratransit (uber/taxi), I was frustrated.	4.71 4.64 3.54 3.46	1.610 1.632 1.731 1.736

	• During traveling on paratransit (uber/taxi), I was irritated.		

An exploratory factor analysis was conducted to explore the patterns of variables. On the basis of dataset, six (6) factors were identified from "Maximum Likelihood" extraction and "Promax" rotation method. This rotation allowed the variables to further correlate among themselves up to the maximum possible extent. It is illustrated in the **Table 4-5**.

Table 4-5. Factors Pattern Matrix[2]

Ser.	Factor					
	1	2	3	4	5	6
INT1			0.734			
INT2			0.797			
INT3			0.826			
ATT1				0.719		
ATT2				0.603		
ATT3				0.894		
PBC1	0.641					
PBC2	0.581					
PBC3	0.544					
PD2	0.653					
PC1	0.752					

[2] Extraction Method: Maximum Likelihood.
Rotation Method: Promax with Kaiser Normalization.
a. Rotation converged in 6 iterations.

PC2	0.640					
AFF1		0.876				
AFF2		0.835				
AFF3		0.967				
EMO1						0.757
EMO2						0.790
EMO3					0.908	
EMO4					0.738	

We have carried out further analysis using a two-step approach as proposed by [96]. The two-step approach are measurement model and structural model. The CFA is the assessment being carried out through latent variables of measurement model along with observed variables and SEM deals with the latent variables pattern. The results are detailed discussed in the following sections.

4.3 Measurement Model

The CFA was performed to assess the validity and reliability of constructs in our conceptual model. A model fit was analyzed through fit indices (i.e., ratio of chi-square statistics and degree of freedom (χ^2/d.f.)). It should be less than 5 as recommended by [34], [97]. The goodness of fit indices (GFI), adjusted goodness of fit indices (AGFI), comparative fit index (CFI), and normed fit index (NFI) should be greater than 0.9, and root mean square error of approximation (RMSEA) should be less than 0.08. This indicates a good fit suggested by [14], [98].

There are three (3) basic checks to access the validity of the measurement model in CFA which are item reliability, construct reliability, and average variance extracted (AVE). This

study has applied AVE for determining the reliability in which latent constructs are assessed individually through convergent validity technique [98]. The findings values of the AVE for the individual constructs used in this study is shown in the **Table 4-6** which should be greater than shared variance between construct and other constructs and is recognized as discriminant validity criterion [99]. One of the latent constructs (PBC) have an AVE greater than 4 but less than 5. The AVE value is recommended to be above 0.5. We have one variable named as PBC having value 0.410 which is lower than the recommended. However, it can be acceptable to proceed further in a condition where the value of the composite reliability is greater than 0.6 [99]–[101].

Table 4-6. Convergent and Discriminant Validity of the Constructs

	CR[3]	**AVE**[4]	**PosEMO**[5]	**INT**[5]	**ATT**[5]	**PBC**[5]	**AFF**[5]	**NegEMO**[5]
PosEMO	0.812	0.683	**0.827**					
INT	0.828	0.617	0.189	**0.786**				
ATT	0.799	0.572	0.450	0.376	**0.756**			
PBC	0.806	0.410	0.496	0.405	0.536	**0.641**		
AFF	0.928	0.811	0.655	0.273	0.457	0.416	**0.901**	
NegEMO	0.805	0.675	-0.282	-0.037	-0.162	-0.123	-0.248	**0.821**

In results, we have analyzed the chi-square statistics came out to be (chi-square = 351.888 and d.f. = 137) statistically significant ($p < 0.001$). The ratio of chi-square to degree of freedom (χ^2/d.f = 2.569) which is less than 5. The fit indices values, i.e., GFI (0.917), AGFI (0.884), CFI (0.944), NFI (0.912) and RMSEA (0.060) has indicated a good fit for the analysis of the conceptual model as mentioned by [102], and are tabulated in the **Table 4-7**.

[3] Composite Reliability
[4] Average Variance Extracted
[5] Correlation of the constructs examining discriminant validity

4.3.1 Common Method Bias

Common method bias is doing analysis for identifying variation in responses caused by the instrument rather than the actual predispositions of the respondents that the instruments attempt to uncover. It is assessed and tested through a common latent factor method. The common model of bias was tested on our model resulted in a value of chi-square statistics as (chi-square = 348.802 and d.f. = 136). It has come out to be non-significant as the recommended value should be less than 3.84 for the difference of 1 degree of freedom [103]. The value of chi-square difference was 3.086 less than 3.84, showing biasness did not exist up to an influential level to be included in the model.

Table 4-7. Model Fit for CFA

Indices	**Values**
Ratio of Chi-square and D.F.	2.569
GFI	0.917
AGFI	0.884
CFI	0.944
NFI	0.912
RMSEA	0.060

4.3.2 Invariance Testing

The model was tested for invariance using configural and metric tests which are the most commonly adopted and considered in testing among groups [104]. The configural invariance is recognized as comprehensive in differentiating among groups which determines the paths between the groups whether be the different or the same. It is accessed through using technique of chi-square difference test. The p-value (0.146) showing our model as an insignificant, which confirmed the presence of ‘invariance’ among gender group. However, the chi-square test is

considered as a sensitive in nature. Therefore, the CFI test as an alternative is recommended by [105]. The results of both the tessts are performed and shown in **Table 4-8**.

Table 4-8. Model Fit Indices for Invariance Testing

Model	**Configural**	**Metric**
Chi-Square	549.501	571.426
df	277	293
Difference (chi-square)	-	21.925
Difference (df)	-	16
Difference (p value)	-	0.146
CFI	0.930	0.928
TLI	0.913	0.916
RMSEA	0.048	0.047
SRMR	0.0526	0.0554

4.4 Structural Model and Hypothesis Testing

Structural Equation Modelling (SEM) is a multivariate analysis by developing a latent variable and analyzing the relationships between them [106, p. 314]. The latent variables were constructed based on the combination of observed variables [36, p. 178]. The relationship between the variables is measured in the measurement model, and the relationship between the latent variables measuring causal relationship carried out through structural model [107] [10], [36, p. 183]. The results of structural model will indicate a direct or indirect relationships among latent variables [36, p. 185].

Usually the maximum likelihood estimation was adopted for the analysis of the hypothesized model. The hypothesized theory will help in evaluating the causal effects between the constructs. It will assist in determining the behavioral intentions as it defines utility of

transport mode in the future [36, p. 176], which is recognized as a taste factor. This taste factor has indicated behavioral intentions of the people towards specific action in choosing mode choice.

4.4.1 Structural Model

The hypothesized model is used to develop a relationship between emotions and affects. The emotions are derived from the theory of interpersonal behavior. Whilst, the attitude and perceived behavioral control is in lined with a theory of planned behavior. We have used these two theories to model commuters/users' intentions in using paratransit service. Multi-collinearity within independent constructs was determined by the variance inflation factor at path level and the value of it should not be greater than 5 [108]. The results are shown in the **Table 4-9**.

Table 4-9. Variance Inflation Factor (VIF)

Constructs	**Intentions to Use Paratransit (Dependent variable)**
Negative Emotions	1.133
Positive Emotions	2.603
Affect	2.223
Perceived Behavioral Control	1.918
Attitude	1.853

The model fit test (full structural model) was once again tested and findings are indicated as good model fit (χ^2/df = 2.546 (chi-square = 356.486 and d.f = 140), GFI = 0.916, AGFI = 0.886, CFI = 0.944, NFI = 0.911, RMSEA = 0.060 and SRMR = 0.0467). We have observed that the model is good enough to explain the relationship among the constructs in the structural model. The details are shown in the **Table 4-10**.

Table 4-10. Model Fit for SEM

Indices	**Values**
Ratio of Chi-square and D.F.	2.546
GFI	0.916
AGFI	0.886
CFI	0.944
NFI	0.911
RMSEA	0.060
SRMR	0.0467

4.4.2 Hypothesis Testing

A hypothesis testing was done to determine relationships among variables. It has resulted in development of hypothesized paths on which the variables are understood as significant or not. All these paths based on prescribed theory were found as significant except for negative emotions on their respective paths ($p > 0.05$) irrespective of being observed negatively on affect and attitude. Also, an insignificant relationship was found between affect and intentions as well in using paratransit.

The attitude towards using paratransit shows a significantly positive effect on the intention ($\beta = 0.201$, t-value = 2.709); and perceived behavioral control ($\beta = 0.397$, t-value = 5.920). This shows that people's attitudes play an important role in their intentions to use the service. People with a positive attitude show more control towards their resources and their perceptions towards behavioral control. Perceived behavioral control has a stronger significant direct effect ($\beta = 0.262$, t-value = 3.600) on the intentions to use paratransit service than attitude ($\beta = 0.201$, t-value = 2.709). This shows that people are more inclined towards control of their resources rather than satisfaction level of the service.

Moreover, affect shows a significant positive influence towards attitude (β = 0.292, t-value = 3.995). This shows that experience during the journey determines the attitude of the people towards the use of paratransit services. Positive emotions show a significant positive effect on their respective hypothesized paths ($p < 0.05$) and have a greater influence on affect (β = 0.638, t-value = 11.366), as compare to an attitude (β = 0.248, t-value = 3.124) and perceived behavioral control (β = 0.329, t-value = 4.952). The structural paths are developed and shown in **Table 4-11**.

4.4.3 Mediation Effects

We used the bootstrapping in AMOS v26 to test the mediation effects at the path level in the model [109]. We adopted a more detailed mediation test adopted by James Gaskin by testing the mediation of each individual path [110]. Negative emotions did not show any mediation to their dependent constructs ($p > 0.05$). Whereas, the positive emotions manifested the mediation effect towards 'intentions' through all mediators ($p < 0.001$), except through the affect construct ($p = 0.312$). The same results were examined through serial mediation of the constructs. Positive emotions exhibited a significant effect ($p < 0.001$) through serial mediation towards 'intentions' and negative emotions were insignificant ($p > 0.05$) towards intentions. Affect influenced intentions indirectly through attitude (β = 0.046, $p < 0.001$, CI: [0.018, 0.090]). Negative emotions did not show any serial mediation through the dependent constructs ($p > 0.05$) towards intentions. Positive emotions were significantly ($p < 0.001$) serially mediated towards intentions via all construct paths.

4.4.4 Multi-group

A multi-group comparison was done to analyze differences across the gender group at the path level. The model was no different (insignificant) for the gender (male, female) comparison (chi-square = 11.107, d.f = 11, p = 0.434).

Table 4-11. Structural Path Estimates

Paths	**Standardized Estimates (t-value)**	**p-value**
NegEMO → AFF	-0.066 (-1.359^{ns})	0.174
PosEMO → AFF	0.638 (11.366***)	< 0.001
AFF → ATT	0.292 (3.995***)	< 0.001
NegEMO → ATT	-0.018 (-0.326^{ns})	0.745
PosEMO → ATT	0.248 (3.124**)	0.002
NegEMO → PBC	0.035 (0.648^{ns})	0.517
PosEMO → PBC	0.329 (4.952***)	< 0.001
ATT → PBC	0.397 (5.920***)	< 0.001
ATT → INT	0.201 (2.709**)	0.007
AFF → INT	0.070 (1.188^{ns})	0.235
PBC → INT	0.262 (3.600***)	< 0.001

Notes: ns=Not Significant, ** = p < 0.01, *** = p < 0.001

4.4.5 Categorical Context

The dummy variables were used to test the categorical variables with the reference category. Age, income, trip purpose, and car ownership showed an insignificant ($p > 0.05$) relationship towards the dependent constructs (attitude, perceived behavioral control, affect, and intentions to use paratransit) in the model. Gender and Education revealed a significant relationship with specific dependent latent variables. Females were having a positive significant ($B = 0.389$, $\beta = 0.173$, $p < 0.001$) impact on 'intentions' as compared to males (reference category). People with post-graduate education levels had a significant positive ($B = 0.277$, $\beta = 0.107$, $p = 0.009$) and secondary education levels revealed a negative ($B = 0.704$, $\beta = -0.093$, $p = 0.019$) influence towards 'attitude' as compared to undergraduate (reference

category). Higher education levels had no significant effect on the dependent constructs (i.e., attitude, PBC, affect and intentions).

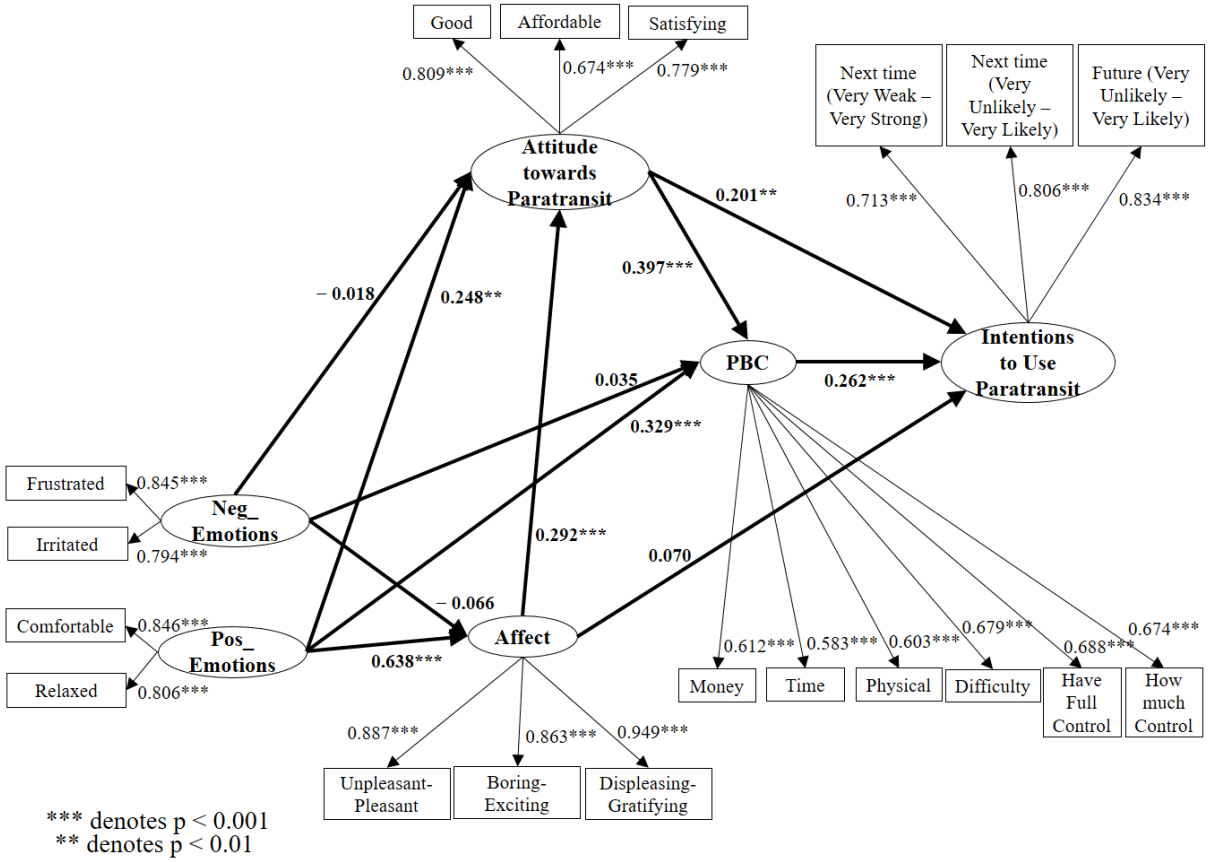

Figure 4-3. Full SEM Model

4.5 Discussions

This study has aimed to determine the intentions towards the use of paratransit service to provide accessibility to Metro stations using the theory of planned behavior (TPB) and the theory of interpersonal behavior (TIB). The variables used in TPB's approach/model are attitude and perceived behavioral control, whereas emotions and affect are modelled in TIB's. These were investigated in order to determine the intention to use paratransit service to access the Metro stations in Islamabad.

The results depicted that the attitude and perceived behavioral control have a significant relationship towards the intentions to use the paratransit service which is consistent with TPB

[46]. Perceived behavioral control has a greater impact than attitude toward intentions. It reveals a concern that people are more inclined towards their control of resources than the satisfaction of the transport service. These results are different in magnitude of concern than the previous study [34]. PBC demonstrates a significant mediator between attitude and intention to use paratransit service. Attitude also showed a significant influence on road traffic safety [111] and scrambling behavior of drivers [112] in previous studies. Therefore, there is a need to focus on the quality of the paratransit service to have a good perception towards the service to enhance its' acceptance among users. Attitude is also indirectly influencing the intentions of utilizing the paratransit service through perceived behavioral control. If a person has a positive attitude but low perceived behavioral control, it is possible that s/he will not use the service. This result is consistent with previous study of M-REB conducted in the marine environmental context [113]. Therefore, there is a need to have a reasonable fare for travel to encourage the use of paratransit service in a city.

The study has investigated the impact of "emotions" and "affect" on future intentions to use the paratransit service using the theory of interpersonal behavior. Negative emotions had no significant indirect impact on intentions via affect, whereas positive emotions had a significant direct impact on affect; and affect had no significant impact on intentions, which is partially consistent with TIB [58]. Affect has shown an indirect impact on intentions through attitude. This means that people's experiences with transportation services have shaped their attitudes towards either using or not using paratransit services in the future.

According to literature [66], [114]–[116], there is consensus that people who experience positive emotions have converged latterly into their behavioral actions. However, people's emotions cannot be disregarded in the influence of their behavior. Whereas, high performance is mostly observed by people who are influenced by positive emotions [72]. In light of the study [117], on the Broaden and Build Model of Positive Emotions, posits that positive

emotions have long-lasting cognition that becomes a behavior. We have hypothesized that positive emotions would lead to a reduction in the tendency of an individual to resist change. This study highlights positive emotions as more influential than negative emotions due to their flexible nature in decision making. Emotions and/or states of mind are fleeting in nature and cannot be stored. On the other hand, attitudes are the evaluative inclinations that persists in mind and not easy to dissipate when individual is not much concerned about it at the moment.

The positive emotion has significantly influenced the PBC for our study while evaluating commuters' intentions to use paratransit service. Moreover, the negative emotions have been assessed as insignificant towards PBC. Our results differ from a study [66] conducted on climate change wherein both positive and negative anticipated emotions were assessed as significant towards PBC.

Affect is an internal construct developed as a result of previous experience and is based on the emotional framework of the individual [118]. The affect influences on intentions indirectly through attitude. Emotions are involved in altering past experiences with the latest one. A motivational dimension (i.e. arousal components) of the affect is helpful in making cognitive repository. In the case of positive or negative affect with low motivational intensity, this will result in the proliferating of cognitive repositories. However, doing the same with a high motivational intensity will result in narrow cognition and attention [72]. In our study, low motivational intensity has been observed as dominantly manifested and it cannot be correlated with high motivational intensity, which has no significant impact. Therefore, resources play a crucial role in regulating people's behavior. However, in the case of limited processing resources, consumers are more likely to employ affective responses. Cognitive reactions, on the other hand, are more likely to be dominant [55].

4.5.1 Implications for interventions

The behavioral or taste factor studies are aimed at adopting policies by government agencies that are acceptable to the public, especially in the case of transportation engineering. It is said so because transportation projects bear high capital investments, and the use of public money should be spent accordingly to the needs of the commuters or people. That makes the policy recognized as sustainable, which meets the needs of the present without being compromised for future generations. Such studies would assist policymakers in understanding the needs of the users by introducing those strategies and interventions subjected to influencing people's attitudes positively. In support of it, various tactical (promotional) measures should be used to promote interventions (e.g., advertisements and fares, women's driving only, subsidized tickets for weekly, monthly-incentives, etc.). Such measures would assist in getting acceptance for the paratransit model of journey for various commuter types.

Additionally, it assists government agencies to improve or build networks in support of paratransit. This would provide a basis for the model shift, which would be beneficial in attaining the required level of service (LOS) at peak hours in terms of mitigating congestion. Also, such interventions and strategies would assist in the demarcation of hotspot areas where there is a need to enhance accessibility without being compromised on the mobility aspect.

As the positive emotions are significant in our study, it can effectively be used in promoting paratransit not confined to connecting metro stations but to larger perspectives (e.g., other trip purposes) as well. There should be an arrangement of the focus groups (e.g., watchdog, etc.) that will help in enhancing the positive feelings in favor of paratransit for the purpose of the trip [119].

CHAPTER 5: CONCLUSION

This study investigates people's intentions to use paratransit service to access BRT/Metro line stations where they are situated far from the residential and commercial/CBD areas of Islamabad, Pakistan. It is the first case study being conducted in this developing country's capital city in which we have used the theory of planned behavior and interpersonal behavior to model attitude and perceived behavioral control as significant predictors of intentions. People's emotions and their experiences during a journey can play a key role in developing their attitude and control towards performing any behavior. The analysis has outcome in favor of positive emotions and affect as the most significant one. Whilst, the role of negative emotions was observed as insignificant. It is also revealed that the females have a stronger intention of using paratransit because they feel more secure while traveling in a group, indicating their satisfaction level in addition to the accessibility point of view. This reflects an insecurity perception found among female commuters about the current public transport modes not being safe, user-friendly, and accessible. It is also determined that the education level plays an important role in shaping their attitude, as the higher the level implies, the easier to convince them to change their attitude. Therefore, this study suggests adopting measures focusing on these aforesaid areas to get public acceptance for using paratransit services that eventually would influence commuters to make public transport their mode of travel rather than relying on private modes of travel.

LIMITATION AND FUTURE RESEARCH

This study has focused on the two dimensions, focusing on positive deactivating and negative activating. However, another study needs to focus on other dimensions of emotions and affect (activating and deactivating) can be a part of future studies in determining people's intentions of using paratransit services.

In our study, we have restricted it to the metro stations and catchment areas. However, a detailed household survey (in the form of travel diaries etc.) covering the residents of Islamabad will be more impactful in determining their behavior towards transportation usage. Additionally, we have asked in the questionnaire about the income value. A detailed economic density model would be more fruitful.

It is recommended that further studies based on public transportation modes be initiated focusing on feeder routes, bus-fare systems, integrated transport models, gender discrimination, safety and equity, etc.

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APPENDIX –I

QUESTIONNAIRE

I Demographic Information:

1. Your Gender:

   a) Male b) Female

2. Your Age

   a) 0-14 b) 15-24 c) 25-64 d) > 64

3. Your Income Level (Monthly):

   a) <=20,000 Rs b) >20,000<=40,000 Rs c) >40,000<=60000 Rs

   d) >60,000 Rs e) No Income

4. Trip Purpose:

   a) Work b) Educational c) Business d) Recreational/Leisure

5. Do you own a car?

   a) Yes b) No

6. Your Education Level:

   a) Primary b) Secondary c) Higher d) Graduate e) Post Graduate

III Paratransit:

Definition: Paratransit means alongside transit. It includes all public and private mass transportation in between private automobile and conventional transit. Modes that are demand responsive and provide shared rides are within the scope of the Committee on Paratransit. There is no public paratransit like van operating in Pakistan.

7. Which mode/vehicle do you usually use or will use to reach Metro Station from Home?

a) Bicycle b) Motorcycle c) Private Car d) Walk

e) Public Transport f) Uber/Careem g) Taxi

8. Which mode/vehicle do you usually use or will use to reach your Job/Work location from Metro?

   a) Bicycle b) Motorcycle c) Private Car d) Walk

   e) Public Transport f) Uber/Careem g) Taxi

a) Intentions to use Paratransit:

9. My intention to take the paratransit(uber/taxi) to get to the Metro station next time:

   a) Very Weak b) Weak c) Slightly Weak d) Neither Strong nor Weak

   e) Slightly Strong f) Strong g) Very Strong

10. I intend to take the paratransit(uber/taxi) to get to the Metro station next time:

    a) Extremely Unlikely b) Quite Unlikely c) Slightly Unlikely

    d) Neither Likely nor Unlikely e) Slightly Likely f) Quite Likely

    g) Extremely Likely

11. I intend to use the paratransit service if there will be good transport service available in future:

    a) Extremely Unlikely b) Quite Unlikely c) Slightly Unlikely

    d) Neither Likely nor Unlikely e) Slightly Likely f) Quite Likely

    g) Extremely Likely

b) Attitude towards Paratransit:

12. Using paratransit(uber/taxi) services is good:

    a) Strongly Disagree b) Disagree c) Somewhat Disagree

    d) Neither Agree nor Disagree e) Somewhat Agree

    f) Agree g) Strongly Agree

13. Using paratransit(uber/taxi) services is affordable:

a) Strongly Disagree b) Disagree c) Somewhat Disagree

d) Neither Agree nor Disagree e) Somewhat Agree

f) Agree g) Strongly Agree

14. Using paratransit(uber/taxi) services is satisfying:

a) Strongly Disagree b) Disagree c) Somewhat Disagree

d) Neither Agree nor Disagree e) Somewhat Agree

f) Agree g) Strongly Agree

c) Perceived Behavioral Control:

15. My money allows me to use paratransit(uber/taxi) service:

a) Strongly Disagree b) Disagree c) Somewhat Disagree

d) Neither Agree nor Disagree e) Somewhat Agree

f) Agree g) Strongly Agree

16. My time allows me to use paratransit(uber/taxi) service:

a) Strongly Disagree b) Disagree c) Somewhat Disagree

d) Neither Agree nor Disagree e) Somewhat Agree

f) Agree g) Strongly Agree

17. My physical condition allows me to use paratransit(uber/taxi) service:

a) Strongly Disagree b) Disagree c) Somewhat Disagree

d) Neither Agree nor Disagree e) Somewhat Agree

f) Agree g) Strongly Agree

18. How easy or difficult would it be for you to use paratransit(uber/taxi) service next time:

a) Very Difficult b) Difficult c) Somewhat Difficult d) Moderate

e) Somewhat Easy f) Easy g) Very Easy

19. I have full control over to use paratransit(uber/taxi) service next time:

a) Completely Disagree b) Disagree c) Somewhat Disagree

d) Neither Agree nor Disagree e) Somewhat Agree

f) Agree g) Completely Agree

20. How much control do you feel over using paratransit(uber/taxi) service next time:

a) No Control at All b) No Control c) Somewhat No Control

d) Moderate e) Somewhat Control f) Control

g) Completely Control

f) Affect:

21. I felt that using paratransit(uber/taxi) service is:

a) Extremely Unpleasant b) Moderately Unpleasant c) Mildly Unpleasant

d) Neither Pleasant nor Unpleasant e) Mildly Pleasant f) Moderately Pleasant

g) Extremely Pleasant

22. I felt that using paratransit(uber/taxi) service is:

a) Extremely Boring b) Boring c) Slightly Boring

d) Neither Boring nor Exciting e) Slightly Exciting f) Exciting

g) Extremely Exciting

23. I felt that using paratransit(uber/taxi) service is:

a) Extremely Displeasing b) Displeasing c) Slightly Displeasing

d) Neither Displeasing nor Gratifying e) Slightly Gratifying

f) Gratifying g) Extremely Gratifying

g) Emotions:

24. During travelling on paratransit(uber/taxi), I felt comfortable: *Relaxation*

a) Completely Disagree b) Disagree c) Somewhat Disagree

d) Neither Agree nor Disagree e) Somewhat Agree

f) Agree g) Completely Agree

25. During travelling on paratransit(uber/taxi), I felt relaxed: *Relaxation*

a) Completely Disagree b) Disagree c) Somewhat Disagree

d) Neither Agree nor Disagree e) Somewhat Agree

f) Agree g) Completely Agree

26. During travelling on paratransit(uber/taxi), I was frustrated: *Anger*

a) Completely Disagree b) Disagree c) Somewhat Disagree

d) Neither Agree nor Disagree e) Somewhat Agree

f) Agree g) Completely Agree

27. During travelling on paratransit(uber/taxi), I was irritated: *Anger*

a) Completely Disagree b) Disagree c) Somewhat Disagree

d) Neither Agree nor Disagree e) Somewhat Agree

f) Agree g) Completely Agree