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Summary

In 2050, urban areas are expected to house over 50% of the world's population. On account of such a significant rural-urban exodus and migration between and within areas, the transportation sector across the globe is overwhelmed. This is certainly the case in Bengaluru, the "Silicon Valley of India". Sustainable mobility transitions are the need of the hour, and so Mobility Integration strategies are being hotly debated. But implementing the same without correctly estimating the needs and demands of commuters will not produce the desired output. Thus, a comprehensive analysis of the consumer attitudes shaping mobility behaviour, would put policy makers in a better position to implement more plausible and accurate mobility measures to improve and meet transportation requirements.

Consequently, the main objective of this study is to identify the most significant attitudinal barriers to mobility integration in Bengaluru. This is done using the Exploratory Factor Analysis technique. A variety of attitudes identified from existing literature and semi-structured interviews with industry experts are collated and condensed into the most significant ones. From a descriptive analysis of the collected data along with the Theory of Reasoned Action, how these attitudes pose a barrier is described. Moreover, a regression analysis of the consumer attitude toward public transportation before and after the construction of the metro deconstructs its impact and helps identify if the metro is the way forward for superior mobility integration. Lastly, a document analysis of commuter attitudes of ride sharing and hailing services which are another popular means of travel, helps with an understanding of whether this will pose a barrier or function as a driver to mobility integration.

From this analysis, it is evident that positive attitudes toward private vehicles and ride sharing and hailing, combined with negative attitudes regarding public transportation in the city constitute a significant barrier to mobility integration. Rightfully so, some of the key policy recommendations are inducing positive attitudes regarding public transit and bringing a change to the overtly positive attitudes regarding private vehicles and ride sharing and hailing in the city. This will help orient consumer attitudes in favour of public transit which is the central aspect of mobility integration.

Keywords

Mobility integration, Attitudes, Barriers, Mobility behaviour, Bengaluru

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Abbreviations

BMRCL	Bengaluru Metro Rail Corporation Limited
BMTC	Bengaluru Metro Transit Corporation
BPAC	Bangalore Political Action Committee
CET	Central European Time
CLF	Carbon Leadership Forum
DULT	Directorate of Urban Land Transport
EFA	Exploratory Factor Analysis
EV	Electric Vehicles
FAME India	Faster Adoption and Manufacturing of (Hybrid and) Electric Vehicles in India
GOK	Government of Karnataka
IDECK	Infrastructure Development Corporation (Karnataka) Limited
IISC	Indian Institute of Science
IRCTC	Indian Railway Catering and Tourism Corporation
MAAS	Mobility as a Service
MI	Mobility Integration
MMV	Micro-Mobility Vehicle
SBI	State Bank of India
WRI India	World Resources Institute India

1. Introduction

With the world population having hit 8 billion towards the end of 2022, and with rapid globalisation in the 21st century, there is an increasing need to develop high quality, accessible transit in order to transport the mass in an economically and environmentally feasible manner (United Nations, 2022). The urban transportation sector as a whole, especially in large parts of the global south, still has a long way to go. Unfortunately, more often than not, the development of transport infrastructure comes at the expense of the environment and liveability of urban areas (Griškevičiūtė-Gečienė & Griškevičienė, 2016; Lund et al., 2017). In large parts of the world, this has occurred on account of private vehicle dominance. With over half the world's population living in urban areas, it's no surprise that these regions contribute most significantly to unsustainability. But these areas can also stimulate innovation and enable a very necessary modal shift to more sustainable means of transit. In line with this, Mobility Integration (MI) has been highly talked off and implemented in large parts of the world.

In Bengaluru as well, one of the largest metropolitans in southern India, the number of private vehicles has skyrocketed while the number of buses, its most dominant form of public transportation, has remained stagnant (Kidiyoor, 2022). Originally known as the "pensioner's paradise", this city of 13 million people (CS, 2022) consists of streets that were built to largely cater to buses, pedestrians, cyclists and other non-motorised means of transit. On account of the technology boom in the city in the late 90s, Bengaluru transitioned into the "Silicon Valley of India". With one of the fastest growing economies in the country, the city has some of the largest population of vehicles as well. However, in a city whose roads were constructed keeping in mind a more gradual rate of growth, such a density of people and vehicles is problematic, consequently, in a study by TomTom, Bengaluru was reported to be the second most traffic congested city in the world as of 2022 (Prasad, 2023).

The impact of this has more far-reaching consequences than the inconvenience caused with increasing aerosol levels being attributed to rising emissions from traffic in the city. In 2022, transportation and road dust were the biggest contributors to air pollution in the city (Express News Service, 2022). While different means of mobility are bound to grow, rapidly so in urban areas, a lack of integration between them will lead to the dominance of one of them leading to inefficient mobility circumstances. Each of these types of transit should be interconnected and need to come together to provide one easily accessible and streamlined transit chain. This is the essence of MI.

1.1 Background information and problem statement

Owing to automobile friendly government policies and easy finance schemes and the city's "park where you can"[1] policy, consumer attitudes are increasingly shifting in favour of private-vehicle ownership (Verma, 2015). Moreover, the consumer attitude towards public transit in the city and their view that it is unsafe, slow, uncomfortable and unclean is contributing to the diminishing popularity of public transit (Pucher & Korattyswaroopam, 2004). In a study conducted by the Indian Institute of Science (IISc) in Bengaluru regarding the degree of satisfaction with public buses, it was found that there was an alarming gap between consumer expectations and the actual quality of services being provided (Chhakchhuak, 2014). Accordingly, poor consumer attitudes regarding public transit and positive attitudes towards private vehicles implies growing disconnection between the two. This poses an issue as public transport is to be the central unit of MI. In an effort to alleviate strain on an already overtaxed bus network, the Bengaluru metro was constructed in 2011, though it is unclear whether consumer attitudes have seen significant change even from the implementation of modern, clean, transit (Bangalore Mirror Bureau, 2022).

Furthermore, ride sharing and hailing apps have become popular amongst the middle-class due to their convenience (Nair, 2016). As of 2019, India became the world capital for scooter sharing with almost the entirety of this fleet being based in Bengaluru (Singh, 2020). Growing consumer attitudes in favour of such a means of transit implies potential for these to be integrated with the existing public transport infrastructure. However, its growth disconnected from public transport implies increasing number of single passenger vehicles on the roads on account of individual consumers hailing one car/two-wheeler for themselves, which has in turn worsened traffic congestion (Press Trust of India, 2018).

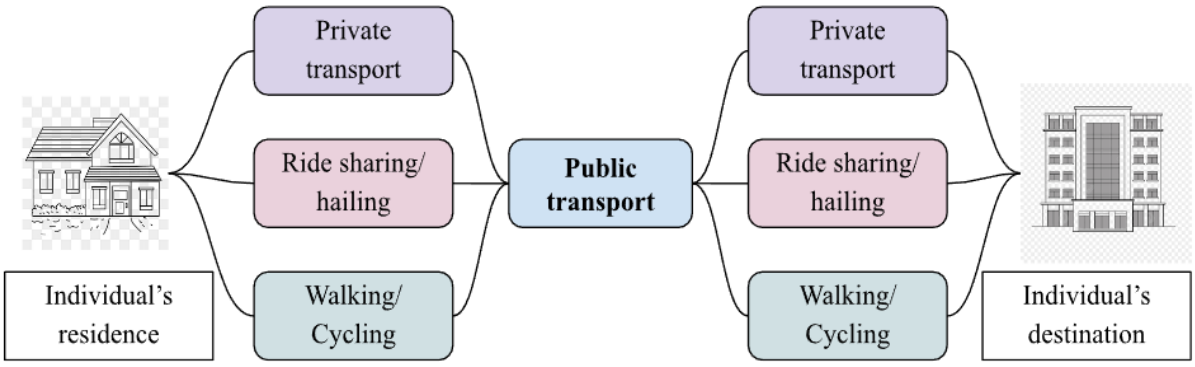
While bicycling is a common form of transit in many parts of the world, the same is not true for this city. In fact, in an article titled "Why bicycling in Bengaluru is a cruel joke on cyclists" by Menezes (2019), the demerits of cycling from road safety concerns, to the absolute lack of cycling infrastructure and the prevalence of flyovers which are difficult to traverse on a cycle, in addition to the poor air quality, explain why cycling in the city is not popular. In an attempt to promote cycling here, the state government, under the Directorate of Urban Land Transport

[1] The city does not have designated parking spots and free parking is allowed by the side of most streets unless otherwise mentioned

(DULT), introduced a Public Bike Sharing system in 2019 which saw failure on account of underutilisation of funds, lack of understanding of consumer demands and lack of integration to existing transport (TNN, 2020).

A multitude of consumer attitudes have led to growing popularity of a variety of means of transit; however, their lack of interconnectivity is driving automobile prevalence (Philip, 2019). The increasing disconnection of public transit will pose a significant barrier to MI which Sochor et al. (2018) defines as the integration of different means of transit on the basis of the needs of the masses. In essence, MI will, to a great extent, rely on public transportation with ride sharing and other modes of transit functioning as first and last-mile connectivity solutions (Li & Voege, 2017). This model would both bring down emissions by reducing the number of vehicles on the streets while also targeting the public transit inefficiencies that foster private vehicle dependency (Clauss & Döppe, 2016; Martinez & Viegas, 2017).

Figure 1. ***Diagrammatic representation of Integrated Mobility***



Source. Author generated

Moreover, it is imperative to identify and analyse attitudinal aspects regarding mobility in order to prevent misalignment between consumer demand and supply of transport. This also helps understand the resulting behavioural actions owing to the above attitudinal factors, which is line with the Theory of Reasoned Action (Fishbein & Ajzen, 1975). Increasing acceptance and willingness to the use of better MI services will invariably be the deciding factor regarding its uptake (Schabka et al, 2022). Rightfully, Sopjani et al. (2019) suggests the early involvement of users and an analysis of their responses to attitudes regarding mobility policy interventions in order to provide sufficient time to integrate consumer expectations and preferences.

1.2 Relevance of the Research topic and research gap

While multiple studies have been conducted regarding the key barriers and drivers of MI in urban areas, it has been largely limited to countries and cities of the global north (Naujoks, 2022). MI is beyond doubt present and efficiently functioning in many cities of the global south, however, this is not true for Bengaluru. This city is unique when compared to other megacities of the world on account of its recent and rapid growth. Owing to the suddenness of its population and urban expansion, the development of Bengaluru's transit infrastructure lacked centralised oversight - resulting in an inefficient and overtaxed network. However, given its geographical scale and denizen density, the integration of mobility into the urban sphere is crucial. While plans have been proposed to address this, they remain unimplemented to date (Mukherjee et al., 2017). Certainly, a variety of factors contribute to the lack of MI in the city. However, consumer attitudes regarding transportation in this city must be actively analysed.

While transport infrastructure and public transit in specific is being improved in the city, not too much attention is being paid to key consumer attitudes that lead to certain consumer behaviours [2] that are causing poor usage of said infrastructure as is evidenced in a study by Alonso-González, et al. (2020). Thus, a study like this could be beneficial to policy makers and stakeholders in terms of introducing consumer incentives to popularise public transit. Consequently, consumers will also benefit from having improved access to and comfort in using public transportation which is essentially the core element of MI.

When considering transformation of mobility patterns in the city, it is important to not only focus on the introduction and construction of new technology or new means of transit or transit routes but to identify and analyse consumer demand patterns, behaviour and attitudes. A lot of modal shifts in transport and investment in infrastructure have seen failure on account of poor understanding of consumer needs (Sopjani et al, 2019). It is only the collaborative design processes that take into account commuter attitudes and behaviour that are successful and are able to penetrate the existing market better. This leads to not only better acceptance of such infrastructure and/or policy changes but also improved willingness in using newer means of transit (Bardal et al., 2020). Consumer safety and the perception of easy adaptability needs to be considered. The goal is to improve user acceptance. This is especially the case when

[2] This paper is studying consumer attitudes, but this invariably leads to consumer behaviour

considering novel technologies where important factors to be considered are its environmental impact, and the ethical and safety concerns (Bezai et al, 2021).

1.3 Research Objectives

In line with the above, **this research aims to examine the consumer attitudinal factors that translate into transport and mobility behaviour which are posing barriers to the integration of mobility in the city of Bengaluru.**

Clearly, there is a difference in attitudes regarding the different dominant means of transit in the city, thus, the study benefits from segregating them into different sections. From an understanding of the most prominent transport systems in Bengaluru, the study identifies private vehicles, public transport and ride sharing and hailing to be the most significant. Consequently, the sub-objectives of this research are as follows:

1. To identify attitudinal factors regarding private transit that translate into transport behaviour that pose barriers to better mobility integration in the city.

2. To identify attitudinal patterns regarding public transit that could potentially pose a barrier to mobility integration in the city.

2.1 To identify whether consumer attitudes towards public transit before and after the construction of the metro have different impacts on ridership of public transit.

3. To identify attitudinal factors regarding ride sharing and hailing that translates into behaviour patterns that pose a barrier to mobility integration in the city.

3.1 To identify if these attitudinal factors indicate the increasing popularity of ride hailing and sharing as first and last-mile connectivity or if they are posing a barrier to mobility integration in the city.

1.4 Main research question and Sub-research questions

Even though the city is one of the most congested, with arguably the slowest moving traffic in the world, the number of private vehicles is seeing an upward trend. The number of passengers on public transit has barely increased in Bengaluru (Kaushik, 2018). As such, it is important to identify and analyse what factors are shaping consumer attitudes towards actively adopting private vehicle-based transportation as opposed to public transit, which will be the centre of

MI. Thus, the primary research question this thesis aims to cover is "**What are the consumer attitudinal factors that translate into transport and mobility behaviour, which are posing barriers to the integration of mobility in the city of Bengaluru?"**

In order to assist in unpacking the core question, the following sub-questions have been composed to guide the process.

Q1. What attitudinal factors regarding private transit translate into transport behaviour that pose barriers to better mobility integration in Bengaluru?

Q.2 What attitudinal factors regarding public transport translate into transport behaviour that pose barriers to better mobility integration in Bengaluru?

Q2.1 Do consumer attitudes towards public transit before and after the construction of the metro have different impacts on ridership of public transit?

Q3. What attitudinal factors regarding ride sharing and hailing translate into transport behaviour that pose barriers to better mobility integration in Bengaluru?

Q3.1 Are these attitudinal factors indicating the increasing popularity of ride hailing and sharing as first and last-mile connectivity or are they posing a barrier to mobility integration in the city?

When considering the second question regarding identifying consumer attitude patterns concerning public transport, the study breaks this down by analysing the impact of the metro. The metro is chosen over studying the effect of the introduction of new buses or bus routes on account of poor data collection regarding bus routes and maps. Moreover, the metro was constructed in an attempt to solve the shortcomings of the public bus, like its large travel time from being stuck in traffic like other means of road transit. It also aimed to improve perception of and attitude towards public transit in the city. Additionally, with the coming up of new metro stations, a variety of metro-feeder bus routes and buses have been introduced thereby tackling bus ridership issues as well. Thus, the impact of the metro is supposed to have had the dual effect of having increased public transit ridership and improved attitudes towards it. Consequently, studying the attitudes before and after its establishment will allow for a better understanding of whether the above phenomenon has played out.

In the third question, investigating if ride sharing/hailing services are more popular amongst different consumer bases, will help identify what changes in mobility patterns can occur on account of MI. Moreover, as one of the largest bases of such services in the world, its role in the transit system is only growing. But understanding whether consumers view it as a stand-alone means of transport or as a source of first and last-mile connectivity will define whether positive attitudes towards this works as a barrier to MI.

2. Literature review and hypothesis

2.1 What is Integrated Mobility and what are its benefits?

While there is no agreed upon definition to what MI actually is, it can be described as a system which actively tackles transport issues, especially in larger cities. Also known as Mobility as a Service (MaaS), it works to combine multiple means and types of transport into one seamless network as opposed to the user being dependent on one mode of transit for their entire journey. Public transit is to be the core element of this system with different mobility options being offered for first and last-mile connectivity (Sochor et al., 2018). It is an emerging strategy to support the implementation of the sustainable transit policies and is expected to function as an alternative to private vehicles. Not only does it seek to integrate transport but also its associated services thereby providing users with an enhanced travel experience. Such an improved transit system would allow the user to plan out their journey and make reservations in advance thereby offering improved multimodality and better flexibility (Caiati et al., 2020).

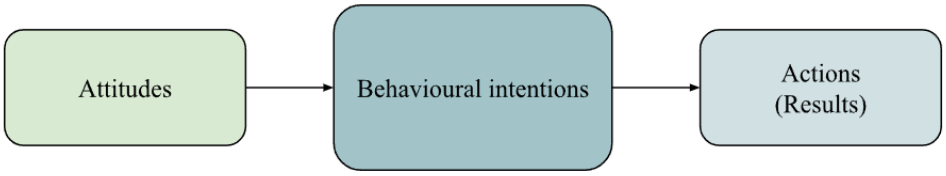
In a report by Mckinsey, the benefit in terms of reduced environmental pollution on account of the implementation of MI was calculated. This amounted to $600 billion in 50 metropolitans around the world, across over half a billion people (Bouton, 2017). Moreover, Noble (2005) argues that there is evidence to show that an increase in the share of other modes of transit will invariably lead to a reduction of private vehicles on the streets thereby reducing congestion.

Improved ridership for public transport will in turn lead to reduced private vehicle dependency. In growing cities, with emerging innovative means of transit such as car and scooter/bike sharing and hailing, these would be employed as first and last-mile connectivity options as opposed to it being used for one's entire journey. Moreover, a commuter's perception of this transit system is bound to be positive on account of it being customised as per the individual's requirement. This is essentially what MI embodies (Jittrapirom et al., 2017). In this manner, MI would allow for an improved transition to more sustainable transit and higher standard of living (Giesecke et al., 2016). Only if consumers have a positive attitude towards the mobility system, will it see an increase in ridership and will this model see success. Poor perception or attitudes towards the elements of this system will pose a significant barrier.

2.2 Theory of Reasoned Action

First proposed by psychologists Fishbein and Ajzen (1975), this theory explains how behavioural intentions and actions are a function of attitudes. One of the more important components of this theory is the attitude of individuals. They explain that attitudes concern whether the said individual believes that a certain outcome is favourable to them or not. Thus, it highlights the significance of understanding attitudes in order to shape behaviour and actions. Accordingly, a certain attitude leads to a behavioural intention which results in an action.

Figure 2. ***Pictorial representation of Theory of Reasoned Action***



Source. Fishbein & Ajzen, 1975

This theory has been applied to many studies of which a significant one by Staats (2004) aims to identify the behavioural change on account of pro-environmental attitudes. It is also popularly used in a variety of studies concerning health behaviour changes.

2.3 Best practices of MI around the world

With rapid development in technology, a variety of forms of transportation and mobility services have begun to evolve in order to increase consumer satisfaction and convenience. Off late, the introduction of different ride-sharing and hailing services as well other on-demand mobility services have the potential to improve connectivity and accessibility. In Austria, the municipality, alone or in cooperation with other stakeholders, has worked to establish on-demand bus systems, local car-sharing and private ride-sharing schemes as well as other autonomous systems to solve first and last-mile connectivity issues (Schabka et al., 2022). A trial for MI began in Australia in 2019. An attempt was made to integrate local ride-sharing and car sharing schemes, in addition to on-demand bus and other autonomous systems in order to bridge the first and last-mile connectivity gap (Hensher et al., 2021).

In parts of south-east Asia, urban mobility patterns have seen rapid change. In Jakarta, one of the most densely populated metropolitans in the world, Maas has actively been adopted in order to meet transport demands for the city's fast-growing population. Of late, motorcycle taxis in

the city are one of the most popular on-demand mobility services providing not only transit solutions but also first and last-mile connectivity (Huiling & Goh, 2017).

Moreover, studies on existing integrated and other novel mobility systems are increasingly diverting their attention to analysing consumer attitudes towards the same in order to ensure best practices (Caiati et al., 2020). In a study on the adoption of innovative bike-sharing in Madrid, some key attributes that were studied were the influence of perceived attributes of such a system and also personal characteristics of individuals, at the time of adoption of such a scheme (Munkàcsy & Monzòn, 2018). Mallat et al. (2006) explain how the rate at which public transit adopts revolutionary mobile ticketing is significantly dependent on commuter perceptions and attitudes.

2.4 Current situation and perception of MI in the city of Bengaluru

The most popular forms of public transit in the city of Bengaluru are public buses, both electric and non-electric provided by the Bengaluru Metro Transit Corporation (BMTC) and the Bengaluru Metro also known as "Namma Metro"[3] that functions under the Bengaluru Metro Rail Corporation Limited (BMRCL). The city also has the suburban railways, provided by the Indian Railways, that transport people through portions of the city (Express News Service, 2023). However, more often than not each of these means of public transit function independent of each other. Though public transport options have grown over decades, it has failed to do so in an integrated manner (Verma et al., 2020). Moreover, the lack of positive attitudes towards the same implies that ridership is not growing along with its development.

It was only as recently as 2020 that the BMRCL, in collaboration with the DULT and the Urban Development Department of the Government of Karnataka (GoK), introduced the city's 'Comprehensive Mobility Plan' (Gok, 2020). Under this, the BMTC established bus stops next to metro stations and introduced metro feeder buses to serve as first and last-mile connectivity to the metro (The Hindu Bureau, 2023). The main objective under this plan is to ensure compliance to the principles of sustainability by increasing the mode share of public transit in the city in order to meet the transport demand and subsequently reducing the emissions associated with traffic thereby alleviating air pollution concerns. However, in a study by Bandyopadhyay (2020), it was found that with increasing metro ridership, first and last-mile

[3] meaning "Our metro" in the local language of Kannada

connectivity, of which taking the Auto rickshaw[4] or using and parking one's personal vehicle at the metro station, is becoming increasingly more expensive. Thus, the lack of consideration of consumer attitudes and requirements is causing them to orient their behaviour in a manner that is not enabling better MI.

While ride sharing and hailing apps are yet to directly tie up with the metro or bus system, the city has seen some level of MI between these two means of transit. 'Ola', the city and country's leading ride sharing company announced in 2018 that they were tying up with the Indian Railway Catering and Tourism Corporation (IRCTC) to enable travellers to be able to book cabs and Auto rickshaws through the IRCTC platform (Mannan, 2018). This also applies to travellers within the city using the suburban railways. Moreover, the city's Micro-Mobility Vehicles (MMV) or mini-scooter provider 'Yulu' has set up bike stations at multiple railway stations across the city (Express News Service, 2019). As of 2019, many mini-scooters have been added to multiple locations, of which many were introduced in popular metro stations towards the centre and east of the city (Tiwari, 2019).

While certain options have been growing, others have been decreasing. Some of the city's leading dockless scooter sharing services such as 'Bounce' and 'Vogo' had scaled down or had their operations remain stagnant on account of lack of support from authorities as of 2022 (Philip, 2022a). Even the public bicycle sharing project introduced by DULT saw complete failure largely on account of lack of consumer awareness regarding the same and the misalignment between consumer demand and public mobility projects established (TNN, 2020). This highlights the importance of correctly estimating consumer demand and behaviour regarding MI which can be done through analysing mobility attitudes in the city.

2.5 General barriers to MI in India

2.5.1 Growing popularity of private vehicles in India

2.5.1.1 Financial policies and growing perception of affordability

When it comes to easy access to financial resources, the Government of India has introduced a variety of easy finance schemes. The Federal bank as well as the State Bank of India (SBI), amongst other banks in the country have begun offering car loans with significantly lower rates

[4] Also known as a Tuk tuk, it is a motorised version of a hand-pulled or cycle rickshaw. It is a three-wheeler vehicle and is usually hailed for short distances. It is common across many cities in South and South-east Asia.

of interest making owning a car a financial possibility for a larger segment of the population (Pradhan & Tambe, 2023). In addition to government schemes, many private companies have also introduced automobile financing schemes, often, as a part of their marketing strategy attempting to increase car sales. In fact, in a study by Verma (2015), when understanding the change in borrowing rate compared to a change in aggregate sales of three specific automobile companies in India, namely, Hyundai Motor India, Maruti Suzuki and Tata motors, it was found that, with an increase in sales, there has been a steady decline in the interest rate. This clearly implies a strong relation between car sales and interest rates (Verma, 2015). Increasing financial schemes leads to the increased perception of affordability thereby orienting consumer attitudes and behaviour patterns further in favour of private vehicles.

2.5.1.2 Status and pride

Almost every middle to upper class family in the country either owns or has access to a car or other private vehicles. Many Indians view owning a car as a significant status symbol (Bhargava, 2012). It implies that an individual is capable of affording comfortable travel that is not necessarily cheap. This idea amongst predominantly car owning families that the car is one of the most comfortable means of transit is known as the “club effect” which Saidi (2013) describes as being the “direct externality” associated with the usage of cars amongst certain segments of the community. From data collected from parts of the Indian population, Verma (2015) explained how over 30% of their respondents believed that owning a car was directly associated with having high enough status. Almost 70% of the respondents believe that it is actually enjoyable to travel by car, whereas, over 80% of respondents believe travelling by car is far more comfortable than using public transit. A sizable majority of respondents are also of the opinion that car travel is less tiring and will enhance one's quality of life.

2.5.1.3 Perception of Comfort and reliability

The two-wheeler, be it a motorbike or scooter, is the most dominant form of private vehicle in the country. It is the most popular choice for the first vehicle the youth choose to purchase. It is the most reliable transport to weave through heavy traffic in dense metropolitans across the country. Moreover, it is popular amongst women in India because they enjoy the freedom from the hassle of taking unsafe public transit, having to walk through dark streets or relying on a male family member to pick them up. Additionally, the privacy that both the car and two-wheeler offer also contributes to increasing comfort (Jindel & Ollivier, 2021). Moreover, with the introduction of the electric two-wheelers, the popularity of scooters in specific, has shot up

even further. It is this perception of increased comfort and reliability of the two-wheeler that enabled the country to become its largest market in the world in 2017 (Doval, 2017). This view is true for private cars as well (Verma, 2015). This explains why consumer attitudes are in favour of private vehicles and how it is seen as the most comfortable, flexible and reliable means of transit.

2.5.1.4 Lack of alternative to private transit

For those who want exclusive control over their commute and want to use only one means of transit throughout, there is no alternative to their car or two-wheeler. No other means of transport offers such flexible end to end commute (İmre & Çelebi, 2017). Moreover, in more remote parts of the city where frequency of public transport and ride hailing is low, private transportation is usually the primary mode of commute. And with transit policies largely limiting their jurisdiction to urban parts of the city, travellers are often left with no other options but to use their private vehicles (Mohan, 2019). Lastly, public transport in the city is yet to actively accommodate those with limited mobility and other disabilities, thus, private vehicles or ride sharing/hailing is preferred over public transit again. Though the metro has actively worked to incorporate mobility assists throughout all its stations and trains, consumer attitude and awareness of this is poor. Moreover, even with inclusivity efforts, those with mobility issues still find it difficult to travel on the metro (Suresh, 2022).

2.5.1.5 Introduction of Electric-vehicles and growing one-sided environmentally friendly attitudes of consumers

While Electric-vehicles (EVs) have taken the world by storm, the same can be said about India as well. As of 2022, the EV market had grown by 223%. The market share of electric cars and scooters have seen colossal expansion to a point that its sales is expected to reach 22 million units by 2030 (IANS, 2023). With rapidly expanding charging infrastructure and on account of ease of use and maintenance of such e-scooters, more individuals are opting to travel on their 2-wheelers as opposed to taking public transit. Growing environmental consciousness regarding the impacts of vehicular emissions have translated into higher adoption of EVs as opposed to improved adoption of public transit. Moreover, the “Faster Adoption and Manufacturing of (Hybrid and) Electric Vehicles in India” policy, also known as the FAME India policy has significantly boosted EV popularity. Its second phase was recently launched and will continue to better establish the market here (PTI, 2021; PTI, 2023).

2.5.2 Lack of popularity of public transport in India

2.5.2.1 Urbanisation and changing travel behaviour

Almost 35% of the country's population reside in urban areas and the rural urban exodus is only increasing (Singh, 2016). With an increase in urbanisation, travel patterns have also changed. Governments in urban areas have traditionally responded to increasing transport requirements with expanding roads and highways as opposed to investing in public transport infrastructure (Mantri, 2016). Moreover, the population density in Indian metropolitan cities is exponentially higher than in other parts of the country. Though investment in public transit is essentially much higher here, the transport requirement in comparison to the population is often abysmally low. For a city whose population grew by over 4 million, the BMTC has only been able to increase its fleet by around 600 buses which is inadequate considering the city's current population (Kidiyoor, 2022). With increasing road networks, there is a growing perception that travel by road will be comfortable.

2.5.2.2 Political issues

When considering the local government's attempt to mitigate traffic congestion issues, more often than not, their first choice is to construct flyovers. It is a visible sign of public investment into a legitimate government project leading to the city's growth and development and is also a symbol of modernity in the country. In India, with a change in the national government in 1995, the modus operandi regarding urban development saw a transition into the increasing popularity of flyovers or overpasses in order to alleviate traffic congestion issues. Politicians see these as "big ticket" projects that bring in a lot of investment. However, increasing establishment of flyovers is also seeing the dominance of cars and is leading to the phenomena of "induced driving" which explains how roads are seeing more vehicles because flyovers give the perception that there is increasing road space and reduced traffic congestion (Doctor, 2014). However, more often than not they tend to generate more congestion as opposed to solving it but are still a popular solution to traffic problems especially in metropolitan cities across India (Maitra et al., 2004).

2.5.2.3 Perception of lack of reliability

The most popular means of public transport in the country is the Bus system; however, it is often seen as not reliable (Desai & Rawal, 2019). There is a perception that it is not comfortable on account of it not being clean or safe and being overcrowded, especially during peak hours.

The lack of air-conditioning on a lot of buses as well as the local train is another impediment. Across many routes and stops, there have been complaints of poor frequency. Moreover, people are often of the view that the lack of end-to-end connection implies a less comfortable and more time-consuming journey. Additionally, from a study done in Bengaluru city, it was found that commuters prefer to be in/on their private vehicle when stuck in traffic as opposed to being on the bus (Sarmmah, 2018). The BMTC has also received complaints of pressing issues like the lack of frequent schedule and timetable updates. Poor timeliness also implies the lack of reliability of the public bus, orienting consumer attitudes against it, which poses a significant barrier to MI (Mukherjee, 2022).

2.5.2.4 Lack of benefits that private vehicles offer

One of the more significant drawbacks of the public bus in the city is the long travel time not only owing to traffic congestion but also on account of lack of direct routes or too many stops and intervals. Sarmmah (2018) explains the many reasons why more citizens of the city are pulling away from bus travel in exchange for using their cars and two-wheelers. Moreover, public transit is yet to be inclusive to those with limited mobility and with other physical and mental disabilities. Lastly, for individuals who are uncomfortable with sharing their journey with others, there is no alternative to their private vehicle (Mukherjee, 2013).

2.5.2.5 Issues with stations and waiting conditions

The problemss don’t end with public transit itself but extends to the whole system. Poorly lit and maintained stations prevent commuters from viewing it positively, even if the journey on the bus were comfortable (Prakash, 2023). Moreover, in a country with harsh summers and torrential rains, protection from the elements is essential and an absence of the same leads to increasing discomfort for travellers (N, 2015). Lastly, transit stations are often not digitised and so in the event of a delay, the commuter is unaware of when the transit will arrive (Mishra, 2018).

2.5.2.6 Lack of popularity of the Bengaluru metro

The Bengaluru metro was established in 2011 in order to make-up for the shortcomings of the public bus and increase public transport options to commuters in the city. However, even a decade later, the BMRCL is not able to increase ridership enough to breakeven. According to a report prepared by the International Association of Public Transport, the Bengaluru metro would require a 208% increase in its daily ridership to accomplish this (TNN, 2021). While it offers certain benefits in comparison to its counterpart the public bus, like respite from the

city's torrential rains which causes unpredictable and erratic traffic patterns and congestion, it has other limitations. Commuters have raised concerns regarding its frequency and its schedule with the last train leaving well before midnight. Moreover, the metro doesn't necessarily connect a lot of important parts of the city and consequently is not very popular among travellers (Philip, 2022).

2.5.3 Growing popularity of ride sharing and hailing

2.5.3.1 For general use and as first and last-mile connectivity

Some of the more popular ride sharing and hailing apps in the city are Uber and Bengaluru's very own, "Ola". Philip (2019) explains how these apps have changed the face of mobility in the city but away from public transit and towards ride sharing and hailing. Commuters who contributed to bus ridership actively shifted towards booking a cab or taxi instead, thus, orienting customers away from public transport which is posing a significant problem to MI in the city. However, public transport ridership has been abysmally low often owing to poor first and last-mile connectivity as well. In a report by the Bangalore Political Action Committee (BPAC), the importance of investment into and expansion of means of first and last-mile connectivity is explained (Nandy, 2020). According to Upadhyay (2017), such ride sharing and hailing is necessary because it became a reliable solution to first and last-mile connectivity issues across many big cities in India.

2.5.3.2 Image of Comfort and reliability

The first ride hailing apps that entered the Indian market campaigned by highlighting the significant comfort of such air-conditioned taxis as an alternative to existing taxis and to a certain extent, the public transport. In fact, with increasing private vehicles and taxis on the streets, parking requirements have gone up considerably and in light of this, such a mode of transit eliminates the hassle of finding parking which would be a concern if consumers opted to use their private transit instead (Upadhyay, 2017). While initially this means of transit was reviewed positively on account of the ease of booking, payment and its accessibility to those with limited mobility, off-late surge pricing and constant cancellations have questioned its reliability (Kashyap, 2022). When coming to ride sharing, Yulu is one of the more popular, dockless, electric mobility sharing services in the city. It tries to bridge the first and last-mile connectivity gap and is largely used by commuters who are looking to travel a distance of 3 to

5 km (Biswas, 2019). Though many such sharing services have come up throughout the city, its popularity as a first and last-mile service is unclear.

2.5.3.3 Technological capacity and accessibility

With a growing middle-class, more people have access to a combination of technology, the internet and online payment applications and consequently ridership of this mode of transport is growing. While ride sharing and hailing is certainly growing in popularity largely amongst the middle and upper class, the same cannot be said for the lower and lower-middle class. Affordability is a major concern amongst the poor and a lot of them are forced to use the bus even if it isn't as efficient simply because ride hailing is too expensive for them (Nair, 2016). This means of transit has also left out those who don't have access to credit cards and higher-end technology (Shrikant, 2019).

2.6 Significant attitudinal barriers to MI from past studies

In a study by Schabka et al. (2022) regarding the identification of drivers and barriers to mobility service implementation in Austria, one of the most crucial factors identified was the administering of "needs-oriented mobility services". This essentially entails developing mobility and transport services that directly meet the needs of the consumers. Thus, a poor understanding of consumer preferences and user demands, which dictate travel behaviour, will pose a significant barrier to the adoption of novel transport services and better MI. Moreover, a major driver to mobility service adoption is tailoring such services to different consumer groups.

A significant barrier is a tendency to prefer private vehicles over public transport which is the key element of MaaS. In fact, the rate of MaaS adoption amongst those who have preferences towards cars is abysmally low. This is especially the case in the Netherlands according to Alonso-González et al. (2020). Having collected primary data via a Likert-scale questionnaire and having employed the Exploratory Factor analysis as their main approach, they were able to identify how higher cost of public transit, in the Dutch context in specific, could pose a significant barrier in terms of better integration of mobility. Moreover, growing demand for ride-sharing independent of public transport also has the potential to negatively affect adoption of MI.

Lund et al. (2017) explain how some of the large-scale drivers to MI are urbanisation, growing environmental issues and congestion. However, lobbying by private players to bend consumer

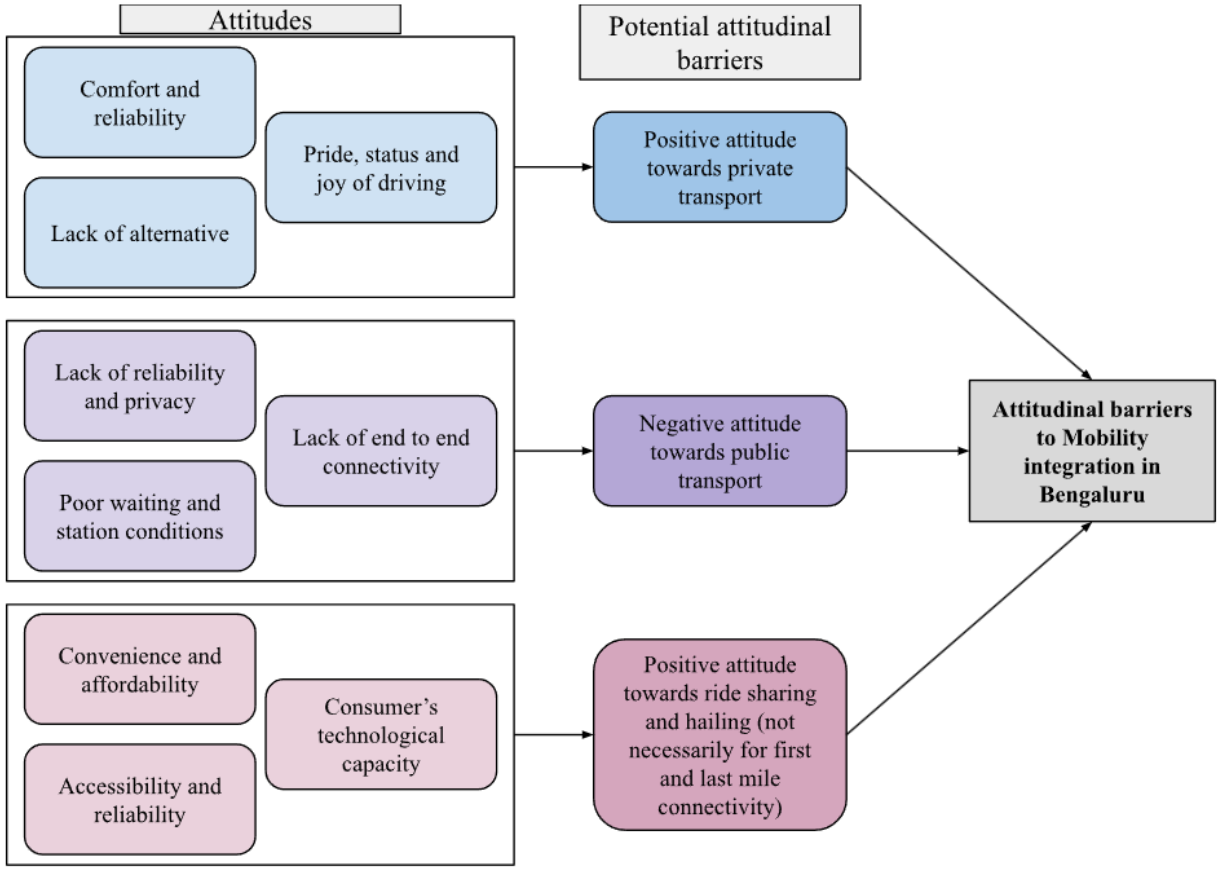
attitudes towards private vehicles is bound to shape their behaviour into a car dependent unimodal pattern. This, is something providers of public transit service will actively have to combat when working to better integrate mobility.

2.7 Conceptual Framework

The conceptual framework used in this paper is adopted partially from the framework established in the study by Alonso-González et al. (2020) where the independent variables are converted into Likert-scale statements that are rated on a scale between 1 to 5. In our study, identifiable attitudinal factors that have the potential to pose a barrier to better MI in the city have been picked up from existing literature. These factors are further condensed into three specific variables being that of, a) attitude regarding private vehicles, b) attitude regarding public transport and c) attitude regarding ride sharing and hailing.

These attributes respectively decide the rate of adoption or alternatively, the attitudinal barriers to the adoption of MI in the city of Bengaluru. The pictorial representation of the same has been included below.

Figure 3. ***Conceptual framework***



Source. Author generated

3. Research Design and Methodology

3.1 Operationalisation table

The variables for this study have been identified from existing literature. The format of the variables and the derived indicators have been adapted, partly, from the study by Alonso-González et al. (2020). Other indicators were also introduced from interviews with experts in the field. The three key variables are a) attitude towards private transport, b) attitude towards public transit and c) attitude towards ride sharing and hailing in the city. The indicators for each of these variables has been mentioned in the operationalisation table below.

Table 1. ***Operationalisation Table***

Research objective and sub-ROs	**Research questions and sub-RQs**	**Variables**	**Indicators**	**Data collection method**	**Data analysis method**
To identify attitudinal factors regarding private transit that translate into transport behaviour that pose barriers to better mobility integration in the city	What attitudinal factors regarding private transit translate into transport behaviour that pose barriers to better mobility integration in Bengaluru?	Attitude towards Private vehicles	Private vehicles are the most comfortable means of transit	Survey Questionnaire	Exploratory Factor analysis (EFA)
			I enjoy the privacy in my private vehicle		
			I enjoy driving/ riding my private vehicle		
			My private vehicle is more time efficient than the public transport		
			Using my private vehicle is cheaper than taking the public transport		
			My private vehicle is more flexible than the public transport		
			My private vehicle is the most reliable means of transit		

I currently do not have an alternative to my private vehicle

My private vehicle is my pride

I want to have to take only one mode of transit to get to my destination and my private vehicle allows for me to do that

I think public transit in Bengaluru is of poor quality and I do not want to take it or experiment with it so I use only my private vehicle

I think other means of transit such as ride sharing and hailing are not in my price range or are uncomfortable so I only use my private vehicle

I believe my private transit is most inclusive to those with limited mobility

I do not mind trying to find parking or having to pay for it when it is not free

Emissions from my vehicle and its impact on the environment do not bother me

To identify attitudinal patterns regarding public transit that could potentially pose a barrier to mobility integration in the city	What attitudinal factors regarding public transport translate into transport behaviour that pose barriers to better mobility integration in Bengaluru?	Attitude towards public transportation before the construction of the metro	I was comfortable taking the public transit even before the construction of the metro	Survey Questionnaire	EFA and linear regression
			The frequency of the public transit was good even before the construction of the metro		
			The public transit was clean even before the construction of the metro		
			I didn't mind sharing my journey with others even before the construction of the metro		
			The public transit was timely even before the construction of the metro		
			I didn't mind travelling for a longer period of time even before the construction of the metro		
			There was enough information regarding schedules for the public transit even before the construction of the metro		
			I preferred taking the public transit over my private vehicle even before the construction of the metro		

			Public transit stops and stations were not too far even before construction of the metro		
			The waiting conditions and situation of the stations were good even before the construction of the metro		
			I believe that the public transit was inclusive to those with limited mobility even before the construction of the metro		
			I believed it was more environmentally friendly than private transit even before the construction of the metro		
To identify attitudinal patterns regarding public transit that could potentially pose a barrier to mobility integration in the city	What attitudinal factors regarding public transport translate into transport behaviour that pose barriers to better mobility integration in Bengaluru?	Attitude towards public transportation after the construction of the metro	I am comfortable taking the public transit only after the construction of the metro	Survey Questionnaire	EFA and linear regression
			The frequency of the public transit is good only after the construction of the metro		
			The public transit is clean but has become this way only after the construction of the metro		
			I don't mind sharing my journey with others but this has come to be only after the construction of the metro		

The public transit is timely but this is true only after the construction of the metro

I don't mind the travel time if it is long but this is true only after the construction of the metro

There is enough information regarding schedules for the existing public transit but this has come to be only after the construction of the metro

I prefer taking the public transit over my private vehicle but this is true only after the construction of the metro

Public transit stops and stations are not too far but this is true only after the construction of the metro

The waiting conditions and situation of the stations are good but only after the construction of the metro

I believe that the public transit is inclusive to those with limited mobility but this is true only after the construction of the metro

I believe it is more environmentally friendly than private transit but more so after the construction of the

			metro		
To identify attitudinal factors regarding ride sharing and hailing that translates into behaviour patterns that pose a barrier to mobility integration in the city	What attitudinal factors regarding ride sharing and hailing translate into transport behaviour that pose barriers to better mobility integration in Bengaluru?	Attitude towards ride-sharing and hailing apps in general	I find ride sharing and hailing to be a very comfortable mode of transport	Survey Questionnaire	EFA and case study analysis
			I believe ride sharing and hailing is very time efficient		
			I believe ride sharing and hailing is more flexible because I don't have to find parking		
			I have my privacy to a degree while using ride sharing and hailing		
			I find ride sharing and hailing to be cost effective		
			I believe I have the technological capacity to use the apps and make necessary payments when using ride sharing and hailing		
			I believe ride share and hailing is accessible to those with limited mobility		

				Survey Questionnaire	EFA and case study analysis
To identify attitudinal factors regarding ride sharing and hailing that translates into behaviour patterns that pose a barrier to mobility integration in the city	What attitudinal factors regarding ride sharing and hailing translate into transport behaviour that pose barriers to better mobility integration in Bengaluru?	Attitude towards ride-sharing and hailing apps as first and last mile connectivity	I prefer ride sharing and hailing to my private vehicle because I don't have to find or pay for parking at the metro/ bus station or at my destination		
			I believe ride sharing and hailing is most time efficient for first and last mile connectivity		
			I believe ride sharing and hailing is cost effective for first and last mile connectivity		
			Ride sharing and hailing is the perfect means of transit to complement the public transit		
			I believe ride sharing and hailing is easy to access/ find		
			I believe ride sharing and hailing is accessible to those with limited mobility as a first and last-mile connectivity option		

Source. Author generated

3.2 Research strategies and design

The main research strategy employed here in order to answer the above-mentioned research questions is Exploratory research. The study aims to understand and analyse if the attitudinal variables identified from literature pose a barrier to MI in Bengaluru and how significant a

barrier they are. Thus, there is no recognised hypothesis because the study seeks to identify the most significant attitudinal barriers.

A hypothesis can only be proposed after data collection and analysis. The research design follows the process of the identification of potential barriers from existing literature and interviews. From this a Likert-scale questionnaire (See Appendix, Table 1) was developed and the same was circulated amongst individuals who are eighteen and older in the city of Bengaluru. Once this data was collated and properly cleansed, it was analysed via the Exploratory Factor Analysis (EFA) method to answer the main research question. The first sub-question is also answered through this process. An ordinal regression process is used to answer the second sub-question and document analysis is employed to analyse and answer the third sub-question. A solid conclusion has been built based on this analysis.

3.3 Data collection method

3.3.1 Survey design and sampling

The survey consists of statements which are to be rated on a Likert-scale from 1 to 5 between strongly agree and strongly disagree. These are the indicators in the study. This type of questionnaire is important for its ability to accurately measure affective variables (Nemoto & Beglar, 2014). The three sections, as previously mentioned are the variables of attitude towards private transit, attitude regarding public transportation and attitude towards ride sharing and hailing. The questionnaire is structured similarly to Alonso-González et al.'s (2020). The second and third sections are further divided into 2 sub-sections each. The second section on attitudes regarding public transit is split up into attitudes regarding public transport before the construction of the metro and attitudes regarding public transport after the construction of the metro.

As previously mentioned, the metro was an intervention to improve overall public transport ridership in the city and to convert commuter attitudes in favour of it. Thus, an analysis of attitudes before and after its establishment will help with a better understanding of whether commuter attitudes are shifting towards or away from public transportation and consequently MI.

The third section regarding attitude towards ride sharing and hailing in the city is also split into two sub-sections, one being the attitude towards ride sharing and hailing in general and the second being the attitude towards ride sharing and hailing as first and last-mile connectivity.

Again, as in the above section, separately understanding ride sharing and hailing's impact in these two situations will provide a better understanding of what commuter attitudes regarding this mode of transit is posing a barrier to better MI in Bengaluru. There is a slight overlap of statements in these two sections but it is necessary in order to have an accurate understanding.

The sample for the survey questionnaire involves individuals above the age of 18 in the city who have the freedom in choice of transportation used. Moreover, the data was collected via random sampling to maintain data normality with regard to the demographic. The sample size considering a 95% confidence level with 5% margin of error, and a population proportion of 50%[5] is 385. However, owing to time shortage and lack of extended resources, 61 responses were collected instead. The questionnaire was shared online through WhatsApp, Email and other social media platforms. However, once the data was cleansed, only 60 responses were used as only these matched the requirements of not having only one response to all questions and the respondent being a resident of Bengaluru.

3.3.2 Interviews for the construction of the questionnaire

More indicators for the questionnaire were adopted, in addition to the ones from existing literature. This was done via semi-structured interviews with experts in the field in order to cover that which could have been overlooked from the review of literature (Dearnley, 2005). Snowball sampling was employed in order to identify the interviewees. A description of the topic of discussion and background of the respondents is provided below.

[5] The population proportion is 50% on account of public transport share in Bengaluru being approximately 50% as of 2023 (Philip, 2022)

Table 2. ***Description of interview and interviewees***

Interviewee	Interview date and time	Interview method	Interview topic
Respondent 1: Infrastructure Development Corporation (Karnataka) Limited (iDeCK)	February 12th, 2023 7:45 am (CET)	Via Phone call	Discussion regarding current situation of mobility integration in Bengaluru and consumer trends in the same.
Respondent 2: Carbon Leadership Forum (CLF)	February 25th, 2023 6:25 pm (CET)	Via Phone call	
Respondent 3: Integrated Transport and Road Safety (WRI India)	May 31st, 2023 7:40 am (CET)	Via Phone call	

Source. Author generated

3.3.3 Secondary data for regression for analysing attitudinal change toward public transport before and after the construction of metro

Secondary data for the dependent variable being public transit ridership in the city is collected. Ridership of the public bus or BMTC in Bengaluru, is collected from the BMTC's official website as well as the Statista website. The citation for both websites have been mentioned in the references section. BMTC daily ridership from the years 2001 to 2021 is collected. This functions as a proxy variable for ridership of public transport in the city on account of the bus being the most predominant means of public transportation in the city as mentioned from literature. Moreover, the metro came up only in 2011 and there is a lack of data for suburban rail ridership in the city. The regression is further explained in the next section.

3.4 Data analysis method

3.4.1 Exploratory Factor Analysis

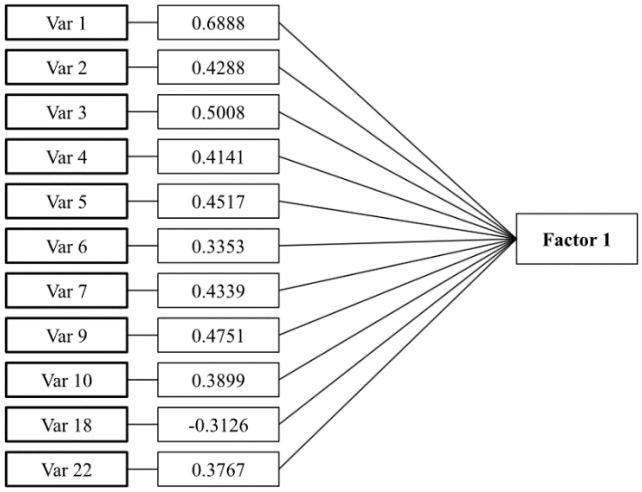
The EFA is used in studies with an abundance of variables. It is a technique to condense the indicators of the variables into a set of summary variables or factors and to further explore the underlying phenomena of these grouped variables. Moreover, there needs to be at least five categories in the data in order to conduct an EFA (Treiblmaier & Filzmoser, 2010). The data in this study has five categories being Strongly agree, Agree, Neutral, Disagree and Strongly disagree. These take a value from 1 to 5 respectively. Each of the variables from the questionnaire, being that of attitude toward private transport, attitude toward public transport and attitude toward ride sharing and hailing, consist of positive statements which are to be rated on this scale of 1 to 5. These statements are the indicators in the study which are mentioned in the operationalisation table. There are 52 indicators or statements in total with the first section having 15, the second section having 24 and the final section having 13 statements. The EFA here condenses all 52 indicators of the 3 variables from the questionnaire into smaller groups so that the key attitudinal factors which pose as barriers can be identified.

As mentioned previously, the second sub-section is split into two between data on attitudes before the construction of the metro and after the construction of the metro. Thus, the whole data set and indicators have been split into two on account of this division. The EFA is run twice. The first EFA is conducted with the data from the first section, the data from the second section only regarding attitudes toward public transit *before* the construction of the metro and data from the third section. The second EFA is conducted with the data from the first section, the data from the second section only regarding attitudes toward public transit *after* the construction of the metro and the third section. In each EFA, data for the first and third section remains the same. Only data from the second section changes between the two sub-sections. Thus, ideally, in each EFA there are 40 indicators under the 3 variables. However, on account of some overlap in the indicators between the two sub-sections in section three regarding ride sharing and hailing, 4 indicators are dropped, and so in total, each EFA is run with 36 indicators and the most significant summary variables or factors are identified in each EFA.

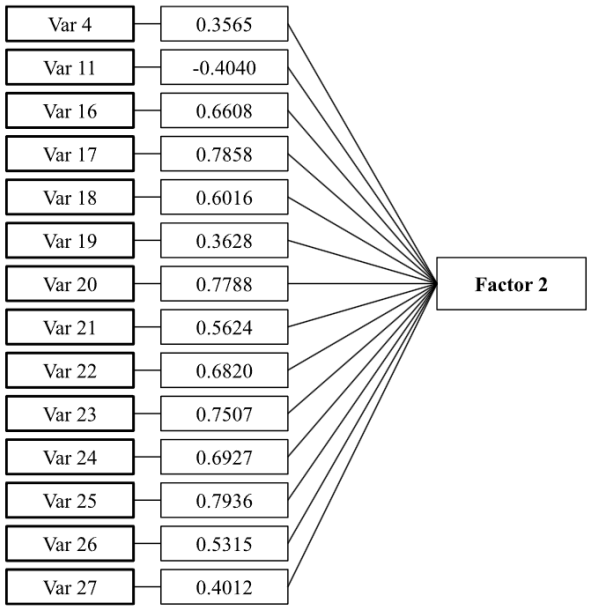
Summary statistics for this data are calculated. Post this, a correlation matrix is constructed with all the indicators. Any instance of a correlation coefficient being greater than 0.7 warrants the elimination of either of the indicators (Calkins, 2005). No indicators need to be dropped for the first EFA but 3 highly-correlated indicators are dropped in EFA two. After this, the

Principal Component Analysis (PCA) test and its representation as a Scree plot is conducted, identifying number of indicators with Eigenvalues above 1 which tells us the number of summary variables or factors that the data set will be reduced to. The PCA produces 11 factors in each case but the Scree plot, which is a better indicator, identifies 3 and 4 factors for the first and second EFA respectively. The number of points after which the line on the Scree plot is almost straight gives us this number of factors. The same has been highlighted in Figures 21 and 22 (Appendix). The PCA is run again after specifying the number of summary variables and the factor loadings are produced. This produces the variable grouping or clusters.

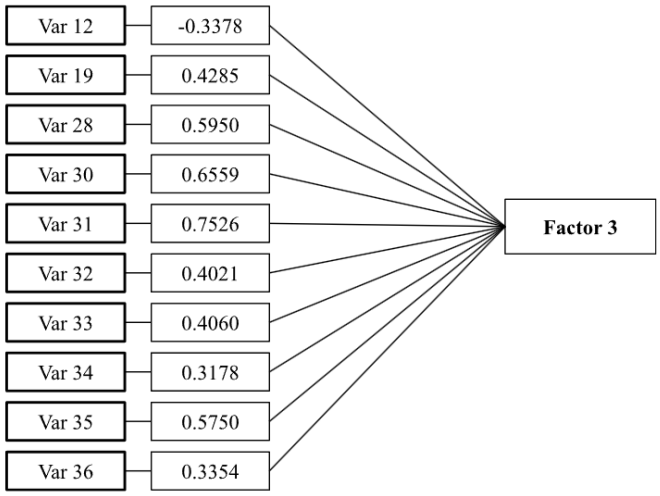
Figure 4. ***Factor loadings/ grouping for PFA 1***



PCA equation: Factor 1 = 0.6888(Var 1) + 0.4288(Var 2) + 0.5008(Var 3) + 0.4141(Var 4) + 0.4517(Var 5) + 0.3353(Var 6) + 0.4339(Var 7) + 0.4751(Var 9) + 0.3899(Var 10) - 0.3126(Var 18) + 0.3767(Var 22)



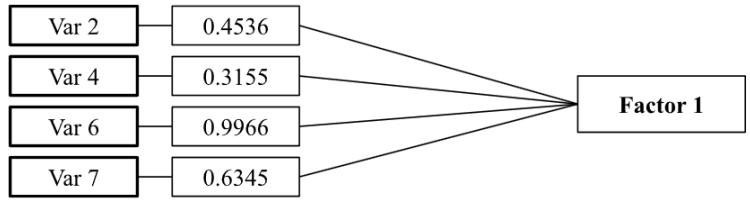
PCA equation: Factor 2 = 0.3565(Var4) - 0.4040(Var 11) + 0.6608(Var 16) + 0.7858(Var 17) + 0.6016(Var18) + 0.3628(Var 19) + 0.7788(Var 20) + 0.5624(Var 21) + 0.6820(Var 22) + 0.7507(Var 23) + 0.6927(Var 24) + 0.7936(Var 25) + 0.5315(Var 26) + 0.4012(Var 27)



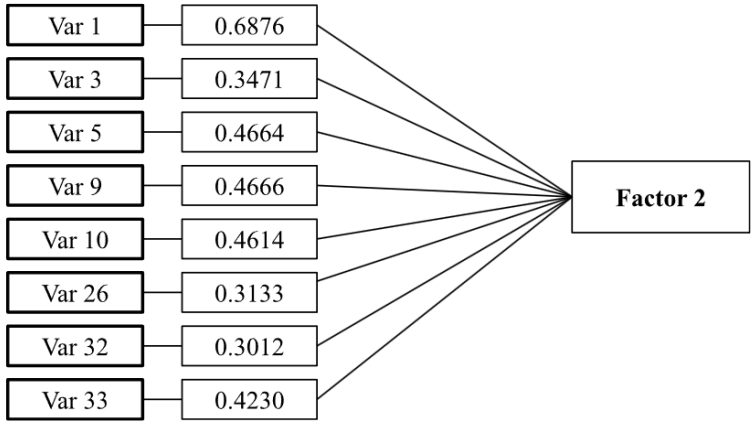
PCA equation: Factor 3 = -0.3378(Var 12) + 0.4285(Var 19) + 0.5950(Var 28) + 0.6559(Var 30) + 0.7526(Var 31) + 0.4021(Var 32) + 0.4060(Var 33) + 0.3178(Var 34) + 0.5750(Var 35) + 0.3354(Var 36)

Source. Author generated

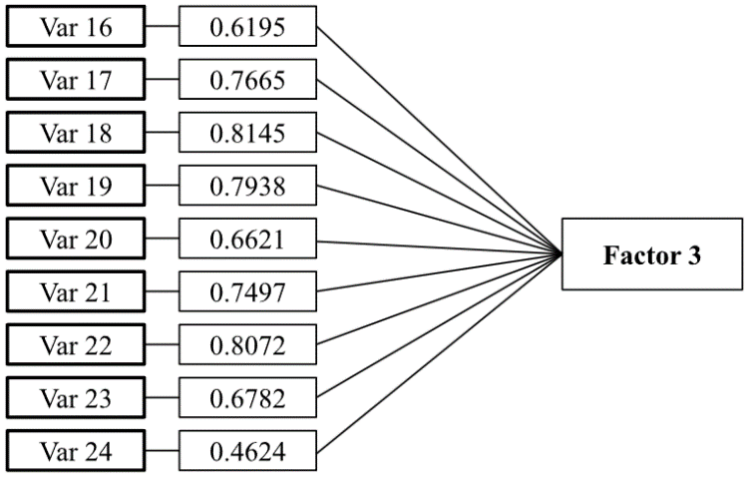
Figure 5. ***Factor loadings/ grouping for PFA 2***



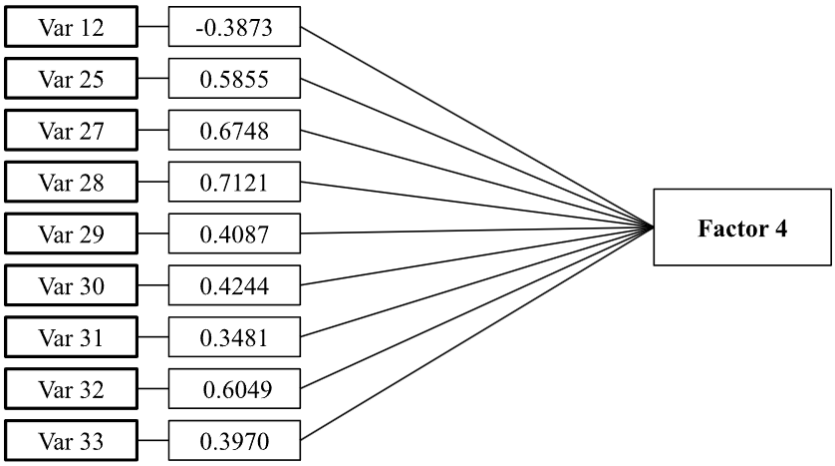
PCA equation: Attitude = 0.4536(Var 2) + 0.3155(Var 4) + 0.9966(Var 6) + 0.6345(Var 7)



PCA equation: Attitude = 0.6876(Var 1) + 0.3471(Var 3) + 0.4664(Var 5) + 0.4666(Var 9) + 0.4614(Var 10) + 0.3133(Var 26) + 0.3012(Var 32) + 0.4230(Var 33)



PCA equation: Attitude = 0.6195(Var 16) + 0.7665(Var 17) + 0.8145(Var 18) + 0.7938(Var 19) + 0.6621(Var 20) + 0.7497(Var 21) + 0.8072(Var 22) + 0.6782(Var 23) + 0.4624(Var 24)



PCA equation: Attitude = -0.3873(Var 12) + 0.5855(Var 25) + 0.6748(var 27) + 0.7121(Var 28) + 0.4087(Var 29) + 0.4244(Var 30) + 0.3481(Var 31) + 0.6049(Var 32) + 0.3970(Var 33)

Source. Author generated

However, what exactly these factors are, are derived from an analysis of and the manual grouping of the indicator names in order to obtain legitimate summary variables. This is the result of the EFA and is explained in the next chapter.

3.4.2 Regression analysis

Public transit is the key element of MI. While the bus has been the most dominant form of public transit, the establishment of the metro service in 2011 was done in order to induce change in consumer attitudes regarding public transport in the city. Analysing the difference in consumer attitudes towards public transit before and after the construction of the metro will explain whether the metro is the right way to go ahead and if it is aligning consumer attitudes with the attitudinal and behaviour patterns required to boost MI in the city, or if it is posing a barrier. Thus, a regression is conducted to answer the second sub-question because it is the best tool to identify the extent of the relationship between certain dependent and independent variables and indicators (Braun & Oswald, 2011).

Here, clearly, the independent indicators are the attitudes towards public transit from the operationalisation table and questionnaire, of which a few are attitude regarding comfort, reliability, accessibility, timeliness etc. of the public transit before and after the construction of the metro. These indicators of the “attitudes regarding public transit before/after the construction of the metro” variable are the regressors. And because we are looking to

understand its impact on ridership, the dependent or response variable is public transit ridership in the city. Thus, two regressions have been run, one for the data before the construction of the metro and one for after. Therefore, the 12 indicators from the first and the 12 indicators from the sub-sections of variable 2 are the regressors and the 1 dependent variable in each regression is bus ridership. A correlation matrix is conducted and it is found that only the second dataset has a few highly correlated indicators which are dropped. A simple ordinal regression is then run, on account of Likert-scale data being ordinal and the assumptions of a simple linear regression not applying here. Here the p-value does not identify the level of statistical significance and only the r-square value is analysed which gives the degree of relationship between the variables. Similarly, no model specification is produced because it is difficult to identify the same for ordinal data (Ananth & Kleinbaum, 1997).

Moreover, owing to the metro coming up only in 2011 and there existing no regulated data of suburban rail ridership in the city, the ridership for the bus between the years 2001 and 2011 is taken as a proxy variable to public transport ridership in the city. This will help us understand if there has been a change in the perception of public transit in the city post the construction of the metro. Thus, a hypothesis is built for this sub-question only. The Null hypothesis in the regressions, $\mathbf{H_0}$, explains that there is no significant relationship between consumer attitude regarding public transport before/after the construction of the metro on the ridership of public transit in the city. The alternate hypothesis $\mathbf{H_1}$ explains that there is a significant relationship between the two. It is represented as:

$$\mathbf{H_0 = 0}$$

$$\mathbf{H_1 \neq 0}$$

$$\mathbf{Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \beta_9 X_9 + \beta_{10} X_{10} + \beta_{11} X_{11} + \beta_{12} X_{12} + \epsilon}$$

This is the equation for the above two regression models where **Y** is the dependent variable being that of bus ridership in Bengaluru from the years 2001 to 2021 and $\mathbf{X_1}$-$\mathbf{X_{12}}$ are the indicators which constitute the independent variable of "attitudes regarding public transport before/after the construction of the metro". Here, $\boldsymbol{\beta_0}$ is the **Y** intercept meaning that it is the value of **Y** when $\mathbf{X_1}$-$\mathbf{X_{12}}$ is equal to zero. $\boldsymbol{\beta_1}$-$\boldsymbol{\beta_{12}}$ on the other hand is the slope of the regression line. Lastly, $\boldsymbol{\epsilon}$ is the error value or the remainder that is not explained by the $\mathbf{X_1}$-$\mathbf{X_{12}}$ variables. This regression shows the relation between these $\mathbf{X_1}$-$\mathbf{X_{12}}$ and **Y** variables.

3.4.3 Document analysis

To better deconstruct the data collected regarding ride sharing and hailing in the city, a document study analysis is conducted. This technique is able to bring to light information which does not necessarily have numeric backing (Love, 2013). Owing to poor or unpublished data records of ride sharing in the city, a qualitative analysis of the same has been done utilising government documents, newspaper and other media articles.

3.5 Reliability and Validity

Reliability is confirmed through the replicable nature of this study. This is ensured through the minimisation of errors while collecting data by identifying the right instrument for this process, through data validation and finally, through covering as many indicators as possible which were rigorously identified from literature and interviews. Moreover, the multiple techniques and statistical methods to analyse the data further reinforces the degree of accuracy of the results. A thorough cleansing of the data before the analysis leads to better reliability and the reduction of errors. Lastly, conversations with experts in the field have further strengthened the argument of the study ensuring high reliability.

Coming to the validity of the study, in addition to the above factors to ensure high degree of accuracy, a degree of consistency of responses to the questionnaire gives a positive indication to the attention paid to detail while conducting data collection. Thus, this study exhibits a good degree of validity as well as reliability. Moreover, the shortcomings of any one of the analysis techniques are eliminated due to the inclusion of three tools of analysis being the EFA, the regression analysis and the document analysis complementing each other to ensure a more solid conclusion.

3.6 Possible limitations to data collection

One of the most significant limitations to the data collected could be too much similarity in responses on account of a degree of snowballing even though attempts have been made to maintain data normality. Other limitations could be the lack of the required number of responses to a certain extent on account of the questionnaire being slightly long and time consuming.

Coming to the process of analysis, being that of the EFA, one of the possible limitations could be the lack of historical perspective to a slight degree on account of the issue considered being novel to the city. Additionally, it is difficult to very accurately determine whether the number of summary variables the analysis generates is correct. Consequently, there could be fewer or more “significant attitudinal barriers” to MI in the city.

4. Results Analysis and Discussion

A variety of means of transit have begun to take the city by storm. However, a detailed understanding of the consumer attitudes and perspectives regarding each of them is yet to be understood and analysed. Consequently, a primary study allows for us to bring to light the nuances that exist in the attitudinal barriers to MI in the city of Bengaluru. A descriptive analysis is conducted before the statistical, econometric and qualitative one in order to better understand the context.

4.1 Findings

Data regarding certain demographic factors have been collected. Data for each individual variable is presented in a table and graph form (See Appendix, Tables 12-19 and Figures 14 - 20). A summary version is presented below.

Table 3. ***Summary data regarding demographic factors***

Demographic data variable	Most popular response	Percentage of response out of total
Age of respondents	18 – 25 years	45%
Gender of respondents	Almost evenly split between male and female	Male: 46.7% Female: 51.7%
Area of residence of respondents	Largely South and East Bengaluru	South: 36% East: 35%
Level of education of respondents	Largely Bachelor's and Master's graduate	Bachelor's: 51.7% Master's: 33.3%
Number of years of work experience of respondents	0-5 years	58.3%
Most commonly used mode of transit of the respondent	Personal car and Auto rickshaw	Personal car: 65% Auto rickshaw: 43.3%
Average commute distance of respondents	5 - 10 km and 10 – 20 km	5 – 10 km: 28.3 km 10 – 20 km: 31.7 km
Number of respondents with driver's/ rider's license	Respondents with driver's license	83.3%

Source. Author generated

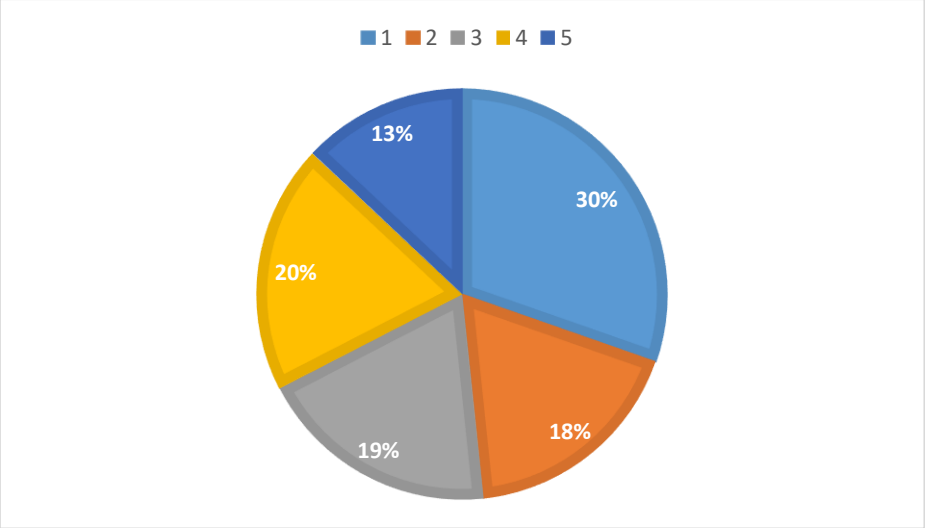
It is evident from the table that the sample for this study, predominantly consists of the youth (age 18–35) who are almost equally split between male and female, who are largely located around Southern and Eastern Bengaluru, with mostly bachelor's and masters' degrees, with less than five years of work experience, whose most commonly used means of transit is their private vehicle, with an average commute distance of 5 to 20 km and who largely have a driver's and/or rider's license.

Table 4. ***Average of responses for Section 1***

Responses for section 1	Number of responses for section 1	Percent of responses for section 1
1	273	30%
2	162	18%
3	172	19%
4	176	20%
5	117	13%

Source. Author generated

Figure 6. ***Average of responses for Section 1***



Source. Author generated

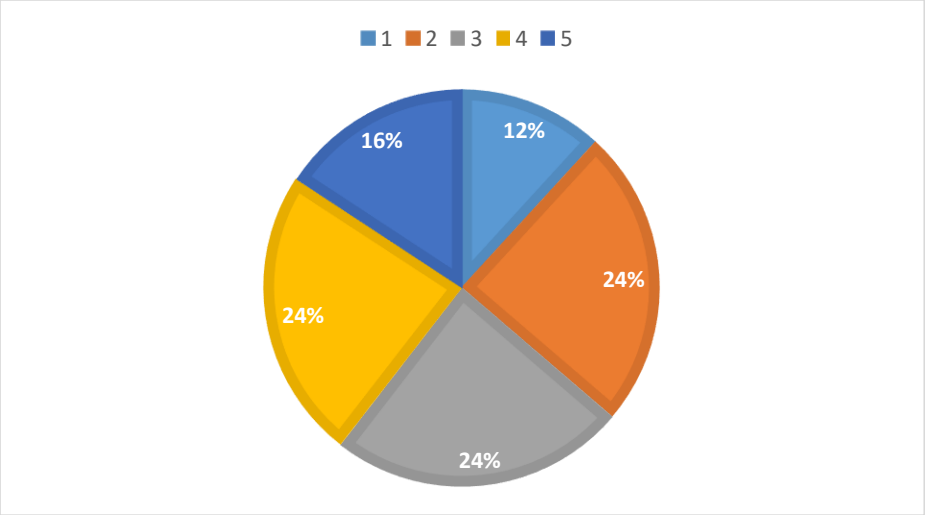
As is evident from the above table and graph, in the first section regarding attitudes toward private vehicles, a rating of 1 has been opted for 30% of the time, and rating 2 has been opted for 18% of the time on average. A rating of 4 and 5 have been opted for only 20% and 13% of the time. A rating of 3 has been opted for 19% of the time.

Table 5. ***Average of responses for Section 2***

Responses for section 2	Number of responses for section 2	Percent of responses for section 2
1	170	12%
2	352	24%
3	349	24%
4	342	24%
5	227	16%

Source. Author generated

Figure 7. ***Average of responses for Section 2***



Source. Author generated

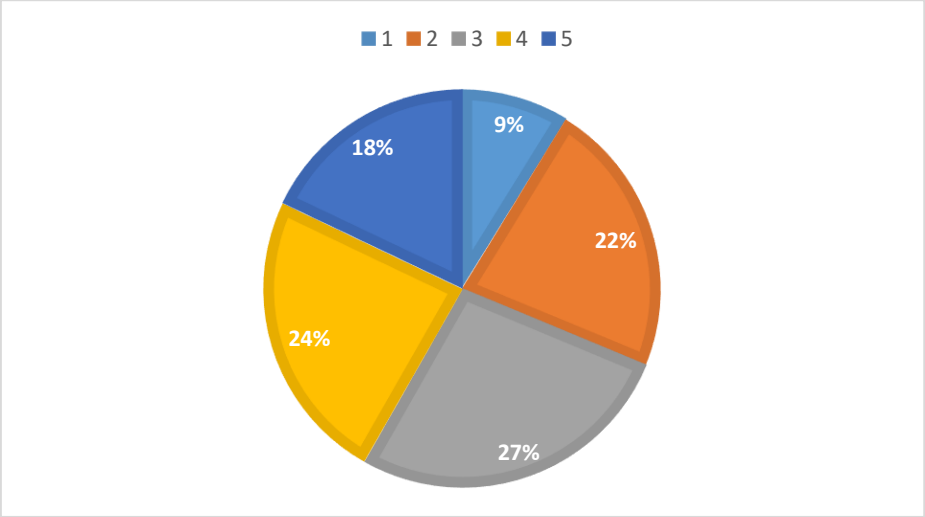
In the second section regarding attitudes toward public transport, a rating of 1 has been opted for only 12% of the time, and rating 2 has been opted for 24% of the time on average. A rating of 4 and 5 have been opted for 24% and 16% of the time. A rating of 3 has been opted for 24% of the time.

Table 6. ***Average of responses for Section 2, Sub-section 1***

Responses for section 2, sub-section 1	Number of responses for section 2, sub-section 1	Percent of responses for section 2, sub-section 1
1	63	9%
2	162	22%
3	194	27%
4	172	24%
5	129	18%

Source. Author generated

Figure 8. ***Average of responses for Section 2, Sub-section 1***



Source. Author generated

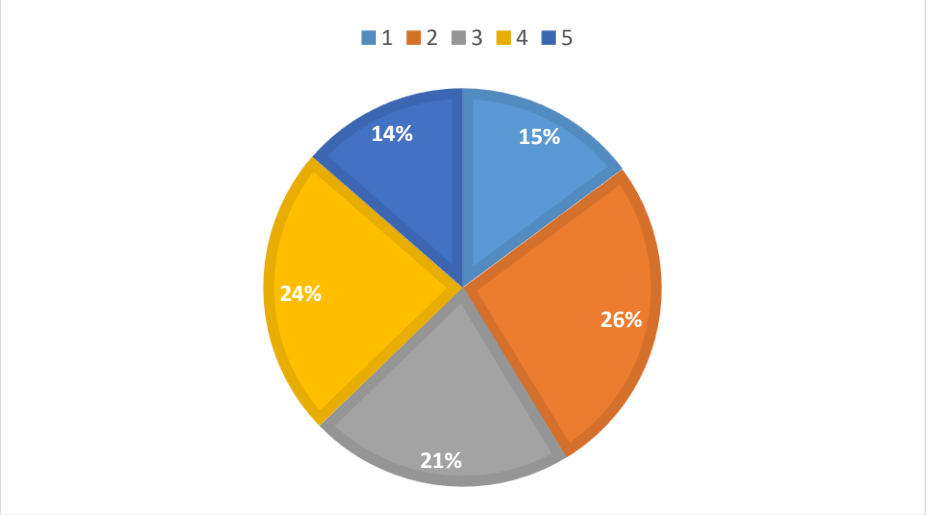
However, the second section is split into 2 sub-sections being that of attitudes regarding public transit before and after the construction of the metro. Accordingly, for attitudes before the construction of the metro a rating of 1 has been opted for only 9% of the time, and rating 2 has been opted for 22% of the time on average. A rating of 4 and 5 have been opted for 24% and 18% of the time. A rating of 3 has been opted for 27% of the time.

Table 7. ***Average of responses for Section 2, Sub-section 2***

Responses for section 2, sub-section 2	Number of responses for section 2, sub-section 2	Percent of responses for section 2, sub-section 2
1	107	15%
2	190	26%
3	155	21%
4	170	24%
5	98	14%

Source. Author generated

Figure 9. ***Average of responses for Section 2, Sub-section 2***



Source. Author generated

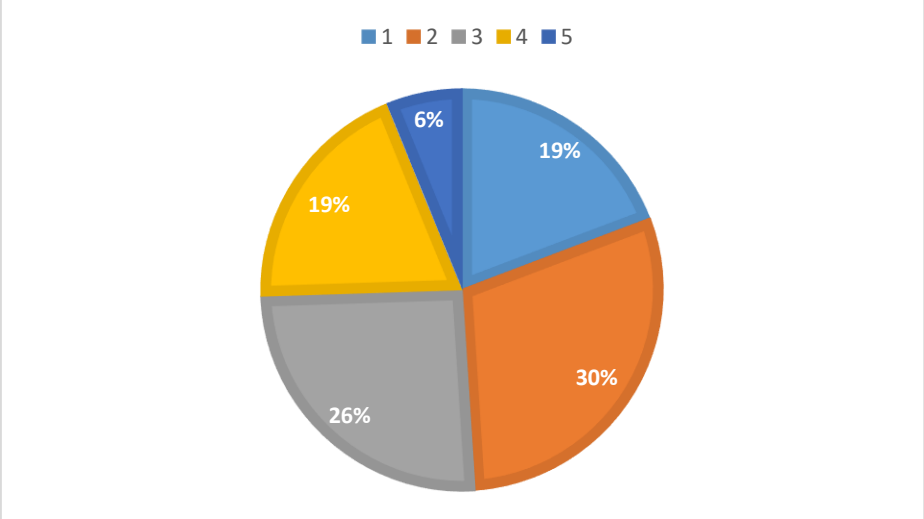
As for attitudes after the construction of the metro, a rating of 1 has been opted for 15% of the time, and rating 2 has been opted for 26% of the time on average. A rating of 4 and 5 have been opted for 24% and 14% of the time. A rating of 3 has been opted for 21% of the time.

Table 8. ***Average of responses for Section 3***

Responses for section 3	Number of responses for section 3	Percent of responses for section 3
1	150	19%
2	232	30%
3	199	26%
4	151	19%
5	48	6%

Source. Author generated

Figure 10. ***Average of responses for section 3***



Source. Author generated

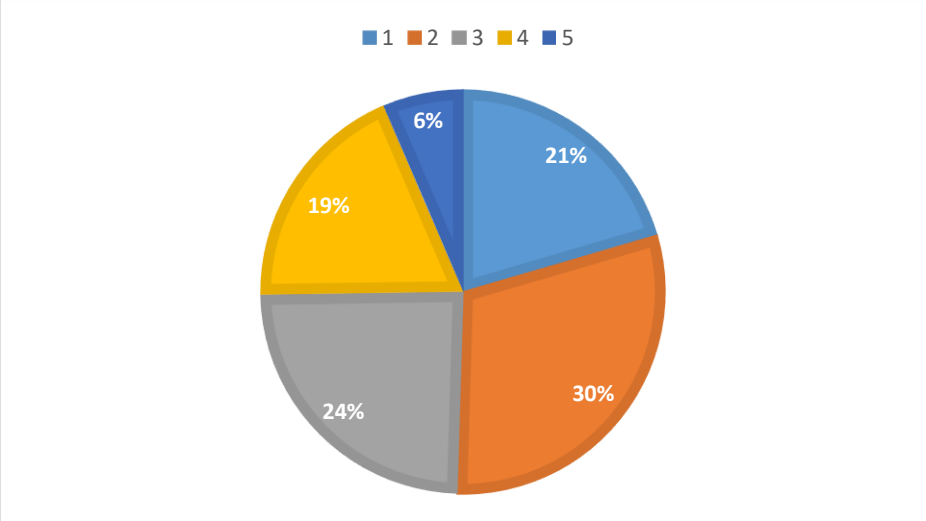
In the third section regarding attitudes toward ride sharing and hailing, a rating of 1 has been opted for 19% of the time, and rating 2 has been opted for 30% of the time on average. A rating of 4 and 5 have been opted for 19% and 6% of the time. A rating of 3 has been opted for 26% of the time.

Table 9. ***Average of responses for Section 3, Sub-section 1***

Responses for section 3, sub-section 1	Number of responses for section 3, sub-section 1	Percent of responses for section 3, sub-section 1
1	86	21%
2	126	30%
3	102	24%
4	79	19%
5	27	6%

Source. Author generated

Figure 11. ***Average of responses for Section 3, Sub-section 1***



Source. Author generated

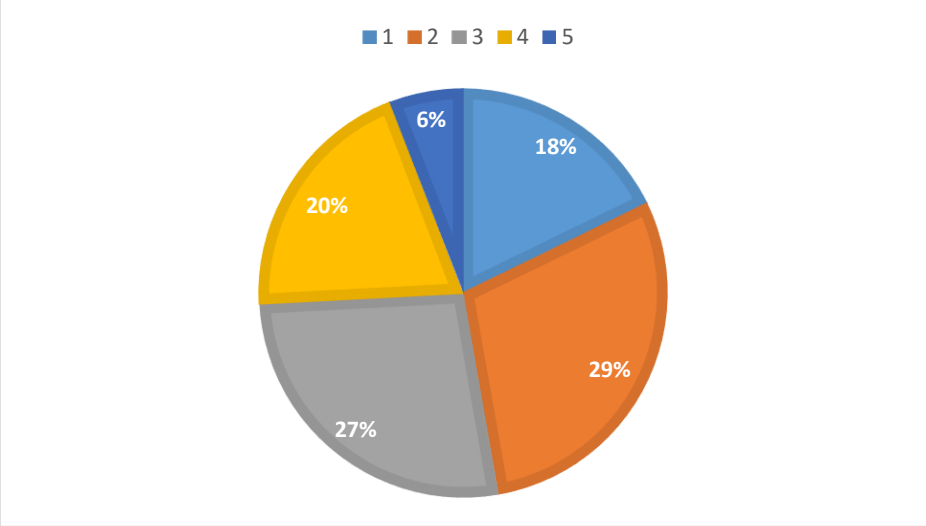
This section as well is split into 2 sub-sections being that of attitude toward ride sharing and hailing in general and as first and last-mile connections. Thus, for attitudes in general, a rating of 1 has been opted for 21% of the time, and rating 2 has been opted for 30% of the time on average. A rating of 4 and 5 have been opted for only 19% and 6% of the time. A rating of 3 has been opted for 24% of the time.

Table 10. ***Average of responses for Section 3, Sub-section 2***

Responses for section 3, sub-section 2	Number of responses for section 3, sub-section 2	Percent of responses for section 3, sub-section 2
1	64	18%
2	106	29%
3	97	27%
4	72	20%
5	21	6%

Source. Author generated

Figure 12. ***Average of responses for Section 3, Sub-section 2***



Source. Author generated

As for attitudes as first and last-mile connectivity, a rating of 1 has been opted for 18% of the time, and rating 2 has been opted for 29% of the time on average. A rating of 4 and 5 have been opted for only 20% and 6% of the time. A rating of 3 has been opted for 27% of the time.

4.2 Analysis

From the above data, a basic descriptive analysis is conducted. A rating of 1 (Strongly agree) and 2 (Agree) imply a positive rating, and 4 (Disagree) and 5 (Strongly disagree) imply negative rating. A rating of 3 implies neutrality. These 52 statements as previously mentioned were divided into three groups or variables being that of "attitudes regarding private vehicles", "attitudes regarding public transport" and "attitudes regarding ride sharing and hailing" in Bengaluru. The exact grouping of the indicators under these variables into legitimate factors is decided by the Exploratory Factor Analysis process conducted on the Stata software.

For a sample that predominantly consists of the youth (age 18–35), almost equally split between male and female, largely located around Southern and Eastern Bengaluru, with mostly bachelor's and masters' degrees, with less than five years of work experience, whose most commonly used means of transit is their private vehicle, the following are the attitude patterns.

From the first section, since almost half the responses are positive, in that rating 1 and 2 have almost 50% of the vote, and has a higher vote than rating 4 and 5, there is more of a positive perception regarding private vehicles in the city. This translates into positive attitudes toward private vehicles in the city, thereby constituting a significant barrier to MI in the city.

From section 2, almost half the responses are negative instead, in that rating 4 and 5 have almost 50% of the vote, and has a higher vote than rating 1 and 2, which implies that there is a negative perception regarding public transport in the city. This translates into negative attitudes toward public transport in the city, thereby constituting another significant barrier to MI in the city. When coming to the sub-sections, the first one regarding attitudes before the construction of the metro has received a significantly more negative rating than a positive one. The second one regarding attitudes toward public transit after the construction of the metro has its rating split almost evenly between positive and negative. This implies that attitudes toward public transit before the construction of the metro was slightly worse than the attitudes after.

In the third section, like the first one, almost half the responses are positive. Here, rating 1 and 2 have a significantly higher vote than rating 4 and 5, implying that there is a positive perception regarding ride sharing and hailing in the city. However, a positive rating for the two sub-sections has different implications. A positive rating of the first sub-section regarding attitude toward ride sharing and hailing in general works as a barrier and for the second-subsection regarding attitudes toward this mode of transport as first and last-mile connectivity,

it functions as a driver. Both sub-sections have received positive rating implying that it partly functions as a driver and barrier to MI.

However, whether these are significant barriers is not confirmed just via descriptive analysis. The EFA is what identifies what factors in specific constitute barriers to MI in Bengaluru. This process is conducted twice, as mentioned before.

4.2.1 Exploratory Factor Analysis

4.2.1.1 EFA one

The summary statistics for the first data set (Table 20, Appendix) have been calculated and the EFA is conducted. The correlation matrix (Table 21, Appendix) was then run and after it was determined that there is no high degree of the same between any of the indicators, the number of summary variables from the number of Eigenvalues above 1 in the PCA were identified to be 11 (Table 22, Appendix). However, the Scree plot identifies 3 summary variables and so the study goes ahead with only 3 (Figure 21, Appendix). From the factor-loadings or groupings (Table 23, Appendix), the 3 summary variables were identified to be:

1. Attitude of valuing private vehicles for its comfort, efficiency and associated personal pride
2. Attitude of valuing public transit before the construction of the metro for its reliability, comfort, good frequency and well-maintained stations and stops
3. Attitude of valuing ride hailing and sharing for its comfort, reliability, accessibility and ease of use of the required technology

Therefore, these are the most significant summary variables or factors from the first EFA.

4.2.1.2 EFA two

As in EFA one, the summary statistics (Table 24, Appendix) for this data set is also calculated and after this the correlation matrix (Table 25, Appendix) is run. On account of correlation between a few variables, the 17^{th}, 20^{th} and 23^{rd} variables are eliminated (Table 26, Appendix). The PCA was run for this data as well and the number of summary variables from this analysis is also 11 (Table 27, Appendix). However, the Scree plot points to there being only 4 summary

variables (Figure 22, Appendix). From the factor loadings and groupings (Table 28, Appendix) for this data set, the 4 summary variables were identified to be:

1. Attitude of valuing private vehicles for their efficiency and reliability
2. Attitude of valuing private vehicles for their comfort pride and affordability.
3. Attitude of valuing public transit post the construction of the metro on account of its reliability, comfort, good frequency and well-maintained stations and stops
4. Attitude of valuing ride sharing and hailing owing to perception of high degree of comfort, accessibility and the idea of it being a good complement to public transit

Therefore, these are the most significant summary variables from the second EFA. On account of how the first two summary variables both talk of attitude regarding private vehicles, it can be combined into one being that of 'Attitude of valuing private vehicles for their comfort, reliability and associated pride'. Thus, the three most significant summary variables are as follows:

1. Attitude of valuing private vehicles for their comfort, reliability and associated pride
2. Attitude of valuing public transit post the construction of the metro on account of its reliability, comfort, good frequency and well-maintained stations and stops
3. Attitude of valuing ride sharing and hailing owing to a perception of high degree of comfort, accessibility and the idea of it being a good complement to public transit

4.2.1.3 Analysis of Results of EFA

Thus, the summary variables, or the most significant factors are almost the same between the two EFAs. From a combination of the above analysis, the previously conducted descriptive analysis and the Theory of reasoned Action, we can conclude that the first attitude constitutes a significant barrier to MI in the city. This is because the first section in the questionnaire has received a largely positive rating, and consequently, a significant summary variable is the 'Attitude of valuing private vehicles for their comfort, reliability and associated pride'. As mentioned before, a positive attitude towards private vehicles implies reducing popularity of public transit. And from the above-mentioned theory, this attitude shapes behaviour in order to create an action of private vehicle dominance. The finding from this analysis is also in line with the trend identified in the review of literature, especially Verma (2015), which talks about increasing car dependence and popularity on account of the growing perception of its comfort

and reliability and its function as a symbol of status. In fact, almost 60% of the respondents strongly agree over the importance of the privacy they enjoy in their private vehicle. Over 65% of the respondents believe that their private vehicle is the most flexible means of transportation. Furthermore, a little over 50% of respondents strongly agree over their private vehicle being the most reliable mode of transit. Lastly, this is also in alignment with the results from the demographic data which show that a high percentage of respondents use their private vehicles as their most common means of transport and are largely license holders. Thus, this attitudinal factor regarding private vehicles translates into transport behaviour that poses a barrier to better MI in Bengaluru, thereby answering the first research question.

Coming to the second summary variable, being the attitude of "valuing public transit before and after the construction of the metro for its reliability, comfort, good frequency and well-maintained stations and stops" this also most certainly contributes to being a significant barrier. As is evident from the combination of the descriptive analysis and the EFA, the second section from the questionnaire has received a slightly higher negative rating and such a rating toward this attitude implies the diminishing popularity of public transit implying the attitude of poor valuation of public transit before and after the construction of the metro. Even from looking at the 2 sub-sections, the first one regarding attitudes before the construction of the metro has a slightly higher negative rating. Approximately 30% of the respondents disagree that the public transit is reliable, timely and has good frequency before the construction of the metro. They also disagree that it is comfortable owing to its long travel time before the construction of the metro. Lastly, from the demographic data as well, only 20% of the respondents take the bus and no one uses the suburban railways. This is also in line with the study by IISc that Chhakchhuak (2014) details by explaining how the disparity between what commuters expect and what they have access to regarding the city's public transit is causing them to lose faith in the transit system and have negative attitudes towards public transit in general.

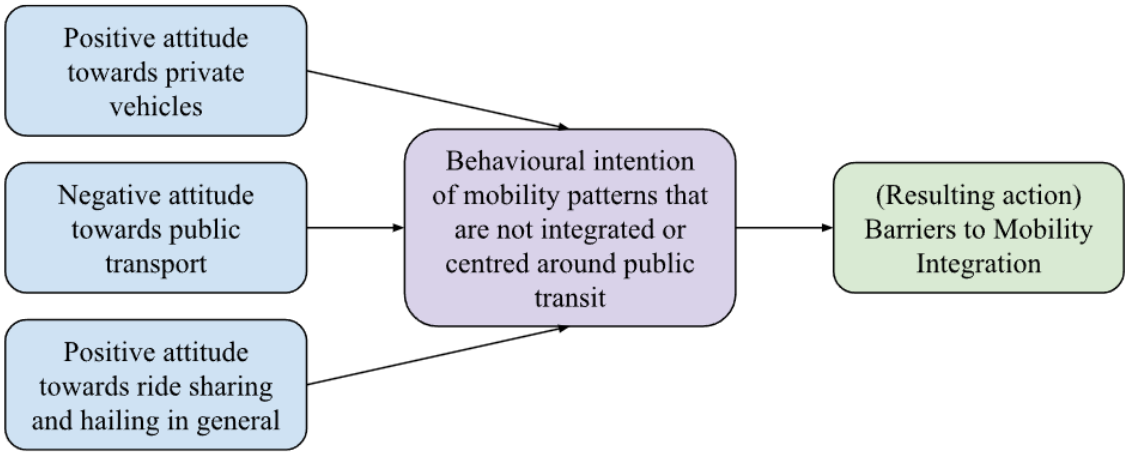
The Theory of Reasoned Action also helps further understand this. The attitude here leads to the behaviour of reduced usage of the public transit system. Considering public transportation is the most integral part of MI, this behaviour produces a result of impeding MI in the city, implying that this attitude is a significant barrier to MI. In the second sub-section, the ratings are almost evenly split between being positive and negative. The demographic data reflects this slightly positive rating as approximately 30% of the respondents take the metro. However, on account of it receiving not a high positive rating, the "attitude of valuing public transit post the

construction of the metro on account of its reliability, comfort, good frequency and well-maintained stations and stops" is also a barrier. Lastly, this also confirms TNN's (2021) argument of the lack of popularity of the metro and its inability to improve ridership. On account of public transportation being the centre of MI, this is bound to be a challenge. Thus, from the Theory of reasoned Action again, this attitudinal factor regarding public transport translates into transport behaviour that poses a barrier to better MI in Bengaluru, answering the second research question and sub-question.

The third summary variable of "Attitude of valuing ride sharing and hailing owing to a perception of high degree of comfort, accessibility and the idea of it being a good complement to public transit", is both a barrier and a driver. From the descriptive analysis, the first sub-section regarding attitudes toward this transit in general has a positive rating implying that this significant attitude is a barrier to MI. Approximately 30% and 40% of the respondents agree that ride-sharing and hailing are one of the most comfortable and flexible means of transit respectively. Using the theory of Reasoned Action, such a positive attitude would lead to a behaviour pattern of increasing popularity of this means of transit, disconnected from the existing public transport network. This complements Philip's (2019) explanation regarding ride sharing and hailing having "revolutionised transit" in the city but consequently increased congestion on the street and taking away ridership from the existing public transport network. This answers the third research question. The second sub-section has also received a positive rating; however, this poses a driver and not a barrier, because ride sharing and hailing's growing popularity as first and last-mile connectivity to public transit is a significant driver. The implications of the same will be analysed in the section regarding the document analysis.

Thus, these are the consumer attitudinal factors that translate into transport and mobility behaviour, that pose a significant barrier to MI in the city of Bengaluru. With the help of the of the Theory of Reasoned Action, we can now see how the above attitudes result in being barriers to MI in Bengaluru. As mentioned above, each of these attitudes create certain behavioural intentions. Thus, the relevant attitudes combine to produce an action or result which invariably is the barrier to MI in the city. The same is diagrammatically represented below. This answers the core research question of this study.

Figure 13. ***Diagrammatic representation of results from analysis with Theory of Reasoned Action***



Source. Author generated

4.2.2 Regression analysis

As mentioned previously, the model is represented by the equation $\mathbf{Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \beta_9 X_9 + \beta_{10} X_{10} + \beta_{11} X_{11} + \beta_{12} X_{12} + \epsilon}$, where **Y** is the dependent variable being that of bus ridership in the city, and $\mathbf{X_1}$-$\mathbf{X_{12}}$ represents the independent indicators being the 12 indicators describing attitude towards public transit before and after construction of the metro. The null hypothesis $\mathbf{H_0}$ is that there is no significant relation between the attitudes regarding public transport before and after the construction of the metro and public transport ridership in the city. The alternate hypothesis $\mathbf{H_1}$ is that there is a significant relation.

4.2.2.1 Regression one

From the first regression, where the independent variable is the "attitude regarding public transport before the construction of the metro" comprising of the 12 attitudes or indicators regarding public transport before the construction of the metro, the r-squared value is equal to 0.4949. This means that 49.49% or almost 50% of variation in **Y** is explained by $\mathbf{X_1}$-$\mathbf{X_{12}}$. This implies that almost 50% of variation in Bus ridership is explained by the attitudes regarding public transit before the construction of the metro. While 0.4949 is a decent positive r-square, it doesn't explain a significant change in **Y,** implying that there is only a moderate relationship between the variables. The rest is captured in the error term ϵ. Thus, we fail to reject the null hypothesis $\mathbf{H_0}$ and can conclude that there is no significant relation between the attitudes

regarding public transit before the construction of the metro and public transit ridership in the city.

4.2.2.2 Regression two

From the second regression, where the independent variable is the "attitude regarding public transport after the construction of the metro" comprising of the 12 attitudes or indicators regarding public transport after the construction of the metro, the r-squared value is equal to 0.4122. This means that 41.22% of variation in **Y** is explained by $\mathbf{X_1}$-$\mathbf{X_{12}}$. This implies that 41.22% of variation in Bus ridership is explained by the attitudes regarding public transit after the construction of the metro. While 0.4122 is a decent positive r-square, this value as well, does not explain a significant change in **Y** implying only a moderate relationship between the regressor and the dependent variable. The rest, again, is captured in the error term ϵ. Owing to this, we fail to reject the null hypothesis $\mathbf{H_0}$ and can conclude that there is no significant relation between the attitudes regarding public transit after the construction of the metro and public transit ridership in the city.

4.2.2.3 Analysis of Results of Regression

As can be seen from the above regressions, the r-square value for the first regression is slightly higher than the r-square value for the second regression. This explains how the attitudes regarding public transit before the construction of the metro better explain public transport ridership in the city than the attitudes regarding public transit after the construction of the metro, to a small extent. Moreover, the attitudes after the construction of the metro have even lesser explaining power. Thus, it can be concluded that the construction of the metro has not had a very significant impact on the perception of or the attitudes toward public transport in Bengaluru. Thus, consumer attitudes towards public transit before and after the construction of the metro have not had a significantly different impact on ridership of public transit in Bengaluru, thereby answering the second research question's sub-question.

The lack of a significant difference between the r-square values from the data before and after the construction of the metro is evident from the descriptive analysis as well from both sub-sections having received an almost similar rating as mentioned before. This is also in line with Philip (2022) who argues that the ridership for the metro is low and how it failed to boost public transit ridership in comparison to the growth of the number of private vehicles in the city.

Thus, the government would have to make drastic changes in order to better orient consumer attitudes in favour of public transit in the city, which will be at the centre of transport infrastructure in the city.

4.2.3 Document analysis regarding ride sharing and hailing as first and last-mile connectivity

Coming to ride-sharing and hailing in the city, less than half the population from the collected data believe it to be a comfortable means of transport. It fairs a little better in terms of its flexibility on account of the lack of parking requirements. There is a more neutral response when considering the element of privacy that it offers but there is generally a positive opinion regarding how cost effective it is. Moreover, an overwhelming majority of respondents believe they have the technological capacity required to operate ride-sharing and hailing apps and the necessary payment apps. Lastly, the response is positive to neutral regarding the accessibility of such a mode of transport to those with limited mobility.

Considering its perception on the grounds of its effectiveness as a means of first and last-mile connectivity, 35% of respondents agree and 20% strongly agree over it being quite time efficient. Thus, more than half the respondents believe it to be time efficient. The same is true for its cost effectiveness as well. Almost 50% and 20% of the respondents agree and strongly agree respectively, implying that almost 70% of the respondents believe that it is the perfect means of transit to complement the public transport in the city. However, there is more of a neutral response when looking at how easy it is to access and find it and also in terms of how accessible it is to those with limited mobility. This sub-section of ride sharing and hailing functioning as first and last-mile connectivity has received a largely positive rating which is necessary for MI where travel will be centered around public transport. Thus, from just a descriptive analysis, these attitudes do not pose a barrier to MI.

While this mode of transport is growing in popularity, especially amongst the middle and upper class, its impact on MI is yet to be determined. The descriptive analysis is not enough to ascertain the same. As previously mentioned by Philip (2019), ride hailing has only created more congestion and has not necessarily complemented public transit well enough. The model of such a mode of transit was based on the idea of reducing the number of private cars on the roads. However, while private cars saw a slight decline, the number of single

passenger taxis began to steadily climb. Moreover, ridership of public transit also saw a dip on account of increasing use of such apps. A disconnect between such a mode of transit and the developing public transport, in addition to the growing perception and attitude that such transit is a good alternative to public transport brings down public transport ridership instead of increasing it (N, 2019).

While ride-sharing and hailing is commonly used, constant cancellations, long wait times and surge pricing has led to inconveniences caused to commuters in another article by (Bhatt, 2016). Unfortunately, even though this mode of transportation has its many cons, a lot of consumers are forced to consider it owing to poor public transport in the city (Ravi, 2022). Thus, attitudes of commuters are increasingly being oriented towards this means of transit as an alternative to public transport and not as a complement to it largely on account of the many shortcomings of public transport. However, with growing number of metro stations and better metro feeder buses, there will be increasing requirement for such first and last-mile connectivity. Accordingly, in a report by the Bangalore Political Action Committee (BPAC), the most cost-effective and convenient way to increase first and last-mile connectivity in the city would be to improve such ride sharing and hailing services (Nandy, 2020). Thus, while such apps are certainly an integral part of transit in the city, much has to be done to improve consumer attitudes regarding the same in terms of it being a first and last-mile connectivity solution to public transport.

Thus, attitudinal factors from the descriptive analysis indicate the increasing popularity of ride hailing and sharing as first and last-mile connectivity which poses a driver to MI. However, a deeper document analysis of the same shows how this is not always true. Unchecked growth in positive attitudes to ride sharing and hailing, without a combined improvement in the attitudes towards public transportation will certainly pose a barrier to MI in the city. This answers the third research question’s sub-question.

5. Conclusion and discussion

Different means of mobility have had significant development over the past few decades in Bengaluru. While a multitude of novel transit models, with the modus operandum of reducing traffic congestion and increasing consumer satisfaction have been introduced, very few of them have delivered on their promises. From an analysis of consumer attitudes that eventually shape such mobility behaviour patterns, it is evident that there is a disconnect between the popular means of transport in the city. MI requires appropriate infrastructure development, but the same can come only after an analysis of consumer requirements, attitudes and behaviours. Only then the gap between mobility demand and supply can be bridged in an efficient manner, thereby ensuring a significantly smoother transition to better MI. Thus, the main aim of this study was to understand what attitudes regarding mobility prevent MI in the city.

5.1 Growing popularity of private vehicles

From a sample of respondents who largely use their private car to get around the city, it is clear how the comfort of using one's personal vehicle to navigate through heavy traffic in the city will always trump being on the bus. Car and two-wheeler dominance in the city is inevitable owing to the benefits its offers and its corresponding positive attitude driving up its demand. Consequently, one of the most significant attitudinal barriers to MI is that of valuing private vehicles for its comfort, reliability and its associated status and pride. In a city with unpredictable and heavy traffic, a private vehicle offers flexibility, that most other means of transit fail to provide.

Thus, from a policy maker's perspective, tackling private vehicle popularity would involve improving other means of transit in order to improve consumer attitudes regarding said means, thereby, challenging the dominance of private vehicles. Another key recommendation would be to induce a negative attitude towards private vehicles by introducing disincentives like increasing the cost of parking and the emissions tax rate.

5.2 Inadequate public transport

While there has been a degree of investment towards improving the bus system in the city, the ridership has not reflected the same and so it continues to remain quite poor. The metro, on the other hand, is certainly seeing growing popularity but is not able to attract enough commuters

for it to effectively reduce traffic congestion which is its main mission. Consumer attitudes have remained more or less stagnant before and after the construction of the metro and its impact on ridership of public transit is minimal. This is due to the significant attitudinal barrier of negatively viewing public transit owing to its lack of comfort, reliability, poor frequency and substandard stations and waiting conditions, answering the second research question as well as its sub-question.

Constant transport policy failures are becoming increasingly frequent not only on account of poor plans and projects but because consumer perceptions and attitudes are not being given due importance. Thus, these is a gap between the implementation of transit policies and consumer expectations. MI at the city level can only see success if this gap can be bridged. Thus, a key recommendation would be to improve consumer attitudes towards the most widely used public transit, the bus. This can be accomplished by investment towards increasing the number of buses, so as to improve frequency, dedicate funds towards maintenance and digitisation of bust stations to increase reliability and expand the number of metro feeder services and routes. All these suggestions are in line with the attitudes and indicators that received the most negative ratings and are in need of immediate improvement. Investment towards this, will consequently improve the ridership of the metro as well, thereby tackling its first and last-mile connectivity issues. Overall, it would improve consumer attitudes toward public transport thereby inducing behaviour change which will encourage superior MI in the city.

5.3 Ride sharing and hailing; the third most common means of transit in the city

This study rightly seeks to emphasise the significance of identifying and analysing consumer attitudes regarding mobility before developing strategies to tackle MI. When considering ride sharing and hailing, a positive attitude towards it constitutes both a driver and barrier. On the one hand, public transit can only function effectively with quality first and last-mile connectivity solutions. On the other hand, the popularity of this mode of transport is sky-rocketing owing to the many shortcomings of public transit. Thus, the increase in ride-sharing and hailing in the city due to positive consumer attitudes is a driver only if it is largely being used for first and last-mile commute. Otherwise, it is a barrier, thereby answering the third research question and sub-research question.

The ideal recommendation in this case echoes the previous one regarding improving consumer attitudes with respect to public transit in the city. This would ensure that this mode of transit does not see an increase in ridership at the expense of public transport ridership. Thus, ride sharing and hailing would function as a compliment to public transport as opposed to a substitute. This is what is required for better MI.

5.4 Limitations and recommendations for further research

When considering the limitations of the study, the possibility of bias, on account of a degree of snowballing of the sample, exists. Even so, the data is largely normally distributed as is mentioned in the analysis segment. Owing to limited financial resources and time, largely respondents of one demographic have responded to the survey. Moreover, a smaller dataset, in this case, could potentially imply a slightly less representative sample. However, a degree diversity in responses is evident in the descriptive analysis. Moreover, the variety in the statistical and analytical techniques, in addition to proper cleansing of data counter such problems. In terms of recommendations for similar studies in the future, a larger sample size in addition to a more scientific analysis of the behavioural patterns linked to the attitudes identified by this study would provide a better understanding of how exactly these attitudes function as a barrier. This will therefore assist policy makers in their attempt to introduce the best mobility practices and subsequently MI.

6. Bibliography

Ananth, C., & Kleinbaum, D. G. (1997). Regression models for ordinal responses: A review of methods and applications. *International Journal of Epidemiology*, *26*(6), 1323–1333. https://doi.org/10.1093/ije/26.6.1323

Alonso-González, M. J., Hoogendoorn-Lanser, S., van Oort, N., Cats, O., & Hoogendoorn, S. (2020). Drivers and barriers in adopting mobility as a service (Maas) – a latent class cluster analysis of attitudes. *Transportation Research Part A: Policy and Practice*, *132*, 378–401. https://doi.org/10.1016/j.tra.2019.11.022

Bandyopadhyay, S. (2020). Public transport during pandemic. *Clean Technologies and Environmental Policy*, *22*(9), 1755–1756. https://doi.org/10.1007/s10098-020-01958-0

Bangalore Mirror Bureau. (2022). Tap the chatter: what are the problems with public transport. *Bangalore Mirror*. Retrieved 2023, from https://bangaloremirror.indiatimes.com/bangalore/others/tap-the-chatter-what-are-the-problems-with-public-transport-that-discourage-you-from-using-it/articleshow/93060552.cms.

Bardal, K. G., Gjertsen, A., & Reinar, M. B. (2020). Sustainable mobility: Policy design and implementation in three Norwegian cities. *Transportation Research Part D: Transport and Environment*, *82*, 102330. https://doi.org/10.1016/j.trd.2020.102330

Bhargava, R. (2012). Owning a maruti 800 was a status symbol: rc bhargava . *The Economic Times*. Retrieved 2023, from https://economictimes.indiatimes.com/opinion/interviews/owning-a-maruti-800-was-a-status-symbol-rc-bhargava/articleshow/16702201.cms?from=mdr.

Bhatt, S. (2016). Is outrage against surge-pricing hurting ola and uber? . Retrieved 2023, from https://economictimes.indiatimes.com/is-outrage-against-surge-pricing-hurting-ola-and-uber/articleshow/50543623.cms?from=mdr.

Bezai, N. E., Medjdoub, B., Al-Habaibeh, A., Chalal, M. L., & Fadli, F. (2021). Future cities and autonomous vehicles: Analysis of the barriers to full adoption. *Energy and Built Environment*, *2*(1), 65–81. https://doi.org/10.1016/j.enbenv.2020.05.002

Biswas, D. (2019). *Why Yulu believes putting electric vehicles on the road can tackle Bengaluru's growing traffic trouble*. YourStory.com. https://yourstory.com/2019/02/yulu-electric-vehicles-launch-3kpqpjdrgu

Bouton, S., Hannon, E., Knupfer, S., & Ramkumar, S. (2017). The future(s) of mobility: How cities can benefit. *McKinsey & Company*. https://doi.org/https://www.mckinsey.com/~/media/McKinsey/Business%20Functions/Sustainability/Our%20Insights/The%20futures%20of%20mobility%20How%20cities%20can%20benefit/The-futures-of-mobility-How-cities-can-benefit

Braun, M. T., & Oswald, F. L. (2011). Exploratory regression analysis: A tool for selecting models and determining predictor importance. *Behavior Research Methods*, *43*(2), 331–339. https://doi.org/10.3758/s13428-010-0046-8

Caiati, V., Feneri, A. M., Jittrapirom, P., Rasouli, S., & Timmermans, H. J. P. (2020). An analysis of the potential adoption of Mobility as a Service across different age groups and lifestages: A mixed-methods approach. *TRA 2020, Helsinki*. https://doi.org/https://www.researchgate.net/publication/339875819_An_analysis_of_the_potential_adoption_of_Mobility_as_a_Service_across_different_age_groups_and_lifestages_A_mixed-methods_approach

Calkins, K. G. (2005). *Applied Statistics - Lesson 5 Correlation Coefficients*. Correlation coefficients. https://www.andrews.edu/~calkins/math/edrm611/edrm05.htm#:~:text=Correlation%20coefficients%20whose%20magnitude%20are%20between%200.7%20and%200.9%20indicate,can%20be%20considered%20moderately%20correlated.

Chhakchhuak, R. (2014). Commuters not satisfied with BMTC, finds study. *Deccan Herald*. https://www.deccanherald.com/content/385492/commuters-not-satisfied-bmtc-finds.html

Clauss, T., & Döppe, S. (2016). Why do urban travelers select multimodal travel options: A repertory grid analysis. *Transportation Research Part A: Policy and Practice*, *93*, 93–116. https://doi.org/10.1016/j.tra.2016.08.021

CS, Y. (2022). *Bengaluru Water Crisis: What is causing it?* Hindustan Times. https://www.hindustantimes.com/cities/bengaluru-news/bengaluru-water-crisis-what-is-causing-it-101649830971943.html

Dearnley, C. (2005). A reflection on the use of semi-structured interviews. *Nurse Researcher*, *13*(1), 19–28. https://doi.org/10.7748/nr2005.07.13.1.19.c5997

Desai, D., & Rawal, P. (2019). What ails India's public transport systems? The case of Mumbai. *Observer Research Foundation*. https://doi.org/https://www.orfonline.org/research/what-ails-indias-public-transport-systems-the-case-of-mumbai-55426/

Doctor, V. (2014). Is it time to stop the endless building of flyovers in india? . *The Economic Times*. Retrieved 2023, from https://economictimes.indiatimes.com/news/economy/infrastructure/is-it-time-to-stop-the-endless-building-of-flyovers-in-india/articleshow/33297954.cms?from=mdr.

Doval, P. (2017). India is now the world's biggest two-wheeler market. *Times of India*. Retrieved 2023, from https://timesofindia.indiatimes.com/auto/bikes/india-is-now-worlds-biggest-2-wheeler-market/articleshow/58555735.cms.

Express News Service. (2019). Eco-friendly yulu bikes launched at bengaluru railway stations for last-mile connectivity. *The New Indian Express*. Retrieved 2023, from https://www.newindianexpress.com/cities/bengaluru/2019/dec/20/eco-friendly-yulu-bikes-launched-at-bengaluru-railway-stations-for-last-mile-connectivity-2078888.html.

Express News Service. (2022). Transportation and road dust biggest contributors to air pollution in Bengaluru: Study. *The Indian Express*. https://indianexpress.com/article/cities/bangalore/transportation-and-road-dust-biggest-contributors-to-air-pollution-in-bengaluru-study-7758119/

Express News Service. (2023). Minister mb patil plans to extend bengaluru suburban rail project to mysuru, gauribidanur and kolar. *The Indian Express*. Retrieved 2023, from https://indianexpress.com/article/cities/bangalore/mb-patil-plans-to-extend-bengaluru-suburban-rail-project-to-mysuru-gauribidanur-kolar-8649307/.

Fishbein, M., & Ajzen, I. (1975). *UMass Amherst*. MA: Addison-Wesley.

Giesecke, R., Surakka, T., & Hakonen, M. (2016). Conceptualising mobility as a Service. *2016 Eleventh International Conference on Ecological Vehicles and Renewable Energies (EVER)*. https://doi.org/10.1109/ever.2016.7476443

GoK. (2020). Comprehensive Mobility Plan for Bengaluru, Final Report 2020. *Infrastructure Development Corporation*.

Griškevičiūtė-Gečienė, A., & Griškevičienė, D. (2016). The influence of transport infrastructure development on Sustainable Living Environment in Lithuania. *Procedia Engineering*, *134*, 215–223. https://doi.org/10.1016/j.proeng.2016.01.062

Hensher, D. A., Mulley, C., & Nelson, J. D. (2021). Mobility as a service (Maas) – going somewhere or nowhere? *Transport Policy*, *111*, 153–156. https://doi.org/10.1016/j.tranpol.2021.07.021

Home - Bengaluru Metropolitan Transport Corporation. See English version of the Website. (n.d.). https://mybmtc.karnataka.gov.in/english

Huiling, E., & Goh, B. (2017). *Ai, robotics and mobility as a service: The case of singapore*. Field Actions Science Reports. The journal of field actions. https://journals.openedition.org/factsreports/4411?lang=en

IANS. (2023). EV 2-wheeler sales in india to reach 22 million by 2030: report . *The Economic Times*. Retrieved 2023, from https://economictimes.indiatimes.com/industry/renewables/ev-2-wheeler-sales-in-india-to-reach-22-mn-by-2030-report/articleshow/97512568.cms.

Jindel, J., & Ollivier, G. (2021). *Making Roads Safer for India's popular two-wheelers*. World Bank Blogs. https://blogs.worldbank.org/endpovertyinsouthasia/making-roads-safer-indias-popular-two-wheelers

Jittrapirom, P., Caiati, V., Feneri, A.-M., Ebrahimigharehbaghi, S., González, M. J., & Narayan, J. (2017). Mobility as a service: A critical review of definitions, assessments of schemes, and key challenges. *Urban Planning*, *2*(2), 13–25. https://doi.org/10.17645/up.v2i2.931

Kaushik, H. (2018). *BRT traffic stagnant despite bigger network, fleet*. The Times of India. https://timesofindia.indiatimes.com/city/ahmedabad/brt-traffic-stagnant-despite-bigger-network-fleet/articleshow/64936831.cms

Kashyap, H. (2022). Cancelled rides, declining service & safety: how do ola & uber fare on customer experience? *Inc 42*. Retrieved 2023, from https://inc42.com/features/uber-vs-ola-how-does-the-two-cab-giants-fare-on-customer-experience/.

Kidiyoor, S. (2022). Bengaluru's number of vehicles doubles in a decade, but BMTC fleet size remains stagnant. *The Hindu*. https://www.thehindu.com/news/cities/bangalore/bengalurus-number-of-vehicles-doubles-in-a-decade-but-bmtc-fleet-size-remains-stagnant/article65442021.ece

Li, Y., & Voege, T. (2017). Mobility as a service (MAAS): Challenges of implementation and policy required. *Journal of Transportation Technologies*, *07*(02), 95–106. https://doi.org/10.4236/jtts.2017.72007

Love, P. (2013). Research in the college context. *New York University*. https://doi.org/10.4324/9780203952740

Lund, E., Kerttu, J., & Koglin, T. (2017). Drivers and Barriers for Integrated Mobility Services . *Lund University*. https://doi.org/https://lucris.lub.lu.se/ws/portalfiles/portal/25112574/Lund_et_al_2017_Drivers_and_barriers_for_integrated_mobility_services.pdf

Maitra, B., Azmi, M., Kumar, N., & Sarkar, J. R. (2004). Modeling traffic impact of flyover at an urban intersection under mixed traffic environment. *Indian Institute of*

Technology, Kharagpur. https://doi.org/https://www.researchgate.net/publication/227580160_Modeling_traffic_impact_of_flyover_at_an_urban_intersection_under_mixed_traffic_environment

Mallat, N., Rossi, M., Tuunainen, V. K., & Öörni, A. (2006). An empirical investigation of mobile ticketing service adoption in public transportation. *Personal and Ubiquitous Computing*, *12*(1), 57–65. https://doi.org/10.1007/s00779-006-0126-z

Mannan, L. (2018). *Ola ties up with IRCTC to provide first and last mile connectivity to rail commuters*. YourStory.com. https://yourstory.com/2018/03/ola-ties-irctc-provide-first-last-mile-connectivity-railway-passengers?utm_pageloadtype=scroll

Mantri, G. (2016). Does bengaluru's flyover obsession hurt more than help? *The News Minute*. Retrieved July 10, 2023, from https://www.thenewsminute.com/article/does-bengalurus-flyover-obsession-hurt-more-help-45170.

Martinez, L. M., & Viegas, J. M. (2017). Assessing the impacts of deploying a shared self-driving urban mobility system: An agent-based model applied to the city of Lisbon, Portugal. *International Journal of Transportation Science and Technology*, *6*(1), 13–27. https://doi.org/10.1016/j.ijtst.2017.05.005cl

Menezes, N. (2019). Why bicycling in Bengaluru is a cruel joke on cyclists . *Economic Times*. Retrieved 2023, from https://economictimes.indiatimes.com/news/politics-and-nation/why-bicycling-in-bengaluru-is-a-cruel-joke-on-cyclists/articleshow/69157348.cms.

Mishra, G. P. (2018). Passenger information system at bus stations yet to go digital. *The New Indian Express*. Retrieved 2023, from https://www.newindianexpress.com/cities/bengaluru/2018/oct/29/passenger-information-system-at-bus-stations-yet-to-go-digital-1891234.html.

Mohan, A. K. (2019). Why Bengaluru's draft transit policy is unlikely to make the city more liveable. *Integrated Design*. https://doi.org/https://www.integrateddesign.org/why-bengalurus-draft-transit-policy-is-unlikely-to-make-the-city-more-liveable

Mukherjee, T. (2013). Uncomfortable ride for commuters. *Decan Herald*. Retrieved 2023, from https://www.deccanherald.com/content/331560/uncomfortable-ride-commuters.html.

Mukherjee, A., Toshniwal, R., & Mulukutla, P. (2017). Enhancing Bengaluru's public transport network: Approaches and challenges. *Journal of Sustainable Urbanization, Planning and Progress, 2*(1). https://doi.org/10.18063/jsupp.2017.01.005

Mukherjee, S. (2022). 'More buses, higher frequency needed' . *Bangalore Mirror*. Retrieved 2023, from https://bangaloremirror.indiatimes.com/bangalore/others/more-buses-higher-frequency-needed/articleshow/95630869.cms.

Munkácsy, A., & Monzón, A. (2018). Diffusion of bike sharing as an innovation vector in the city: The case of bicimad (Madrid). *Journal of Urban Technology, 25*(3), 1–26. https://doi.org/10.1080/10630732.2018.1483679

N, N. (2019). Hit by ola,uber, bmtc to operate app-based service. *Deccan Chronicle*. Retrieved 2023, from https://www.deccanchronicle.com/nation/current-affairs/060119/hit-by-olauber-bmtc-to-operate-app-based-service.html.

N, Y. (2015). Bus shelters in poor condition. *The Hindu*. Retrieved 2023, from https://www.thehindu.com/news/cities/bangalore/bus-shelters-in-poor-condition/article7878389.ece.

Nair, P. (2016). *Bengaluru, the Uber app and poverty in India*. https://www.aljazeera.com/features/2016/2/10/bengaluru-the-uber-app-and-poverty-in-india

Nandy, M. (2020). Back bengaluru needs shared mobility, last mile connectivity: uber-bpac report. *Live Mint*. Retrieved 2023, from https://www.livemint.com/news/india/bengaluru-needs-shared-mobility-last-mile-connectivity-uber-bpac-report-11583945638789.html.

Naujoks, D. (2022). Multilateral approaches to mobility in the Middle East and North Africa Region. *Revue Internationale De Politique De Développement*, (14). https://doi.org/10.4000/poldev.4795

Nemoto, T., & Beglar, D. (2014). Developing Likert-Scale Questionnaires. *Tokyo JALT*. https://doi.org/https://jalt-publications.org/sites/default/files/pdf-article/jalt2013_001

Noble, B. (2004). *Why are some young people choosing not to drive?*. PROCEEDINGS OF ETC 2005, STRASBOURG, FRANCE 18-20 SEPTEMBER 2005 - TRANSPORT POLICY AND OPERATIONS - EUROPEAN POLICY AND RESEARCH - ACCESS TO TRANSPORT AND FUTURE ISSUES. https://trid.trb.org/view/846325

Philip, C. M. (2019). *Ola & Uber revolutionised transport in Bengaluru; but congest city roads & hit use of mass transport*. The Times of India. https://timesofindia.indiatimes.com/city/bengaluru/ride-hailing-services-congest-bengaluru-roads-hit-use-of-mass-transport/articleshow/70224660.cms

Philip, C. M. (2022). Bengaluru's public transport share to dip from 50% to 30% by 2031. *Times of India*. https://timesofindia.indiatimes.com/city/bengaluru/blurus-public-transport-share-to-dip-from-50-to-30-by-2031/articleshow/90241742.cms

Philip, C. M. (2022a). Bengaluru: last-mile connectivity options shrinking for metro passengers. *The Times of India*. Retrieved 2023, from https://timesofindia.indiatimes.com/city/bengaluru/bengaluru-last-mile-connectivity-options-shrink-for-metro-users/articleshow/95328433.cms.

Pradhan, D., & Tambe, N. (2023). *Best car loan in India*. Forbes. https://www.forbes.com/advisor/in/car-loan/

Prakash, A. (2023). Darkest hours at city's bus stops. *Bangalore Mirror*. Retrieved 2023, from https://bangaloremirror.indiatimes.com/bangalore/crime/darkest-hours-at-citys-bus-stops/articleshow/100658849.cms.

Prasad, S. (2023). Bengaluru world's second-most traffic congested cities, after London. *The Indian Express*. https://indianexpress.com/article/cities/bangalore/bengaluru-worlds-second-most-traffic-congested-cities-8448551/

Press Trust of India. (2018). Bengaluru, Kolkata drive growth of Uber, Ola shared rides in India. *HT Tech*. https://tech.hindustantimes.com/tech/news/bengaluru-kolkata-drive-growth-of-uber-ola-shared-rides-in-india-story-McXDOpUlhP0L7SZl3I2kaJ.html

PTI. (2021). Second phase of fame india scheme focuses on supporting electrification of public transportation: ministry. *The Economic Times*. Retrieved 2023, from https://economictimes.indiatimes.com/news/economy/policy/second-phase-of-fame-india-scheme-focuses-on-supporting-electrification-of-public-transportation-ministry/articleshow/81533172.cms.

PTI. (2023). Electric 2-wheeler sales in india rose over twofold to 8,46,976 units in fy23: smev. *The Hindu*. Retrieved 2023, from https://www.thehindu.com/business/electric-2-wheeler-sales-in-india-rose-over-twofold-to-846976-units-in-fy23-smev/article66720941.ece.

Pucher, J., Korattyswaroopam, N., & Ittyerah, N. (2004). The crisis of public transport in India: Overwhelming needs but limited resources. *Journal of Public Transportation*, *7*(3), 95–113. https://doi.org/10.5038/2375-0901.7.3.5

Ravi, P. (2022). When ride-hailing apps fail commuters, what could be the alternatives? *Citizen Matters*. Retrieved 2023, from https://bengaluru.citizenmatters.in/transport-department-role-in-uber-ola-pricing-regulations-92098.

Saidi, A. (2013). Access and Communication Pricing and Club Effect. *International Journal of Business and Social Research*. https://doi.org/https://thejournalofbusiness.org/index.php/site/article/view/383

Sarmmah , S. (2018). Public transport not convenient enough . *Deccan Herald*. Retrieved 2023, from https://www.deccanherald.com/metrolife/public-transport-not-705574.html.

Schabka, M., Kammerhofer, A., Batiajew, V., & Juschten, M. (2022). Driving forces and barriers for the implementation of mobility services in Austria—a practitioner perspective. *Sustainability*, *14*(18), 11431. https://doi.org/10.3390/su141811431

Shrikant, A. (2019). Transportation experts see uber and lyft as the future. but rural communities still don’t use them. *Vox*. Retrieved 2023, from https://www.vox.com/the-goods/2019/1/11/18179036/uber-lyft-rural-areas-subscription-model.

Singh, H. (2016). Increasing rural to urban migration in India: A challenge or an opportunity. *International Journal of Applied Research*. https://doi.org/https://www.shram.org/uploadFiles/20170621121921

Singh, K. (2020). The electric scooter capital of the world: *World Economic Forum*. https://www.weforum.org/agenda/2019/11/bengaluru-scooter-sharing-india

Sochor, J., Arby, H., Karlsson, I. C. M. A., & Sarasini, S. (2018). A topological approach to mobility as a service: A proposed tool for understanding requirements and effects, and for aiding the integration of societal goals. *Research in Transportation Business & Management*, *27*, 3–14. https://doi.org/10.1016/j.rtbm.2018.12.003

Sopjani, L., Stier, J. J., Ritzén, S., Hesselgren, M., & Georén, P. (2019). Involving users and user roles in the transition to sustainable mobility systems: The case of light electric vehicle sharing in Sweden. *Transportation Research Part D: Transport and Environment*, *71*, 207–221. https://doi.org/10.1016/j.trd.2018.12.011

Staats, H. (2004). Pro-environmental attitudes and behavioral change. *Encyclopedia of Applied Psychology*, 127–135. https://doi.org/10.1016/b0-12-657410-3/00817-5

Sun, S. (2022). *India: Average Daily Ridership of buses in Bengaluru 2021*. Statista. https://www.statista.com/statistics/1240167/india-average-daily-ridership-of-buses-in-bengaluru/

Suresh, J. (2022). Namma Metro is not designed for inclusivity. *Citizen Matters*. https://doi.org/https://bengaluru.citizenmatters.in/namma-metro-inclusivity-and-accessibility-97408

The Hindu Bureau. (2023). BMTC operating 396 metro feeder trips between baiyappanahalli and k.r. pura stations. *The Hindu*. Retrieved 2023, from https://www.thehindu.com/news/cities/bangalore/bmtc-operating-396-metro-feeder-trips-between-baiyappanahalli-and-kr-pura-stations/article66707084.ece.

Tiwari, A. (2019). *Micro-mobility: The next wave of urban transportation in India*. YourStory.com. https://yourstory.com/journal/micro-mobility-edc6x8f1y1

TNN. (2020). Bengaluru: Mobility firms exit, DULT's much-hyped cycle-sharing initiative goes off track. *The Times of India*. https://timesofindia.indiatimes.com/city/bengaluru/mobility-firms-exit-dults-much-hyped-cycle-sharing-initiative-goes-off-track/articleshow/80016648.cms

TNN. (2021). Bengaluru: namma metro needs 12 lakh daily ridership to break even. *Times of India*. Retrieved 2023, from https://timesofindia.indiatimes.com/city/bengaluru/metro-needs-12-lakh-daily-ridership-to-break-even/articleshow/88098517.cms.

Treiblmaier, H., & Filzmoser, P. (2010). Exploratory factor analysis revisited: HOW ROBUST methods support the detection of hidden multivariate data structures in is research. *Information & Management*, *47*(4), 197–207. https://doi.org/10.1016/j.im.2010.02.002

United Nations. (2022). *Day of 8 Billion*. https://www.un.org/en/dayof8billion

Upadhyay, T. (2017). Are our traffic jams being caused by the olas and ubers of the world? . *Economic Times, Brand Equity*. Retrieved 2023, from https://brandequity.economictimes.indiatimes.com/news/business-of-brands/are-our-traffic-jams-being-caused-by-the-olas-and-ubers-of-the-world/62128180?redirect=1.

Verma, M. (2015). Growing car ownership and dependence in India and its policy implications. *Case Studies on Transport Policy*, *3*(3), 304–310. https://doi.org/10.1016/j.cstp.2014.04.004

Verma, M., Verma, A., & Khan, M. (2020). Factors Influencing the Adoption of Electric Vehicles in Bengaluru. *Transportation in Developing Economies*. https://doi.org/https://link.springer.com/article/10.1007/s40890-020-0100-x

İmre, Ş., & Çelebi, D. (2017). Measuring comfort in public transport: A case study for istanbul. *Transportation Research Procedia*, *25*, 2441–2449. https://doi.org/10.1016/j.trpro.2017.05.261

7. Appendix

7.1 Tables

Table 11. ***Table of questionnaire***

Sl. no	Attitudes regrading different means of transit	Strongly agree (1)	Agree (2)	Neutral (3)	Disagree (4)	Strongly disagree (5)
Section 1	**Attitudes regrading private transit**					
1.	Private vehicles are the most comfortable means of transit					
2.	I enjoy the privacy in my private vehicle					
3.	I enjoy driving/ riding my private vehicle					
4.	My private vehicle is more time efficient than the public transport					
5.	Using my private vehicle is cheaper than taking the public transport					
6.	My private vehicle is more flexible than the public transport					
7.	My private vehicle is the most reliable means of transit					

8. I currently do not have an alternative to my private vehicle
9. My private vehicle is my pride
10. I want to have to take only one mode of transit to get to my destination and my private vehicle allows for me to do that
11. I think public transit in Bengaluru is of poor quality and I do not want to take it or experiment with it so I use only my private vehicle
12. I think other means of transit such as ride sharing and hailing are not in my price range or are uncomfortable so I only use my private vehicle
13. I believe my private transit is most inclusive to those with limited mobility
14. I do not mind trying to find parking or having to pay for it when it is not free
15. Emissions from my vehicle and its impact on the environment do not bother me

Section 2	Attitudes regarding Public transit
Sub-section 1	**Attitudes regarding public transit before the construction of the metro**
1.	I was comfortable taking the public transit even before the construction of the metro
2.	The frequency of the public transit was good even before the construction of the metro
3.	The public transit was clean even before the construction of the metro
4.	I didn't mind sharing my journey with others even before the construction of the metro
5.	The public transit was timely even before the construction of the metro
6.	I didn’t mind travelling for a longer period of time even before the construction of the metro
7.	There was enough information regarding schedules for the public transit even before the construction of the metro

8.	I preferred taking the public transit over my private vehicle even before the construction of the metro
9.	Public transit stops and stations were not too far even before construction of the metro
10.	The waiting conditions and situation of the stations were good even before the construction of the metro
11.	I believe that the public transit was inclusive to those with limited mobility even before the construction of the metro
12.	I believed it was more environmentally friendly than private transit even before the construction of the metro

Sub-section 2	**Attitudes regarding public transit after the construction of the metro**
1.	I am comfortable taking the public transit only after the construction of the metro
2.	The frequency of the public transit is good only after the construction of the metro

3. The public transit is clean but has become this way only after the construction of the metro
4. I don’t mind sharing my journey with others but this has come to be only after the construction of the metro
5. The public transit is timely but this is true only after the construction of the metro
6. I don’t mind the travel time if it is long but this is true only after the construction of the metro
7. There is enough information regarding schedules for the existing public transit but this has come to be only after the construction of the metro
8. I prefer taking the public transit over my private vehicle but this is true only after the construction of the metro
9. Public transit stops and stations are not too far but this is true only after the construction of the metro

10.	The waiting conditions and situation of the stations are good but only after the construction of the metro
11.	I believe that the public transit is inclusive to those with limited mobility but this is true only after the construction of the metro
12.	I believe it is more environmentally friendly than private transit but more so after the construction of the metro
Section 3	**Attitudes regarding ride sharing and hailing**
Sub-section 1	**Attitudes regarding ride sharing and hailing in general**
1.	I find ride sharing and hailing to be a very comfortable mode of transport
2.	I believe ride sharing and hailing is very time efficient
3.	I believe ride sharing and hailing is more flexible because I don't have to find parking

4.	I have my privacy to a degree while using ride sharing and hailing	
5.	I find ride sharing and hailing to be cost effective	
6.	I believe I have the technological capacity to use the apps and make necessary payments when using ride sharing and hailing	
7.	I believe ride share and hailing is accessible to those with limited mobility	
Sub-section 2	**Attitudes regarding ride sharing and hailing as first and last mile connectivity**	
1.	I prefer ride sharing and hailing to my private vehicle because I don't have to find or pay for parking at the metro/ bus station or at my destination	
2.	I believe ride sharing and hailing is most time efficient for first and last mile connectivity	
3.	I believe ride sharing and hailing is cost effective for	

	first and last mile connectivity	
4.	Ride sharing and hailing is the perfect means of transit to complement the public transit	
5.	I believe ride sharing and hailing is easy to access/ find	
6.	I believe ride sharing and hailing is accessible to those with limited mobility as a first and last-mile connectivity option	

Source. Author generated

Table 12. ***Age of respondents***

Age group	Number of respondents in each category	Percent of respondents in each category
18 - 25	27	45%
25 – 35	13	21.7%
35 - 45	5	8.3%
45 - 55	10	16.7%
55 and above	5	8.3%

Source. Author generated

Table 13. ***Gender of respondents***

Gender	Number of respondents in each category	Percent of respondents in each category
Male	28	46.7%
Female	31	51.7%
Other	1	1.7%

Source. Author generated

Table 14. ***Area of residence respondents***

Area	Number of respondents in each category	Percent of respondents in each category
North Bengaluru	13	22%
East Bengaluru	21	35%
West Bengaluru	4	7%
South Bengaluru	22	36%

Source. Author generated

Table 15. ***Level of education of respondents***

Level of education	Number of respondents in each category	Percent of respondents in each category
School graduate	5	8.3%
Bachelor's graduate	31	51.7%
Master's graduate	20	33.3%
PhD	3	5%
Professional degree	1	1.7%

Source. Author generated

Table 16. ***Number of years of work experience of respondents***

Number of years of work experience	Number of respondents in each category	Percent of respondents in each category
0 – 5	35	58.3%
5 – 10	5	8.3%
10 – 20	8	13.3%
Over 20	12	20%

Source. Author generated

Table 17. ***Most commonly used mode of transit of the respondent***

Mode of transit	Number of respondents in each category	Percent of respondents in each category
Public bus	12	20%
Private bus/ van	1	1.7%
Metro train	21	35%
Suburban train/ railways	0	0%
Auto rickshaw	26	43.3%
Cab/ Taxi	21	35%
Shared mobility bikes/ car	3	5%
Personal car	39	65%
Personal two-wheeler	10	16.7%
Bicycle	7	11.7%
Walking	15	25%
Other	1	1.7%

Source. Author generated

Table 18. ***Average commute distance of respondents***

Average commute distance in Km	Number of respondents in each category	Percent of respondents in each category
0 – 5	13	21.7%
5 – 10	17	28.3%
10 – 20	19	31.7%
20 – 30	7	11.7%
Above 30 km	4	6.7%

Source. Author generated

Table 19. ***Number of respondents with driver's/ rider's license***

Respondents with/ without license	Number of respondents with/ without license	Percent of respondents with/ without license
Respondents with a license	50	83.3%
Respondents without a license	16	16.7%

Source. Author generated

Table 20. ***Table of Summary statistics for EFA one***

Variable	Mean	SD	Skewness	Kurtosis
var1	1.966667	.9560985	.5357595	2.171884
var2	1.616667	.884742	1.566956	5.466875
var3	2.283333	1.450794	.6385399	1.912298
var4	2.283333	1.249972	.6063193	2.186657
var5	3.683333	1.295254	-.857828	2.588556
var6	1.566667	.9806028	1.932948	6.390211
var7	1.8	1.116896	1.28368	3.69896
var8	3.65	1.299609	-.730364	2.450386
var9	3.333333	1.159583	-.3459138	2.654474
var10	2.25	1.385457	.7399254	2.222929
var11	3.166667	1.250988	-.1086459	1.962557
var12	3.133333	1.111827	-.6381688	2.544369
var13	2.533333	1.199812	.1286916	2.066491
var14	2.7	1.356716	.2283268	1.703764
var15	4.066667	1.071458	-1.05	3.483275
var16	2.966667	1.389631	.2127101	1.764266
var17	3.083333	1.21141	-.1603743	2.056509
var18	3.333333	1.159583	-.0828244	2.120613
var19	2.5	1.127469	.5008792	2.664
var20	3.116667	1.090664	-.2326493	2.357005
var21	3.383333	1.165779	-.2005589	2.104546
var22	3.616667	1.090664	-.3808591	2.430091
var23	3.483333	1.214205	-.0754361	1.642154
var24	3.133333	1.156656	.0694148	2.15916
var25	3.566667	1.031153	-.2738183	2.298476
var26	3.583333	1.239077	-.5159958	2.406601
var27	2.6	1.224053	.4652344	2.176491
var28	2.816667	1.096863	.2902643	2.465569
var29	3.066667	1.117908	-.2051016	2.301103
var30	2.516667	1.185958	.5748526	2.316549
var31	2.966667	1.149306	.0652508	2.195597
var32	2.6	1.107754	.3862682	2.336376
var33	1.633333	.9909192	1.628132	4.900434
var34	2.65	1.132344	.1530991	2.23002
var35	2.283333	.975838	.6231616	2.873153
var36	3.05	1.095832	-.0991688	2.288539

.

Source. Author generated

Table 21. ***Table of correlation matrix for EFA one***

	var1	var2	var3	var4	var5	var6	var7	var8	var9	var10	var11	var12	var13
var1	1.0000												
var2	0.3453	1.0000											
var3	0.3613	0.1389	1.0000										
var4	0.4335	0.0999	0.2915	1.0000									
var5	0.3061	0.1437	0.2650	0.0668	1.0000								
var6	0.1470	0.5086	0.3022	0.2955	0.0503	1.0000							
var7	0.2476	0.3328	0.0983	0.3084	0.2835	0.6469	1.0000						
var8	0.0450	0.0730	0.2153	0.1455	-0.0670	0.2115	0.1378	1.0000					
var9	0.2548	0.0936	0.4769	0.0390	0.2633	-0.0646	0.0523	0.0787	1.0000				
var10	0.3007	0.2454	0.0063	0.2520	-0.0213	-0.0062	0.2081	0.1341	0.2216	1.0000			
var11	0.1889	-0.0179	0.1136	0.1427	-0.0715	0.0322	-0.0121	0.5786	0.1013	0.2005	1.0000		
var12	0.1478	0.0011	-0.0133	-0.0886	0.0180	0.0073	-0.1010	0.1619	0.1884	0.2311	0.2397	1.0000	
var13	0.0158	-0.2033	0.2428	0.3383	-0.2603	0.1277	0.1821	0.1109	0.0650	0.0102	0.0866	0.0093	1.0000
var14	0.0967	0.1003	0.2592	0.1809	0.0897	-0.0102	0.0157	0.2855	0.1831	0.1758	0.2497	0.0270	0.0062
var15	0.1511	-0.1871	0.1076	0.0616	0.0399	-0.0204	0.0963	0.1022	0.1592	-0.0799	0.2318	0.1489	0.0510
var16	-0.0519	-0.1622	0.2233	0.1909	0.3236	-0.0730	0.0175	-0.1755	0.1017	-0.1188	-0.3380	-0.1068	0.1430
var17	-0.0268	-0.0488	0.1117	0.0513	0.1683	0.0024	0.0877	-0.2503	-0.0925	-0.1944	-0.4231	-0.2727	0.0505
var18	-0.1885	-0.3029	-0.1075	-0.0780	0.0376	-0.2584	-0.0654	-0.2587	-0.1345	-0.1899	-0.4012	-0.2454	0.0406
var19	-0.1572	-0.1954	0.0570	0.0541	0.2031	-0.0000	0.0538	-0.0636	-0.2074	-0.3309	-0.1923	-0.2569	-0.0376
var20	0.1013	-0.1110	0.1287	0.0499	0.3505	-0.2372	-0.0362	-0.1022	0.0759	-0.1430	-0.3499	-0.1109	-0.0095
var21	-0.1252	-0.2824	-0.0753	-0.0060	0.1042	-0.1636	-0.0182	-0.0442	-0.0585	-0.1023	-0.3467	-0.1055	-0.0032
var22	0.2639	0.1086	0.1983	0.0686	0.3685	-0.0629	0.1308	-0.0723	0.3172	0.0533	-0.2008	-0.0130	0.0035
var23	-0.0005	0.0492	-0.0406	0.0534	0.3576	-0.0489	0.1225	-0.0199	0.0883	0.0277	-0.2102	0.0142	-0.1450
var24	-0.0266	-0.0155	0.0377	0.1610	0.2097	-0.0379	0.1784	-0.1037	-0.0590	-0.1692	-0.1796	-0.2908	0.0090
var25	-0.1181	0.0564	-0.0185	-0.0346	0.3016	-0.0380	0.1442	-0.0898	0.0945	-0.0178	-0.2847	-0.1557	-0.2210
var26	0.1598	0.0992	0.0951	0.0775	0.2543	0.0860	0.0980	0.0974	0.0747	0.1012	0.0346	0.1394	-0.2812
var27	0.0319	-0.0814	0.0172	0.2083	0.0791	-0.1469	-0.0595	-0.3772	-0.1911	-0.0899	-0.3431	-0.1470	-0.0831
var28	0.0749	-0.1784	0.0438	0.0880	0.2567	0.0667	0.2324	-0.0220	-0.1244	-0.2259	-0.0885	-0.2993	0.1528
var29	0.1290	0.0263	-0.0223	0.0226	0.1904	-0.1124	0.0109	0.0630	0.1918	0.1423	0.2343	0.1291	-0.1407
var30	0.0154	-0.1150	0.0317	0.2654	-0.0241	0.1375	0.2201	-0.1776	-0.0041	-0.1212	-0.0476	-0.2202	0.1128
var31	-0.0165	-0.2628	0.1379	0.1011	0.1522	-0.0431	0.1268	-0.0533	-0.0042	-0.1543	-0.1375	-0.2883	0.1729
var32	-0.0448	-0.0899	0.1244	0.0832	-0.0780	-0.0843	-0.1343	0.0306	-0.0264	-0.1546	0.0978	-0.1486	0.0357
var33	0.0048	0.1463	0.0145	0.1263	-0.1580	0.2000	0.1011	0.0829	-0.1426	0.0926	-0.1139	-0.1856	-0.0181
var34	0.1143	-0.1024	-0.0315	-0.0126	0.1312	-0.2763	-0.0965	-0.0386	-0.0258	0.1323	-0.0419	-0.0296	-0.1846
var35	0.2101	-0.0291	0.2177	0.1693	0.2465	0.0242	0.1306	-0.2145	0.0799	0.0470	-0.0671	-0.1291	-0.1313
var36	0.2766	0.0026	0.1189	-0.0971	0.3576	-0.1845	0.1606	-0.1422	0.2001	0.1256	-0.1793	-0.1029	-0.0980

	var14	var15	var16	var17	var18	var19	var20	var21	var22	var23	var24	var25	var26
var14	1.0000												
var15	0.0490	1.0000											
var16	-0.0234	0.1040	1.0000										
var17	-0.0877	0.1393	0.6863	1.0000									
var18	-0.1293	0.0091	0.5434	0.5711	1.0000								
var19	0.2438	-0.0842	0.4976	0.4778	0.4926	1.0000							
var20	-0.0103	0.1093	0.5506	0.5954	0.5316	0.3653	1.0000						
var21	-0.0332	0.0877	0.3742	0.4691	0.3803	0.1999	0.5374	1.0000					
var22	0.0355	0.0658	0.3493	0.4864	0.2368	0.0345	0.6224	0.4241	1.0000				
var23	-0.0340	0.0530	0.5220	0.5483	0.4374	0.3529	0.5710	0.3818	0.4750	1.0000			
var24	0.0259	0.1021	0.4246	0.6451	0.4971	0.3899	0.4711	0.3511	0.4443	0.5085	1.0000		
var25	0.0388	-0.0194	0.4865	0.5450	0.4914	0.2478	0.5430	0.3943	0.4978	0.6033	0.5609	1.0000	
var26	0.0555	0.0723	0.1591	0.3510	0.0983	0.0789	0.3250	0.2650	0.4191	0.3727	0.3351	0.4798	1.0000
var27	-0.1755	0.1241	0.3408	0.4229	0.2866	0.1474	0.4291	0.2518	0.1244	0.2349	0.3615	0.3303	0.2570
var28	-0.0831	0.0394	0.3184	0.3178	0.2887	0.4317	0.2165	0.3740	0.2661	0.1822	0.2333	-0.0115	0.1174
var29	-0.1989	0.0953	0.0669	0.0459	0.0349	0.0403	0.0491	-0.0980	0.2576	0.2131	0.0454	-0.0333	0.1550
var30	-0.1759	-0.0409	0.1649	0.2173	0.0698	0.2725	0.0312	0.1240	-0.0146	-0.0233	0.1096	0.0060	-0.0702
var31	0.0370	-0.1358	0.3389	0.2212	0.2756	0.4709	0.2601	0.2374	0.0572	0.1575	0.1054	0.1020	-0.2003
var32	0.1556	-0.1771	-0.0088	-0.0253	0.1451	0.3121	0.0253	-0.0367	0.1375	-0.0176	-0.0238	0.0683	-0.0617
var33	-0.0076	-0.1522	-0.0583	-0.0306	0.1967	0.0759	0.1030	0.0650	-0.0382	-0.0897	0.0434	-0.0254	-0.1265
var34	-0.0916	-0.0224	-0.0075	0.0216	0.1420	0.0597	-0.0075	-0.0250	-0.0693	-0.0475	-0.0285	-0.1031	0.0634
var35	-0.0243	0.0951	0.0321	0.0227	0.1248	0.0077	0.0640	-0.0673	-0.1192	-0.0317	-0.0340	-0.0949	-0.1390
var36	0.0559	0.0837	0.1792	0.2394	0.3601	0.2538	0.3921	0.0776	0.3141	0.3382	0.1551	0.1995	0.0531

	var27	var28	var29	var30	var31	var32	var33	var34	var35	var36
var27	1.0000									
var28	0.0454	1.0000								
var29	-0.1412	0.3557	1.0000							
var30	0.2382	0.3868	0.2804	1.0000						
var31	0.1470	0.4925	0.1469	0.5227	1.0000					
var32	0.0175	0.2874	0.2683	0.3406	0.2556	1.0000				
var33	0.1845	0.2490	0.0836	0.2793	0.2123	0.2810	1.0000			
var34	0.0929	0.2067	0.2196	0.1622	0.0951	0.1703	0.2311	1.0000		
var35	0.3093	0.2077	0.1533	0.3254	0.4015	0.1693	0.3546	0.4747	1.0000	
var36	0.0278	0.2193	0.3016	0.1232	0.4185	0.0307	0.0796	0.2739	0.3828	1.0000

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Source. Author generated

Table 22. ***Principal Component analysis for EFA one***

Factor	Eigenvalue	Difference	Proportion	Cumulative
Factor1	6.72029	3.17577	0.1867	0.1867
Factor2	3.54452	0.30090	0.0985	0.2851
Factor3	3.24362	0.84461	0.0901	0.3752
Factor4	2.39901	0.30297	0.0666	0.4419
Factor5	2.09605	0.35204	0.0582	0.5001
Factor6	1.74401	0.19546	0.0484	0.5485
Factor7	1.54855	0.06186	0.0430	0.5916
Factor8	1.48669	0.18593	0.0413	0.6329
Factor9	1.30075	0.08718	0.0361	0.6690
Factor10	1.21358	0.16837	0.0337	0.7027
Factor11	1.04521	0.08672	0.0290	0.7317
Factor12	0.95849	0.02390	0.0266	0.7584
Factor13	0.93458	0.05681	0.0260	0.7843
Factor14	0.87777	0.09523	0.0244	0.8087
Factor15	0.78254	0.08341	0.0217	0.8304
Factor16	0.69913	0.08254	0.0194	0.8499
Factor17	0.61659	0.00854	0.0171	0.8670
Factor18	0.60805	0.13954	0.0169	0.8839
Factor19	0.46852	0.00236	0.0130	0.8969
Factor20	0.46615	0.03075	0.0129	0.9098
Factor21	0.43540	0.03880	0.0121	0.9219
Factor22	0.39660	0.02868	0.0110	0.9329
Factor23	0.36791	0.04659	0.0102	0.9432
Factor24	0.32133	0.03784	0.0089	0.9521
Factor25	0.28349	0.03570	0.0079	0.9600
Factor26	0.24779	0.02898	0.0069	0.9669
Factor27	0.21881	0.01783	0.0061	0.9729
Factor28	0.20098	0.04227	0.0056	0.9785
Factor29	0.15872	0.01671	0.0044	0.9829
Factor30	0.14201	0.02868	0.0039	0.9869
Factor31	0.11333	0.00651	0.0031	0.9900
Factor32	0.10681	0.00930	0.0030	0.9930
Factor33	0.09751	0.02545	0.0027	0.9957
Factor34	0.07206	0.01902	0.0020	0.9977
Factor35	0.05305	0.02295	0.0015	0.9992
Factor36	0.03010	.	0.0008	1.0000

LR test: independent vs. saturated: chi2(630) = 1168.26 Prob>chi2 = 0.0000

Source. Author generated

Table 23. ***Rotated factor-loadings giving groupings under the summary variables***

Variable	Factor1	Factor2	Factor3	Uniqueness
var1			0.6888	0.5272
var2			0.4288	0.7568
var3			0.5008	0.7287
var4			0.4141	0.7877
var5	0.3565		0.4517	0.6663
var6			0.3353	0.8678
var7			0.4339	0.7878
var8				0.8741
var9			0.4751	0.7630
var10			0.3899	0.7936
var11	-0.4040			0.7214
var12		-0.3378		0.8099
var13				0.9561
var14				0.9463
var15				0.9639
var16	0.6608			0.4616
var17	0.7858			0.3199
var18	0.6016		-0.3126	0.4048
var19	0.3628	0.4285		0.5610
var20	0.7788			0.3710
var21	0.5624			0.6468
var22	0.6820		0.3767	0.4338
var23	0.7507			0.4514
var24	0.6927			0.5178
var25	0.7936			0.4098
var26	0.5315			0.6322
var27	0.4012			0.7840
var28		0.5950		0.5721
var29				0.8663
var30		0.6559		0.5910
var31		0.7526		0.4096
var32		0.4021		0.8478
var33		0.4060		0.8462
var34		0.3178		0.9049
var35		0.5750		0.6625
var36		0.3354		0.7130

(blanks represent abs(loading)<.3)

Source. Author generated

Table 24. ***Table of summary statistics for EFA two***

Variable	Mean	SD	Skewness	Kurtosis
var1	1.966667	.9560985	.5357595	2.171884
var2	1.616667	.884742	1.566956	5.466875
var3	2.283333	1.450794	.6385399	1.912298
var4	2.283333	1.249972	.6063193	2.186657
var5	3.683333	1.295254	-.857828	2.588556
var6	1.566667	.9806028	1.932948	6.390211
var7	1.8	1.116896	1.28368	3.69896
var8	3.65	1.299609	-.730364	2.450386
var9	3.333333	1.159583	-.3459138	2.654474
var10	2.25	1.385457	.7399254	2.222929
var11	3.166667	1.250988	-.1086459	1.962557
var12	3.133333	1.111827	-.6381688	2.544369
var13	2.533333	1.199812	.1286916	2.066491
var14	2.7	1.356716	.2283268	1.703764
var15	4.066667	1.071458	-1.05	3.483275
var16	3.116667	1.439064	-.0336058	1.574457
var17	3.183333	1.241809	-.137547	2.014154
var18	2.916667	1.139308	-.0441443	2.337931
var19	3.216667	1.222552	-.2518971	2.078379
var20	2.966667	1.261781	.0118739	1.860219
var21	3.05	1.320311	-.0032304	1.801136
var22	2.85	1.312586	.09784	1.817607
var23	3.083333	1.318598	-.0199841	1.731102
var24	3.083333	1.197337	.018117	1.986484
var25	2.7	1.26625	.2252812	1.907723
var26	2.9	1.203103	.1342687	2.191165
var27	2.516667	1.359108	.5569186	2.147521
var28	2.816667	1.096863	.2902643	2.465569
var29	3.066667	1.117908	-.2051016	2.301103
var30	2.516667	1.185958	.5748526	2.316549
var31	2.966667	1.149306	.0652508	2.195597
var32	2.6	1.107754	.3862682	2.336376
var33	1.633333	.9909192	1.628132	4.900434
var34	2.65	1.132344	.1530991	2.23002
var35	2.283333	.975838	.6231616	2.873153
var36	3.05	1.095832	-.0991688	2.288539

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Source. Author generated

Table 25. ***Table of correlation matrix for EFA two***

	var1	var2	var3	var4	var5	var6	var7	var8	var9	var10	var11	var12	var13
var1	1.0000												
var2	0.3453	1.0000											
var3	0.3613	0.1389	1.0000										
var4	0.4335	0.0999	0.2915	1.0000									
var5	0.3061	0.1437	0.2650	0.0668	1.0000								
var6	0.1470	0.5086	0.3022	0.2955	0.0503	1.0000							
var7	0.2476	0.3328	0.0983	0.3084	0.2835	0.6469	1.0000						
var8	0.0450	0.0730	0.2153	0.1455	-0.0670	0.2115	0.1378	1.0000					
var9	0.2548	0.0936	0.4769	0.0390	0.2633	-0.0646	0.0523	0.0787	1.0000				
var10	0.3007	0.2454	0.0063	0.2520	-0.0213	-0.0062	0.2081	0.1341	0.2216	1.0000			
var11	0.1889	-0.0179	0.1136	0.1427	-0.0715	0.0322	-0.0121	0.5786	0.1013	0.2005	1.0000		
var12	0.1478	0.0011	-0.0133	-0.0886	0.0180	0.0073	-0.1010	0.1619	0.1884	0.2311	0.2397	1.0000	
var13	0.0158	-0.2033	0.2428	0.3383	-0.2603	0.1277	0.1821	0.1109	0.0650	0.0102	0.0866	0.0093	1.0000
var14	0.0967	0.1003	0.2592	0.1809	0.0897	-0.0102	0.0157	0.2855	0.1831	0.1758	0.2497	0.0270	0.0062
var15	0.1511	-0.1871	0.1076	0.0616	0.0399	-0.0204	0.0963	0.1022	0.1592	-0.0799	0.2318	0.1489	0.0510
var16	0.2246	-0.0442	-0.0161	0.1038	0.1384	-0.0356	0.0359	0.0766	0.1490	0.1296	0.1491	0.0219	-0.2428
var17	0.2051	0.0959	0.1024	-0.0013	0.1421	0.0803	0.0147	0.0509	0.0157	0.0025	0.1109	-0.0057	-0.0667
var18	0.1841	0.1359	0.0761	-0.0188	0.0852	0.1492	0.1332	-0.0086	-0.0941	-0.0081	0.0932	-0.0446	-0.0785
var19	0.2528	-0.0159	0.0604	0.0146	0.1832	0.0231	0.2309	0.0592	-0.0159	-0.0225	-0.0462	-0.0341	0.0817
var20	0.2801	0.0035	0.0978	0.1995	0.1905	0.0840	0.1756	-0.0796	0.0425	0.0048	0.0465	-0.0572	0.1015
var21	0.1893	-0.0559	-0.0695	0.0426	0.0788	-0.0746	0.1218	-0.0687	-0.0111	0.0116	0.0462	-0.0623	0.0150
var22	0.3066	0.1540	0.0494	0.0780	0.2806	-0.0382	0.1064	-0.0313	0.1336	-0.0163	-0.1084	-0.0906	-0.1098
var23	0.2980	0.0133	0.0583	0.2425	0.1745	0.0939	0.3683	-0.1508	-0.0296	0.0905	-0.0086	-0.1002	0.0036
var24	0.3430	0.0307	-0.0138	-0.0047	0.0392	-0.0120	0.1141	-0.1116	0.0773	0.1405	0.0019	0.0934	0.0865
var25	0.3976	0.1074	0.0009	0.1938	0.1478	0.0983	0.2445	0.0175	-0.0346	0.2174	0.1926	0.0409	-0.0045
var26	0.2623	0.2022	-0.0709	-0.1499	0.1969	0.0632	0.1362	-0.1203	0.0607	0.1068	0.0901	0.2129	-0.1620
var27	0.1178	0.1111	-0.1529	0.1418	0.0079	-0.0581	0.0804	0.1041	0.0287	0.2003	0.1877	0.1443	0.0360
var28	0.0749	-0.1784	0.0438	0.0880	0.2567	0.0667	0.2324	-0.0220	-0.1244	-0.2259	-0.0885	-0.2993	0.1528
var29	0.1290	0.0263	-0.0223	0.0226	0.1904	-0.1124	0.0109	0.0630	0.1918	0.1423	0.2343	0.1291	-0.1407
var30	0.0154	-0.1150	0.0317	0.2654	-0.0241	0.1375	0.2201	-0.1776	-0.0041	-0.1212	-0.0476	-0.2202	0.1128
var31	-0.0165	-0.2628	0.1379	0.1011	0.1522	-0.0431	0.1268	-0.0533	-0.0042	-0.1543	-0.1375	-0.2883	0.1729
var32	-0.0448	-0.0899	0.1244	0.0832	-0.0780	-0.0843	-0.1343	0.0306	-0.0264	-0.1546	0.0978	-0.1486	0.0357
var33	0.0048	0.1463	0.0145	0.1263	-0.1580	0.2000	0.1011	0.0829	-0.1426	0.0926	-0.1139	-0.1856	-0.0181
var34	0.1143	-0.1024	-0.0315	-0.0126	0.1312	-0.2763	-0.0965	-0.0386	-0.0258	0.1323	-0.0419	-0.0296	-0.1846
var35	0.2101	-0.0291	0.2177	0.1693	0.2465	0.0242	0.1306	-0.2145	0.0799	0.0470	-0.0671	-0.1291	-0.1313
var36	0.2766	0.0026	0.1189	-0.0971	0.3576	-0.1845	0.1606	-0.1422	0.2001	0.1256	-0.1793	-0.1029	-0.0980

	var14	var15	var16	var17	var18	var19	var20	var21	var22	var23	var24	var25	var26
var14	1.0000												
var15	0.0490	1.0000											
var16	0.0009	0.0828	1.0000										
var17	-0.0070	0.0416	0.6612	1.0000									
var18	-0.1809	-0.0648	0.4919	0.7298	1.0000								
var19	-0.1441	0.0276	0.4478	0.6879	0.5729	1.0000							
var20	-0.1149	0.1270	0.6369	0.7395	0.6701	0.6640	1.0000						
var21	-0.0577	0.1414	0.6124	0.6869	0.4986	0.6652	0.7539	1.0000					
var22	-0.0923	0.0554	0.4401	0.6307	0.4789	0.5276	0.6212	0.6890	1.0000				
var23	0.0805	0.1280	0.5843	0.5598	0.5237	0.5143	0.7963	0.7180	0.5655	1.0000			
var24	-0.0052	-0.0044	0.3681	0.5709	0.5643	0.5664	0.5404	0.6192	0.6120	0.5108	1.0000		
var25	-0.0434	0.0899	0.5497	0.6069	0.5816	0.5573	0.6513	0.6377	0.6863	0.6344	0.6763	1.0000	
var26	-0.1433	0.1630	0.4180	0.6137	0.4761	0.4874	0.6007	0.5474	0.5592	0.5182	0.4295	0.5251	1.0000
var27	0.0395	0.0923	0.2980	0.3346	0.3676	0.2783	0.3957	0.2971	0.4052	0.3917	0.3585	0.5249	0.3535
var28	-0.0831	0.0394	0.0997	-0.0496	0.1232	-0.0078	0.0935	0.0650	0.1454	0.1631	-0.0140	0.1184	-0.0912
var29	-0.1989	0.0953	0.0478	-0.1433	-0.0222	-0.0480	0.0136	-0.0023	0.0878	-0.0268	-0.0422	0.0383	0.0807
var30	-0.1759	-0.0409	0.1130	-0.0654	0.1328	-0.0434	0.0797	0.0482	0.0942	0.2104	0.0169	0.0147	-0.0107
var31	0.0370	-0.1358	0.1254	0.0756	0.1402	0.1500	0.0927	0.0793	0.1539	0.1696	0.0883	0.0163	-0.0637
var32	0.1556	-0.1771	-0.2041	-0.4386	-0.3492	-0.2353	-0.3371	-0.2758	-0.2634	-0.2785	-0.2684	-0.2562	-0.3993
var33	-0.0076	-0.1522	0.0424	-0.0960	-0.0876	-0.2831	-0.1862	-0.2319	-0.0951	-0.0930	-0.2167	-0.2242	-0.2872
var34	-0.0916	-0.0224	-0.0369	-0.3031	-0.0755	-0.1892	-0.1981	-0.1922	-0.0701	-0.1277	-0.2031	-0.1099	-0.2874
var35	-0.0243	0.0951	0.2657	0.1103	0.2198	0.0897	0.1317	-0.0243	0.0470	0.2184	-0.0351	0.0014	-0.1054
var36	0.0559	0.0837	0.1575	0.1675	0.1392	0.3460	0.2096	0.2325	0.3235	0.2786	0.1905	0.0965	0.1967

	var27	var28	var29	var30	var31	var32	var33	var34	var35	var36
var27	1.0000									
var28	0.1215	1.0000								
var29	0.1777	0.3557	1.0000							
var30	-0.0843	0.3868	0.2804	1.0000						
var31	0.0004	0.4925	0.1469	0.5227	1.0000					
var32	-0.2094	0.2874	0.2683	0.3406	0.2556	1.0000				
var33	-0.2723	0.2490	0.0836	0.2793	0.2123	0.2810	1.0000			
var34	-0.1448	0.2067	0.2196	0.1622	0.0951	0.1703	0.2311	1.0000		
var35	-0.0483	0.2077	0.1533	0.3254	0.4015	0.1693	0.3546	0.4747	1.0000	
var36	0.0506	0.2193	0.3016	0.1232	0.4185	0.0307	0.0796	0.2739	0.3828	1.0000

Source. Author generated

Table 26. ***Table of correlation matrix after dropping highly correlated variables***

	var1	var2	var3	var4	var5	var6	var7	var8	var9	var10	var11	var12	var13
var1	1.0000												
var2	0.3453	1.0000											
var3	0.3613	0.1389	1.0000										
var4	0.4335	0.0999	0.2915	1.0000									
var5	0.3061	0.1437	0.2650	0.0668	1.0000								
var6	0.1470	0.5086	0.3022	0.2955	0.0503	1.0000							
var7	0.2476	0.3328	0.0983	0.3084	0.2835	0.6469	1.0000						
var8	0.0450	0.0730	0.2153	0.1455	-0.0670	0.2115	0.1378	1.0000					
var9	0.2548	0.0936	0.4769	0.0390	0.2633	-0.0646	0.0523	0.0787	1.0000				
var10	0.3007	0.2454	0.0063	0.2520	-0.0213	-0.0062	0.2081	0.1341	0.2216	1.0000			
var11	0.1889	-0.0179	0.1136	0.1427	-0.0715	0.0322	-0.0121	0.5786	0.1013	0.2005	1.0000		
var12	0.1478	0.0011	-0.0133	-0.0886	0.0180	0.0073	-0.1010	0.1619	0.1884	0.2311	0.2397	1.0000	
var13	0.0158	-0.2033	0.2428	0.3383	-0.2603	0.1277	0.1821	0.1109	0.0650	0.0102	0.0866	0.0093	1.0000
var14	0.0967	0.1003	0.2592	0.1809	0.0897	-0.0102	0.0157	0.2855	0.1831	0.1758	0.2497	0.0270	0.0062
var15	0.1511	-0.1871	0.1076	0.0616	0.0399	-0.0204	0.0963	0.1022	0.1592	-0.0799	0.2318	0.1489	0.0510
var16	-0.0346	0.2310	0.0513	-0.1106	-0.1925	0.1759	0.1291	0.2282	0.2038	0.1919	0.3117	0.0765	-0.1201
var17	-0.0772	0.1121	0.0684	-0.0597	-0.1559	0.0546	0.0181	0.0217	0.2123	0.0183	0.1678	-0.1641	-0.0531
var18	-0.0263	0.2026	0.0398	-0.1309	-0.2148	0.2240	0.1096	0.2676	0.0936	0.0517	0.3401	0.0789	-0.2504
var19	-0.0201	0.1871	0.0900	-0.0842	-0.0044	0.2530	0.1900	0.0010	0.1770	-0.1182	0.0978	0.1516	-0.0604
var20	-0.0546	0.2301	0.1244	-0.2882	-0.1475	0.2125	0.1043	0.0368	0.2232	0.0125	0.0979	0.1131	0.0146
var21	-0.0528	0.1764	0.2152	-0.1469	-0.0886	0.2013	0.0123	0.0212	0.1505	-0.0398	0.0587	0.1198	-0.0612
var22	-0.0057	0.2815	-0.0499	-0.1529	-0.1430	0.1246	-0.0425	0.0816	0.1493	0.0080	0.3539	0.1931	-0.1872
var23	-0.0550	0.0283	-0.0909	-0.0444	-0.0959	0.0424	0.1048	-0.0480	-0.0731	0.0505	0.0373	-0.0282	0.2241
var24	0.0749	-0.1784	0.0438	0.0880	0.2567	0.0667	0.2324	-0.0220	-0.1244	-0.2259	-0.0885	-0.2993	0.1528
var25	0.1290	0.0263	-0.0223	0.0226	0.1904	-0.1124	0.0109	0.0630	0.1918	0.1423	0.2343	0.1291	-0.1407
var26	0.0154	-0.1150	0.0317	0.2654	-0.0241	0.1375	0.2201	-0.1776	-0.0041	-0.1212	-0.0476	-0.2202	0.1128
var27	-0.0165	-0.2628	0.1379	0.1011	0.1522	-0.0431	0.1268	-0.0533	-0.0042	-0.1543	-0.1375	-0.2883	0.1729
var28	-0.0448	-0.0899	0.1244	0.0832	-0.0780	-0.0843	-0.1343	0.0306	-0.0264	-0.1546	0.0978	-0.1486	0.0357
var29	0.0048	0.1463	0.0145	0.1263	-0.1580	0.2000	0.1011	0.0829	-0.1426	0.0926	-0.1139	-0.1856	-0.0181
var30	0.1143	-0.1024	-0.0315	-0.0126	0.1312	-0.2763	-0.0965	-0.0386	-0.0258	0.1323	-0.0419	-0.0296	-0.1846
var31	0.2101	-0.0291	0.2177	0.1693	0.2465	0.0242	0.1306	-0.2145	0.0799	0.0470	-0.0671	-0.1291	-0.1313
var32	0.2766	0.0026	0.1189	-0.0971	0.3576	-0.1845	0.1606	-0.1422	0.2001	0.1256	-0.1793	-0.1029	-0.0980

	var14	var15	var16	var17	var18	var19	var20	var21	var22	var23	var24	var25	var26
var14	1.0000												
var15	0.0490	1.0000											
var16	0.0766	-0.0485	1.0000										
var17	0.1078	-0.0784	0.5178	1.0000									
var18	-0.0038	-0.0381	0.6065	0.5129	1.0000								
var19	-0.1564	0.1215	0.3690	0.4287	0.6490	1.0000							
var20	-0.0705	-0.0190	0.4088	0.5845	0.6367	0.5855	1.0000						
var21	-0.0711	-0.0728	0.5281	0.5883	0.6209	0.6531	0.6910	1.0000					
var22	-0.0470	0.1071	0.3838	0.4874	0.5400	0.5097	0.4889	0.4984	1.0000				
var23	-0.1894	-0.2580	0.2341	0.3293	0.2457	0.3842	0.3430	0.4825	0.3092	1.0000			
var24	-0.0831	0.0394	-0.3329	-0.0865	-0.2212	-0.2696	-0.0975	-0.2219	-0.1896	-0.0607	1.0000		
var25	-0.1989	0.0953	0.0381	-0.0622	-0.0365	-0.1063	-0.1050	-0.1930	0.0496	-0.1449	0.3557	1.0000	
var26	-0.1759	-0.0409	-0.0110	0.0922	-0.0223	-0.1079	-0.1475	-0.1007	0.1086	-0.0046	0.3868	0.2804	1.0000
var27	0.0370	-0.1358	-0.3372	-0.0768	-0.3052	-0.3473	-0.3953	-0.3555	-0.1855	-0.0458	0.4925	0.1469	0.5227
var28	0.1556	-0.1771	0.0256	0.0758	0.0447	-0.2082	-0.0776	-0.0622	0.0616	0.0046	0.2874	0.2683	0.3406
var29	-0.0076	-0.1522	0.1455	0.0132	0.0096	-0.1472	0.0079	0.0927	0.0893	0.1481	0.2490	0.0836	0.2793
var30	-0.0916	-0.0224	-0.0094	0.0633	-0.1645	-0.3691	-0.0802	0.0608	0.0020	-0.0213	0.2067	0.2196	0.1622
var31	-0.0243	0.0951	-0.0085	0.1313	-0.0743	-0.1079	-0.0850	0.0800	0.1082	0.0995	0.2077	0.1533	0.3254
var32	0.0559	0.0837	-0.1542	-0.0112	-0.1557	-0.0395	-0.0930	-0.0503	-0.1415	-0.1196	0.2193	0.3016	0.1232

	var27	var28	var29	var30	var31	var32
var27	1.0000					
var28	0.2556	1.0000				
var29	0.2123	0.2810	1.0000			
var30	0.0951	0.1703	0.2311	1.0000		
var31	0.4015	0.1693	0.3546	0.4747	1.0000	
var32	0.4185	0.0307	0.0796	0.2739	0.3828	1.0000

Source. Author generated

Table 27. ***Principal Component analysis for EFA two***

Factor	Eigenvalue	Difference	Proportion	Cumulative
Factor1	5.91062	2.42841	0.1791	0.1791
Factor2	3.48221	0.56223	0.1055	0.2846
Factor3	2.91998	0.50738	0.0885	0.3731
Factor4	2.41260	0.30970	0.0731	0.4462
Factor5	2.10291	0.35050	0.0637	0.5099
Factor6	1.75240	0.19311	0.0531	0.5631
Factor7	1.55929	0.15561	0.0473	0.6103
Factor8	1.40368	0.28303	0.0425	0.6528
Factor9	1.12065	0.05091	0.0340	0.6868
Factor10	1.06975	0.03891	0.0324	0.7192
Factor11	1.03084	0.08883	0.0312	0.7505
Factor12	0.94201	0.08575	0.0285	0.7790
Factor13	0.85625	0.10480	0.0259	0.8049
Factor14	0.75146	0.07224	0.0228	0.8277
Factor15	0.67922	0.05320	0.0206	0.8483
Factor16	0.62602	0.02369	0.0190	0.8673
Factor17	0.60233	0.09679	0.0183	0.8855
Factor18	0.50554	0.06190	0.0153	0.9008
Factor19	0.44364	0.00524	0.0134	0.9143
Factor20	0.43840	0.02782	0.0133	0.9276
Factor21	0.41058	0.07863	0.0124	0.9400
Factor22	0.33196	0.06880	0.0101	0.9501
Factor23	0.26315	0.02415	0.0080	0.9580
Factor24	0.23900	0.01208	0.0072	0.9653
Factor25	0.22693	0.02060	0.0069	0.9722
Factor26	0.20633	0.04158	0.0063	0.9784
Factor27	0.16474	0.03345	0.0050	0.9834
Factor28	0.13130	0.01013	0.0040	0.9874
Factor29	0.12117	0.02834	0.0037	0.9911
Factor30	0.09283	0.00540	0.0028	0.9939
Factor31	0.08743	0.02743	0.0026	0.9965
Factor32	0.06000	0.00525	0.0018	0.9983
Factor33	0.05475	.	0.0017	1.0000

LR test: independent vs. saturated: chi2(528) = 1021.29 Prob>chi2 = 0.0000

Source. Author generated

Table 28. ***Rotated factor-loadings giving groupings under the summary variables***

Variable	Factor1	Factor2	Factor3	Factor4	Uniqueness
var1				0.6876	0.5015
var2			0.4536		0.5924
var3				0.3471	0.7694
var4			0.3155		0.7444
var5				0.4664	0.7379
var6			0.9966		0.0000
var7			0.6345		0.4955
var8					0.9001
var9				0.4666	0.7366
var10				0.4614	0.7630
var11					0.8515
var12		-0.3873			0.8027
var13					0.9220
var14					0.9306
var15					0.9386
var16	0.6195				0.5713
var17	0.7665				0.4344
var18	0.8145				0.2780
var19	0.7938				0.3201
var20	0.6621				0.4580
var21	0.7497				0.3860
var22	0.8072				0.3325
var23	0.6782				0.5476
var24	0.4624				0.7701
var25		0.5855			0.5921
var26				0.3133	0.8171
var27		0.6748			0.5449
var28		0.7121			0.3720
var29		0.4087			0.8259
var30		0.4244			0.7938
var31		0.3481			0.7352
var32		0.6049		0.3012	0.5451
var33		0.3970		0.4230	0.6223

(blanks represent abs(loading)<.3)

Source. Author generated

Table 29. ***Table for correlation matrix in regression 1***

	var1	var2	var3	var4	var5	var6	var7	var8	var9	var10	var11	var12
var1	1.0000											
var2	0.6863	1.0000										
var3	0.5434	0.5711	1.0000									
var4	0.4976	0.4778	0.4926	1.0000								
var5	0.5506	0.5954	0.5316	0.3653	1.0000							
var6	0.3742	0.4691	0.3803	0.1999	0.5374	1.0000						
var7	0.3493	0.4864	0.2368	0.0345	0.6224	0.4241	1.0000					
var8	0.5220	0.5483	0.4374	0.3529	0.5710	0.3818	0.4750	1.0000				
var9	0.4246	0.6451	0.4971	0.3899	0.4711	0.3511	0.4443	0.5085	1.0000			
var10	0.4865	0.5450	0.4914	0.2478	0.5430	0.3943	0.4978	0.6033	0.5609	1.0000		
var11	0.1591	0.3510	0.0983	0.0789	0.3250	0.2650	0.4191	0.3727	0.3351	0.4798	1.0000	
var12	0.3408	0.4229	0.2866	0.1474	0.4291	0.2518	0.1244	0.2349	0.3615	0.3303	0.2570	1.0000

Source. Author generated

Table 30. ***Regression 1 output table***

Source	SS	df	MS	Number of obs	=	21
				F(12, 8)	=	0.65
Model	1.1041e+13	12	9.2006e+11	Prob > F	=	0.7561
Residual	1.1270e+13	8	1.4088e+12	R-squared	=	0.4949
				Adj R-squared	=	-0.2629
Total	2.2311e+13	20	1.1155e+12	Root MSE	=	1.2e+06

ridership	Coefficient	Std. err.	t	P>|t|	[95% conf.	interval]
var1	-174198.1	580837	-0.30	0.772	-1513611	1165215
var2	-113217	596243.9	-0.19	0.854	-1488158	1261724
var3	511692.9	533392.5	0.96	0.365	-718312.5	1741698
var4	-28679.95	475028	-0.06	0.953	-1124096	1066737
var5	709724.3	606124.5	1.17	0.275	-688001.4	2107450
var6	-484377.8	487012.8	-0.99	0.349	-1607431	638675.8
var7	-344595.7	410271.9	-0.84	0.425	-1290684	601493
var8	349299.6	385286.3	0.91	0.391	-539172.2	1237771
var9	-415792.8	340785	-1.22	0.257	-1201644	370058.9
var10	184130.6	570588.8	0.32	0.755	-1131649	1499911
var11	-79488.5	413327.2	-0.19	0.852	-1032623	873645.8
var12	-82592.77	386214.5	-0.21	0.836	-973204.9	808019.4
_cons	3753460	1386400	2.71	0.027	556415.9	6950504

Source. Author generated

Table 31. ***Table for correlation matrix in regression 2***

	var1	var3	var4	var7	var8	var9	var10	var11	var12
var1	1.0000								
var3	0.5178	1.0000							
var4	0.5020	0.5964	1.0000						
var7	0.3690	0.4287	0.5284	1.0000					
var8	0.5792	0.5574	0.5857	0.4779	1.0000				
var9	0.4088	0.5845	0.5861	0.5855	0.5834	1.0000			
var10	0.5281	0.5883	0.6069	0.6531	0.6103	0.6910	1.0000		
var11	0.3838	0.4874	0.5527	0.5097	0.4716	0.4889	0.4984	1.0000	
var12	0.2341	0.3293	0.2895	0.3842	0.3239	0.3430	0.4825	0.3092	1.0000

Source. Author generated

Table 32. ***Regression 2 output after dropping highly correlated variables***

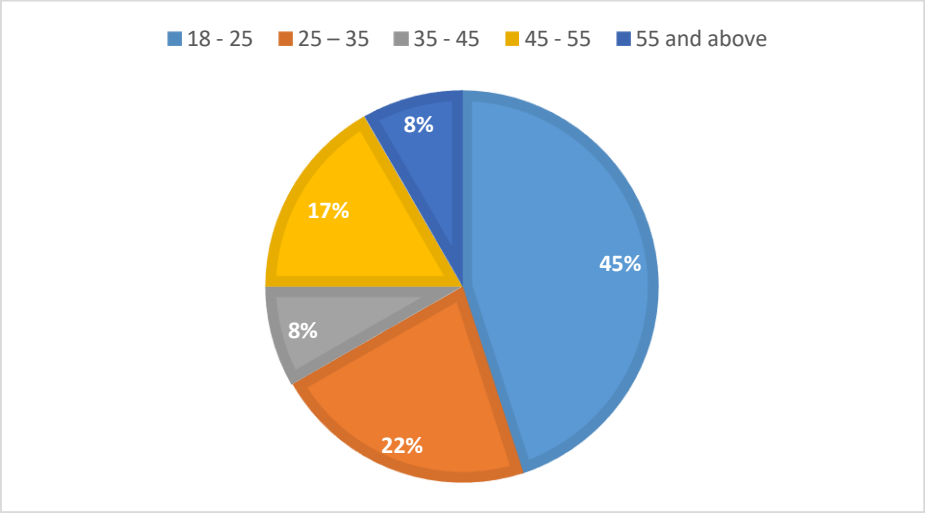
Source	SS	df	MS	Number of obs	=	21
				F(9, 11)	=	0.86
Model	9.1975e+12	9	1.0219e+12	Prob > F	=	0.5848
Residual	1.3114e+13	11	1.1921e+12	R-squared	=	0.4122
				Adj R-squared	=	-0.0687
Total	2.2311e+13	20	1.1155e+12	Root MSE	=	1.1e+06

ridership	Coefficient	Std. err.	t	P>|t|	[95% conf.	interval]
var1	40701.39	227251.2	0.18	0.861	-459475.1	540877.9
var3	-439779.9	310314.9	-1.42	0.184	-1122778	243218.5
var4	118272.9	373411.4	0.32	0.757	-703600	940145.7
var7	568579.4	409727.4	1.39	0.193	-333224.5	1470383
var8	326613.6	276717.3	1.18	0.263	-282437.2	935664.4
var9	43178.09	443373.6	0.10	0.924	-932680.7	1019037
var10	-513611.1	668761.3	-0.77	0.459	-1985545	958322.6
var11	13337.46	257406.9	0.05	0.960	-553211.3	579886.2
var12	-193255.2	180498.5	-1.07	0.307	-590529.6	204019.3
_cons	4099629	770500.4	5.32	0.000	2403769	5795488

Source. Author generated

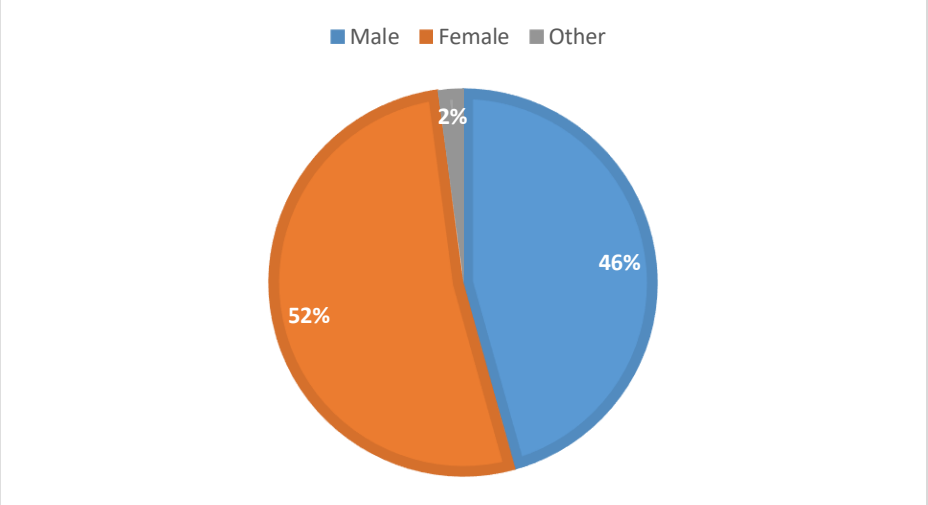
7.2 Charts

Figure 14. ***Age of respondents***



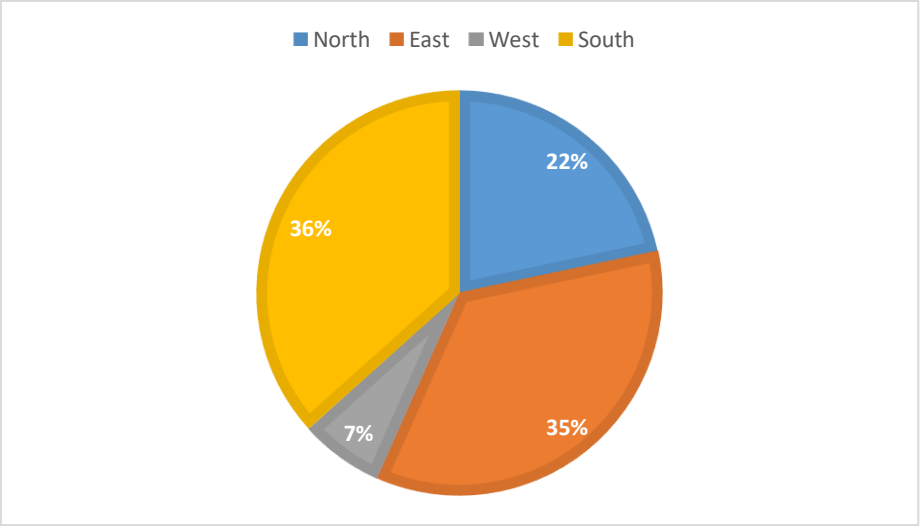
Source. Author generated

Figure 15. ***Gender of respondents***



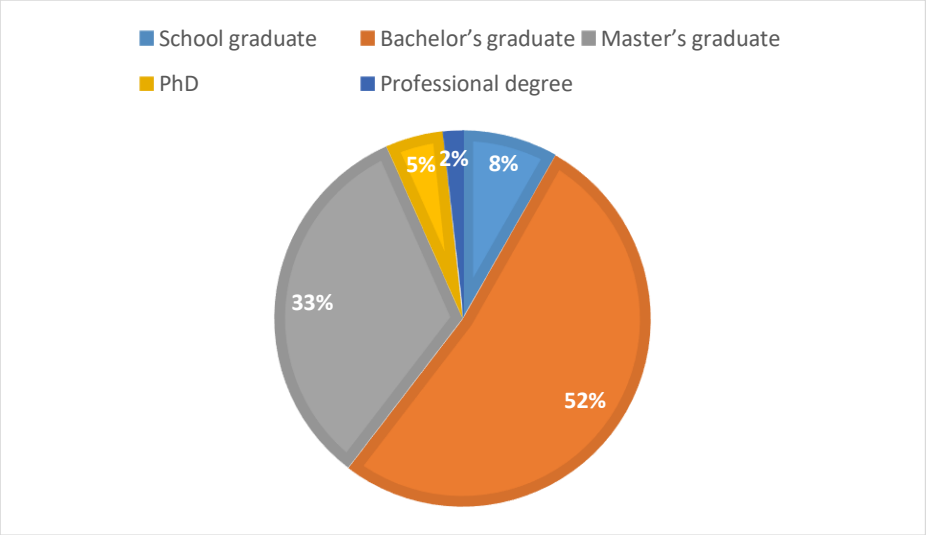
Source. Author generated

Figure 16. ***Area of residence respondents***



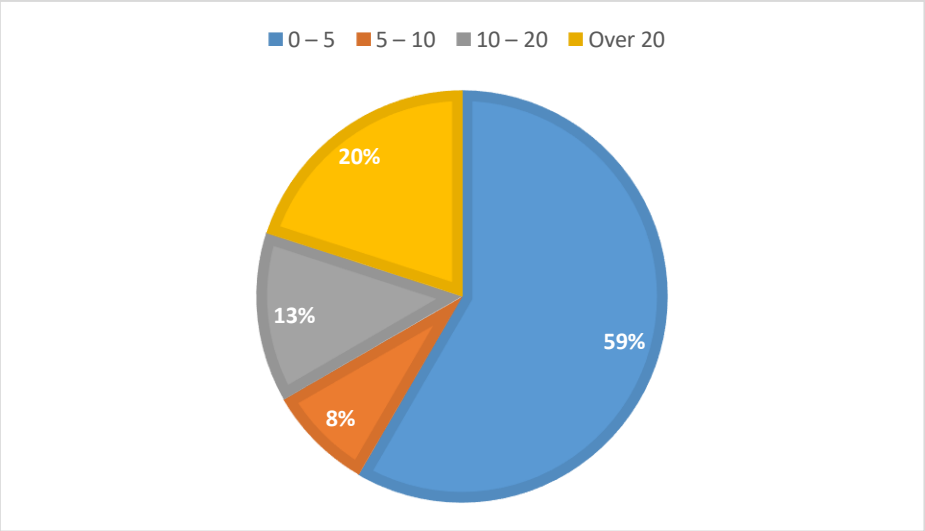
Source. Author generated

Figure 17. ***Level of education of respondents***



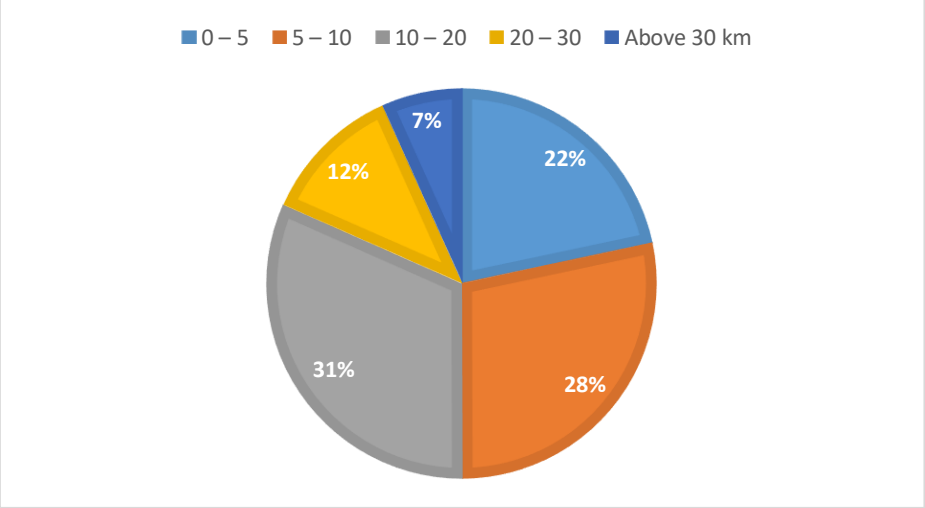
Source. Author generated

Figure 18. ***Number of years of work experience of respondents***



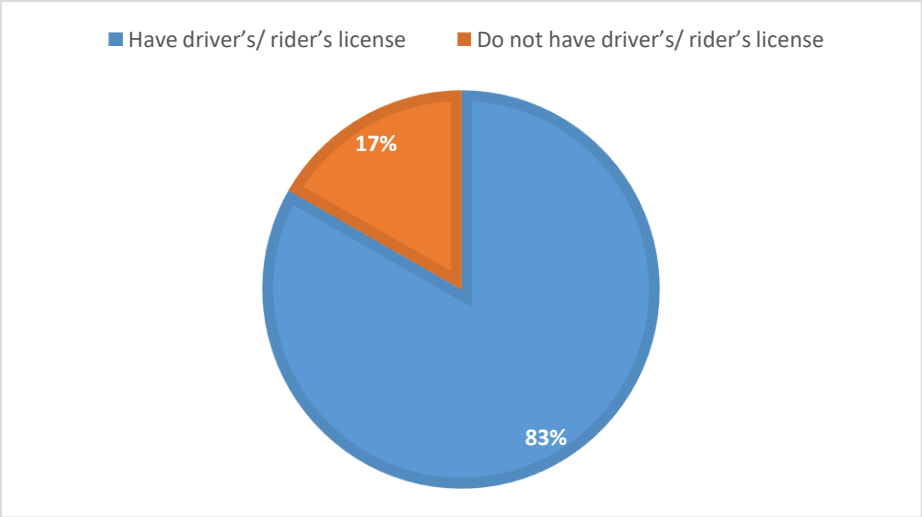
Source. Author generated

Figure 19. ***Average commute distance of respondents***



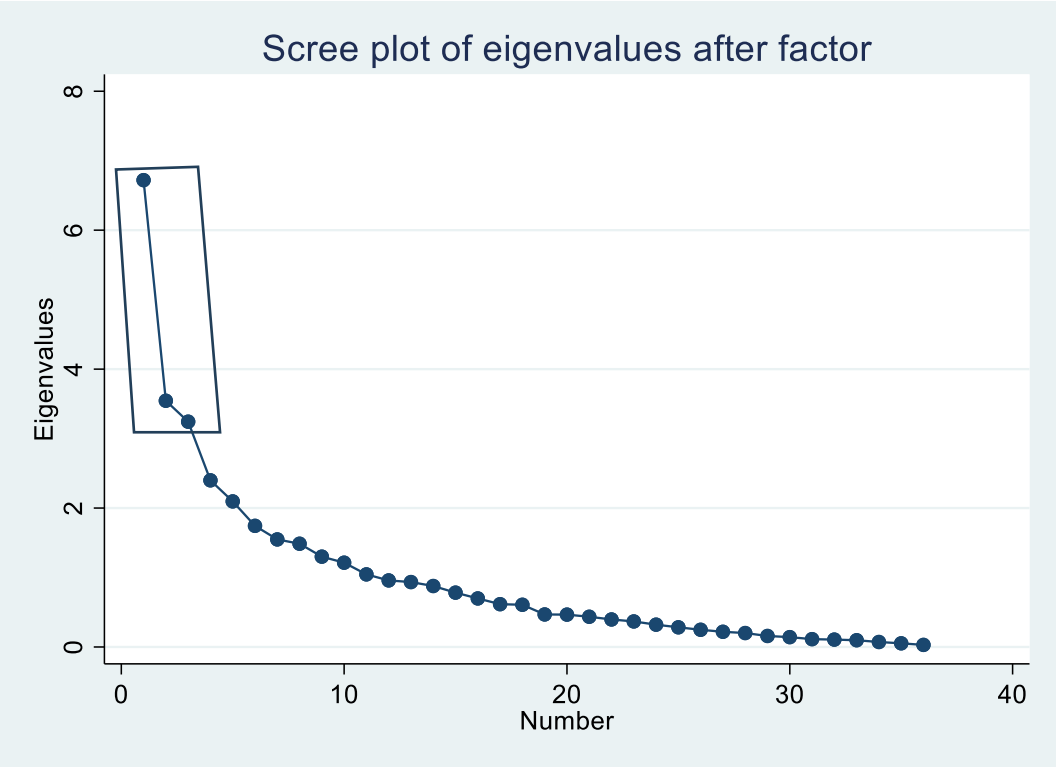
Source. Author generated

Figure 20. ***Number of respondents with driver's/ rider's license***



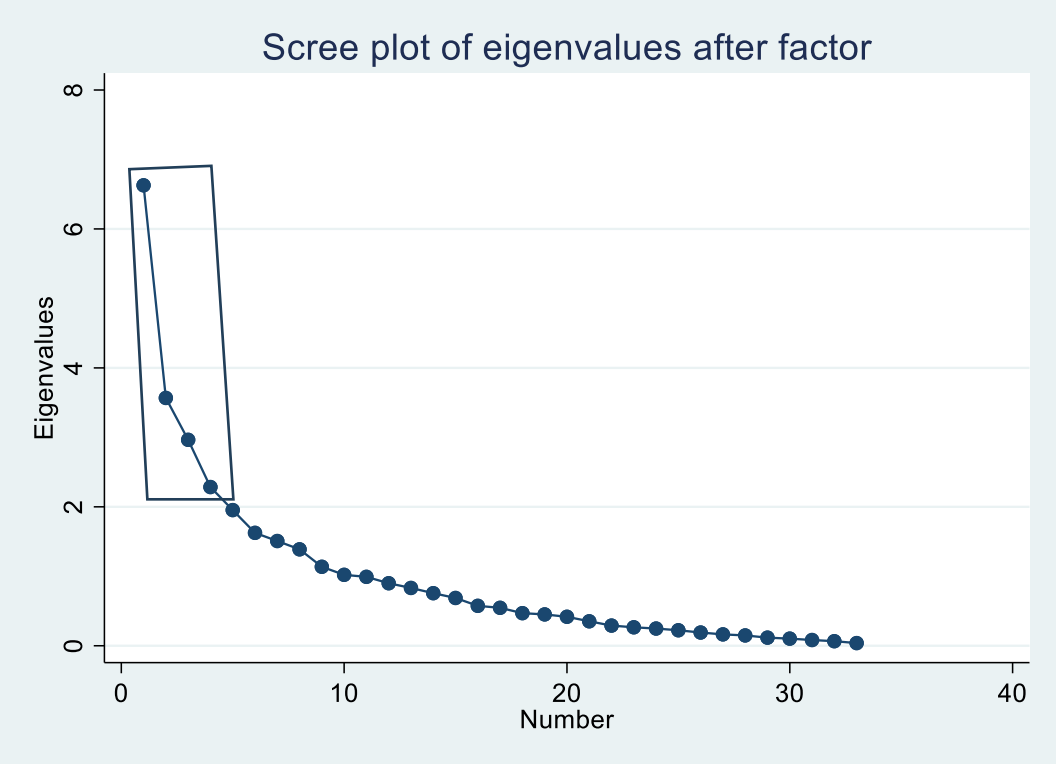
Source. Author generated

Figure 21. ***Chart determining Eigenvalues for EFA one***



Source. Author generated

Figure 22. ***Chart determining Eigenvalues for EFA two***



Source. Author generated

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