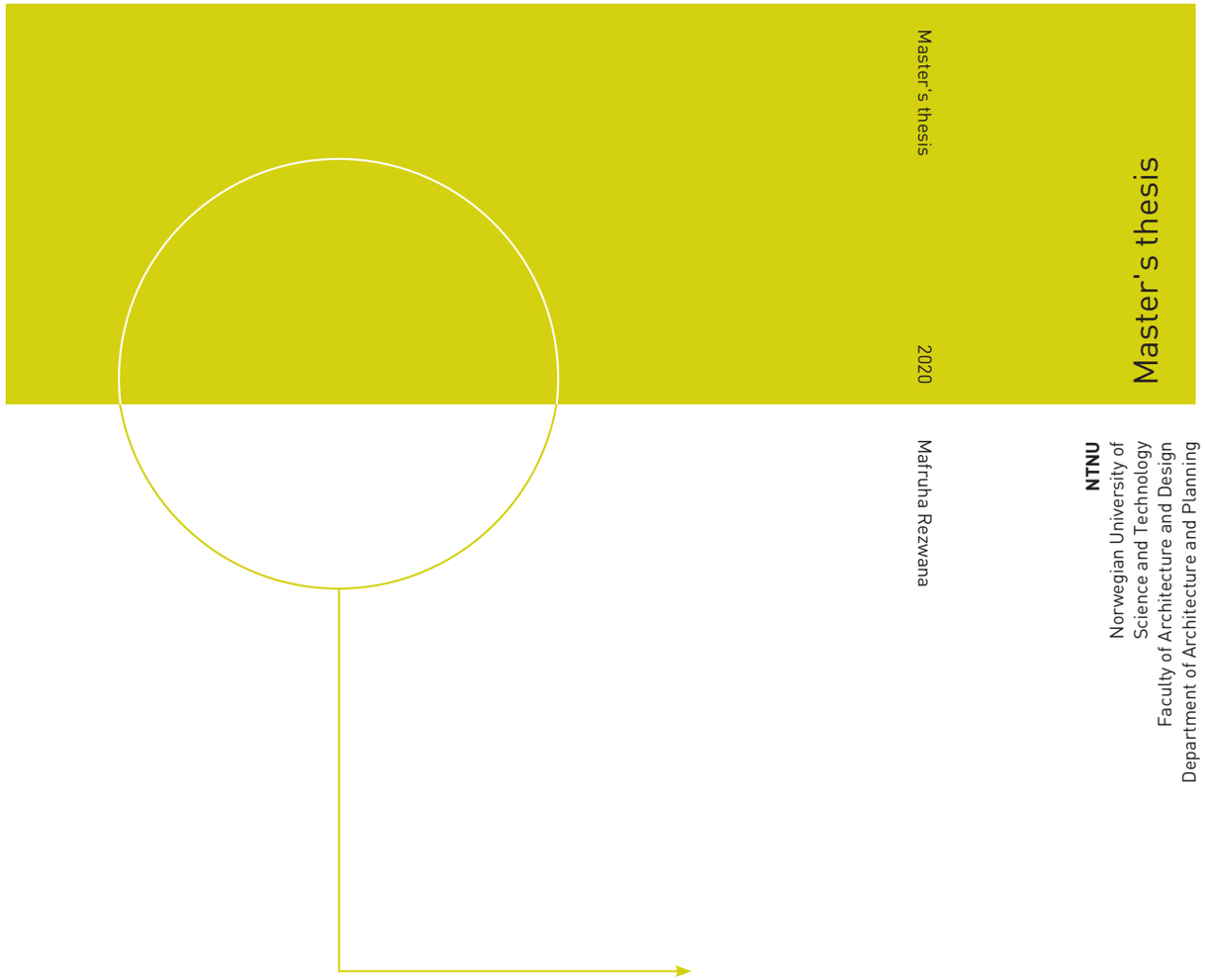

Master's thesis

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Urban Ecological Planning
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I certify that that this research is my own work and has not been published or presented before at anywhere. Use of references drawing upon the knowledge and ideas of others, whether published or unpublished, has been given due acknowledgement. I understand the consequences of cheating in any assessment and if proven, the thesis may be assessed as failed.

Mafruha Rezwana

Trondheim- 18 September 2020

CONTENT

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ABSTRACT

Transport plays a crucial role in guiding development, connecting people and communities to the world, facilitating commercial activities. Although transportation sectors globally prioritized the sustainable framework in recent years, emphasis was given primarily on the two key factors- economy and environmental; whereas, less emphasis is given upon the equity issue (Brussel et al., 2019). Unlike the economic and environmental impacts, there are very few specific strategies, evaluation process and indicators for measuring the social equity factors; because of that, often it is difficult to measure the impact of the transport initiatives on the different groups of society. As a result, the purpose of transportation to help people to reach various opportunities, is still unequally distributed in many cities across the world specially in global south where social segregation is a complex problem often aggravated by the lack of proper transport facilities. (Brussel et al., 2019). Therefore, it is of utmost importance for the policy makers, transport planners, relative experts and stakeholders, to prioritize the assessment of social equity impact of different transport policies and initiatives and explore the indicators that draws upon the equity issues that affects the people from different strata. In the Indian context, a significant number of people are marginalized socially, politically, economically and culturally. With a predominant automobile centric transport system, the implication of the social equity issue is more complex and imperative to implement here.

The thesis aims to contribute to the sustainable transport planning study to highlight the importance of the social equity issue to transport policy makers, relative experts, actors and stakeholders in their actions for sustainable transport for Indian cities. It studies the application of the social equity factors in sustainable transport policies in Indian context. It investigates how Indian cities are operationalizing social equity in their sustainable transport initiatives through analyzing the transport policies from 6 major cities (Delhi, Mumbai, Pune, Bangalore, Ahmedabad, & Hyderabad). It also analyzes the impacts of the practical implementation under those policies with available public data and reports. The study finds that despite of having sustainable transport vision, the transport regulations do not hold the necessary equitable strategies to holistically address the large group of low-income population or other vulnerable groups. There seems to be an emerging need to reform the existing transport policy and project trends to ensure the optimization of public transport services to all level of citizen in the country.

LIST OF FIGURES

LIST OF ABBREVIATIONS

AMTS	Ahmedabad Municipal Transport Service
BEST	Brihanmumbai Electricity Supply and Transport
BMTC	Bengaluru Metropolitan Transport Corporation
BRT	Bus Rapid Transit
CMP	Comprehensive Mobility Plan
CEPT	Centre for Environmental Planning and Technology
CSE	Center for Science and Environment
CSTEP	Center for Study of Science, Technology and Policy
EC	European Commission
EWS	Economically Weaker Section
FYP	Fifth Year Plan
GST	Goods and Services Tax
HMDA	Hyderabad Metropolitan Development Authority
IDEK	Infrastructure Development Corporation Karnataka
ITDP	Institute for Transportation and Development Policy
IUT	Institute of Urban Transport
IIHS	Indian Institute for Human Settlements
GOM	Government of Maharashtra
JnNRUM	Jawaharlal Nehru Urban Renewal Mission
MoHUA	Ministry of Housing and Urban Authority
MoUD	Ministry of Urban Development
MRT	Mass Rapid Transit
MUTP	Mumbai Urban Transport Project
NIUA	National Institute of Urban Affairs
NMT	Non-motorized transport
NUTP	National Urban Transport Policy
PMPML	Pune Mahanagar Parivahan Mahamandal Ltd
PT	Public Transport
SLOCAT	Sustainable Low Carbon Transport
SUTP	Sustainable Urban Transport Project
TOD	Transit Oriented Development
UMTCL	Urban Mass Transit Company Ltd
WRI	World Research Institute

1. INTRODUCTION

Social equity is a very complex but essential element of sustainable development(Opp and Saunders, 2013). Similarly, urban transport is one of the key factors in sustainable urban development(World Bank, 2002). The crucial linkage between these two elements has been acknowledged in many sustainable development and transport literatures and has been emerging as a critical discussion issue globally in recent years(Litman, 2002, Martens et al., 2019, Manaugh et al., 2015, Di Ciommo and Shiftan, 2017, Pereira, 2018). This research is grounded on this increasing need to address social equity in urban transport and aims to explore the issue in the context of India, a prominent face of global south. The thesis studies how social equity is defined in Indian cities' urban transport policies and reflected in different transport initiative implementations. For this, it conducts a qualitative analysis on different important urban transport policies from selected major Indian cities as well as the empirical evidences of their implementation.

In the current globalizing world, the cities are the center for the population growth, economic development and livelihood improvement. Presently, cities are accommodating people more than ever with the swift speed of urbanization. The pressure is increasing gradually. Unfortunately, while the cities are prospering with economic and physical development one hand, motorization, congestion, pollution are increasing as byproducts on the other hand. Therefore, in the wake of global climate change, it is of utmost important for every local governments, to plan their urban area accordingly to ensure a sustainable management of the urban growth, land use and transport system for greater mobility. With the rapid pace of globalization and urbanization, mobility becomes an extreme important urban need, making transport sector one of the key actors in the sustainable development. Transport plays a crucial role in guiding development, connecting people and communities to the world, facilitating commercial activities. Sustainable urban transport system is the vital need for achieving the sustainable development goals (World Bank, 2002, SLoCaT, 2019).

With the unprecedented growth of urban areas, transport demands are increasing across the cities creating a great challenge for the cities to cater the booming urban population. Hence, cities are trying to balance their transport system to cope with the changing urban environment

and demands, and are endorsing in wide range of transportation planning initiatives such as metro rail, bus rapid transit, transit-oriented development, etc. Since, transport has an wide range of impacts on the economic, environmental and social aspects of the urban system, it is of utmost importance for the transport policies to be robust enough to tackle the growing challenges of demand and supply with a comprehensive vision that helps the simultaneous growth of the three spheres (Environment, Economic & Social) of sustainable development(Gwilliam and World Bank, 2002) shown in figure 1.

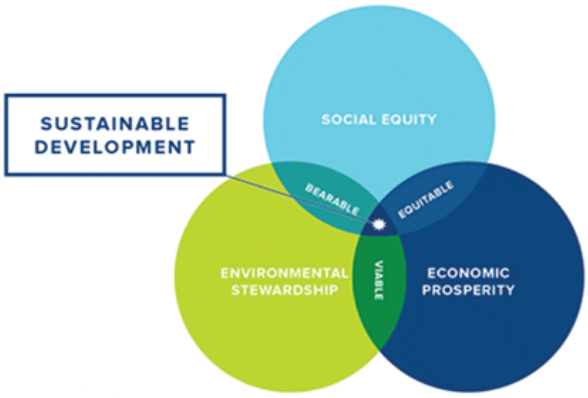

Figure 1: Pillars of sustainable development (Opp and Saunders, 2020)

Although transportation sectors globally prioritized the sustainable framework in recent years, emphasis was given primarily on the economic and environmental factors; whilst, the issue of 'social equity' is comparatively less talked about. The objective of transport to support people to attain various opportunities is still disproportionately distributed in many cities across the world. The trend is prominent specially in global south where social segregation is a complex problem often instigated by the inefficient transport facilities. (Brussel et al., 2019).This imbalance dispersal of transport services differentially affects the unprivileged and vulnerable communities (low income, different ethnic groups, women, elderly people, differently able person etc.) in the cities(Karner et al., 2016). In a WRI (World Research Institute) report on accessibility in global south (2019), it refers that the low-income urbanites significantly experience restricted accessibility to basic opportunities such as job, health, education etc. This restriction leads them to comply with either high transport burden or exclusion from the opportunities(Venter et al., 2019). In another study conducted by the UK Social Exclusion Unit affirms that transport is a significant contributing factor in the exclusion of many low-income groups and communities(Wee and Geurs, 2011). Since, transport is one of the key elements in

reducing poverty and ensuring economic growth of the cities, it is critical that transport policies and investments undertake special consideration of the vulnerable population groups of the society(Gwilliam and World Bank, 2002, SLoCaT, 2019).

In preset decades, in cities from developed and also developing countries, scholars have started to discuss the implication of the matter in transport sectors that sustainable transport planning requires to provide benefits to all level of people in the city irrespective of their social, economic , cultural or physical background, their housing locations, choice of transport mode and so on (Brussel et al., 2019). There has been increasing recognition of the need of transport equity analysis studies in transport plans and policies worldwide(Pereira, 2018, Di Ciommo and Shiftan, 2017). Similar to the many developing countries in global south, the rapidly urbanizing Indian cities are also struggling to cope with the growing transport demand and managing its impact on the society(Badami and Haider, 2007). Public transport in India has degraded over the years making the citizen inclined towards using private vehicles more. (Joshi et al., 2017). Most Indian cities have been overly motorized along with the urbanization and economic development resulting a large amount of carbon emission, heavy traffic congestion, increasing traffic accidents etc.(Pucher et al., 2005).Catering to the need of private motorized vehicle, road infrastructures were always given priority rather than the NMT (non-motorized modes -walking, cycling) and public transport; thus, affecting those vulnerable individuals who need them most.

Acknowledging the need of sustainable changes in urban transport scenario, presently the Indian government has been proactive to bring in a paradigm shift in the transport planning system of the Indian cities. The urban transport authorities are promoting people centric transport planning, implementing wide scale public transport and NMT initiatives to bring the modal shift towards the use of sustainable transport mode. The authorities are very focused to reduce the environmental externalities of transport services in the cities, implementing a wide range of public transport projects. However, there are critics that the urban transport policies and initiatives have not been successful enough to meet the need of the socially marginalized groups specially the urban poor (CSE, 2019). Indian cities consist of diversified population groups and the gap between the well-off privileged social groups and the socio-economically vulnerable groups is significant. In addition, a considerable number of people live below and

near poverty line. According to a study (Iqbal, 2019), Indian population can be divided into three classes, where the low income and lower-middle income group comprise the largest part (figure2).

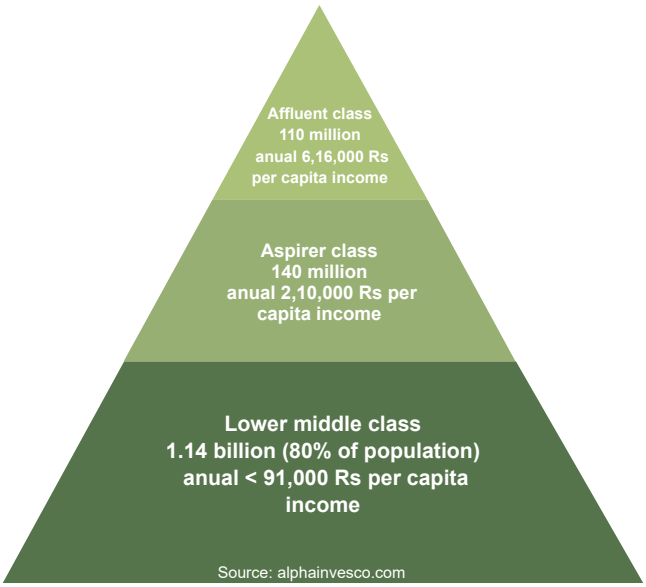

Figure 2: Indian population according to income level (Iqbal, 2019).

Despite the overall economic growth and declining urban poverty in recent years, there has been an increase in the absolute number of the urban poor in Indian cities. The major cities like Mumbai, Delhi have a 20-50% of slum population(Badami and Haider, 2007). This marginalized groups usually have restricted access to livelihood resources and barrier to access affordable quality public transport limit their life opportunities even more(Ghadge, 2013). In the Indian context, a significant number of people marginalized socially, politically, economically, culturally. Therefore, with a predominant automobile centric transport system, the implication of the social equity issue is more complex and imperative to implement.

Recognizing the importance of social equity consideration in the transport planning system, this thesis aims to contribute to the 'transport equity' discussion in Indian cities' transport planning policies and different transport initiatives. To contribute to the discussion, the research selects six major Indian cities (Delhi, Mumbai, Pune, Ahmedabad, Bangalore and Hyderabad) and studies their present transport planning regulations and transport initiative outcomes along with the major national transport policy documents (National transport Policy, 12th five year transport plan, Urban transport project appraisal checklist). The thesis

investigates how social equity consideration is represented and operationalized in these policy documents and through different stated initiatives in these selected cities.

To follow through the discourse, at first the thesis discusses the present urban transport scenario of Indian cities following a literature review of relevant theoretical concepts and backgrounds. Based on the literature studies, it creates a conceptual framework for analyzing the transport policies and through qualitative data analysis it then discusses the challenges in transport equity condition in Indian transport system followed by some strategic recommendations.

2. URBAN TRANSPORT IN INDIA

In this chapter, the thesis discusses briefly the current urban transport scenario in Indian cities to provide the necessary understanding of the existing urban transport issues in India. It provides the background to the specific context and the objectives of the research.

Presently, Indian cities are home to an estimated 377 million people or 31.16% of the country's total population (NIUA, 2016). By 2050, it is estimated that 60% of Indian population will live in urban areas. Cities are sprawling beyond the boundaries into peri-urban areas. Urban built environments are growing at twice the rate of urban populations, reflected directly in the increasing urban sprawls(NIUA, 2016). Although, the hurried urbanization process has generated economic, social and physical growth of the Indian cities, it also has given birth to many complex urban challenges for the urban transport sector by creating concerns such as large scale supply demand of public transport; severe congestion; environmental degradation(Joshi et al., 2017).Consequentially, the predominant trends in urban transportation of Indian cities, seem to be increasing motorization, shrinking share of the modal use of the public transport(PT) and non-motorized transport (NMT) and increasing negative environmental and social externalities(Hoyez and Martin, 2014, KPMG, 2017).

With the rapid and substantial increase in mobility demand over the past few decades, public transport systems have not been able to keep up with the pace, resulting in the massive increase

Figure 3: Current mobility condition in Indian cities (AutoPortal, 2018)

in the private motorization. The motor vehicle growth rate in India is 9% per annum against the urban population growth rate of 3.16% per year(Hoyez and Martin, 2014). The number of registered vehicles increased from 55 million in 2001 to 142 million by 2011 (Baindur, 2015)(figure 4); till 2016 it is estimated 195.6 million(Singh, 2016). Among this, the number of two-wheelers is escalating almost exponentially, constituting about 75 % of this increase(Singh, 2016). According to venter, there are three new vehicle registration for every birth in India (Venter et al., 2019). This excessive growth of private vehicle use is making the congestion problem more extreme which in turns is creating adverse impact on the urban environment, incurring economic losses and health hazards. The booming automobile industry and its appeal of easing the mobility and accessibility with supporting infrastructures are discouraging the use of public transport in most cities of India.

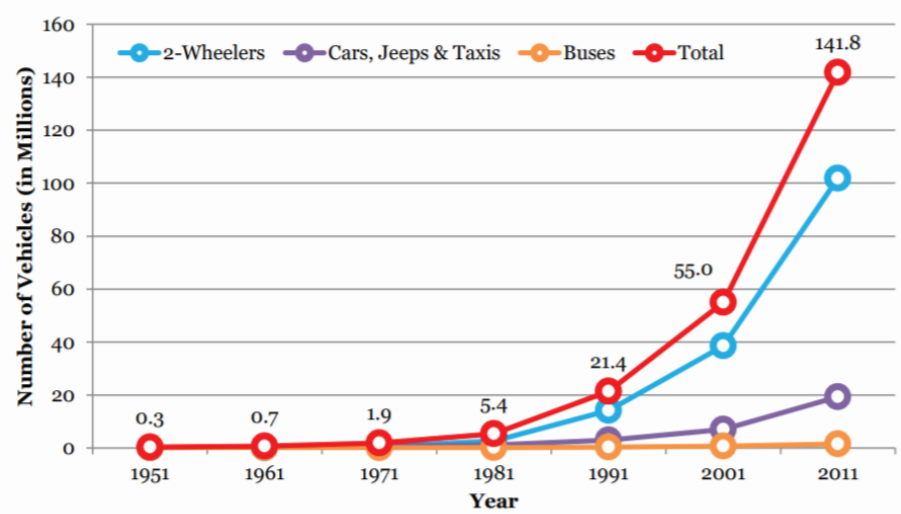

Figure 4: registered vehicle growth in India (Baindur, 2015)

As a consequence of increasing preference for private automobile modes and lack of efficient service, the share of public transport use is decreasing in India dropping off the modal use to 25%-35% in 2018 across the major cities compared to the 80% PT use in 1994 (Prasher, 2018). According to a government survey data on 2016, the share of public transport is just 18.1% of work trips (Singh, 2016). Despite a large number of population are dependent on public transport, in India the trips made by public transport daily is only around 7% (figure 5) , whereas in most other countries across the world is 30-35%(KPMG, 2017)

Country	Estimated Public transport share in total trips (per cent)
India	7*
Australia	17
U.S.	9
Singapore	86
Brazil	29

Figure 5 : PT share in total trips across selected countries (KPMG, 2017)

Experts assert that transport sector in India is extremely energy intensive and need to prioritize investments in public transit to curb the increasing private motorized mobility(Venter et al., 2019). The state of the public transport in most Indian cities has de-graded over the years. Bus services in particular have deteriorated, and their relative output has been further reduced as passengers have turned to personalized modes and intermediate public transport (such as three-wheelers and taxis), adding to traffic congestion, air pollution and traffic accidents (Joshi et al.,2017,Baindur, 2015).

India possesses 1.2 buses per thousand people which is below per developing nation's benchmark. Moreover, only 63 of 458 Indian cities of more than 0.1 million population have a formal city bus system; among which, only 15 cities have a bus or rail-based mass rapid transit system (Times of India,2018). Data(figure 6) shows a steady decline in bus registrations since 1961(Baindur, 2015).

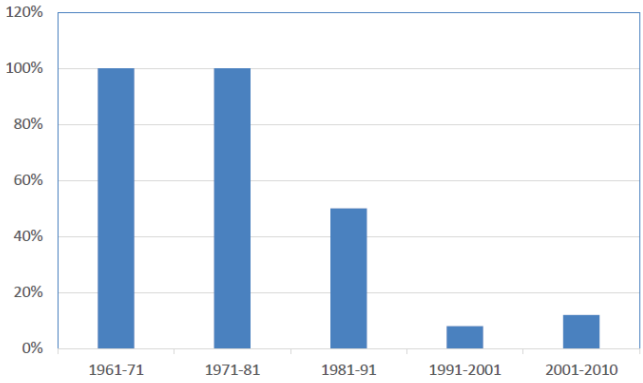

Figure 6 : Decadal growth rate of PT bus fleet in India (Baindur, 2015)

For further example, the following graphics by UITP(International Association of Urban Transport) India, in figure 7 represents the vehicular growth of Pune city in recent years, where it shows the decline in bus numbers from 5,536 in 2010 to 2,540 buses in 2018 and increase of two wheelers and cars to 2.7 and 0.6 million during the same period. This is a common scenario in most of the Indian cities due to which the cities are choking up with extreme congestion and air pollution and creating disproportionate burdens on their citizens (UITP, 2018).

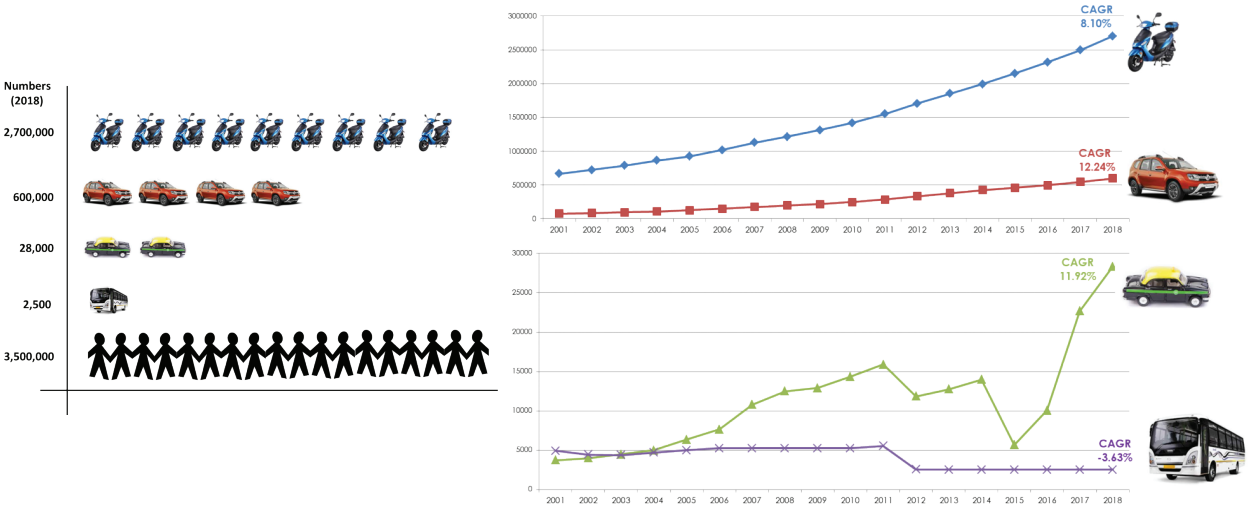

Figure 7: growth of private and public vehicle in Pune, 2000-2018 (UITP, 2018).

As a further matter, NMT(non-motorized transport) has been one of the predominant modes of movement in the Indian cities. Figure 8 represents the transport modal share in major million plus population Indian cities. It seems on average, the share of non-motorized transport in the city is around 30%.(Nasim and Chattopadhyay, 2018).

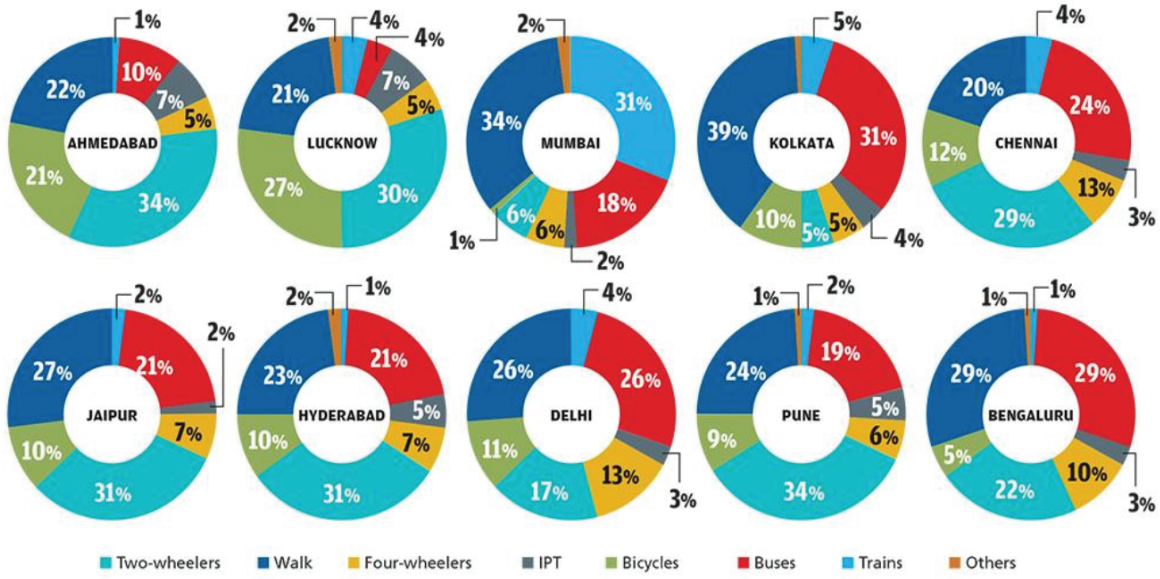

Figure 8: modal share in million plus cities in India (Nasim and Chattopadhyay, 2018).

However, the condition of the non-motorized transport infrastructure is poor in most Indian cities due to the current increasing urban sprawl and heavy motorization trend. In most Indian cities, hardly 30% of the streets has pedestrian walkways, even then they are encroached by parking or other activities or sometimes in delipidated conditions (Suryanarayanan and Ro, 2019). Despite being a prominent mode, the walking and cycling mode usage are declining gradually due to the inadequate provision of NMT infrastructures (figure 9). Although many cities in India has been working on developing well designed pedestrian and bicycle lanes, in many cities the situation are really poor (for example: Pune, Delhi, Bangalore, Ahmedabad etc.). Even so, the private vehicles are still favored over the NMT users in the roads(Litman, 2002).

Figure 9: Poor pedestrian conditions in Bangalore (Gatty, 2020)

The government of India has been actively working on multiple transport incentives acknowledging the need of a paradigm shift towards sustainable transport practice (KPMG, 2017). The urban transport authorities have adopted new strategic visions and objectives through National Urban Transport Policy (NUTP), 2006 to ensure sustainable, equitable transport system for the people of India. Many supporting policies and schemes such as 'National Action Plan on Climate Change (NAPCC)', 'Green Mobility Scheme', Smart Cities Mission, Jawaharlal Nehru Urban Renewal Mission (JnNURM) have been launched in different timeline to operationalize the sustainable transport visions. Modal share of Public transport and NMT modes has been emphasized and the cities have adopted elaborate plans to enhance the public transport and NMT capacities. Under JnNURM scheme, large scale public transport improvement and extension has been funded and operationalized (KPMG, 2017). Yet the comprehensive outcome of all these initiatives is yet to be seen. Indian transport system still seems to be inefficient under the pressure of uncoordinated governance system, political biasness and inadequate planning system skewed towards automobilization(Vaidyanathan et al., 2017).

Such automobilization tendency is reflected in the actions taken under different circumstances. For instance, despite the increasing emphasis towards public transport network development, the budget distribution of transport sector seems to be skewed towards road infrastructure improvement which promotes the automobile use. According to The National Transport Development Policy Committee, urban transport in India will need , Rs 10,900–18,500 billion estimated budget , of which public transport alone will need almost 55% (CSE, 2019). But, The Ministry of Housing and Urban Affairs(MoHUA)'s has allocated only 11.5% of their 2011-31 period budget to the mass transit, 44% is allocated for the road development and the rest is for the other purposes(figure 10)(KPMG, 2017).

Figure 10: Transport fund allocation by MoHUA (KPMG, 2017)

Institutional inefficiency is one of the significant barriers for Indian cities in achieving the desired outcome of different transport strategies Indian transport system does not have any integrated governing authorities to oversee the total transportation planning system. There are multiple segregated ministries, departments and organizations across the central, state and city levels, involved in different tasks regarding urban transport planning and implementation (figure 11). This fragmented nature of the institutional framework results in the lack of proper coordination and disoriented focused on realizing transport goals (Vaidyanathan et al., 2017, Baindur, 2015, Hidalgo et al., 2012).

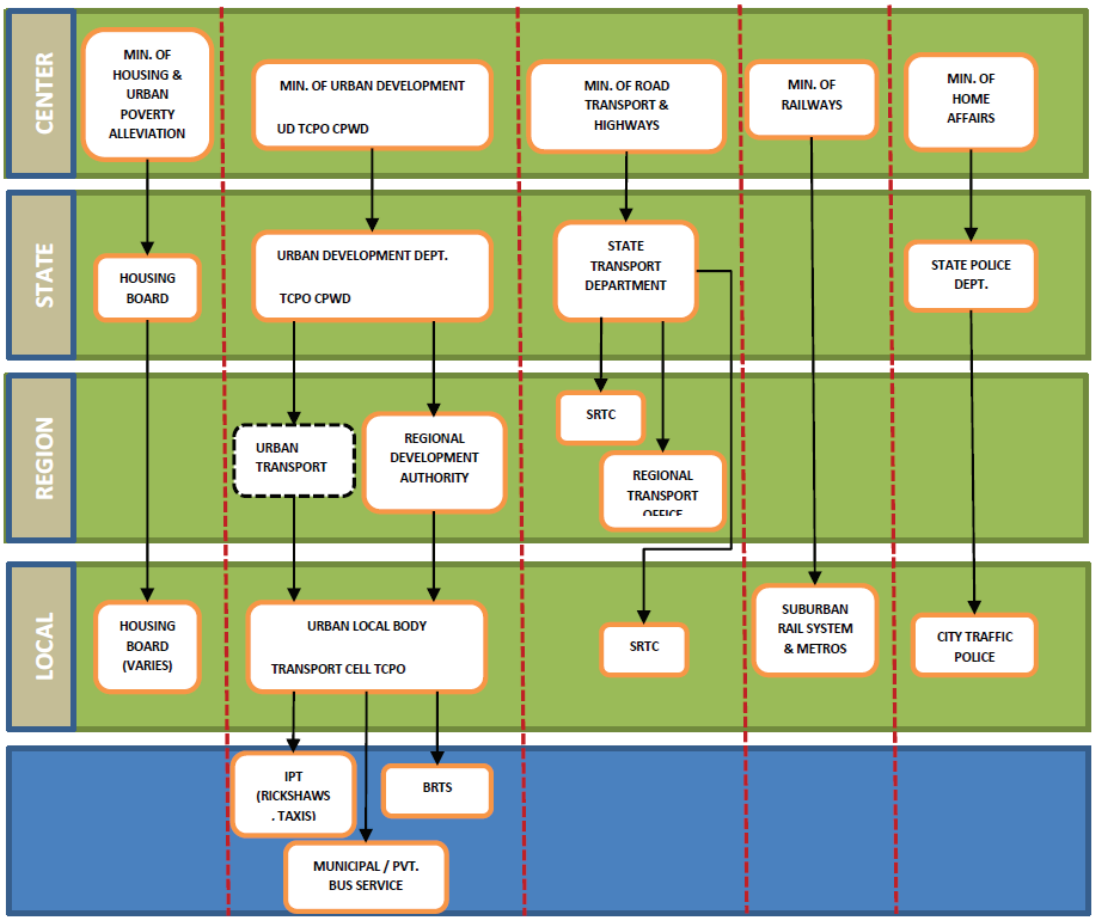

Figure 11: Hierarchy of institutional framework with function of managing land use and transport in Indian cities (Baindur, 2015)

Moreover, the centralized power system does not enable different agencies to act upon their need and goals without the approval of the central authority. Transport system in India is a state affair, therefore the city level authorities require financial support and permission to enact and implement transport initiatives from the national and state level. Which many times compels

the local govt. to follow through the state agendas rather than their own needs (Vaidyanathan et al., 2017, Baindur, 2015, Hidalgo et al.,2012). Even though, Indian constitution (amendments act 73rd and 74th) enables the local government bodies to use power to responds to local issues and needs, the decentralization of power in different levels has not been realized enough to ensure freedom to the city levels to work with their own transport agendas. Also public participation in transport planning in planning system still represent tokenism not aiding the community to be active part in the planning structure.(Maiti et al., 2017). Although NUTP has mandated to create integrated transport governing bodies in national state and local level, very few states have been able to take up on that and due to the restricted power and authority, they are not able to perform as desired (Vaidyanathan et al., 2017, Baindur, 2015, Hidalgo et al., 2012).

Urban transport planning in India is evolving gradually, going through social, environmental and economic challenges the cities are facing to ensure an efficient transport system for all urbanites.Rapidly growing private vehicles, low quality and decreasing public transport ridership, congestion, high transport expenditure (figure 12 shows high transport affordability index of several major Indian cities among other global cities) combining with inadequate land use and transport planning structure have created a dire transport crisis in Indian cities (Prasad, 2013).

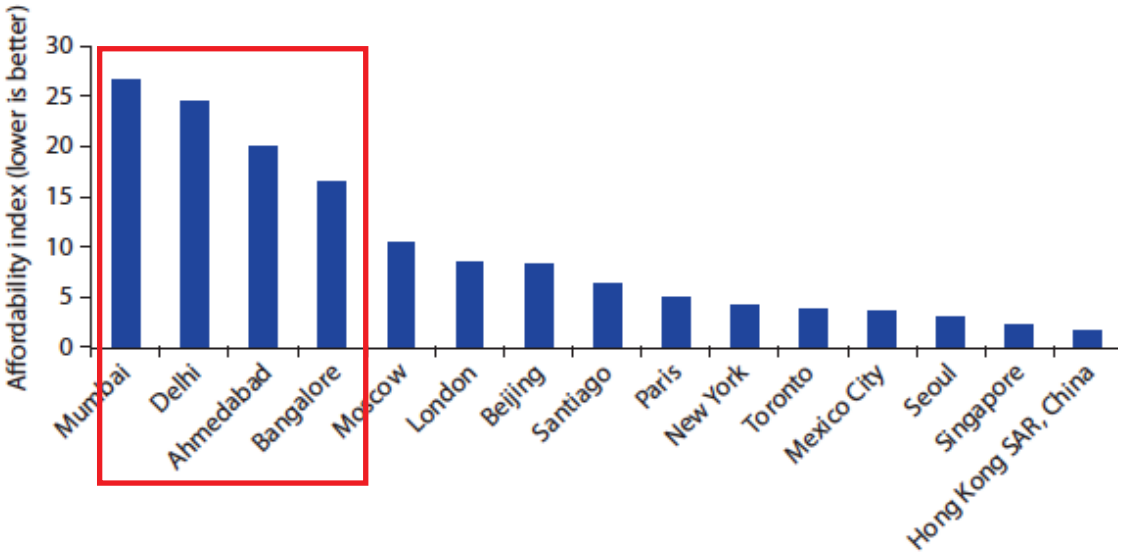

Figure 12: Public transport affordability Index of different cities worldwide (Prasad, 2013).

As well as any developing countries, the poor are suffering the most from these severe and worsening transport problems. Indian cities have a large proportion of low income marginalized working class population group. Without efficient and affordable public transport facilities, vulnerable walking and cycling infrastructure, their access to the livelihood opportunities get more restricted, whereas it is them who needs the mobility support most. Yet the government policies seem to be inclined to serve the minor upper class, by allocating more funds towards roads infrastructure that promotes private vehicle use and providing less policy and financial support towards affordable PT (bus, suburban rails) and NMT modes (Pucher et al.,2005); consequently , creating a great social equity concern in the Indian transport planning sector.

3. RESEARCH CONTEXT AND OBJECTIVES

Continuing the discussion from last chapter, this chapter develop the context of the research. It also presents the aim and objectives of this research and a set of guiding questions to achieve that.

3.1. RESEARCH CONTEXT

Urban transport is a very critical element of urban development that affect the access to livelihood opportunities of the individuals in the society and the holistic economic growth of the cities. But, in the urban society, the poor and vulnerable population groups always suffer from the negative externalities of the complex urban transport problems since they are underrepresented in the transport policies and goals. Due to their lack of political and economic power to influence policy makers, transport policies generally focus on the needs of the automobile-owning upper class, by focusing on unaffordable expensive transport modes, directly or indirectly encouraging private vehicle use by investing in road infrastructure etc. Thus, the poor and marginalized groups who already lack the livelihood resources become more impaired by restricted mobility (Pucher et al., 2005). However, to ensure sustainable public transport in cities, this large proportion of urban population cannot be ignored specially when it is them who needs the most support to access life opportunities. Hence, although still

not emphasized enough in the most cities' transport planning, ensuring equitable transport system is paramount to the cities' urban development strategies, particularly in developing countries, where, a large share of under-privileged individuals is present(Di Ciommo and Shiftan, 2017).

From the previous chapters' discussions of Indian current transport scenario, it is apparent that the Indian cities are going through a complex transport development growth burdened with a lot of negative externalities. But as one of the active actors in embracing sustainable development goals initiatives to battle the emerging urban issues, the country has stepped forward taking initiatives to fight back the increasing pressure of transport demand, booming automobiles in the streets, congestion and carbon emission.

To cope with the increasing demand and as a measure to bring shift in the modal use from private to public transport the country is more organized people centric transport policies; the cities are endorsing heavily on the enhancement of public transport capacity (metro system, BRTS, city bus service); also, recently focusing on developing NMT networks. Whereas all these initiatives are a positive step towards the changing paradigm of transport planning indicating the boost towards economic development and environmental consciousness, there are certain practices that question the depth of the social sustainability of the transport system of the country.

Among the many public transport initiatives that have been implemented and ongoing in Indian cities, there still seems to be a lack of priority for the affordable, cost effective transport modes such as suburban rails, city bus system, BRTs and NMT. Despite of NUTP's (National Urban Transport Policy) people centric transport objectives and their own pro-poor sustainable transport mandates, various adopted urban development schemes have shown less priorities in these modes than the capital-intensive big infrastructure projects. For instance, among JnNURM's (Jawaharlal Nehru National Urban Renewal Mission, a city-modernization scheme launched by the Government of India) total transport infrastructure fund 70% has funded roads and flyovers, while only 15% has been allocated to mass transit(Hidalgo et al., 2012). Besides, despite claiming to focus on making cities more pedestrian-friendly, the Ministry of Urban Development (MoUD) India's 'Smart City Mission' (SCM) has allocated only 8 per cent of the Rs. 20,500-crore budget for urban transport for creating 'walkable localities', which is less than

the 15% for parking and the largest share is for road infrastructures (Kukreti, 2018). Furthermore, the analysis of the cities' individual transport budgets shows a tendency to invest more in motor vehicle related projects rather than the public transits and NMT projects (Hidalgo et al., 2012). As it happens, it is also observed that even in the mass transit development, expensive metro projects are being promoted over the more cost effective, affordable bus system in most of the cities(Vaidyanathan et al., 2017). Even due to the lack of pro-poor strategies the bus services sometimes become out of reach for the urban poor (Mahadevia et al., 2013).

Poverty and inequality have been always major concerns for the Indian cities. And it is the marginalized poor groups that always suffers and need the most support in transport to access different livelihood opportunities. Almost one third of India's population lives in slums (17.4% of the urban population) according to the census, 2011(Johnson, 2013). and 22% people lives below poverty line. There is an even bigger percentage of people who just live very near to this line(Sharma, 2019). Therefore, it can be said that a good number of populations in the Indian cities have affordability issues.

According to study of CSE(Center for Science and Environment) India (CSE, 2019), in India people spend average 15% of their household incomes in transport expenditures which is the higher limit of the affordability standard and considered above average. More importantly, the percentage is higher among the lower skilled labors than the high skilled groups meaning that low income group spends more on the transport than the mid and high-income groups. The study (figure 13) analyzed the different modes of public transport costs in Delhi, Ahmedabad and Bangalore and shows that adding up the fast and last mile mobility cost with already above average public transport cost compelled limited income groups to shift to the cheapest mode such as two wheelers and the poorest to the walking and cycling as last resort (CSE, 2019).

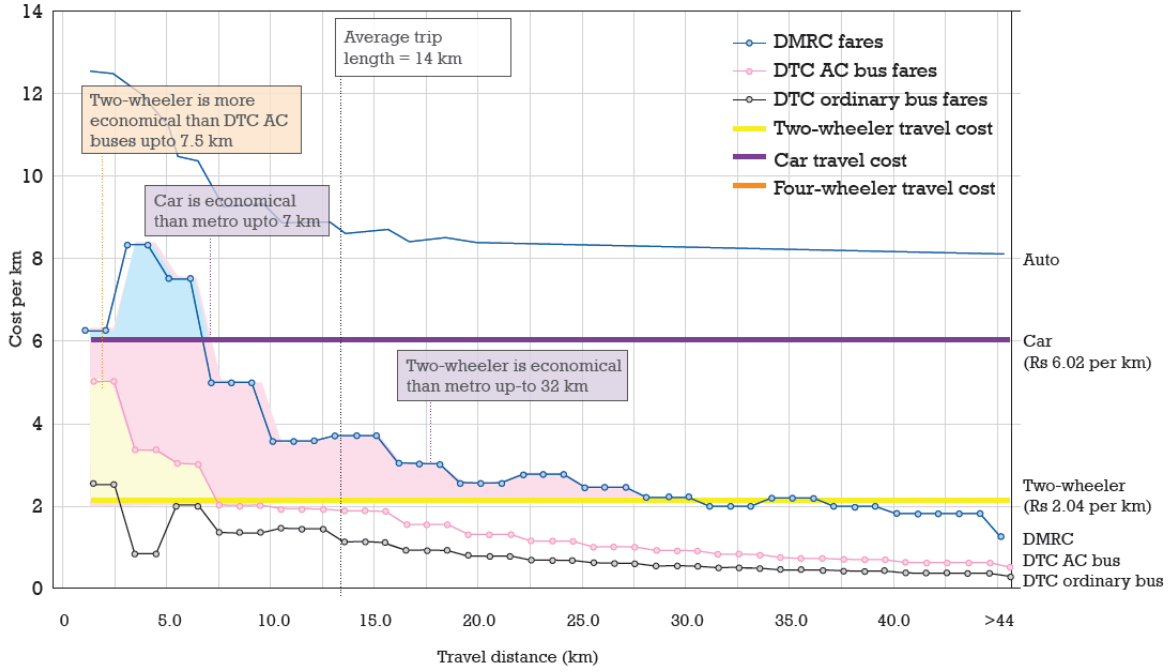

Figure 13: mode-wise travel cost in Delhi (CSE, 2019).

From the above frame of reference of India's transport investment trends, there seems to be a disconnect between the national transport vision and the transport project priorities. It raises question about how does the transport system impact the economically disadvantaged groups in the society? How the outcomes of multiple elaborate transport project distributed among the different social groups in urban areas?

With the growing social awareness worldwide, understanding the equity implications of transport policies and investments is becoming increasingly important. Therefore, this research is set in the context of understanding the implication 'social equity' aspect in the transportation planning of Indian cities given its vital role in the sustainable transport development.

3.2 AIMS AND OBJECTIVES

The aim of the thesis is to understand the existing social equity scenario in Indian transport. It tries to investigate how much importance is given to the issues in Indian transport policies in selected 6 major cities and how it is operationalized in urban transport initiatives in these cities. The major objectives are-

i. To study the important role of 'social equity' factor in urban transport planning to achieve sustainable development

ii. To explore how social equity is defined in Indian cities urban transport policies and reflected in different transport initiatives implementations.

To fulfill the objectives the study will try to find the answers of the following questions-

1. What is the importance of 'social equity' in attaining sustainable urban development?

2. How is 'social equity' generally addressed in urban transport planning?

3. How is the issue reflected in Indian transport plans and policies in the selected 6 cities?

4. Are the initiatives for sustainable transport system facilitated in India able to address the social equity effectively? Who benefits from the current transport infrastructure?

5. What are the gaps between the policies and practical implementation?

4. LITERATURE FRAMEWORK

In this chapter, the thesis studies and discuss the key concepts of the research on social equity in transport. It draws knowledges from the available transport literatures and tries to understand the concept of social equity, its role in the sustainable transport development and how to comprehend its implementations in the transport regulations.

4.1 SUSTAINABLE TRANSPORT

Urban transport is a crucial element of urban system which plays a great role in mobilizing the economic growth of the system and has a wide range of impacts on many other aspects (social & environmental) of urban environment and on varied groups of individuals. Transport serves as a mean to move resources and to reach opportunities and needs of the people. It is the bloodline of the urban growth, therefore a sustainable urban transport system has a vital role to play in the sustainable urban development of the world cities (World Bank, 2002, Manaugh et al., 2015, Litman and Brenman, 2012).

In line with the sustainable development concept sustainable transport also has economic, environmental and social component to consider (Manaugh et al., 2015). There are many ways to define sustainable transport, this thesis finds the definition from the European Commission (EC) very comprehensive and relevant. According to EC's Joint Expert Group on Transport and Environment, a sustainable transport system is one that:

1. "allows for basic access needs and development of individuals, companies and societies to be met safely and in a manner consistent with human and ecosystem health, and promotes equity within and between generations;
2. "is affordable, operates efficiently, offers choice of transport mode, and supports a vibrant economy and regional development; and,
3. "limits emissions and waste within the planet's ability to absorb them, uses renewable resources at or below rates of generation, and, uses nonrenewable resources at or below rates of development of renewable substitutes and minimizes the use of land and the generation of noise" (COMMISSION OF THE EUROPEAN COMMUNITIES, 2004, Litman, 2019).

Ensuring social equity has been always considered one of the crucial elements of sustainable transport concept as it has been one of the central pillars of the sustainability concept (figure 14).

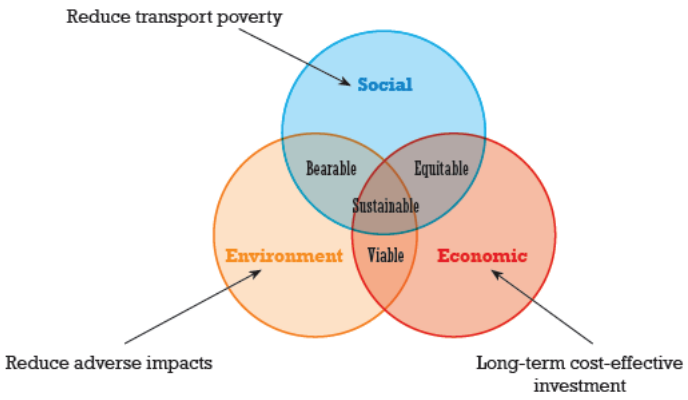

Figure 14: sustainable transport concept (CSE, 2019)

The United Nations sustainable development agendas acknowledge the need of sustainable transport for cities and prioritize people's accessibility to urban facilities and social equity (IRU, 2016). Sustainable transport is a prevalent theme in the 2030 Agenda for Sustainable Development as it is represented in at least 8 of the 17 Sustainable Development Goals (SDGs)

and makes direct and indirect contributions to at least 13 SDG targets. Transport issue is directly related to the five SDG indicators (Yiu, 2019) in figure 15.

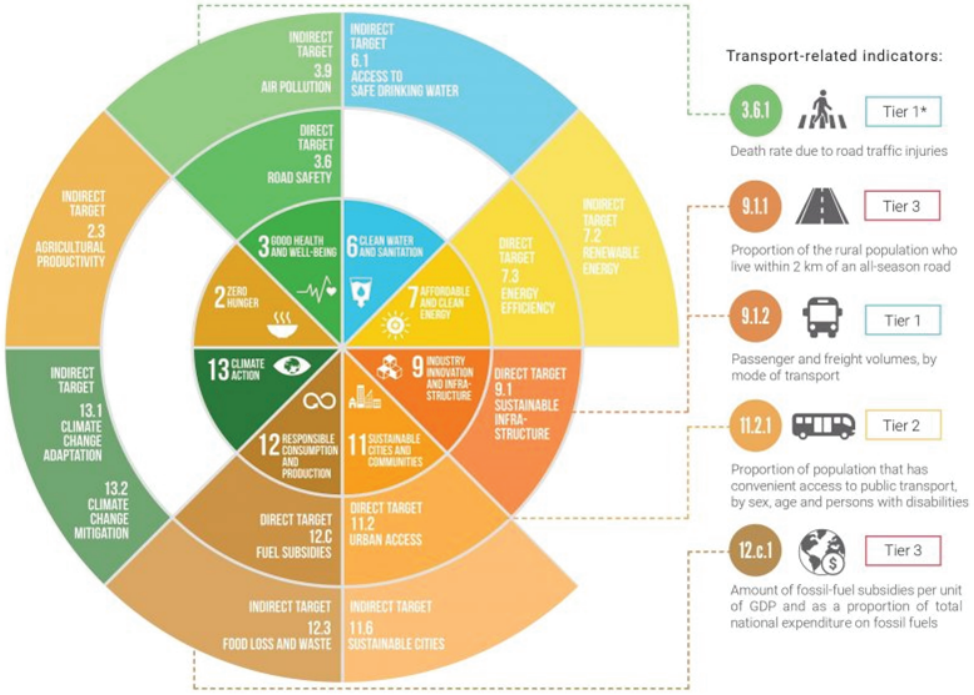

Figure 15: sustainable transport relevant SDG indicators (Yiu, 2019)

The SloCaT report on Sustainable Development Goals (SDGs) observed that although there is a clear connection between transport and infrastructure & energy-oriented development goals, its coherence with the social parameters of sustainable developments should be more explored and emphasized to achieve the goals related to poverty alleviation, food security and social equity to achieve the agenda 2030's vision- 'Leaving No One Behind'(SLoCaT, 2019). Global transport literatures, also potently refers that ensuring 'social equity' is a prerequisite for any kind of sustainable development (Litman and Brenman, 2012, Martens et al., 2019, Carleton and Porter, 2018).Hence, it is indisputable that 'social equity' plays a pivotal role in enacting 'sustainable urban transport 'in cities globally.

4.2 SOCIAL EQUITY

Social equity refers to the equitable or fair distribution of impacts (benefits, disadvantages or costs) among the individuals. Essentially it is a form of distributive justice concerned with the

morally proper distribution of the benefits and burdens of some service, policies or actions over the heterogenous group of people in the society(Martens et al., 2019, Litman, 2002). The term 'Equity" is often confused with 'Equality' and it is crucial to distinguish between the two when analyzing social equity parameters. Equality refers that all individual or groups have the same rights and therefore gets equal opportunities. But equity suggests providing necessary support and opportunities to the vulnerable individuals or groups so that they can avail the same right as others who are in a better position. For instance, in case of public transport everyone has equal rights to public transport service. But due to different social or economic constraints such as affordability, gender, or physical issue etc. many cannot access the service fully. Social equity consideration in transport ensure their right to access the right properly(Carleton and Porter, 2018).

Based on the above definition, three key components of 'Equity' are distinguished to focus in social equity study. They are - a). distributed benefits and disadvantages; b). the population group over which they are distributed; and c). the principles for determining the justness/ fairness of the equity measure(Martens et al., 2019, Carleton and Porter, 2018, Di Ciommo and Shiftan, 2017).

4.3 EQUITY IN TRANSPORT PLANNING

Since, transport system has a far-reaching impact on people's livelihood opportunities it is important to ensure the impact is distributed fairly among individuals with different needs and burdens. Each transport initiative produces many benefits and burdens as outcome that affect the society. They provide benefits such as access to the basic needs (education, job, health facilities etc.). Also, they may create various direct and indirect costs. For instance, increase overall household expenditures, health risk due to traffic accidents and pollution, congestion delays, opportunity loss forced relocation, etc. All these risks and benefits affect the diverse population in a society distinctively, especially the vulnerable and marginalized groups such as low-income, women, elderly people, different ethnicity, migrants etc. Due to their already existing vulnerabilities and obstacles, they take the brunt of direct and indirect costs of the transport strategies. Hence, social equity in transport is a critical issue to consider for ensuring fair distribution of the impact of this very important service. Although the environmental and

economic impact of transport have been discussed elaborately in the literatures and transport planning, the social impacts have not gained enough acknowledgements(Caulfield et al., 2014).

As a multidisciplinary term, equity can be defined from different perspective. In the transport literature, according to Litman(Litman, 2002) , there are three categories of equity –

1. Horizontal Equity, which refers that each individual and groups should get equally treated in terms of resource/benefit/risk and cost distribution. This is the egalitarian perspective that believes that no one should get more favors compared to others in the society. The distribution of the risks or benefits should be equal unless concessions or favors are specifically justified.

The other two are of vertical equity category that focuses on the distribution of the impacts of the transport initiatives among different socio-economic groups who differs in resource, abilities and their needs-

2. Vertical Equity regarding Income and Social Class- it promotes transport policies and plans that favors the marginalized groups in the society to balance the overall inequalities by providing special support for them like subsidies, discounts etc. This equity category concerns with the disadvantaged populations based on income, gender, race, age etc. who have limited opportunities and advocate for providing them with the additional helps to access the facilities and services.

3. Vertical Equity regarding Mobility Need and Ability, meaning that transport facilities and services provides for all who have mobility need including the users with special needs. This category mainly promotes the universal accessibility in the transport facilities for the differently able users. (Litman,2002)

Usually the transport equity related literatures focus on the issue of vertical equity as it concerns with different socio-economic groups and their inequitable experiences from different transport projects and policies. This stratification of the disadvantages or vulnerable groups can be done regarding the gender, race, ethnicity , income or employment status, immigration status and physical disadvantages (Carleton and Porter, 2018, Martens et al., 2019).

Economical vulnerability is one of the key concerns of the transport equity issue. The interrelation between transport and poverty has been long discussed and addressed in different transport literatures and urban development studies (Jennings, 2016, Di Ciommo and Shiftan, 2017, World Bank, 2002). The disproportionate distribution of transport facilities and outcome is more prominent among the low-income groups where limited income combining with less opportunities to basic services make the groups more vulnerable in the society. Also the other marginalized groups such as differently able , different ethnic people, women etc. due to their inherent vulnerability to access opportunities become also financially vulnerable and thus facing similar issues like low income groups(Pereira, 2018).Hence, it is essential for the transport policies to provide these underserved social groups the extra support they need to avail the transport service like the other citizen. Integration of the specific strategies for providing affordable transport modes public transport opportunities, financial support such as subsidies, reduce the cost of transport externalities etc. can help to minimize he gap between the common people and the vulnerable ones (World Bank, 2002, Karner et al., 2016). Therefore, analysis of equity parameter in the transport policies and projects for the low-income groups is imperative.

4.4 MEASURING SOCIAL EQUITY

Due to its multi-faceted nature measuring equity is a complex process and there is no particular process or system to measure it and the outcome heavily depends upon some predefined boundaries (Martens et al., 2019, Di Ciommo and Shiftan, 2017, Litman, 2002). Globally different approaches such as spatial mismatch analysis-based approach, gap analysis, Gini index and Lorenzo curve approach, statistical methods (such as correlation, regression modeling etc.) have been used to analyze different aspects of equity. But these methods cannot individually provide a comprehensive equity scenario of a distributive outcome (Yujie et al., 2018). Elaborated discussion of these methods is not in the scope of this study as it focuses more on the discussion of equity inference in transport planning and policies. For that, it discusses the major elements of equity analysis.

Transport Equity literatures(Martens et al., 2019, Di Ciommo and Shiftan, 2017) contend that it is important to determine the distributives and the desired outcome before evaluating it. What

kind of benefit or burden is being distributed, over what kind of population group, what kind of distribution can be considered moral or proper in that analysis – these are the questions that frame the equity analysis. Based on these questions, a three step framework for equity analysis is proposed (Yujie et al., 2018)-

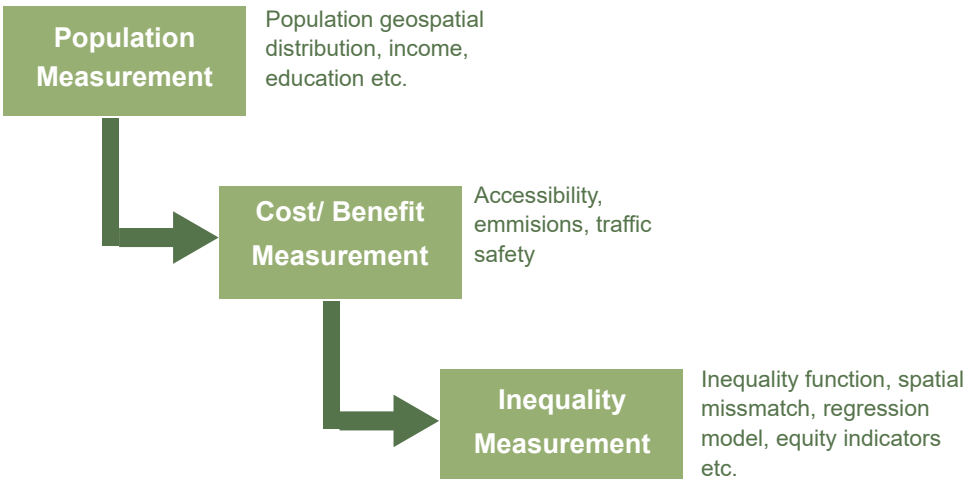

Figure 16: equity assessment framework (Yujie et al., 2018)

The 1st step defines the population groups among which the distribution of impact will be considered or distributed; for instance- low income quantile, women, elderly etc. The 2nd step identifies the benefits or cost that will be measured such as accessibility to the public transport or jobs among different income groups. The third step is to measure if the distribution of the impact is fair or proper regarding the context using target indicators, scientific data analysis etc. (Yujie et al., 2018).

Furthermore, as stated before that transport has a wide range of impact in economic, social and environmental sphere of urban system, equity can be analyzed from many different impact perspectives. Marten and Lucas (Martens et al., 2019) discuss four key dimensions of transport equity analysis – Mobility/Accessibility; Traffic related pollution; Traffic safety; and Health. They suggest that transport equity analysis should measure the impact of any transport facility or policy against these key parameters over disaggregated population group. Additionally, they also emphasize on following key concerns for an equitable transport system-

- A fair allocation of transport resources
- A fair opportunity to get accessibility to the key life chances activities

- Reduction of adverse effect of transport system
- Widening participation in decision making process

To ensure the fair distribution of the transport resources, life opportunities risks and participation it is necessary to have a proper distribution standard in the transport planning. From the equity perspective, it is highly imperative to define the standards/indicators that represent the clear picture of the distribution of the impacts across the disaggregated population (Di Ciommo and Shiftan, 2017, Litman, 2002, Martens et al., 2019, Pereira, 2018).

Unfortunately, traditional transportation analyses are inclined to measure the economic aspects such as reduction of congestion, travel cost, increase travel speed, ridership, traffic safety etc. and later in recent years, environmental aspects like carbon emission, pollution level etc. are also included in the planning considerations (Litman and Brenman, 2012). Whereas, the presence of social equity assessment is very fractional or overly generic. The reason behind this might be the complex and tangible nature of the social parameters that are difficult to define than the economic and environmental ones which are easy to measure in the usual transport evaluation process of cost benefit analysis (CBA). But, the traditional cost benefit analysis framework for most transport project evaluation fails to incorporate the equity impact in monetary terms therefore in most cases the equity analysis does not represent the wholesome picture.

Globally we have seen evolving of many indicators measure the economic and environmental impacts of transports systems. But there are no standard and significand indicators to evaluate the social equity factors of these transport plans and policies. (Litman and Brenman, 2012, Martens et al., 2019) In most cases of transport equity analysis, there seems to be lack of the standard as to what is equitable in terms of distribution (for instance, what is exactly affordable or accessible for the diversified groups) and necessary indicators. Even if there are indicators, mostly they fails to represent the data in disaggregated scale(Pereira, 2018, Jennings, 2016). For instance, none of the commonly used transport evaluation indicators such as public transport frequency, distance to public transport, quality of the services, job % near public transit etc. adequately reflect on the fairness of the outcome that facilitate the poor or the other vulnerable groups to fulfill their needs (Jennings, 2016).

Accessibility has been one of the key measuring elements in the transportation and equity analysis literature as it is the key goal of all transportation services to ensure access to all life opportunities by all group of populations(Di Ciommo and Shiftan, 2017, Litman, 2002, Pereira, 2018). Littman encouraged accessibility-based transport planning as it focuses on people centric transport system and promotes equity objectives. There are vast transport literature on accessibility analysis in transport systems and most transport policy and plans set targets and indictors to improve accessibility towards public transports(Pereira, 2018, Jennings, 2016). In transport planning equitable transport is vastly measured by the increased level of accessibility of public transport opportunities. Nevertheless, in most cases, the analysis process and used indicators fail to assess the outcome of the increased accessibility limiting the proper evaluation of equity scenario(Pereira, 2018, Jennings, 2016).

Most the of the accessibility evaluations of transport projects conducted by academics and transport authorities are based on cumulative opportunity measures, mainly because they are easy to communicate and have few data requirements. For instance, spatial accessibility to public transport or to job opportunities is one of the most used indicators of accessibility measurements in transport planning)(Pereira, 2018). But just this single notion of 'increased access to public transport or jobs' does not ensure that the poor or marginalized segment are able to successfully utilize this accessibility opportunity (Jennings, 2016).

Therefore, to evaluate equity measures it is important to adopt a multivariable study approach for accessibility so that the accessibility indicators can represent the holistic picture of the transport initiative outcomes (Boisjoly and El-Geneidy, 2017, Caulfield et al., 2014, Litman, 2002). The need of a properly designed evaluation process with relevant indicators to represent the positive/negative changes after implementation is highly recommended in the literature (Martens et al., 2019, Pereira, 2018, Litman, 2002, Jennings, 2016). The table in Figure 17 presents some examples of indicators measuring transport equity by disaggregated groups suggested in equity literatures(Martens et al., 2019, Litman, 2002)

Important Indictors For Equity Analysis For Different Social Groups	
Equity measure indicators	**Possible Disaggregation**
Access to basic services (job, education, heath)	by neighborhood, income groups, gender, modes, and age
Transport cost	by income groups, modes
Travel length	by neighborhood, income groups and modes
Travel time	by income groups and modes
Availability of different modes of transport	by neighborhood, income groups and physical ability
Exposure to noise and pollution	by neighborhood, income groups and modes
Risk of health incidents due to the traffic	by neighborhood, income groups and modes
Decrease in life expectancy due to transport pollution effect	by neighborhood, income group, age and mode users
Available NMT infrastructure	by neighborhood, physical ability, and gender
Exposure to traffic risks	by income group, age, gender and mode
Level of satisfaction with transport service	by neighborhood, income group, age, gender, modes and physical ability

Figure 17: examples of indicators measuring transport equity suggested in literatures(Martens et al., 2019, Litman, 2002)

4.5 EQUITY IN GLOBAL TRANSPORT POLICIES

The transport policies worldwide, although are set to achieve equitable transport system for all, do lack sufficient focus on equity analysis measures(El-Geneidy et al., 2016, Jennings, 2016, Pereira, 2018). In recent years, social equity concerns are discussed and to some extent are included in long term transport plans but there is insufficient focus on the standard of the equity is to be achieved(El-Geneidy et al., 2016). In most cases, the equitable transport visions are not translated into clearly stipulated actions, and the policies lacks the necessary initiatives to evaluate the achievement of equity goal in an eloquent, disaggregated manner. The SLoCaT report (SLoCaT, 2019) on UN's SDGs shows that, very few of the countries in their voluntary

national reports on SDG' have included equity concerns on social sustainability elements while highlighting the sustainable transport need. Most of their transport references are infrastructure and energy based. Hence, the report recommended to explicitly incorporate the transport need of various demographic groups to ensure sustainable transport achievements.

There is not enough equity analysis integrated in transport policies and planning in cities. Most of the transport equity studies by the academics and the city authorities are ad hoc, cross sectional and empirical. For example, inequality studies have been conducted over transport supply ,accessibility to public transport or accessibility jobs in Melbourne, Perth ,San Francisco Bay area and many other countries (Ricciardi et al., 2015, Golub and Martens, 2014, Pereira, 2018). Although these analyses provide valuable insights on the equity scenario among heterogenous demographic groups, they fail to demonstrate the transport policies and investments impact behind those distributive outcomes.

To understand how the transport policies and investments change the social condition of different population groups, there is need of 'before and after implementation' data analysis. Although, this kind of analysis is getting popular in the developed countries, in developing countries it is still lagging behind (Pereira, 2018, El-Geneidy et al., 2016). But these studies are earning momentum in recent times, such as the study on the impact of BRT system implementation in Cali(Colombia), on the accessibility of the common people where it shows the benefits of the project favors mostly the middle and upper middle income groups than the poor (Venter et al., 2017b), or study on how Bogota's pro-poor subsidy policy is actually improving the accessibility of the low income groups(figure 18)(Guzman and Oviedo, 2018). Nevertheless , the integration of the equity analysis consideration in the policy stages and after implementation stage has not been done enough compared to the environmental and economic analysis of transport projects (Pereira, 2018). But it is high time to incorporate the equity parameter significantly in the transport planning system making it a fundamental component rather ad hoc or optional attribute, so that the transport initiatives can bring actual change in the social sustainability rather than just being a list of investment.

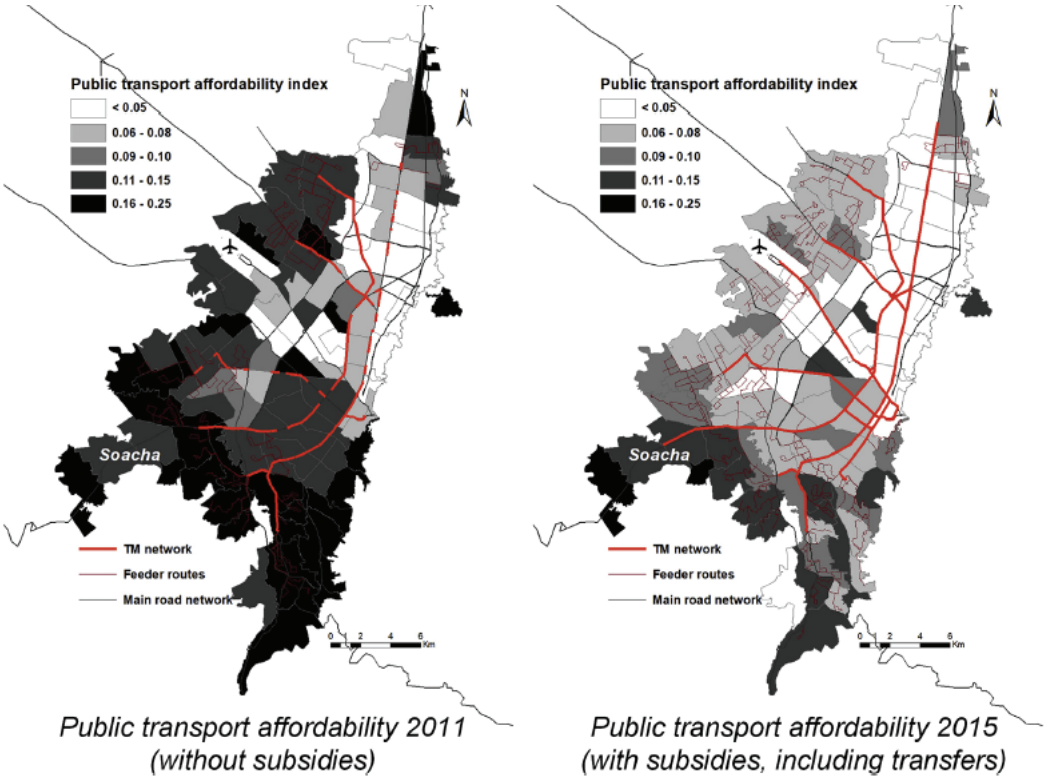

Figure 18: Improvement in public transport affordability after implementing pro-poor subsidies strategies in Bogota(Guzman and Oviedo, 2018).

5. METHODOLOGY

This chapter provides an outline of the research methodology used to answer the research questions- the research approach, the description of used data, data analysis process and the limitation of the adopted research process.

This thesis is a social research which aims to bring forth the discussion of social equity consideration in transportation planning in Indian cities. It particularly focuses on the vertical equity that analyze the public transport equity consideration for the vulnerable low-income group of people. Hence, it investigates the current city, state transport policies and development plans of six major Indian cities along with the national transport policies and visions of the country to understand how social equity is operationalized in these regulations. The practical implementation outcome of different transport initiatives taken in the cities are also investigated.

There is no single 'best' strategy to adopt for a research in general circumstances. The strategy that can achieve the aim and objectives stated in the particular research should be chosen(Denscombe, 2014). For this thesis, to fulfill the objectives of the research, 'The Case Study Approach'(Denscombe, 2014) is chosen as the research strategy, where it selects six major Indian cities (Delhi, Mumbai, Bangalore, Ahmedabad, Pune and Hyderabad) and follows through closely their transport planning and policy documents and the transport initiatives taken by the respective authorities. The case study approach is preferable for cases where the research is focusing on in-depth investigation of a specific issue in a certain context. It acknowledges the interconnection and the relationships among multiple elements in that specific context and allows the use of different data sources to accumulate data, which provides a holistic idea of the studied issue (Denscombe, 2014). Thus, this strategy is particularly suited for this thesis as it singularly focuses on vertical equity issue in urban transport in Indian cities. By selecting the cities as case studies to analyze their transport policies and trends, it helps to acquire a comprehensive knowledge of equity implication in the cities' urban transport system and the factors that affect it.

The selection of the case studies has been done according to their relevance of the research issue and available relevant data to conduct the research. Indian cities although varies in structure, culture, and economy, they have similar transport issues. Apart from being some of the major iconic urban centers of India, the selected six cities (Delhi, Mumbai, Bangalore, Ahmedabad, Pune and Hyderabad) have elaborated existing urban transport system which provides a wider scope to investigate the equity implication in multiple incidents. Besides, there are available relevant data on these cities that provides necessary support to fulfill the objectives of the thesis which is to understand the social equity scenario in urban transport policies and initiatives in major Indian cities.

Literature suggests that there are four main research methods that a social researcher can use: questionnaires, interviews, observation and documents(Denscombe, 2014). This thesis uses 'documents analysis' and 'interviews' as research method. The primary tool has been the document analysis. The necessary data for this study is mostly obtained from different secondary sources such as government publications statistics and policy documents; reports from multiple nationals and international research organizations and NGOs'; transport research journals, articles and books; relevant newspapers and website articles etc. A total of

four semi- structured and unstructured virtual interviews have been conducted with experts and academics working in urban transport field in India .

This research is based on 'qualitative analysis' and the research ground is based on the study of many transports' equity-based literature. Qualitative research is best aligned with case study approach and provide holistic perspective and context sensitivity(Denscombe, 2014); therefore, it is suitable for this thesis's purpose. Moreover, the qualitative analysis does not have any particular structure, rather is guided by the research objectives and questions(Denscombe, 2014). Hence, in this particular case, a conceptual framework is formed based on the literature and guided by the research questions to ultimately reach the aim of the thesis. For the literature studies, different transport research journals, books and papers from the experts in the transport sectors are studied to understand the social equity concept in transport system. The equity definition, its characteristics, and measuring indicators are identified through these literature studies and a framework for data analysis is created to analyze the existing transport plan and policies in equity aspect.

The thesis investigates the available transport planning and policy documents from individual cities such as comprehensive mobility plans, city development plans which represent the present and future transport visions and objective for the cities. Additionally, it also follows through the national policy documents such as National Urban Transport Policy(NUTP), National Transport Project Appraisal toolkit, Transport Project benchmarking toolkit for Indian cities from the perspective of social equity consideration in public transport and make an analysis on the characteristics of the social equity factors and indicators these national policies demonstrate.

The study investigates the following factors while analyzing the policy papers-

- Visions/objectives reflecting equity consideration
- Strategies/measures/ actions taken under equity issue for the different socio-economic groups
- Evaluation indicators related to equity

As transport equity does not have any specific structure to be measured, the analyzing components are drawn from the discussion of literature in chapter 4. The three components of the selected policy documents are analyzed against the three equity analysis elements derived from the literatures as shown in figure 19 to understand their inherent equity prospects.

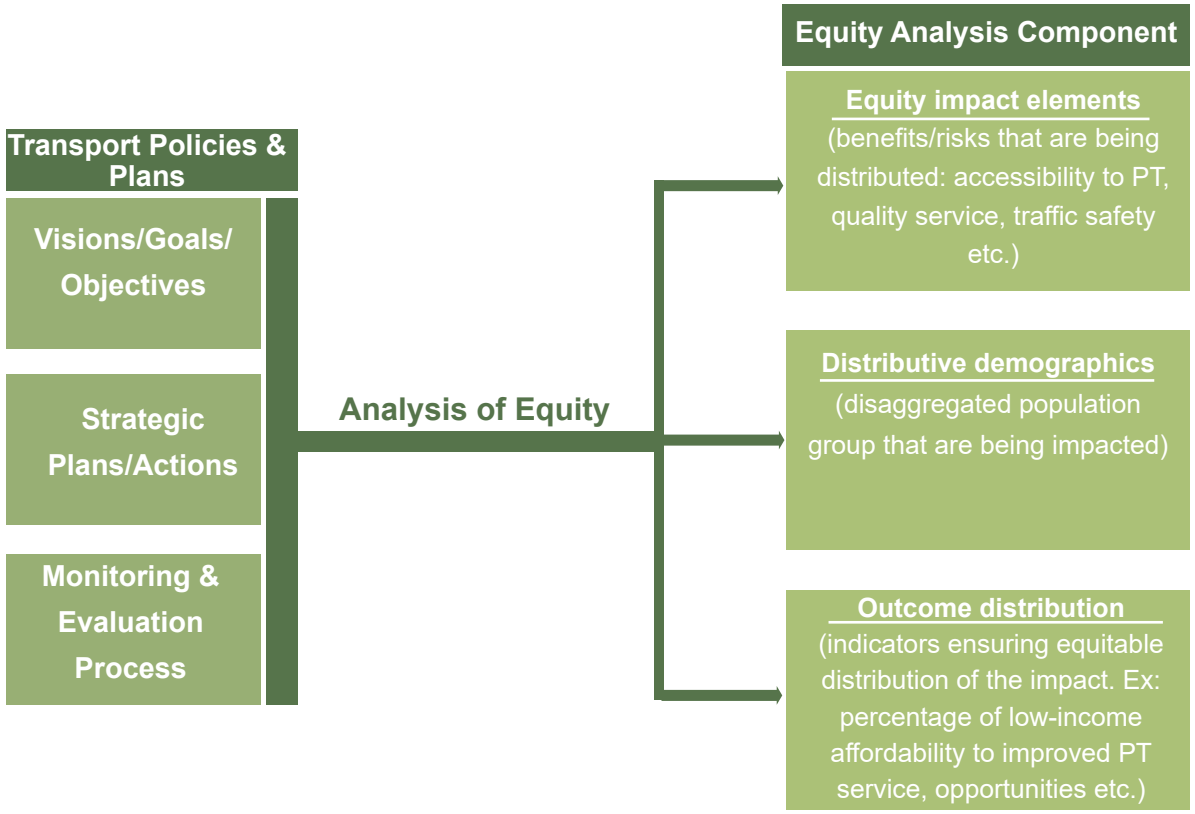

Figure 19: Conceptual Framework for equity study

Further, for an empirical evidence on the practical impact of the different transport initiatives, the study investigates the current transport facilities in these cities from the social equity perspective to understand what extent they ensure equity for various marginalized groups. Hence, in addition to the policy documents, different transport initiative impact evaluations are also studied with equity perspective. For example: how the economically vulnerable are affected by the public transit project like BRTs or metro in the cities. For these analyses, data are accumulated from different study reports, evaluation reports from various research institutes and educational institutions working with the sustainable transport development concept in Indian cities.

Finally, there are also some limitations with the research work which is important to mention. It is important to note that the study is done form the equity perspective and therefore focuses

mainly on the equity related transport objectives and evaluation indicators and do not discuss in depth on other sustainability issues. The discussion of the different initiatives such as MRT/BRT project impact and evaluation, are carried on regarding the equity impacts on vulnerable socio-economic group. It also particularly focusses on the economically vulnerable section of population and their equity among the vast strata of socially disadvantaged groups. Therefore, the affordability and accessibility to basic needs issues of the public transport has been prioritized. Although the research talks about India's overall transport equity issue due to the time and resource constraints it only selects six cities as representative case studies and several selective but important transport related national policies. The research is majorly depended on the available secondary data sources and very limited virtual interviews, as due to the unprecedented situation with the global pandemic worldwide, there is restrictions on performing fieldwork and physically communication with people.

6. EQUITY STUDY OF THE TRANSPORT PLANS AND POLICIES FROM SIX SELECTED INDIAN CITIES

This chapter present the social equity analysis of the multiple transport planning and policy documents from the national level and the six selected case study cities followed by a detail discussion in next chapter.

To understand and identify transport equity concern in Indian cities, this thesis investigates multiple transport policies and planning documents from the six major selected cities – Delhi, Mumbai, Pune, Bangalore, Ahmedabad and Hyderabad. The documents are ranging from national urban transport policy (NUTP) to individual city's comprehensive mobility plan (CMP). These are the transport blueprints that shape the country's national, state and local transportation system of the designated cities. In figure 20, a brief profile of the six selected cities on population and low-income urban population has been presented to highlight the need of equity consideration in transport system in these cities.

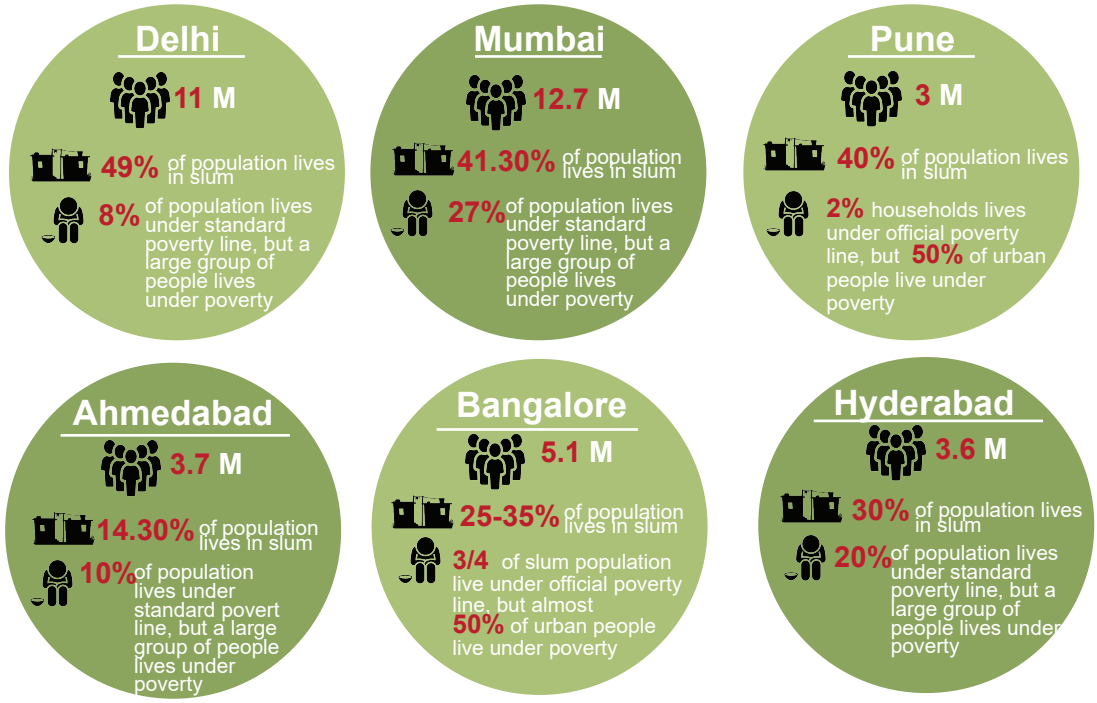

Figure 20 : urban population and low income population profile of the selected six cities (World Population Review, 2020, Suares, 2017, Killemsetty, 2013, Mahapatra, 2012, Rathore, 2015)

As stated in methodology chapter the study derives three aspects from the literature studies to look for-

- The presence of equity strategies/principles
- How different social groups are addressed (focusing on the low-income population segment)
- Evaluation process of the impact distribution of the transport initiatives.

The analysis has been summarized in the following table (figure 21) according to these three aspects and followed by a discussion -

EQUITY RELATED TRANSPORT GOALS, OBJECTIVES, STRATEGIC ACTIONS PLANS AND EVALUATION INDICATORS			
Policies/ Plans	**Visions/ Goals/ Objectives**	**Measures/ Strategic action Plans**	**Equity Component Analysis**
National Urban Transport Policy (NUTP) 2006,2014	**Visions:** To recognize that people occupy center-stage in the cities and plan for their common benefit and well-being. **Objective:** To plan for the people rather than vehicles by providing sustainable mobility and accessibility to all citizens to jobs, education, social services and recreation at affordable cost and within reasonable time.	**Strategic Plans:** - Prioritize Public Transport and NMT modes over private vehicles - Multi modal integrated transport - basic subsidized service for marginalized and fare control - universal accessibility - participatory planning	**Equity analysis:** - focus on equitable distribution of transport mode users - acknowledged demographic groups: mode wise users, differently abled users, low income PT users, women & children - no specific regulation/ indicators for measuring equitable distribution of the strategy implementation impact.
12th Five Year Plan for Urban Transport, 2011	**Objective:** Cities should grow as compact cities and be livable and walkable and Public transport should be the 'preferred' mode of transport.	**Strategic plans:** - Capacity enhancement of PT and NMT infrastructure - encourage tax exemptions for public transport to make provision of quality public transport cost effective - recommend financial support to bus service from central govt. to facilitate affordable good service.	**Equity analysis:** - focus on more equitable distribution of transport mode uses - strategic recommendations on affordable modes such as bus - acknowledged demographic groups: mode wise users - no specific regulation/ indicators for measuring equitable distribution of the strategy implementation impact.
Appraisal Checklist for Urban Transport Projects, Toolkit-2015	**Objective:** improving urban mobility in a sustainable manner by addressing minimization of greenhouse gas emissions; encouraging social inclusiveness and gender equality; and promoting economic efficiency	**Strategies:** Appraisal is categorized into 3 division-social, economic & environment social indicators proposed to use are- • modal shift to PT and NMT, •network coverage of PT and NMT •accessibility, •reduction in traffic accidents, •road security •reduction in motorized traffic on road	**Equity analysis:** - focus on equitable distribution of transport mode - social indicators do not represent demographic groups - indicators do not represent equitable distribution of the project impact on different social groups.
Delhi Master-plan 2021(Revised transport section)	**Vision:** to have a mobility transition which will deliver a sustainable urban transport system for the city that is equitable, safe, comfortable, affordable, energy efficient and environment-friendly; a system that satisfies the mobility needs of all sections of the population and enhances their quality of life.	**Strategic plans:** - Multi modal transport network for safe and accessible commute for all - Making all roads usable and safe at all times for women, children, elderly and the differentially abled by creating barrier free infrastructure	**Equity analysis:** - focus on equitable distribution of transport mode - mostly generic acknowledgement of different demographic groups

Policies/ Plans	Visions/ Goals/ Objectives	Measures/ Strategic action Plans	Equity Component Analysis
Delhi Master-plan 2021(Revised transport section)	**Primary objectives:** -80:20 modal share among PT and other modes excluding walk trips by 2021. -Safety and accessibility and mobility for all -Equitable distribution of road space for all modes -Affordability by providing range of mobility options for all users -Efficiency in movement of people and goods	-imposing high parking charges for private vehicles and subsidize the cycle parking. - transit oriented development with affordable housing provision for economically weaker sections(EWS)	- no specific regulation/ indicators for measuring equitable distribution of the strategy implementation impact on different social groups.
Maharashtra State Urban Transport Policy (SUTP),2017	**Vision:** people friendly cities with integrated land use and transport systems that provide safe, reliable, and convenient access for people of all ages, incomes, genders, and abilities and enable the movement of people and goods at the least environmental, social, and economic cost. **Primary Goals:** -80% use of PT and NMT -Basic PT service within 500m for 80% pop -MRT service within 500m for 50% pop -60% job accessibility near basic PT, 40% job accessibility near MRT -100% universal accessibility to public services	**Strategies:** - Promote PT and NMT use by enhancing the PT capacity - Build complete streets in the cities -Ensure barrier free movement for universal accessibility - Establish equitable public transit fare structure and provide subsidies - Monitoring Indicators: improvement in modal share, increase in PT and NMT users, Increase accessibility to PT, reduction in traffic fatalities and pollutions.	**Equity analysis:** - focus on equitable distribution of transport modes - Proposed indicators do not represent equitable distribution of the project impact on different social groups.
Comprehensive Mobility Plan (CMP) for Greater Mumbai	**Objective:** Development of transportation network for all mode to achieve convenient and cost-effective accessibility to places of employment and education and for optimal utilization of funds and human resources.	**Strategies:** Public transport (metro, bus) infrastructure improvement and expansion over the city with a horizon 2034 vision.	**Equity analysis:** Public transport facilities improvement to increase ridership. - No specific demography wise strategies - No equity measures or indicators mentioned.
Comprehensive Mobility Plan (CMP) for Pune City, 2018	**Vision:** To make Pune Metropolitan Region a people friendly Region with integrated land-use and transport systems that provide safe, reliable and convenient access for people and enable the movement of people and goods at the least environmental, social and economic cost. **Goals:** Increase PT share up to 50% & NMT share up to 35%, Basic PT	**Strategic Plans:** - Enhancement of PT and NMT modes - Improvement of basic bus service and increase BRT coverage - Pedestrian infrastructure enhancement.	**Equity analysis:** - Public transport facilities improvement to increase ridership. - Prioritized demographic groups: pedestrian users, - No equity measures or indicators mentioned.

Policies/ Plans	Visions/ Goals/ Objectives	Measures/ Strategic action Plans	Equity Component Analysis
Comprehensive Mobility Plan (CMP) for Pune City, 2018	service within 500m for 80% pop -MRT service within 500m for 50% pop -60% job accessibility near basic PT, 40% job accessibility near MRT -100% universal accessibility to public services - 90% reduction in traffic accident -99% pollution control		
Comprehensive Mobility Plan (CMP) for Bangalore	**Vision:** to achieve "Efficient and Sustainable Transportation for All", with a system that serves to help fulfil the economic and social needs of residents and visitors.	**Strategic Proposals:** -Multi modal transit network to provide citizen with more transport options and increase PT share up to 70% - Transit oriented development	**Equity analysis:** - Public transport facilities improvement to increase ridership. - Prioritized demographic groups: PT and NMT user in general - No specific regulation/ indicators for measuring equitable distribution of the strategy implementation impact.
Comprehensive Mobility Plan (CMP) for Bangalore	**Vision:** to achieve "Efficient and Sustainable Transportation for All", with a system that serves to help fulfil the economic and social needs of residents and visitors.	**Strategic Proposals:** -Multi modal transit network to provide citizen with more transport options and increase PT share up to 70% - Transit oriented development	**Equity analysis:** - Public transport facilities improvement to increase ridership. - Prioritized demographic groups: PT and NMT user in general - No specific regulation/ indicators for measuring equitable distribution of the strategy implementation impact.
Integrated Mobility Plan for Greater Ahmedabad Region, Horizon year 2031	**Vision:** Integrate city structure and transport system towards greater accessibility, efficient mobility and lower carbon future. Goals: -to facilitate efficient movement of people and goods by improving transportation network and providing more transportation choices to its residents -to provide a sustainable and safer transportation system focusing on non-motorized modes and public transportation system.	**Strategic Actions:** - improve public transport system (metro, BRT, AMTS bus service) in terms of better area coverage, capacity enhancements and service frequencies. - create safe and barrier free pedestrian and cycling infrastructures	**Equity analysis:** - Focus on PT mode increase. - Prioritized demographic groups: PT and NMT users - No specific regulation/ indicators for measuring equitable distribution of the strategy implementation impact on different population groups.

Policies/ Plans	Visions/ Goals/ Objectives	Measures/ Strategic action Plans	Equity Component Analysis
Long Term Strategy for the Transport Sector of Hyderabad Metropolitan Area (HMA)-2041	**Vision:** to provide with the safe and reliable transport system that is sustainable, environmental friendly and to significantly improve the share and quality of public transport service that would improve the traffic management. **Goals:** -Road Network increase 15 % of Total Area -Public Transport share to 75% -Rail transport share of total PT 40 % -Average speed (km/h) 35% -Sidewalks 95% of the requirement -Use of alternative fuel 60% -Road accidents reduce by 70 %	**Strategic Actions:** - improve public transport system (metro, Bus service, Sub urban railway) in terms of better area coverage, capacity enhancements and service frequencies. - Build good quality nonmo-torized transport networks. - Introducing congestion fees, paid parking - Introducing TOD	**Equity analysis:** - Focus on PT mode increase. - Prioritized demographic groups: PT and NMT users - No specific regulation/ indicators for measuring equitable distribution of the strategy implementation impact on different popula-tion groups.

Figure 21: Study of equity related transport goals, objectives, strategic action plans and evaluation indicators in different Indian transport policies and planning documents.

India is going through a crucial time of development where urban transport planning and policy needed a comprehensive guidance to tackle the transport challenges in the different cities. **National Urban Transport Policy(NUTP) (2006 & 2014)**(MoUD, 2006, IUT, 2014) has set the notion of paradigm shift in transport planning tradition in. India. Though transport planning is mainly governed by the individual states or local govt. bodies NUTP provides a national guideline as an umbrella under which all the cities develop their own legislations. NUTP through its visions and objectives acknowledges the India's growing automobile dependency and environmental impact and recommends more people centric planning. The policy showcases equity concerns in the proposed strategic plans. It suggests equitable road space for the people by prioritizing the use of public transport and NMT modes and improving multi-modal integrated public transport network. Universal accessibility has been mandated for all kind of transport facilities. NUTP, acknowledges the affordability groups and recommends provides different choice of transport services to the people to choose according to their affordability range. It proposed the monitoring and regulation of transport fares by authorities to keep them cost effective. The policy recommend participatory planning process

including citizen in the planning process. (MoUD, 2006). NUTP mainly focuses on the equitable distribution of transport modes in the cities so that the excessive automobilization reduces. It addresses certain population groups such as low-income groups, women, differently able groups etc. briefly in its strategic recommendations. But it does not provide any specific regulation on the evaluation of the distributive outcomes of the stated policies.

In line with the NUTP, the working group committee of Indian Govt. in their **'12th five-year Plan for Urban Transport** (MoUD, 2011) provides elaborate strategies to realize inclusive sustainable transport vision for India. As per NUTP's mandates this planning document also promote wide range use of public transport and NMT and provides elaborate actions to increase the multi modal public transport coverage. Along with that it recommends the exemption of current 25% tax policy from all kind of transport projects of the public and private companies that provide public transport service so that they can deliver quality service with cost effective measures as an acknowledgement of that the public transport and intermediate public transport are social service.

Acknowledging the importance of bus service as an affordable effective public transport mode in most cities, this five year plan also emphasize on the financing of bus based transport projects and recommends giving them infrastructure status as railway to avail the priority financing, lower rate of interest, financing for working capital, longer tenure of financing, and other fiscal incentives. It calls for a paradigm shift in treating bus service as a public service rather than revenue earning source and in order to maintain the quality the suggestion on a PPP model with government taking the revenue risk has been recommended. A dedicated urban transport fund has been recommended for supporting the public transport services. The fund will be generated from the fuel tax on the private vehicle's taxes, congestion taxes, land monetization, parking charges etc. Fare integration through single card-based ticket system is recommended to promote easy transition between different mode and to avoid extra cost for mode changes (MoUD, 2011). This extended planning documents of NUTP as usual focus on the public transport user share increase. Although it does not single out any demographic group it indirectly promotes affordable users by encouraging bus infrastructure reform in taxation and funding ground. But the plan does not provide recommendation on measuring disaggregated outcome evaluation.

'Appraisal Checklist for Urban Transport Projects Toolkit,2015' prepared by Institute of Urban Transport (IUT) under Ministry of Urban Development (MoUD) to provide a tool for assessment and evaluation of the varied urban transport projects from the economic, environmental and social perspectives.

Alongside economic efficiency and GHG emissions reduction, the toolkit encourages social inclusiveness and gender equality. The toolkit presents five appraisal criteria components to measure transport projects-

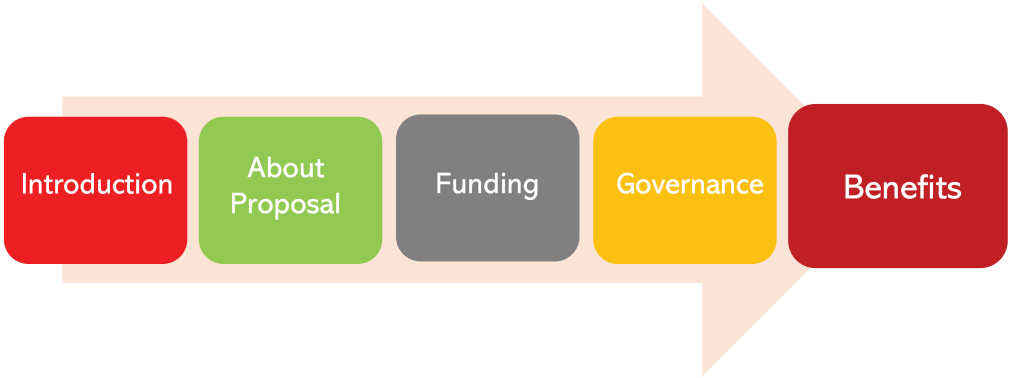

Figure 22: Appraisal criteria for measuring transport project (MoUD, 2015)

The checklist also provide guidelines to measure 5 categories of transport project- Transport Planning (includes Comprehensive Mobility Plan); Public Transport(City Bus System and Bus Rapid Transit System only); Non-Motorized Transport Plan; Transport Infrastructure(Network Improvement and Expansion; and Parking Management) and Urban Freight. The toolkit uses economic, environmental and social indicators to evaluate the sustainable benefits of the transport projects in Indian cities. The social indicators proposed to use are- modal shift to public transport and non-motorized transport; Network coverage of public and non-motorized transport; accessibility; reduction in accidents; road security; reduction in motorized traffic on road.

The appraisal checklist includes a wide range of disaggregated data analysis on different social-economic groups in the study phase. For Example: in the comprehensive plan category, the checklist includes equity parameters in the vision and the objectives of the plans. Moreover, in the city transport study it included disaggregated data that ranged from the household income, transport expenditure percentage to average trip length, average travel time according to income level. Although background study data indicators reflect a good amount

of equity concerns, it is noticeable that in the sustainable benefit analyzing segment, the checklist presents a more generic set of social indicators such as overall shift in modal share, overall improve in accessibility. Therefore, the distribution of the benefits does not reflect the distribution of impacts on varied socio-economic population groups.

Moving onto State or local based planning documents ,**Delhi Masterplan 2021** (MoUD, 2015a) assert the vision of creating sustainable transport system in the city to satisfy the mobility need of all segment of people. The major objectives of the transport plan are to increase public transport share to 80%; to provide safety and accessibility to all; ensure equitable road space for all modes of transport and affordability for all by providing multiple transport mode options. The primary strategic measure is to create integrated multi modal transport connecting MRT, Bus system, rail service, pedestrian and cycling paths all the modes in a systematic process. Barrier free NMT infrastructure plan is recommended to ensure safe and comfortable movement for different vulnerable groups (women, elderly people, children and differently able). Affordable housing provision in the transit-oriented development areas has been mandated foe economically weaker section (EWS). Though the plan shows affordability and equity concern in its objectives it does not emphasize enough to provide vulnerable group specific measures and targeted indicators to ensure the successful achievement of those objectives (MoUD, 2015a).

Maharashtra State Urban transport policy (SUTP)(GOM, 2017) stated the vision for its cities to have an integrated land use-transport system efficient for all groups of people and with minimal adverse impact. The policy has set goals to achieve 80% use of PT and NMT. The policy also focuses on improving accessibility to public transit by 50-80%, job accessibility near transit up to 40-60% and 100% universal accessibility to public services. To attain the goals the policy has identifies multimodal transport initiatives. The policy recommends setting equitable fare structure to ensure that the low-income group does not suffer from the unaffordability issue. annual revision of the fare system is also encouraged. Subsidies to the public transit provider are recommended to consider in order to maintain affordable and quality service. Govt of Maharashtra has also provided with necessary indicators reflecting the stated goal to evaluate the impact of the taken strategic actions such as increase in the use of PT, NMT, bus fleets, length of NMT network, accessibility to the PT etc. (GOM, 2017) but the indicators does not reflect the impact distribution on the different social groups.

Under Maharashtra SUTP(Sustainable Urban Transport Project), Mumbai and Pune have structured their comprehensive mobility plans. **The Comprehensive Mobility Plan(CMP) for Greater Mumbai**(MCGM, 2016) stated as its vision to achieve convenient and cost effective accessibility to places of employment and education. As strategies to realize this vision the plan provides elaborate capacity enhancement of the public transport infrastructure (expanding metro and bus service corridors, improvement of the supporting facilities etc.). In Pune, the **CMP**(PMRDA, 2018) also has set the targets in line with the SUTP's goals and to achieve that the strategies have been the enhancement of Public transits and NMT facilities to improve accessibility and safe mobility. It also proposed congestion charging and parking pricing to discourage the use of private vehicles. Pune highlighted strategic plans for pedestrian users. Other than that, both CMPs' provides very generic focus on improving public transit share.

'The Comprehensive Mobility Plan for Bengaluru'(IDEK, 2019) acknowledges the need to ensure transport facilities to all sector of citizen; It emphasize on the increase of the public transport and NMT use through elaborately planned expansion of multimodal public transport system. It explores and suggests different strategic options for transport mode from pedestrian to intermediate para transit service to ensure transport service for all. Additionally, affordable housing provision is recommended in TOD implementation. Nevertheless, the plan mainly focuses on PT and NMT users in general and does not provide specific indicators it recommends choosing qualitative and qualitative indicators that can measure the outcome and achievable targets.

Integrated Mobility Plan for Greater Ahmedabad Region: Horizon 2034(CEPT and UMTCL, 2016) has the vision of a Integrate city structure and transport system towards greater accessibility, efficient mobility and lower carbon future. To realize the vision, it put emphasis on the developing integrated growth strategies for compact growth and economic development; facilitating the enhanced public transport network and promote safer sustainable transport mode (NMT). It provides elaborate instruction on the development and of metro, suburban rail system, BRT and bus services to develop a multi modal transport network. Specific guidelines and design by laws have been recommended to ensure the safe pedestrian and bicycle paths to improve the facilities and encourage the NMT mode use. The plan focuses mobility options, expansion and improvement of different modes of transit have been

on improving modal share of PT and NMT and economic development. To create better recommended. But the plan does not provide regulations on monitoring and evaluation process to reflect on the distributive implementation outcome on different social groups.

The Long Term Strategies for the Transport Sectors of Hyderabad Metropolitan Area 2041(HMDA, 2013), emphasize on increasing share of public transport and NMT use and set out goals to achieve increase share of different public transport mode uses. Like the other cities, it focuses on expansion and improvement of the different public transport mode, integrate TOD, recommendation to provide parking and private vehicle use regulations. The plan does not propose any specific strategies to ensure benefits for the different socio-economic groups.

7. DISCUSSION

7.1 SOCIAL EQUITY IN INDIAN TRANSPORT PLANS AND POLICIES

India plays a very active role in the journey of attaining UN's sustainable development goals and as a part of that, achieving sustainable transport system has been very important priority in its transport planning. From the study of the above-mentioned national, state and local transport policies and planning documents of Indian cities, it is evident that they have a very similar approach in the vision and strategies under the National Urban Transport Policy. Tackling the increasing negative environmental impact of rapid uncontrolled automobilization has been one of the major driving forces behind these policy strategies. All the documents represent clear objectives to bring in the modal shift towards sustainable transport mode like public transport, walking and cycling to reduce the adverse impact on the environment and economy caused by the growing congestion and increasing automobilization trend in India.
The environmental and economic objectives are very clear to understand from these transport planning documents; however, the equity aspect seems a bit imprecise comparing with the other two components of sustainable transport. Although the common vision and objectives of

these transport regulations is to provide affordable, equitable and accessible transport for all, with a focus on sustainable transport mode such as public transport and NMT, the stated strategies and implemented actions do not provide any clear direction to how the transportation benefits is planned to be distributed over the wide and diverse range of socio-economic population groups in the cities to achieve that. When the policies say 'for all' how they ensure that the benefits of the policies are properly distributed over all is not very clear. From equity perspective, there are no coherent mandates to take explicit measures to ensure equitable distribution of the benefits and the burden for all level of society in the stated policies.

All the six cities' mobility plans along with the national urban transport policy, share goals like increasing the share of public transport and NMT (non-motorized transport) use to the targeted percentage, increasing accessibility to the public transit and jobs. Enhancement of the public transport capacity of different modes (metro, BRT, rail, para transit etc.), improvement of the non-motorized transport infrastructures around the city and land use transport integration (TOD) etc. are the major recommended strategies.

As for the equity strategy, there have been very few targeted initiatives for specific population groups. For instance, NMT infrastructure improvement has been prioritized as a pro-poor strategy since walking and cycling are the major modes used by low income marginalized group; universal accessibility has been mandated in consideration of elderly, children and differently able groups. Affordable housing provision has been introduced in transit-oriented development plans and congestion charges, fuel tax, and parking charges recommendation have been mandated to equalize the private vehicles advantages. But apart from that, the other strategic actions have been more generic in the equity concern. Public transport and NMT improvement surely provide benefits to the marginalized group as these are the only option to their mobility. But affordability plays a big factor for the poor to avail these extended benefits of the transport initiatives. A low-income group may manage somehow to live near a metro transit, but they may struggle to afford the metro service and then move to the poor-quality bus service or NMT mode to access the other opportunities. Living near transit does not always means everybody can access them. Also increasing job percentage near transit does not automatically ensure that the marginalized group can access those jobs as the other advantaged population group(Martens et al., 2019).

Although some of the public transport modes (city bus service, suburban railway, para transit etc.) offers cheapest travel options but still a good number of low income people in India struggle to afford that (Vineet, 2020). Moreover, modes such as metro and BRT which are featured elaborately in the above plans, have a higher fare rate than the former ones. While subsidies in the Indian public transport system is not new concept, there is no clear policy advises on this issue and it is rather dependent on political interest(Vasudevan and Mulukutla, 2014). Guidance on the fare structure and provision of subsidies has not been elaborated enough in the studied policies and planning documents, to understand how they can be distributed equitably and favors those who really needs it. The 12th FYP has presented few policy recommendations for bus system considering it is the most affordable., effective public transport mode for the low- income groups. It recommends on tax exemption on public transport to ensure affordable service and also advised to bear at least 50% of bus infrastructure cost from the central govt(MoUD, 2011). Nevertheless, they are not reflected any other planning documents.

Transport equity literatures(Di Ciommo and Shiftan, 2017, Litman, 2002, Martens et al., 2019) stresses on the choice of indicators to measure the propriety of the distribution of the impacts among the different groups. However, the studied transport plans from the selected cities shows the lack of transport evaluation indicator guidelines to evaluate the outcome of the initiatives. A CSTEP (Center for Study of Science, Technology and Policy) study argues that the available used indicators in Indian transport plans cannot provide the equity picture of the development initiatives. It emphasized on the shift towards outcome-based indicators from the asset-based indicators that present the real impact on the multiple sectors of population (Bhattacharya and Rathi, 2015). According to the transport experts in India, creating CMP has been a positive initiative; nevertheless, it has failed to offer the comprehensiveness of the long-term strategies due to the lack of transparent holistic plans and proper monitoring and evaluation indicators.

Even though Maharashtra State Urban Transport Policy (SUTP), CMP Pune have introduced some monitoring indicators they do not reflect the equity outlook in them. Increase ridership in PT, accessibility to PT, average length trip, buses per .1 million population etc.- these are some common indicators proposed to be used. These indicators do not represent the impacts

distribution among the varied population group entirely, specially the socially disadvantaged ones. More disaggregated data are needed for that purpose. The Appraisal checklist has incorporated several disaggregated data indicators regarding different income quantile population (such as mode of travel, travel length, transport expenditure according to varied income quantile) in the background study of the planning process; however, in the benefit evaluation, the used indicators do not reflect the process and represent more cumulative information. They do not seem sensitive enough to the variable experience of different social groups.

Although the national level transport policies (national urban Transport policy, 12th five years transport plan) exhibits essential equity concerns in their sustainable transport goal, the city level compressive mobility plans lack the incentives to act upon in realizing those goals.

7.2 EMPIRICAL EVIDENCE ANALYSIS FROM THE EXISTING TRANSPORT PROJECTS AND POLICY OUTCOMES

Even though Indian transport policies and plans from different government level showcase an inclusive vision and a long range of initiatives supporting sustainable urban transport development, the absence of dedicated equity strategies for the vulnerable social groups fails to draw a comprehensive picture of the heterogeneous experiences shared by them. The empirical evidences from the current existing transport projects and trends in the studied cities proves that.

Among the many public transport initiatives that have been implemented and are ongoing in Indian cities in recent years, there still seems to be a lack of priority for the affordable, cost effective transport modes such as suburban rails or bus system like city bus service, or BRTs. This tendency is perceptible in the many transport investments and funding system. For instance, despite of NUTP's people centric transport objectives, among JNNURM's (Jawaharlal Nehru National Urban Renewal Mission, a city-modernization scheme launched by the Government of India) total transport infrastructure fund of 24.2%, only 33% was allocated to mass transit, the 57% was allocated toward roads, flyover; rest was to parking etc. projects (Venter et al., 2019) (figure 23).

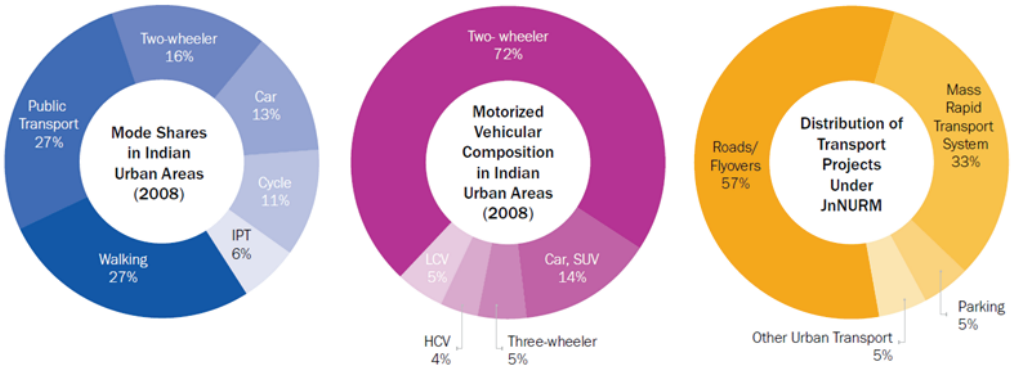

Figure 23 : Mode shares, motorized vehicles and transport investment in Indian cities (Venter et al., 2019)

Furthermore, among the relatively insufficient investment tendency in public transport, the affordable modes are derelict by capital intensive expensive modes. Most of the Indian cities public transport is dominated by public bus system (almost 90% PT users) and due to the cost effectiveness and compatibility with the Indian city structures, BRT has been considered one of the best potential solution for sustainable public transport mode in India (Venter et al., 2017a). Already many cities have launched BRT and the studied planning documents from the six cities suggest that in the coming years the policies intended to carry on with the ideas. However, the BRT development appears to be shadowed by the metro system implementation. There seems to be an inclination of the govt. authorities towards investing in metro system, which tends to slow down the BRT implementation and expansion process in many cities. Due to the fact that the metro infrastructure is more capital-intensive development and catch more international fund base , it is preferred in decision-making levels to facilitate the image of a smart developed global city (Mahadevia et al., 2013b). Moreover, there were protests from media and private vehicle users in cities like Delhi and Pune, complaining that BRTs are reducing the road capacity for the other vehicles (Gadepalli, 2019) and this protest won against the poor community's interest due to the inherent political biasness towards the powerful voice. As per NUTP's recommendation JNNRUM(The Jawaharlal Nehru National Urban Renewal Mission) provided funds for selected cities for BRTs system initially , but most of the projects have been slowed down due to further adequate financial supports (after JNNURM/world bank fund ended) and priority and threatened by the metro systems (Gadepalli, 2019).

A study by the Centre for Science and Environment (CSE) has found that after the fare hike in 2017, Delhi metro has become the second-most unaffordable service in the world among the cities that charge less than half a US dollar for a trip. The study reports that Delhi Commuters spend about 14% of their income on metro rides, which is lower only to 25% spent by commuters in Hanoi, Vietnam. For the lowest income quantile, the expenditure is 20% of their income if not more. The analysis also founds that the ridership has also dropped 32 per cent in 2018 in comparison to previous year (The Economic Times, 2018, CSE, 2019). This raises question that how much the metro system implementation like Delhi help to pull the public transport ridership or provide mobility to the marginalized population to access basic opportunities, despite of being considered one of the most successful metro project in the country in many aspects. Then there are bus services in the cities which are more affordable than metro and preferred by the huge group of low-income population are not given enough resource support and attention. In Delhi, the city buses have about 4 million ridership whereas the Delhi metro has been catering to the need of as of 2019 about 2.3 million daily passengers (Somvanshi, 2018).Despite that, the bus services have not been improved in the city. The Delhi BRT project which could be a mean to outreach transport services to the disadvantage groups also failed due to the lack of proper planning , management and financial support (James, 2019). The DTC (Delhi transport corporation) bus service also struggles without proper management and planning initiatives and recorded a decline in the ridership by 31% in 2017-18(CSE, 2019).

Even though BRT has the potential to offer more cheap and accessible service to the wider group of population in the city of Pune, it has been sidetracked by the big -ticket metro project. A Pune based NGO, Parisar's study on the Pune metro contends that considering the average trip length (between7-9 kms) of 75% people in Pune a proper planned BRT would have been a better solution to the city's transport issues (Vernekar, 2017, Vernekar, 2018). Despite that metro project is getting build on the same corridor as BRT, disrupting the operation of BRT services. Apart from BRT, Pune's city bus service (PMPML) which caters daily almost 1.1-1.2 million lower to middle income population, is in a very vulnerable condition(Hindustan Times, 2019). The daily ridership of Mumbai BEST bus service has lessened over the years. Regardless of the deplorable condition of the bus service, Indian Govt. seems to prioritizing metro projects by providing financial help and subsidies to them(CSE, 2019).

Paradoxically, there is also arguments over pro-poor bus system between the BRT and the city bus services. For all consideration as an affordable strategy than metro system, from a critical vertical equity perspective, there are discussions about BRT system that often the outcome of this implementation has a skewed impact towards middle to high income users rather than the lower income quantile (Venter et al., 2017a). Venter, in his paper, discussed on empirical analysis of the BRT system analyzing few cities from Africa, Asia, Latin America and contended that BRT has a potential factors to offer an equitable public transport system but it needs clear pro-poor policy objectives and their dedicated implementation to distribute the benefits over all strata of population. India cities seem to lack these pro-poor policy objectives.

The outcome of the shortfall of pro-poor strategies can be observed in the case of Ahmedabad BRT. 'Janmarg' BRT in Ahmedabad is considered India's most successful BRT implementation and it has achieved many recognitions as well. While it has truly presented a quality service of bus system to the citizen to attract them using public transport which is very significant outcome, from this thesis's research perspective taking into the equity consideration, we see a very different picture. A study from Mahadevia (Mahadevia et al., 2013a) , reflects on the Janmarg's impact on different social groups in the city and how the benefits have been distributed among them. The research shows that Ahmedabad Janmarg BRT had a very diverse impact on different population group specially between income and gender groups. Though the BRT project had advertised pro-poor mobility for all objectives and, data shows that, the people in the lowest income and highest income quantile do not use the BRT much. The former due to the accessibility and affordability issue and the later due to having own vehicles. BRT use is seen less among the working -class group with labor works or wage-earning jobs than private job employees, self-employed or regular office workers. Also, women use the service less than men, especially among the lower income groups. To improve the BRT ridership, the existing city bus service has been cut short in some overlapping corridor, which has exaggerated the affordability of the poor more.

From the modal shift perspective, the 'Janmarg' BRT has attracted only 12% new users from private vehicle user group and 1% from walking group. The rest were either using existing state-run bus AMTS(Ahmedabad Municipal Transport Service) or, shared autos etc. Hence,

he environmental impact of modal shift does not seem a lot (Mahadevia et al., 2013a). 40% of urban people in Ahmedabad live in informal settlements. The public transport user in the city are 17% and NMT users are 54%. It suggests a high percentage of urban people cannot afford PT for commuting(Shah and Adhvaryu, 2016). There seems to be a lack of detailed studies similar to this on BRT's impact on different socioeconomic groups specially urban poor in other cities But this study of Ahmedabad BRT offers a glimpse of how a seemingly successful transport initiatives can show the ineffectiveness of the project from an equity point of view.

In Bangalore, BMTC (Bengaluru Metropolitan Transport Corporation) bus service is a major mode of public transport system in the city. BMTC provides variety of bus services from air conditioning to basic non-ac bus service in multiple direction. As the service does not have any financial support from state the fare rate is higher than other bus services in the cities in India (Philip, 2018). But as a pro-poor strategy to comply by the mandate of NUTP to provide subsidies to the poor, BMTC has launched a bus service named 'Atal Sarige' for the low-income working-class group in selective routes. A study on its impact on the urban poor has been done by Shastry and Bhatt(SHASTRY and BHATT, 2013), where it shows that the service is provided for a very limited number of routes and it only serve 77 out of 500 slums in the city area. The other slum areas are too far to access this service. Also, the frequency of the service is very low. Hence, the purpose of the incentive to provide basic bus service to the poor is not achieved effectively. There is no incentive to improve the route structure and the service so far.

In Mumbai, where the general people's average transport expenditure is 11-12% of their income, the lowest income groups spend more than 16% of theirs'(Cropper and Bhattacharya, 2012, MCGM, 2016). Suburban rail system is one of the cheapest modes of transport for low income people in some of the Indian cities and among them, Mumbai has the biggest suburban railway network and it is the lifeline of the city commute. But unfortunately, this affordable mode of public transport did not get enough priority and have dilapidated over the years. Though under the Mumbai Urban Transport Project (MUTP) funded by World bank, capacity enhancement initiatives have been taken still they fail to meet the increasing travel demand. In addition, the quality and safety issues has been neglected for years. In 2018, Mumbai suburban

rail has seen 2734 deaths (Hub, 2019). Furthermore, Mumbai's century long bus service 'BEST', the second most affordable and popular public transport mode after the suburban rail in Mumbai, does not get enough attention and priorities from the state and city level government as much as the metro, monorail etc. system. Apart from the metro service, most transport projects seem to encourage private transport modes (Gaikwad, 2017). In Hyderabad, the state and city level authorities also seem to have similar reluctancy towards upscaling the affordable public transport system and bad shaped pedestrian infrastructures; rather focusing on mostly on road widening, grade separators, signal free movement, multi-level parking lots etc. (Singh, 2018).

The condition of Non-motorized transport infrastructure in Indian cities has been declining although a major portion of people use this mode. Despite the city transport plans have highly emphasized on the building better NMT infrastructure, the outcome is yet to been seen. Moreover, the pedestrian traffic fatalities are increasing in the Indian cities as it has gone up to 62% in last years. Pedestrians and cyclists accounted for 15% and 2.4% of total traffic death rate (Dash, 2019). The comparison of the walking mode share with rate of pedestrian death (figure 24) of the shows that more people is getting killed than the number of them walking with only slight exception with Mumbai (The Footpath Initiative, 2019).

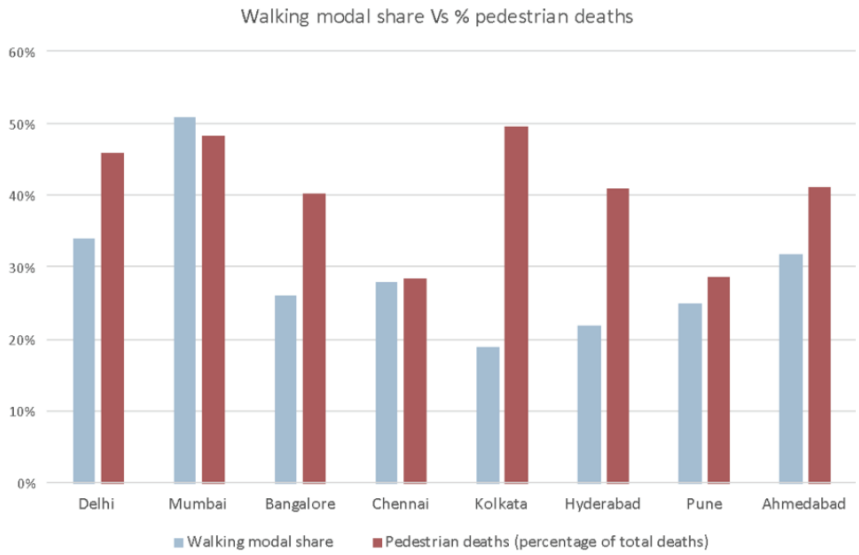

Figure 24: comparison of walking mode share and pedestrian death rate. (The Footpath Initiative, 2019)

NMT improvement has been the key equity consideration to facilitate the low-income population in Indian cities as it is considered their primary transport mode. But this recent statistic shows that how equitable the transport plans are in traffic safety issue for a certain group of people.

Apart from the empirical evidences of the different transport project outcomes, the supporting policy like tax regulations also exhibits the inherent unfairness of the transport policy of Indian cities. The taxation system of the public transport in India, also manifests the discriminatory preferences towards metro systems and private vehicles. Public transport system pays different taxes (passenger tax, fuel tax, motor vehicle tax, GST etc.) and while the metro system is exempted from various tax burdens the bus system has taken the full burden of the taxation process. Even private vehicles are exempted from certain taxes, but the bus system is not. Figure 25 shows GST rate for different transport modes and the bus system pays the highest.

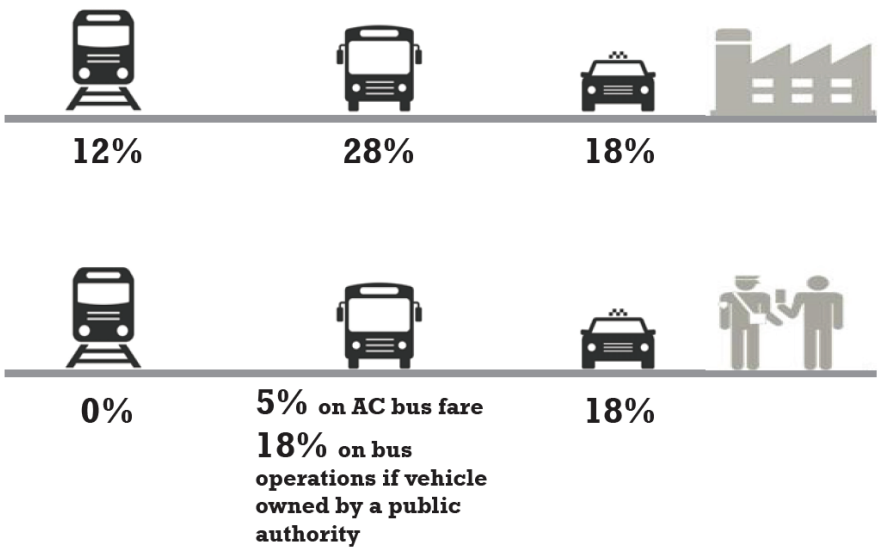

Figure 25: GST on public transport system in India (CSE, 2019).

These trends of valuing high cost intensive transport project over improving the cost-effective affordable ones does show the insensitivities towards equity concern of the transport plans and policies.

8. CHALLENGES AND WAY FORWARD

From the above discussion, it is perceptible that there is a disconnect between the envisioned transport planning objectives and the empirical experiences of the outcomes of the transport initiatives. Although having elaborate sustainable transport strategies, the findings of this thesis observe that the benefits are not reaching to the people in equitable proportion, specially to the low-income groups due to the lack of explicit equity strategies. The national urban transport policy and other city level comprehensive mobility plans such as Delhi masterplan, Maharashtra state urban transport policy, comprehensive mobility plans of Pune, Mumbai etc. (MoHUA, 2019, MoUD, 2006, MoUD, 2015b, GOM, 2017)all acknowledge the need of an equitable urban transport. Nevertheless, they provide very little direction to what should be that equity principle and how to meet that standard for the heterogenous population groups according to their varied needs and obstacles. In consequence, the effect of disproportionate distribution of transport projects outcomes are visible in the empirical examples discussed in section 7.2 in previous chapter. Transport experts contend that the comprehensive mobility plans (CMP) seems to lack the holistic strategical approach towards an integrated transport system; instead, they appear as more of a compilation of transport projects list thus fails to address the complex issues like equity.

The absence of proper evaluation framework with precise equity indicators to understand the practical outcomes of the adopted transport decisions, reflects in the above discussed public transport project cases. The multimodal public transport expansion plans do not ensure that the diverse socio-economic population will succeed to avail those services; just like the success stories of the Ahmedabad BRT or Delhi Metro disregard the biased impacts they have on a certain group of population. In the discussion with few transport experts and academics working in India, they assert that the transport planning system in India does not have long term objectives rather more project-based approach and mostly driven by funding and big-ticket project thus make social equity factors neglected. The political inclination towards creating global image and capital-intensive investments, motivate investing in this kind of project-based actions rather focusing on the marginalized population.

Furthermore, the poor institutional framework and governance of urban transport system in the cities the study looked at do not help either. The lack of co-ordination among the fragmented organizational structures and the multiple agencies with different focuses make the planning process more complex and inefficient. Although the policies recommend and refers to the strong public private partnership (PPP), currently there seems to be a lack of strategic coordination among stakeholders. For example, in public bus sectors, there are many private sector stakeholders are involved; but the govt. has not been able to build a strategic relationship with them to boost the development of the this very important public transport mode(CSE, 2019, Vaidyanathan et al., 2017, Hidalgo et al., 2013). Besides, the tokenistic nature of the public participation in the planning process does not help to bring out the real issues needed to be addressed by the policy and planning actions. The lack of equity in public participation in planning only reflect the need of the well-off society neglecting the poor vulnerable individuals' whose voice are never heard.

Nevertheless, there are also some equity-based strategy examples present in Indian cities, but they are mostly ad hoc basis. For example, in terms of gender equity, India Govt. has taken multiple initiatives to make public transport safe for women. Reserving the first coach for the ladies in 'Delhi Metro', Operating special Ladies Buses and dedicated cab fleet (She Taxi), launching of safety apps etc. initiatives are taken by the Government of India. They has also set up a fund in this purpose(Shah et al., 2017). Delhi Govt. has declared public transport free for the women to encourage them to use public transport and participate in job sectors more (Bhowmik, 2019). The Bangalore's 'Atal Sarige' bus services for the low -income groups like informal vendors, daily laborers etc.(SHASTRY and BHATT, 2013) has been a positive initiative to cater the poor. Nevertheless, the lack of the dedicated policy statements fails to provide this kind of supports to the large groups of vulnerable populations specially the economically weaker groups.

However, as majority of urban population in India are from low-income group(Hidalgo et al., 2013), the best way to ensure sustainable transport for all is to ensure the service to the poorest. Indian cities transport policies should acknowledge this need of dedicated equity strategies with the focus on maximizing the distribution of the transport benefits among the diverse demographics. As per expert's recommendation, a result-oriented approach is needed which

will include adequate goal specific actions and proper regulations for data collections, evaluation framework, capacity building for monitoring process, integration of relevant indicators to assess the outcome of different implemented transport projects.

To realize the 'sustainable transport for all' vision of Indian transport policies, a more well-constructed integration of equity aspects in the policies is needed. The thesis has identified seven key issues to focus-

i. **Explicit integration of pro-poor transport strategies in the transport policies:**
Considering the large proportion of the low-income population, transport policies should incorporate more specific pro-poor strategies integrated to the core and not just ad hoc. Currently, it seems that NMT mode improvement is highlighted as only strategy to improve accessibility of the poor. But NMT improvement is needed for all not only for the vulnerable groups. More explicit pro-poor strategies such as prioritizing bus system over other PT, ensure affordable PT to the majority of citizen, providing dedicated subsidies to those who need it, tracking the outcome and impact distribution among diversified population etc. are needed to be considered in the policies and plans. The transport policy and comprehensive mobility plans need to address the informal sector population specifically. For example, Bogota's government has mandated pro-poor subsidies for the urban poor of the city, which has effectively increased the affordability of public transport for the poor to a great extent. (showed in figure 17 in chapter 4)(Guzman and Oviedo, 2018)

ii. **Prioritize affordable modes in investment and implementation:**
The transport policies should strictly mandate the prioritization of the investment and implementation of affordable public transport modes such as city bus services, BRT, sub urban railways, pedestrian and cycling tracks etc. so that the political biasness or preference towards big-ticket image building projects cannot slow down or hamper the operationalization of those modes. Central govt. should consider increasing the financial support to the bus sector to improve its service and efficiency.

iii. Robust evaluation framework with appropriate indicator set:

It cannot be emphasized enough from the transport equity literatures(Litman, 2002, Martens et al., 2019, Pereira, 2018, Di Ciommo and Shiftan, 2017) as well as the experts from the professional fields, on the establishment of an efficient evaluation framework integrated with appropriate indicators to ensure the projected outcome of the taken transport initiatives. The indicators should be able to reflect on the impacts among different group of population specially the marginalized groups as they are most neglected and in need. Indian's present transport planning framework seems to really lack in this aspect and need working on this issue. For instance, instead of using generic indicator like 'increase in user % of public transport' focusing on more disaggregated data such as' increase in public transport users by different income or gender groups will represent more accurate outcome of the transport projects. A list of equity measuring indicators and possible disaggregation of data suggested by different transport equity literatures is shown in figure 16 in chapter 4. The indicators should be able to depict the positive or negative impacts of the transport policies and projects or their overall distribution of the outcome over the existing diverse population groups in the society.

iv. Reformation of transport taxation systems, fare-structure and subsidies:

The current transport taxation system in India does not support the equitable vision of India's transport policy. Thus, it needs reforms to enable the reduction of taxation burden from the public transport sectors against the private modes(Hidalgo et al., 2012). Moreover, affordable modes (bus, sub urban rail) should get at least equal tax benefits and concessions like the metro systems if not more.

There should be a concrete transparent fare structure policy with periodic evaluation process that ensure affordable fare system that serve majority of the urban population. Even though the metro system is the naturally considered expensive due to its heavy infrastructure and maintenance cost, it should be able to serve a good proportion of urban population cost effectively as it considered one of the major PT modes in the cities. Provision of subsidies to users should be established for those who need it most based on defined criteria such as- lowest income quantile, individuals under certain household incomes etc. According to the global experience, direct demand-based subsidies like user discounts and concessions can help the poor users more efficiently than the subsidies provided to transport companies(CSE, 2019).

v. Disaggregated data analysis:

To ensure holistic transport benefits policies need to shift from the accumulative data analysis towards analyzing the transport impact on segregated population groups. Mahadevia's work on Ahmedabad BRT(Mahadevia et al., 2013a) provides a good example of the need of micro data analysis as it depicts the clear picture of the inequitable impact distribution of the BRT project in Ahmedabad city, which is considered most successful BRT in India in general. Integration of these kind of detailed data study should be emphasized. Regulation and recommendation on the use of information technology and big data analysis methods should be planned accordingly to ensure the proper handling of the huge bulk of data. Investments should be made in disaggregated data analysis and capacity building in local levels to do the job. Coordination with different academic and research institutions, NGOs' who conducts the equity analyses on ad hoc basis or research purposes, can be brought under regulatory frameworks to use these resources for the betterment of urban transport service.

vi. Integrated institutional framework, distributed power:

At present the segregated transport governing bodies is impeding the realization and optimization of the transport policies. Moreover, change of power and priority agenda in different level of governance does not help to realize the national transport policy vision. An integrated intuitional framework is needed with central policy guidelines in national and state level in line with the National transport policy. The city level govt. should be provided with the liberties to take transport decision and operationalization according to their own need under the central guidelines.

vii. Strong stakeholder coordination and participatory planning:

The govt. needs to focus on improving coordination with existing stakeholders in the transport sectors. Strategic contracts with the private companies to ensure the transport demand supply and quality service is crucial for the efficient transport system. NUTP's recommendation on participatory planning approach should be implemented more thoroughly. Participation in decision making among the national, state and local level is must. Additionally, the integration of community participation to address the local need is also vital. Community groups should be an active part of the planning process rather than just demographic survey data provider.

Ultimately, ensuring equity in the public transport system, needs a robust comprehensive approach. There are two terms argued over in equity literatures - 'equity of opportunity' and 'equity of outcome'. Most of the transport study agree over the former term which implies that vulnerable groups should have adequate access to the life opportunities such as employments, education, health etc. But the latter one is more debated over or neglected where it put emphasis on the analysis of whether the vulnerable groups succeed to access those opportunities (Caulfield et al., 2014, Litman, 2002). But it is the latter that shows how equitable a system is. Hence, Indian cities transport policy should provide more attention towards the outcome of their comprehensive transport plans to ensure a more equitable distribution of transport benefits among the diversified population.

9. CONCLUSION

Within the limitation and scope of the research, this thesis has explored the urban transport equity issue in Indian context in a holistic perception by discussing the status of the equity consideration in different aspects of transport planning. The analysis of policy level and empirical data, has identified the mismatch among different policy goals and outcomes regarding equitable distribution of transport benefits among heterogenous social groups. Although, presently, transport equity has been a rising concern in the global transport literature and practice, developing countries like India, are still lagging regarding providing equitable transport policies and adequate incentives to ensure the realization of those policies. The study from this thesis finds very limited transport research and initiatives in the Indian context that are directly focused on transport equity, at present. Those that are present are very project specific, voluntary and ad hoc basis; and the others are focused on the environmental challenges of urban transport, acknowledging equity issues as a secondary concern. The various studied transport policies and future strategies also show similar traits. The lack of comprehensiveness of the strategies undertaken to address the heterogeneous population groups, particularly the majority urban poor, is one of the reasons that the Indian cities are still struggling with the inefficacy of the urban transport system.

Thus, the thesis discovers a wide scope for further work on transport equity issues in Indian context. Social equity is a multi-dimensional and highly contextual issue. Hence, further research can be advanced on issues like- defining transport equity in Indian context, identifying the proper distributive principles for Indian cities; defining the standards for disaggregation of the different population group to ensure equitable distribution of impact; or how would social equity be perceived and integrated in the era of technology and smart cities and so on. To cater transport service to India's massive population is a challenge itself; thus, ensuring the fair and proper distribution of the service needs more thorough reserach in this field.

The 2030 New Urban Agenda is focused on realizing sustainable development in cities with a promise to leave no one behind(SLoCaT, 2019). Therefore, as a key driver of the sustainable growth and development of the cities, urban transport need to follow through that promise. Public transport policies often have multiple equity impacts as they shape the growth of the inclusive societies and their collective and individual economic development(SLoCaT, 2019, Hidalgo et al., 2012). Thus, ensuring equitable transport system is paramount to the cities' urban development strategies. Even more so in India, where the income disparities and social segregation are so widespread, equity concerns need more priority in the policy. Because, without securing their rights in proper structural framework of planning policies, it is easy to neglect the impact of transport strategies on underrepresented population groups. The research findings suggest that the policy mandates for equitable road space for people to use different modes is not enough; the necessary legislations to provide equitable opportunities for different social groups to access those modes is very crucial as well. Hence, explicit social equity strategies are needed to be adopted in the national, state and local level policies to ensure the fair distribution of transport benefits in the societies. Strong and focused explicit equity policy and robust disaggregated transport strategy evaluation can only ensure that the transport incentives outcome is distributed fairly among all urban population.

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