

CHAPTER 2

REVIEW OF LITERATURE

2.1 Introduction

Inequality is a fundamental issue in studies on economic development. Inequality exists not only in terms of unequal distribution of income and wealth but also in terms of differential access to opportunities on the basis of gender, race and ethnicity (Wade, 2014). Gender inequality in India exists in terms of access to health, education and employment. The very basis of prevalence of gender inequality in these spheres is differences in access to transportation facilities. Access to transportation services facilitates access all indicators of empowerment (Batra and Reio, 2016). A coordinated and well-knit system of transportation is crucial for promoting gender equality and thereby expanding economic development (Crespo-Sancho, 2015).

Travel pattern is the study of what people do over space, and how they use transport. The questions studied in the analysis of travel pattern include the number of trips that people make, the destination where they go, the mode that they use, whom are they accompanied with, schedule of the trip, their choice of route, purpose of their travel, their awareness and willingness to rationalize the environmental and climate impacts of their travel choices. Studies have identified that the mode of transport used is the most important measure of travel pattern (Mahadevia and Advani, 2016; Singh and Vasudevan, 2018).

United Nations Economic and Social Council define gender mainstreaming as the process of integrating a gender perspective into designing, implementation, and evaluation of policies and programs thereby realizing gender equality. While gender has increasingly being incorporated in many areas, little progress has been made in its relationship with infrastructure, more

specifically transport. Transport networks shape one of the most important elements of a country's infrastructure and are a crucial factor in determining economic development (Crespo-Sancho, 2015). Transportation has generally been assumed to be gender-neutral. It is believed that both men and women benefit equally from transport projects and there exist no differences in travel needs and patterns between the sexes. However, scholars and studies over the years have been consistently highlighting the contrary. It has been shown that there exist significant differences in travel needs and behavior of men and women (Mahadevia and Advani, 2016). It is only recently that infrastructure projects have started to include gender awareness as part of their investment decisions owing to women's increasing role in economic growth and prosperity.

The demand for transport services and travel needs and patterns not only vary between women and men but also among different socioeconomic groups. Therefore, the present study aims to examine gender differences in measures of travel patterns within specific sets of population. The outcome of this study will help in framing appropriate policy measures to not only promote women's empowerment but also to curtail poverty and increase economic growth.

This chapter on review of literature has been carefully crafted to include well-defined sections that explore literature on every aspect of the topic, thereby allowing identification of research gaps and assisting in framing of research objectives.

2.2 What is Travel Behavior/ Travel Pattern?

Travel behavior is a complex exercise undertaken by travelers of making choices over various aspects of a trip. Liepmann (1945) conducted one of the preliminary works in travel behavior and examined ride sharing and time spent as few of the important defining parameters of the aspect. Lu and Pas (1999) interpret travel behavior in terms of number of trips made, trip chaining, time taken to travel and mode of travel. A study by Handy *et al.* (2005) define travel

behavior as a combination of responses to choice of mode and miles driven. Newbold *et al.* (2005) who conducted a study in Canada determine the variable in terms of frequency of trips made, their durations, the modes used for these trips and the purpose of making these trips. Limanond *et al.* (2011) used various aspects of a trip, such as, mode splits, distance covered, and time spent on traveling, to define it. It is with reference to choice of modes and distance travelled to that Næss (2012) defines travel behavior as in the Nordic context. Mahadevia and Advani (2016) explain travel patterns as an amalgamation of choices made for mode choice, distance commuted, frequency of traveling and purpose of traveling. Travel behavior is predominantly determined in terms of decision made about modes of transport (Ettema and Nieuwenhuis, 2017).

2.3 Trends in Travel Pattern across the Globe

Sustainable mobility is a central challenge facing both urban and rural areas across all socio-economic dimensions. Mobility patterns depend upon rural/urban form, socio-cultural, and socio-economic aspects of the travelers (Ahmad and Puppim de Oliveira, 2016). It is important to determine the factors affecting mobility owing to the sharp increase in the count of automobiles, i.e., motorization and expansion of the distances travelled. Increased motorization has adverse environmental impacts, and widening of travel distances deprive the needy of economic opportunities (Jain *et al.*, 2018).

An essential determinant of travel behavior in both developed and developing economies is income (Ahmad and Puppim de Oliveira, 2016; Burguillo *et al.*, 2017; Manoj and Verma, 2015; Olvera *et al.*, 2015). With income, households can own and use Personal Motorized Vehicles (PMV) (Li *et al.*, 2012). People with lower levels of income do not have enough to spend on transport and depend on walking. Analysis of travel behavior concerning different income groups allows identifying the needs of different segments of society. However, one important

limitation associated with studying travel behavior with income is the problem of under-reporting of income data (Olvera *et al.*, 2015). Under-reporting exists due to the existence of informal sector, seasonal variation in the money made, self-employment, recall bias, difficulty in accounting for all income-generating activities like rents, pensions, and presence of corruption (Olvera *et al.*, 2015; Jain and Tiwari, 2019; Saha *et al.*, 2014). It is, therefore, necessary to substitute income with such a proxy which helps in analyzing travel behavior variations across different socioeconomic groups (Jain and Tiwari, 2019). People in low-income groups of both developed and developing economies rely more on using non-motorized modes of transport and less on public transport (Li *et al.*, 2015).

In India, one-third of all the trips made for employment is undertaken either by a bicycle or by walking and one-fourth by public transport (Census of India, 2011g). In a study comparing the commuting patterns of non-agricultural workers in rural and urban areas of NCR of India, the urban residents are found to have a higher tendency to use Personal Motorized Vehicles (PMVs) for both short and long trips whereas residents in the rural areas are identified by the usage of non-motorized vehicles for long trips. Women in high-income groups in urban areas prefer using the car over green modes of transportation (Korzhenevych and Jain, 2018). In cities in India, 40 per cent of the population travels by walking and cycling, 36 per cent uses private transport, and 15 per cent uses public transport (MOUD, 2008). A household survey data from 98 large cities in India is examined to find that as densification increases, the usage of private transport decreases and the likelihood of using public transport increases (Ahmad and Puppim de Oliveira, 2016). Small and medium-sized cities are characterized by the prominent use of private motorized vehicles as against the use of public transport in large cities.

Unlike a wide range of studies examining travel behaviors in developed countries, limited studies assess the travel patterns in cities in India and other developing economies due to lack of available data (Creutzig, 2014; Banister, 2005; Ahmad and Puppim de Oliveira, 2016; Jain

and Tiwari, 2016). Insufficiency of knowledge on this issue weakens the designing and implementation of effective transportation policies (Elias *et al.*, 2015).

2.4 Travel behavior in Rural-Urban Areas

In a study comparing the commuting patterns of non-agricultural workers in urban and rural areas of National Capital Region of India, it was found that the urban residents have a higher tendency to use Personal Motorized Vehicles (PMVs) for both short and long trips whereas rural areas are identified by the usage of non-motorized vehicles for long trips. It was also found that women in urban areas commute by car rather than using green modes of transportation (Korzheneych and Jain, 2018). According to MOUD (2008) in Indian cities, 40 per cent of the population travels by walking and cycling, 36 per cent uses private transport, 15per cent uses public transport and 5 per cent uses intermediate public transport. In a study by Ahmad and Puppim de Oliveira (2016) a household survey data from 98 large Indian cities was examined, and it was found that as the densification increases, the usage of private transport decreases and the probability of using public transport increases. While small and medium-sized cities use more of private transport, large cities use public transport. Another study conducted by Manoj *et al.* (2015) finds that in urban areas of Bangalore city in India house-renters travel longer distance than house-owners while in rural areas house-owners travel longer distance than house-renters. Certain modes of transport used in rural areas are not much prevalent in urban areas and vice versa (Sudhakara Reddy and Balachandra, 2012). There are not many studies exploring the existing differences in travel behavior between urban and rural areas of India (Jain, Korzhenevych and Hecht, 2018; Korzhenevych and Jain, 2018).

2.5 Use of Public Transportation Services: Trends, Determinants and Issues Related

The challenge imposed by rising levels of dependency on motorized vehicles, urbanization, congestion and traffic on roads, and also air pollution and carbon dioxide emissions demands

a strategy which replaces private automobile vehicles with sustainable transport. Usage of public transport is proposed to be closely associated with the concept of sustainable transportation (Guo and Peeta, 2020; Ko *et al.*, 2019; Meinardi *et al.*, 2008; Ngoc *et al.*, 2017). National Urban Transport Policy (2006, 2014) also boost the use of public transport in urban areas to reduce pollution levels.

Despite the benefits attached with public transport use, a declining trend has been observed in its use over time. A study by Parikesit and Susantono (2013) finds the share of public transport use to be diminishing over time in various developing cities like Bangkok, Jakarta and Ho Chi Minh City. Zegras and Srinivasan (2006) point out the fall in share of passenger trips in public transport in China despite growth in the number of public transit vehicles. Private vehicle ownership in China is reportedly rising and use of public transport is simultaneously declining (J. Li *et al.*, 2015; Mu and de Jong, 2012). In India, on the other hand, a sizeable section of population still does not own automobiles and relies a great deal on use of public transport (Goel and Mohan, 2020). Its usage, over the years, is apparently declining (Tiwari *et al.*, 2016). Wilbur Smith and MoUD (2008) report public transport use in India as approximately 27 per cent. It is only about 20 per cent of total commuting trips undertaken in National Capital Region of India which are made using a public transport (Jain *et al.*, 2018). A study conducted in Rajkot also mentions how private vehicles are on a rise in the city (Mahadevia and Advani, 2016).

Income plays a crucial role in demand for public transportation services (Aworemi *et al.*, 2008). While certain studies demonstrate how use of public transport is dominant amongst low-income households (Ahmad and Puppim de Oliveira, 2016; Srinivasan and Rogers, 2005), other studies offer a different view of the same. Carruthers *et al.* (2005) conducted a study in 27 cities worldwide and concluded that in about 15 of the cities, public transport was unaffordable for lower quantile of income. The unaffordability of public transport for poor

people has also been illustrated for regions of Cordoba in Argentina, Montevideo in Uruguay (Falavigna and Hernandez, 2016), Japan (Matsushita *et al.*, 2015) and Sub-Saharan African cities (Olvera *et al.*, 2008).

Other socioeconomic factors, such as employment, level of education also act as important determinants of public transport use. T. Li *et al.* (2015) conducted a study in Brisbane, Australia and conclude that regions with low socioeconomic status, determined by ownership of house, employment, educational status and income, have high transportation cost of public transport.

Use of public transport also has an associated risk of safety attached to it. In a survey conducted in Mexico, about 36 per cent of the users of public transport recorded feeling unsafe (Vilalta, 2011). The frequency with which this mode is used in Melbourne, Australia is significantly determined by feelings of safety (Delbosch and Currie, 2012).

Gender-based restriction on mobility has long-term implications in terms of limiting women's access to opportunities in the domains of education, health, decision-making power, quality of life, and financial independence (Dickerson, 2019). Access to public transportation services crucially determines women's access to mobility (Smith, 2008). In certain cases, while it improves mobility, in certain other situations it only provides inferior mobility compared to other modes of transportation (Cervero *et al.*, 2002; Elias *et al.*, 2015; Gopal and Shin, 2019). Gender disparities in use of public transport are inclined towards women (Best and Lanzendorf, 2005; Dunlap *et al.*, 2000; Pickup, 1978; Polk, 2004; White, 1986).

Despite being the dominant users of public transport, the system in a large number of cities is unfit for women (Chowdhury and Wee, 2020). A study conducted in Melbourne (Australia) finds women to be more likely to feeling unsafe on a public transport (Currie *et al.*, 2013). About 80 per cent of the women in Delhi report being harassed sexually on a public transport (Bhattacharya, 2009) and approximately 50 per cent feel unsafe while using public transport

(Jagori and UN Women, 2010; Tiwari, 2014). 51.1 per cent of the individuals in Mangalore feel public transport to be unsafe for women to travel at night (Fernandes *et al.*, 2017) and sexual harassment against women is most common in public transport in Lucknow (Tripathi *et al.*, 2017). Once women start feeling unsafe, they are more prone to avoiding certain routes and modes (Jubainville and Vanier, 2017). Experience or knowledge of existence of crime affects women's decision of if and when public transport should be used (Smith, 2008).

Though public transport's share in overall modal use is in its favor, historical trends reveal a fall in its use. This declining trend can be attributed to the poor quality of infrastructure of public transportation services which pose risk of traffic accidents (Tiwari *et al.*, 2016). This poor quality is a result of lack of efficient quality management system and awareness for perceived quality. Mid-sized cities in India lack a good public transportation system (Sreela, Lakshmi and Anjaneyulu, 2018). An example is Rajkot which is reported to be lacking an operational public transportation service (Mahadevia and Advani, 2016; Munshi, 2016). Public transportation services in India are slow, overcrowded, inconvenient, dangerous and undependable (Pucher and Korattyswaroopam, 2004). They not only demand huge investments but also low-cost improvements such as improvement in service quality and customer satisfaction (Beirão and Sarsfield Cabral, 2007; Ngoc *et al.*, 2017). Majority of the users of public transport in Pune demand improvement in regularity of services (Astrop *et al.*, 1996). Reliability of services, improvement in frequency and trimming down the problem of overcrowding are crucial for mitigating the decline in use of public transportation services (Cantwell *et al.*, 2009; Redman *et al.*, 2013). Meng *et al.* (2018) also suggest consideration of travel time in this regard. Reduction in fare of these services can prove significantly beneficial for low-income individuals (Tiwari, 2001, 2014; Aworemi *et al.*, 2008; Olvera *et al.*, 2013; Burguillo *et al.*, 2017).

2.6 Gender and Mobility

Kabeer (2000) interprets empowerment as a complete process of allowing those individuals to make strategic life choices who have earlier been denied such an ability. She clearly distinguishes between first and second-order choices, where the former are those strategic life choices which are critical for people to live the lives, they want (such as choice of livelihood, whether and who to marry, whether to have children, etc.). These strategic life choices, in turn, help to frame other, second-order, less consequential choices, which may be important for the quality of one's life but do not make up a defining parameter. The concept of empowerment is explored through three closely interrelated dimensions: agency, resources, and achievements. Agency represents the processes by which choices are made and put into effect. It is, therefore, central to the concept of empowerment. Resources are the medium through which agency is exercised; and achievements refer to the outcomes of agency (Kabeer, 2005). Chakrabarti and Biswas (2012) believe that women's empowerment does not merely mean the provision of basic human rights to women but instead, creating an environment, which ensures full freedom in making use of these opportunities and in which equality with men can be enjoyed by all women everywhere.

Mahadevia (2015) points out that mobility is pivotal to women's empowerment. It not only helps women in accessing opportunities but also challenges restrictions imposed upon them. Women's access to economic opportunities enhances her family's chances of escaping poverty as well. However, a lack of affordable and convenient transport option is a big turn down in achieving these goals.

Hanson (2010) argues that gender and mobility are inseparable and there exists a two-way relationship between the them. Mahadevia and Advani (2016), Beyazit (2011) find that mobility reduces gender inequality, influences social justice and enhances capabilities.

Mobility which signifies freedom is provided by transport; freedom provides choice, choice enhances capabilities and enhancement of capabilities is important for social justice. Limited mobility and access to inadequate, slow and expensive means of transport have been proposed as reasons for the poor standard of living of women in Delhi in a study by Anand and Tiwari (2007). Gender also has an impact on mobility. Mahadevia and Advani (2016) argue that in India where two-wheelers frame an important constituent of privately owned vehicles, there are far few women users of them. In a study conducted in Pune by Astrop *et al.* (1996) it was found that the trip rate per day of women was much lower than that of men. Hanson (2010), Anand and Tiwari (2007) argue that women make shorter trips to work and value safe local streets. Women use more public transport and fewer cars for longer distances (Polk, 2004; Vance and Iovanna, 2007; Srinivasan and Rogers, 2005; Mahadevia, 2012; Anand and Tiwari, 2007). For shorter distances, women prefer walking more than men (Srinivasan and Rogers, 2005; Mahadevia, 2012).

Duchène (2011) comments that the issue of incorporating gender into transport is a recent one. It is difficult to understand the gender differences in transport issues in the absence of gender disaggregated data in the sector. Pioneer studies on the issue in the US have been by Dr. Sandra Rosenbloom since 1975. The issue first emerged in Europe in the 1990s in France after the *Femmes en mouvement* creating associations of professional women working in the transport sector, after that in Sweden and Scotland when there were movements for increasing women's employment in the transport sector.

2.7 Gender and Measures of Travel Pattern

For women to abandon traditional gender roles and enter the labor force, educational institutions, and public life and to improve their economic and social conditions, affordable and convenient transport options are pivotal. Studies have shown that men's travel needs and

patterns are different from those of women. Widely used measures of travel behavior include mode choice, trip length, trip time, trip frequency, trip purpose, trip cost, route choice, etc.

2.7.1 Trips by Purpose

In a survey conducted in Bhopal by Bhatt *et al.* (2014) and in studies by Astrop *et al.* (1996); Vance and Iovanna (2007); Root *et al.* (2010); McGuckin (2005); Spain (1997); Tilley and Houston (2016) it is reported that women engage in complicated, multipurpose “trip chaining” where trips are short, multimodal, frequent and there are many sub-trips within one main trip. In theories on gender and development, women are supposed to perform three essential roles which include reproductive, productive and community management work among which they must split their time. If women engage themselves in productive work of income earning activities, it is over and above the time allocated for the other two roles (Mahadevia, 2015). It is for this purpose that women engage themselves in more non-work related trips than men (Vance and Iovanna, 2007; Mahadevia and Advani, 2016). They are more likely to undertake trips related to household requirements, escort children to and from schools and accompany the elderly to health care centers (Murakami and Jennifer, 1997; McGuckin, 2005; Root *et al.*, 2010; Duchène, 2011) In a study conducted in Rajkot by Mahadevia and Advani (2016) it was found that while more than two-thirds of men made work-related trips, it was true for only a quarter of women travelers. Shopping was the major purpose for which trips were undertaken by women followed by education. In another study by Mahadevia (2015) conducted in Vishakhapatnam social or recreational purpose was the prime reason why the majority of the trips were undertaken by women. Saigal *et al.* (2021c) find that for those other than work purposes, women are more prone to using less-polluting modes of transport like walking, cycling and public transport, as compared to men.

2.7.2 Trips by Mode of Transport

Gender differences in mode of transport used have also been studied wherein women's higher dependency on slower modes of transport like buses and walking have been highlighted (Polk, 2004). In studies conducted in both developed and developing countries modes of transport used vary between men and women. The most common mode of travel for women in developing countries is walking. Women are usually 'no choice walkers' because other modes of transport are either unaffordable or inconvenient (Peters, 1999; Mahadevia, 2015). A similar finding was reported in a case study conducted in Casablanca by (World Bank Group, 2012). Mahadevia and Advani (2016) find that the most prominent means of transport for women in Rajkot, India was walking irrespective of their income class. Calvo (1994) highlights that "the most common means of transport in Africa are the legs, heads, and backs of African women". In studying a gendered perspective of the transport-livelihood link in Delhi, Anand and Tiwari (2007) find that women try to find work within walking distance from their homes.

Studies have found that females are more dependent on public transport than their male counterparts. Peters (2002) reports that more women than men depend upon public transport to access regional markets and social, administrative and health facilities. A case study conducted in Casablanca reports that women use public transport extensively (World Bank Group, 2012). Matthies *et al.* (2002) point out that more women use public transport because women have more restricted access to a car or do not have an alternative to traveling by car. In a study conducted in Lucknow, Tripathi *et al.* (2017) find three-wheeled Vikram to be the most commonly used means of transport among women respondents. In analyzing gender differences in patterns of transportation in Sweden, (Carlsson-Kanyama *et al.*, 1999) find that while men travel longer distances in cars, women traveled longer distances by public transport. When available, women tend to use more public transport, and less private cars in Vishakhapatnam Mahadevia and Advani (2016) finds that as income increases men tend to

shift to motorized vehicles, but women tend to shift to public transport or continue to walk in Rajkot. In a study examining the trip frequencies and transport mode choice of the elderly in the Netherlands elderly women are more likely to use public transport than elderly men (Böcker *et al.*, 2017). However, given the gender-specific concerns about safety, Tripathi *et al.* (2017) find that safety concerns negatively affect women's travel decisions. They tend to avoid certain routes and abandon public transport completely sometimes with the fear of getting harassed or victimized during their journey.

Mahadevia and Advani (2016) finds that in small cities in India the shift to using motorized vehicles by women is slower compared to men. This slow transition is more attributable to culture than income. There exist huge gender differences in usage of private motorized transport in Chennai (Srinivasan and Rogers, 2005). Peters (2002) reports that women are less likely to have access to motorized means of transport. Women's lower usage of private motor vehicles is attributed to less access to economic means as well as unfavorable culture and customs of the society. In private motor owning households, it is often only the men who get to drive and women are usually co-passengers (Peters, 1999; Carlsson-Kanyama *et al.*, 1999). Men are observed to have greater access to car-use in a large urban area of France (Havet *et al.*, 2021). In a study conducted in Barcelona city, Cubells *et al.* (2020) observe an inclination towards gender divergence in car use, which is skewed in favor of men. However, the findings of a study conducted in US by Hu (2021) suggest a different outlook. This study observes greater usage of automobiles by women than men.

Mahadevia and Advani (2016) find that women usually do not resort to cycling in Rajkot if they cannot afford public transport or private vehicles. It is believed that because of the attire of women in India, i.e., saree, it is uncomfortable and unsafe to cycle. Peters (2002) reports that cultural norms regarding women riding bicycles are highly variable across African and Asian regions and women are usually seen sitting on the backseat as co-passengers. Grudgings

et al., (2018) find clothing requirements, domestic responsibilities, gendered perceptions of cycling and low-quality cycling environment as important factors discouraging women from cycling in England and Wales. While studying school trip mode choice, studies have found that within the same age group boys are more likely to ride a bicycle than girls (Emond and Handy, 2012; Singh and Vasudevan, 2018). It is, therefore, established that women cycle lesser than men (Shaw *et al.*, 2020).

2.7.3 Trips by Distance covered

Mahadevia and Advani (2016) finds that men travel longer distances in Rajkot than women irrespective of the mode used. It is also observed in the same study that trip lengths increase with an increase in income class. Several studies have documented gender differences in mobility by comparing distances traveled by men and women finding that women travel shorter distances than men (Rosenbloom, 2009). A study conducted in France also documents how women travel shorter distances than men (Havet *et al.*, 2021). Tilley and Houston (2016) finds that men travel further than women because they have more access to cars, lesser roles in domestic chores and higher employment rates.

2.7.4 Trips by Frequency

In the case of Rajkot, the entire population does not make a trip daily. About 81 per cent male and 52 per cent female make a trip daily, and with an increase in income fewer women tend to make a trip every day (Mahadevia and Advani, 2016). There also exist gender differences in per capita trip rate in the city. Hjorthol *et al.* (2010) find that elderly women make fewer trips than elderly men. Havet *et al.* (2021), however, conclude that women make greater number of trips in a day as compared to men in France.

2.8 Socio-Demographic Factors and Travel Behavior

2.8.1 Age

One of the key societal challenges worldwide is aging. Studies have highlighted that the levels of mobility differ between elderly and non-elderly (Böcker *et al.*, 2017). However, it is important to understand that older people are not a homogenous group and there exist differences in mobility needs and travel patterns in them (Böcker *et al.*, 2017; Su and Bell, 2012). Páez *et al.* (2007) find that female unemployed elderly make fewer and shorter trips than male and employed elderly. Elderly women make fewer trips than elderly men (Li *et al.*, 2012). Böcker *et al.* (2017) find that elderly women are more dependent on walking, cycling, and public transport while men depend on using the car in Greater Rotterdam, The Netherlands. Su and Bell (2012) pointed out that compared to older men, older women's mobility is more restricted and elderly men are less likely to make trips for shopping.

Mobility patterns of young adults are different from those of the other age groups. In an interesting study conducted in Lucknow examining the travel behavior of female students in the city, it was found that because the incidences of sexual harassment in public transport were the highest among this age group, women prefer avoiding using this mode (Tripathi *et al.*, 2017). In contrast, a study in the UK finds that young adult women have greater weekly mobility than males (Tilley and Houston, 2016).

The travel behavior of children is at variance with other age groups. Singh and Vasudevan (2018) explore the travel behavior of school-going children in Kanpur and find that girls are less likely to ride a bicycle to schools than boys and girls were less likely to travel independently than boys of the same age group. However, there is a dearth of studies examining the travel mode choices for school trips in developing countries (Singh and Vasudevan, 2018).

2.8.2 Socioeconomic Status

One prominent determinant of socioeconomic status used in studies analyzing travel behavior in both developed and developing economies is income (Ahmad and Puppim de Oliveira, 2016; Burguillo *et al.*, 2017; Manoj and Verma, 2015; Olvera *et al.*, 2015). This socio-economic factor crucially controls the ability to privately own and use motorized vehicles (Li *et al.*, 2012). Generally, people with lower income are more inclined to use non-motorized or public transport (Buehler *et al.*, 2020; Manoj and Verma, 2015). As income and thereby, socioeconomic status is found to improve, the usage and ownership of motorized vehicles is found to simultaneously increase (Bansal *et al.*, 2018; Jain and Tiwari, 2019). However, one major drawback associated with income is its data which is usually under-reported. The presence of informal sector, self-employment, seasonal variability in earnings (Olvera *et al.*, 2015), recall bias, difficulty in accounting for all income generating activities like rents, pensions, (Jain and Tiwari, 2019), and presence of corruption (Saha *et al.*, 2014) are some of the factors promoting under-reporting of income data. There is, therefore, a need to use a proxy of income to achieve our desired objective (Jain and Tiwari, 2019).

2.8.3 Work Status

Working people's preference for faster and convenient modes of transport is much evident (Sharma, 2019). Employed people more likely to use private vehicles than unemployed people (Nkeki and Asikhia, 2019). A study conducted in Seoul, South Korea reveals employed people's stronger propensity towards car transportation than unemployed people (Ko *et al.*, 2019). There also exist gender differences in travel behavior among full time employees in Germany due to disproportionate burden of household responsibilities on women (Nobis *et al.*, 2004).

2.8.4 Education

Sovacool *et al.* (2018) finds that individuals with higher levels of education are more prone to buying low-carbon electric vehicles in Nordic region. A study conducted in Benin, Nigeria reveals how well-educated population prefers private modes of commuting (Nkeki and Asikhia, 2019). Contrastingly, walking and cycling rates were found to be highest among the educated population in US (Buehler *et al.*, 2020).

2.9 Gender-Sensitive Transport Planning

Transportation planning is not gender-neutral. There exist significant differences in the travel needs and patterns of men and women (Chadha *et al.*, 2017). Due to inadequate transport planning, women do not have equal access to public transport restricting their access to employment, healthcare, and educational opportunities. Vulnerability to harassment among other inconveniences frames a major hurdle in perceiving public transport as an equally accessible option for women (Khan, 2015).

Gender-sensitive transportation policies depend upon macro policies at the national and city level. National Urban Transport Policy, 2006 and National Urban Transport Policy, 2014 emphasized the need for increasing access to public transport and avoiding increasing demand for private transport (Ministry of Urban Development, 2006, 2014). However, avoiding the use of private transport may not benefit women in the context of mobility (Mahadevia, 2015). In 2010, UNEP launched the Promoting Low Carbon initiative in India wherein it was ensured that low-carbon transport plans take into account gender considerations (UNEP, 2017). The establishment of multidisciplinary teams, joint use of quantitative and qualitative methods and cross-sectoral knowledge sharing in transport projects for achieving gender mainstreaming in transport has been suggested (Crespo-Sancho, 2015).

2.10 Research Gaps

Above mentioned literature review reveals the following gaps in research:

- While studies have explained the factors determining travel behavior in urban and rural areas, not many studies have compared the gender differences in different measures of travel behavior within and between the two regions in India.
- Existing studies focus on gender differences in travel behavior between different income groups for a specific city in India. However, a comparison between rural and urban areas in the same respect has not yet been covered.
- The influence of socio-demographic and socio-economic factors on gender differences in different measures of travel behavior has not much been explored in India.
- A study examining responses of individuals to policy changes in transportation sector has not been much delved into. In addition, not many policy frameworks have been suggested on the issue of gender-inclusive transport planning.

2.11 Research Questions

- Does there exist any difference in measures of travel pattern on the basis of gender and area of residence of individuals?
- Do the socio-economic factors affect travel behavior of individuals? If yes, are there any gender differences in it?
- What can be the possible policy measures which can be taken to sensitize the transportation system for women? What are the responses of individuals to these measures?

2.12 Summary of literature review

Mobility is pivotal to women's empowerment (Mahadevia, 2015). However, lack of affordable and convenient transport option is a big turn down in achieving these goals. Gender roles also influence mobility. In India, where two-wheelers frame an important constituent of privately owned vehicles, there are far few women users of them (Mahadevia and Advani, 2016). They tend to make shorter trips, get tied to particular localities for work, value safe local streets. Women, around the globe, display a similar low transport demand (Xiao and McCright, 2015), given the disaggregated burden of home and off-home, paid and unpaid work responsibilities, and other crucial factors determining their on-street and onboard safety. Gender roles and mobility, therefore, share a bilateral relationship, i.e., gender roles shape mobility and mobility shapes gender roles (Hanson, 2010).

Gender differences in travel behavior have been drawing the attention of researchers lately. A study conducted in the developed cities of Auckland, Dublin, Helsinki and Lisbon confirms the role of gender in travel behavior (Ng and Acker, 2018). Women are less car-dependent in cities in Belgium (Vos and Alemi, 2020) and Serbia (Simićević *et al.*, 2016), and majorly use them as passengers in Israel (Elias *et al.*, 2015). Related recent literature in the developing economies are few. Similar to the findings of the developed world, findings in developing regions of Novi Sad (Basarić *et al.*, 2016), Hanoi, Jakarta, Kuala Lumpur, Manila (Ng and Acker, 2018) and Suzhou (Yang *et al.*, 2013) also confirm that women travel shorter distances, prefer public transport, walking or cycling over cars. Studies focusing on gender disparities in travel behavior in India also confirm women's travel distances to be shorter, their lower dependence on motorized vehicles, and lower trip rates as compared to men (Jain and Tiwari, 2020; Mahadevia and Advani, 2016; Saigal *et al.*, 2020a).

Few studies discuss the interrelationship between gender, income and travel behavior. In Pune, irrespective of their income class, men have a greater dependence on motorized vehicles and

women of only high-income groups use two-wheelers (Astrop *et al.*, 1996). With increase in income, women shift to public transport and men to motorized vehicles in Rajkot (Mahadevia and Advani, 2016).

Therefore, existing literature not only hints at the inconsistencies in different measures of travel pattern between men and women but also among different socioeconomic groups, and between rural and urban regions. Studies have also aimed to highlight the trends in public transportation use, the risks of safety associated with it and the need for making transportation system more sensitive towards women.



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