MIND THE GAP:

GENDER DIMENSIONS IN URBAN MOBILITY

A CASE STUDY INVESTIGATING
SUSTAINABLE URBAN MOBILITY
OF FEMALE PUBLIC TRANSPORT USERS
IN DELHI, INDIA

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ABSTRACT

Mobility and public transport are crucial determinants of sustainable development in cities. Gender dimensions are overlooked in urban mobility, impacting female public transport users' ability to move freely in urban Delhi, India. Likewise, gender-blind mobility reinforces inequality, power dynamics and exposes city dwellers to environmental risks. Hence, this research aims to shed light on gender dimensions in public transport of Delhi, which are relevant to conceptualize sustainable urban mobility in complexity. A feminist urban geography lens places gender dimensions of urban space in the spotlight of inquiry while the previous discourse on urban space, gender, and mobility provides a theoretical framework. The research integrates five in-depth semi-structured interviews with female students at the University of Delhi, five mind- maps, and five concept- maps based on participatory research principles.

The research concludes that urban space, gender, and mobility are interrelated and multi-layered dimensions relevant to conceptualize sustainable urban mobility. Furthermore, the case study findings reveal intertwined social, economic, and ecological factors perceived as relevant by participants to meet their needs in public transport of Delhi. Thereby, a context-specific and future-oriented explorative approach of sustainable mobility is conceptualized based on the experiences of female public transport users.

Key words: Sustainable mobility, Gender, Mobility, Urban space, Public transport, Delhi-India, Sustainable development, Urban feminist geography

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Content

1. Introduction

L: I am not using public transport a lot",

I: Why?"

L: Cause, I am a woman". (Interview L)

This quote raises a fundamental question: What comes to your mind thinking about the way from home to school or work? Most likely, gender is none of the aspects that may seem relevant. However, gender matters for mobility as much as mobility matters for gender (Cresswell 2010). The quote by a female public transport user in Delhi, India, underlines the tremendous need to shed- light on gender dimensions of mobility to enhance womens´ capabilities in urban space.

Mobility and transportation are relevant for human-environmental interaction in urban space (Cook 2018). While mobility means individuals´ capability to move freely from one place to another, gender is discussed as a characteristic limiting woman to do so (Adey et al. 2014, Cresswell and Merriman 2011). The United Nations states that a lack of mobility and transport constrain women's lives daily (UN 2015, 2018). Urban feminist geographers consider that gender-blind mobility reinforces power structures, deepens inequalities, and produces gender elusive cities (Cresswell and Uteng 2008, Moss et al. 2002). A range of studies reveal that means and ends of mobility are linked to sustainable development goals such as no poverty, good health, education, economic growth, and gender equality (Murray and Upstone 2014, Nielsen et al. 2006, Madariaga 2013). Indeed, the United Nations acknowledges the significance of urban mobility for sustainable development by noting public transport for women in the Agenda 2030:

> **"Provide access to safe, affordable, accessible and sustainable transport systems** for all improving road safety, **notably by expanding public transport systems** with special attention to the needs for those in vulnerable situations, **women**, children, persons with disabilities and older person"

(UN 2015, p. 24, highlights by author)

Nevertheless, womens´ mobility remains limited in rapidly urbanizing cities in India (Cook 2018). Studies in Delhi show that 52% of women, compared to 26% of men, walk to work instead of using public transport (Shah et al. 2017, Anand and Tiwari 2006). Likewise, a study reveals that only 2% of the participants using the bicycle as a transport mode are women (Anand and Tiwari 2006). Furthermore, womens´ participation in the labor market is linked to mobility service (Shah et al. 2017). For instance, 75% of men take work within a 12km radius, whilst more than half of the women take jobs within a 5km radius (ibid). Other studies relate sexual harassment, fear of crime, and unequal distribution of resources to a lack of mobility in India (Pucher et al. 2004, Singh 2005, Vaidya 2020). 90% of females participating in a study state to have experienced sexual harassment in public transport of Delhi (Jagori 2010). Likewise, the sphere of public transport remains dominated by men, which is an indicator of socio-economic gender gaps and exposes women to environmental risks (ibid).

Overlooking case-specific circumstances and underrepresentation of womens´ experiences reinforces existing structures and produces gender elusive public transport. This study aims to conceptualize sustainable mobility with an in-depth focus on female transport users' experiences to understand and approach urban mobility according to the needs of female transport users. Taking feminist urban geography discourse as a point of departure, this research supports the quest to develop inclusive, sustainable mobility by investigating female public transport user's experiences and perceptions in Delhi, India.

1.1 Specific aims and research question

Sustainable mobility and public transport require an in-depth understanding of relevant factors that integrate gendered dimensions and context-specific factors. Hence, this research sheds light on female public transport users´ experiences in Delhi, India, to understand and conceptualize mobility according to their needs.

The research aims to **conceptualize** sustainable mobility based on female public transport user's perceptions at the University of Delhi. Furthermore, the investigation aims to **reveal** relevant factors for sustainable mobility, which seeks to understand present conditions of womens´ mobility while integrating their suggestions on improving public transport sustainably. The research aims to contribute to academia with case-specific findings and to enhance the concept of sustainable mobility, inspiring societal awareness, urban planning,

research, and governance to understand and integrate womens´ perception in future mobility development.

The specific aims of this research are approached by asking the following questions:

Research question:

R1: How do female public transport users conceptualize sustainable mobility in Delhi, India?

R 2: What are the relevant factors for sustainable mobility perceived by female public transport users in Delhi?

The study is designed as a qualitative single case study of Delhi investigating the perceptions and experiences of female students at the University of New Delhi. Moreover, participatory research (PR) is applied to center the inquiry around participants' perception and promote conceptualization of sustainable mobility in linkages to case-specific context.

1.2 Delimitations

This research contains delimitations that demonstrate the scope and scale of the research.

First, the study delimits the definition of gender as to definition Chapter 2.2 and the definition of sustainable mobility as defined in Chapter 4. This choice of definitions delimits the study to other terminologies; however, it ensures coherency within the given scope and scale of this research. Secondly, a single-case study approach delimits the study to context-specific circumstances of urban public transport in Delhi. Hence, findings are not to be generalized and applicable in other contexts while serving as an inspiration elsewhere. Thirdly, the research is delimited to focus on a particular group of women: female students at the University of New Delhi (see Chapter 6.). Fourth, the study is delimited to display female perceptions. It excludes masculine angles of gender dimensions. Moreover, the study does not represent a consensus of female public transport users in New Delhi as findings are bound to the socio-economic, historical, geographical, and cultural background of participants, researcher, and context of the study.

1.3 Structure

The first chapter introduces the subject of the study and justifies the research investigation. Furthermore, it includes stating specific aims and the guiding research question, and an outline of the structure. The second chapter provides an in-depth literature review reflecting previous literature on geographies of urban mobility in linkage to gender dimensions recognizing a gap of women in public transport development. The third chapter localizes the cases´ background by focusing on the urban area of Delhi, its public transport sector, and mobility governance which ends with an evaluation of the case. The fourth chapter evolves a theoretical framework to ground the analytical discussion of its findings. Urban feminist geography is discussed as an analytical lens for study while the concepts of urban mobility and sustainability are connected to derive a theoretical framework linking gender, urban space, and mobility. The fifth chapter is dedicated to the research methodology consisting of the overall research design, data collection, and data analysis. Chapter six includes results and analysis of the findings and chapter seven will critically discuss the results. The final chapter is dedicated to concluding the research.

2. Literature review

This section reviews previous literature to tie the investigation into the broader research interest. An in-depth literature review draws upon an existing discourse of geographies of urban mobility focusing on public transportation. Furthermore, it considers gender dimensions of mobility in urban space. It concludes with a critical evaluation minding a tentative gap integrating women's experience in urban public transport.

2.1 Geographies of urban mobility

Mobility has become a keyword in social science in the past decades (Adey et al. 2014, Cook 2018). Rapid urbanization, population growth, and technological progress are some of the many factors making the twenty-first century being "on the move" in multiple dimensions (Adey et al. 2014, Cresswell 2001). Hence, mobility and transportation gained attention in interdisciplinary social science literature (Sheller and Urry 2006, Warf 2010).

Mobility is scientifically rooted in Geography discourse seeking to understand human-environmental linkages through the lens of space (Cook 2018). Mobility has been considered

in related disciplines such as human geography, urban planning, tourism, transportation, and anthropology (Kwan and Schwanen 2016, Adey et al. 2014). On the one hand, geographers use mobility to analyze the physical movement of people from one place to the other, which has developed qualitative research mapping flows of people, modes of transport, and integrating indicators such as age, gender, location (Massey et al. 1993, Gonzalez et al. 2008, Crang 2002). Cook finds a range of studies measuring mobility based on the frequency of transportation, accessibility of modes from a particular location, and statistics on the different forms of mobility in urban spaces (Algers et al. 2005, Bullard and Johnson 1997, Cook 2018). It has been relevant for infrastructure, transportation, built environment, and urban planning scholars (Adey et al. 2014, Abler et al. 1971).

On the other hand, mobility developed particularly descriptive in human - and cultural geography, seeking an understanding of human-environmental linkages in a holistic sense (Kakihara and Sörensen 2001, Cook 2018, Crang 2002). Its meaning beyond physical movement relates to political, social, cultural, and geographic circumstances in a bounded space (Jensen 2009, Sheller 2017). Ground-breaking work from Hägerstrand stresses that human-environmental dynamics are interrelated (Corbett 2005, Thrift 1977). Cresswell, Urry, and Sheller developed this angle of mobility integrating interlinkages of environment and human interaction, which marks a theoretical and methodological shift of social sciences to acknowledge mobility as a social phenomenon of complexity and multidimensionality (Cresswell 2001, Urry 2007, Sheller 2017).

2.1.1 Urban mobility: A contested concept

Mobility has undergone a transformative development due to its conceptualization and integration across disciplines of social sciences. Urry suggests that mobility has been a widely contested concept (Urry, 2007). Mobility lacks a precise definition, often leading to misunderstanding and limited coherence in its conceptual use (Hannam et al. 2006). Cook points out a vague and fuzzy understanding of the term due to its use as an umbrella to describe different kinds of movement over space (Cook 2018). Geographies of mobility have a strength of complexity, such as weaknesses in conceptual vagueness (Adey et al. 2014). Tying into that, Kakihara and Sörensen identify that the concept has been used isolated by several disciplines (Kakihara and Sörensen 2001). Sheller and Urry both argue that vague

conceptualization leaves an unresponsive analogy for addressing mobility in an urban context nowadays (Sheller and Urry 2006).

Based on this discourse, more contemporary use of the concept of urban mobility surrounding the work of scholars such as Sheller (2018), Adey et al. (2014), and Cresswell (2010) is adopted in this research. The scholarship stresses the term as a multidimensional and dynamic concept to understand the interlinkages of space, societal interaction, and movement in urban areas (Cresswell and Uteng 2008, 2011, Kwan and Schwanen 2016, Jensen 2010). Thereby, urban mobility is as a capability of individuals to move freely over space and time in linkage to transportation opportunities from one place to the other within a bounded urban space (ibid). While this study acknowledges other terminologies, it uses this definition for the coherence of research focus.

2.1.2 Urban mobility: The public transport sector

The public transportation sector (PTS) has evolved as a core facility to approach and provide mobility in urban areas and refers to publicly operated services in urban areas to move from one place to the other (Kapoor 2019, Asian Development Bank 2013, Bergmann and Sager 2018, Sheller and Urry 2006, Hanson 2010). Public transport has been developed by transportation geography and adapted in urban planning and infrastructure scholarship (Shaw and Sidaway 2011). The public transport sector integrates various service forms such as public busses, rapid mass transport systems, and shared vehicles (Simpson 2014). Likewise, Simpson states that rapid urbanization worldwide requires the development of the PTS to organize and combat the increasing flow of people within space (ibid). Banister highlights that the public transport sector aims to provide movement services accessible to city dwellers (Banister 2008).

The relevance of PTS for sustainable development of urban spaces has been recognized in the UN Earth Summit of 1992 and adapted in the World Summit of 2002 (Burinskiené 2009). Likewise, it has been integrated into the Paris Climate Agreement of 2015 and the Sustainable Development Agenda 2030 (Hedenus et al. 2018). Besides, urban public transportation enhances multiple SDGs, notably poverty, health, infrastructure, sustainable communities, and education (UN 2021). The significance of PTS for urban mobility for human development

is replicated in the Agenda 2030 paragraph 11.2, stating that public transport is significant to provide safe, accessible, affordable mobility to all (UN 2015).

2.2 Going beyond urban mobility: gender dimensions

Gender refers to socially constructed categories such as men and women, boys and girls, which relate to assumed differences regarding social norms, roles, expression, and behavior of people based on their gender identity (WHO 2021). Gender is not an inherently binary concept despite it often being constructed as such (Esplen and Jolly 2006, Shah et al. 2017).

Gendered dimensions of urban transport mobility are based on the notion that mobility expresses and shapes urban space (Esplen and Jolly 2006, Moss et al. 2002, Allen 2018, Law 1999). A core element of the gender dimension in mobility is the assumption that gender is a constitutive element of human-environmental interaction within urban space (ibid). It suggests that gender is a characteristic impacting the ability of women to move freely in urban space (Shah et al. 2017, Kapoor 2019). Hanson reasons the assumption in a dichotomy of gender and mobility (Hanson 2010). On the one hand, gender is associated with structural phenomena rooted in social, cultural, institutional differences between and amongst men and women (Nelson and Seager 2008, Sharp 2005, Moss et al. 2002). Feminist urban geographers discuss that patriarchy, unequal power distribution, and cultural preconditions shape urban space (Moss et al. 2002, Allen 2018, Khosla 2005). On the other hand, means and ends to mobility are shaped by existing structures of a bounded urban space (Cresswell and Merriman 2011). The interrelated dichotomy suggests gender matters for mobility as much as mobility matters for gender (Hanson 2010).

2.2.1   Social, economic, and ecological factors

Adopting the notion of a gender and mobility dichotomy links socio-spatial factors of urban space to public transport service. Previous studies relate mobility to gender equality such as women's access to urban opportunities (Kapoor 2019, Cresswell and Merriman 2011).

Spatial factors are relevant to understand gendered urban mobility dimensions (Cook 2018, Bergmann and Sager 2018, Duchéne 2011). Cook et al. discuss that a gender blind production of space creates mobility in cities based on underlying patriarchal structures (Cook et al.

10

2000, Chen et al. 2018). Kapoor finds that patriarchal structures in society create spaces that exclude women structurally (Kapoor 2019). For instance, socio-spatial dynamics are argued to impact physical aspects of mobility that integrate factors such as location, distribution, and modes of transportation (Siemiatycki et al. 2020, Khosla 2005). Indeed, the physical built environment, land use, distribution of frequency, and availability of mobility are spatially formed by underlying structures of society (Cook et al. 2000, Nelson and Seager 2008, Gilbert 1997). Manolache discovers that patriarchal structures remain formative in mobility governance, leading to an urban mobility supply that is not designed for womens´ needs (Manolache 2013). Studies examine that a gender-exclusive built environment of urban spaces create a continuous exclusion of women from society (Kapoor 2019, Shaw and Sidaway 2011, Sharp 2005).

Chen et al. discover that socio-spatial gaps are created due to the gender-blind built environment of public transport (Chen et al. 2018). Tying into Cresswell's findings mobility is the expression of human-environmental interaction over space and time; however, economic, social-cultural, and spatial factors impact the interaction of women with public transport (Cresswell and Merriman 2011, Litman and Burwell 2006, Haghshenas and Vaziri 2012, Warf 2010). Cresswell and Uteng state that excluding women from the labor market reinforces poverty traps and deepens gender inequality in urban space (Cresswell and Uteng 2008). Scholars discover different mobility patterns and use of transport modes of women in cities as women appear to interact with society differently than men (Rosenbloom 1998, Haghshenas and Vaziri 2012). Studies show that women are less likely than men to participate in better employment opportunities when their urban mobility is limited (Asian Development Bank 2013, Shah et al. 2017). Similarly, women prefer local but lower-paid jobs due to combining other trips and proximity to the household location (Kapoor 2019). Hamilton and Jenkins stress a higher dependence on decent daily mobility service as women often carry triple burdens combining child care, household, and employment in urban areas (Hamilton and Jenkins 2000). Whilst men are more likely to commute one-way trips to work and back home, women are interrupting travels to work for other tasks such as groceries and child-care (Nobis and Lenz 2005). Indeed, trip shares differ substantially between men and women (Nobis and Lenz 2005, Rosenbloom 1998).

Thus, womens´ ability to access urban opportunities is relevant to facilitate gender equality and end poverty (UN 2018, Anand and Tiwari 2006, Warf 2010). Likewise, a lack of mobility relates to existing power dynamics, while reinforcing them continuously in urban spaces

(Herbel and Gaines 2009). Thereby, women remain often structurally excluded from equal capabilities in urban spaces (ibid).

2.3 Mind the gap: gender and public transport

This literature review explored previous discourse on urban mobility and public transport in linkage to gender dimensions (Hannam et al. 2006, Cook 2018, Adey et al. 2014).

However, a knowledge gap integrating women's perceptions in conceptualizing sustainable urban public transportation in its multidimensionality and complexity remains (Shaw and Sidaway 2011, Kapoor 2019, Madariaga 2013). Moreover, Cresswell and Uteng stress that a structural overlooking of case-specific conditions in the public transport system produces gender elusive urban spaces (Cresswell and Uteng 2008). Besides, space is a construct of political, economic, and institutional dynamics that constantly shape and reinforce human-environmental interactions (Cook 2018). Hence, the lack of participatory and localized approaches integrating transport users' views hinders responsive approaches to urban mobility.

This study stresses that women deserve a more dedicated research focus combining existing feminist urban geography, mobility, public transport scholarship with female transport user's experiences and perceptions of a specific case- and context.

3. The Case

This chapter provides a background of the case by localizing the urban space of Delhi, India, reviewing the local public transport system and mobility governance while ending with an evaluation of choice of case.

3.1 Localizing Delhi

India is one of the most rapidly urbanizing countries of the global South, with a growing urban population from 25% in 2001 to a predicted 49% in 2030 (Vaidya 2020, WRI India 2020). The capital city Delhi follows that trend. Nearly 1,000 people each day had to move to the city in 2016 (Kundu 2011). It comprises a total population of 18.6 million as of 2016 and is expected to become one of the most populous cities in the world by 2030 (WPR 2020).

Geographically Delhi is located in Northern India between the latitudes of 28°-24'-17" and 28°-53'-00" North and longitudes of 76°-50'-24" and 77°-20'-37" East covering an area of 1,483 sqm (Alams 2015). This research uses the definition of urban agglomeration based on Fang 2017, which defines the boundaries of Delhi integrating spatial factors such as population size, historical coherence, and shared identity of people (Fang and Yu 2017).

Almost half of the urban population in India is female, namely 6,243,273 people (Shah et al. 2017). The Human Development Index ranks India 131 out of 189 countries with an HDI value of 0.645 in 2019, acknowledging gender inequality as a remaining challenge (UNDP 2020). According to the OECD, India is considered a developing nation of the global South that requires holistic approaches to combat social, economic, and ecological risks (OECD 2021).
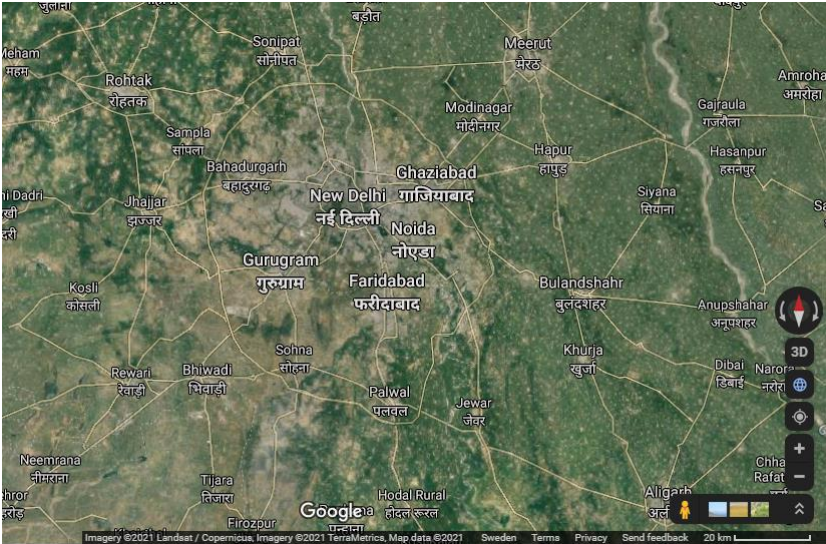
Figure 1: Map of Delhi

(Google maps 2021)

3.1.1 Public Transport Sector

Delimiting various modes of public transport, this study focuses on the bus, metro, rickshaw, bicycle, and walking services in Delhi. On average, 40% of Delhi's population uses public transport modes regularly (The Yamuna River project 2016). The primary modes of public transport today are busses and the metro in Delhi (DDA 2007). The state operates a large bus rapid transit system through the Delhi transport corporation (DTC) (The Yamuna River project 2016). 60% of urban commuters use public busses as the primary transport mode (The Yamuna River project 2016). Delhi Metro integrates a rail-based rapid transit system into the public transport sector of Delhi (DDA 2007). As of 2017, the network included a total

length of 213 kilometres with 160 stations (UNDP 2020). The national government targets to increase its lengths up to 413 km, by 2025 (DDA 2007). On average, 2.4 million ridership's are reported per day (Alams 2015). Moreover, the number of commuters per day is expected to increase up to 4.0 million per day (Alams 2015). Other relevant modes of public transport are often combined with buses and the metro (Pucher et al. 2004). Rikshaws, including e-rickshaws, auto-rickshaws, and bicycles operate short-distance trips at the local level (Tiwari 2002). Furthermore, walking and cycling are used forms of urban mobility (Alams 2015). A railway system connects the urban area via a ring system with peripheral areas and other cities (ibid).

3.1.2   Mobility governance

Previous studies reveal a significant problem of Delhi´s public transportation to approach the movement of a growing population (Vaidya 2020, Kundu 2011). According to the environmental ministry of Delhi, the city requires sustainable approaches to urban public transportation to cater to the needs of a growing population (Environmental Ministry Delhi 2020). Khalid et al. stress that Delhi faces social, economic, and ecological risks induced by both public and private transport sectors (Khalid et al. 2020). Indeed, Delhi is one of the most polluted cities worldwide, while CO_2 emissions are primarily induced from the transportation sector (Alams 2015). Segregation processes, exclusion, and spatial power dynamics relate to a lack of public transportation in Delhi (Litman and Burwell 2006). For instance, the United Nations relates a gender gap in Delhi to a missing public transport (UN 2018, 2021).

The local government of Delhi has announced public transport as a major mission of the city's development (Alams 2015). The Delhi development authority introduced an extensive master development plan in 2007, which targets rapid modernization and expansion of public transport, notably by expanding metro and bus systems (Alams 2015, DDA 2007). A monitoring framework for SDG 11 in India provides an in-depth statement of the lack of sustainable public transportation, including its impact on health, poverty, and inequality in Delhi (Vaidya 2020). Nevertheless, previous studies stress that a gap in integrating various forms of PTS on physical and operational levels remains (Pucher et al. 2004). Likewise, a disproportional disadvantage of women in PTS in Delhi is examined (Vaidya 2020, Alams 2015).

3.2 Evaluation of case

Delhi's public transport sector serves as an ideal case to investigating womens' mobility in urban space. The background justifies a need for public transportation service in Delhi to facilitate sustainable development. Moreover, previous research acknowledges that the city requires case-specific and context-related approaches that conceptualize sustainable mobility specifically for a growing population of female users. Besides, Delhi is a complex and multi-layered urban space integrating unique socio-economic, cultural, economic, and spatial phenomena.

4. Theoretical Framework

This chapter evolves the theoretical framework of this research. A feminist urban geography lens is applied to investigate the urban social phenomena of mobility from a gendered perspective. The concept of sustainability is discussed as an underlying conceptual scheme to promote life-enhancing conditions for all human-environmental interactions over space and time. The concept of urban mobility is discussed as a concept to investigate womens' perception of public transport. On the one hand, gender, sustainability, and mobility are distinct concepts. On the other hand, this research connects the concepts to conceptualize sustainable mobility based on women's perceptions interacting within the urban space.

4.1 Analytical lens: Feminist urban Geography

Scientifically feminist urban geography evolves from a theoretical discussion of feminism and geography (Abler et al. 1971, McDowell 1992). Geography takes a lens of space to social and environmental phenomena (ibid). Feminist scholars discuss differences in power distribution in society between men and women based on the socially constructed category of gender (McDowell 1992, Manolache 2013). Feminist urban geography integrates both notions by applying their assumptions to urban space (Khosla 2005, Manolache 2013, Gilbert 1997). Hence, feminist urban geography assumes that gender dimensions play a role in urban space (Wyer et al. 2001). Likewise, a spatial production of gendered dimensions impacts the interaction of men and women within and across urban space (Sjemiatycki et al. 2020,

Manolache 2013). Cook et al. theorize that gendered dimensions are relevant to understand social phenomena in linkage to urban space (Cook et al. 2000).

Feminist Urban Geography is applied as a lens to assess human-environmental interactions linked to mobility from a gendered perspective (Mohammad 2016, Moss et al. 2002). It allows this research to discuss findings from a critical stance on urban space integrating the concept of gender. Moreover, it places gender and its relation to urban space in the spotlight of analysis. Thus, feminist urban geography is a lens of this research to gain insights into gendered dimensions in mobility and transportation revealed by female transport users (Cook et al. 2000, Beebeejaun 2017, Khosla 2005).

4.2 Conceptual background

Two distinct theoretical concepts serve as pillars of this thesis. On the one hand, urban mobility is applied as a concept to discuss individuals' capabilities to move freely in urban space. On the other hand, sustainability is used as a concept to seek holistic life-enhancing development. Jointly the two concepts form the conceptual foundation to discuss perceptions of female transport users (Cresswell 2010, Kwan and Schwanen 2016, Jensen 2010, Adey et al. 2014)

4.2.1   Urban mobility

A definition is extracted from the broad mobility discourse to serve this research:

> *"Urban mobility is a condition under which an individual is capable of moving freely in the urban environment"*
>
> (Shah et al. 2017, p. J).

Mobility is a concept used across social science disciplines as a socio-spatial expression of humans- environmental linkages integrating all kinds of relevant factors to understanding the intertwined relation between "movement" and "space" (Urry 2007). The work of Cresswell (2010), Kwan, and Schwanen (2016), and Jensen (2010) conceptualizes mobility as interdisciplinary and for urban use. Cook's findings mark a theoretical shift diffusing different lines of mobility research, transforming it to an interdisciplinary conceptualization for

contemporary use in urban spaces (Cook 2018). This consensus adds a new dimension to mobility scholars considering socio-cultural, institutional, and spatial factors constraining the interaction (Kaufmann 2002, Sheller 2017, Adey et al. 2014). Hence, the concept of mobility has been transformed towards a frequently changing notion of space, context-specific factors, and humans interaction (Jensen 2010). Cresswell contributes essential findings to the discourse by understanding mobility as a constantly changing, fluid, and dynamic approach integrating physical aspects, socially attached meaning, and the perceived experience of an individual or a plurality of people whilst moving within an urban context (Cresswell 2001, 2002). Thereby, the concept is suitable to discover mobility as an intertwined social phenomenon in this research grounded in findings of Cresswell (2001, 2002), Jensen (2010), Adey et al. (2014), Murray and Upstone (2014), Sheller (2018).

4.2.2 Sustainability

The United Nations have adopted the concept of sustainability as a guideline to seek holistic human development.

> *"Sustainability means a condition in which present individuals meet their*
> *needs without compromising future generation's needs*

(UN 1987, UNESCO 2021)

Sustainability is a concept used to seek and conceptualize holistic human development in a multidimensional sense (Chen et al. 2018). Hansmann et al. suggests sustainability as a concept to grasp social phenomena in their complexity and holistic nature (Hansmann et al. 2012). Laws et al. argue that the concept goes beyond securing ecological resources as it seeks socially just and ethically acceptable conditions of human-environmental linkages (Laws et al. 2004). Moreover, it provides a basis for improving societal and environmental conditions by focusing on social, economic, and ecological dimensions to conceptualize maintainable conditions of society for all (Scholz 2011, Hedenus et al. 2018). First, social dimensions refer to the facilitation of dynamics that create, replicate, and maintain life-enhancing conditions in a bounded space (Root et al. 2000). Social sustainability encounters dynamics that are relevant for individuals to interact within their social environment (ibid). Secondly, economic sustainability refers to equal distribution of resources to the benefit of society, resilient and maintainable investment of capital, and access to economic opportunities

for all individuals (Laws et al. 2004, Redcliff 2005). Economic factors are relevant to provide long-term access to economic opportunities for individuals to meet their needs (ibid). Thirdly, ecological dimensions refer to conserving environmental natural resources, reducing the Anthropocene impact on the natural environment, and seeking long-term use of natural resources for all (Scholz 2011).

Various terminologies have been presented to describe the vague and dynamic concept of sustainability. The concept is frequently changing as it encounters multidimensional and complex phenomena (Hedenus et al. 2018). Indeed, sustainability lacks clear definitions making the concept difficult to be applied (Harris 2003). Clune and Zehnder state that sustainability is used as a contemporary development approach across disciplines and fields (Clune and Zehnder 2018). Chen et al. criticize applying the umbrella term in various contexts run the risk of leaving unresponsive approaches to issues (Chen et al. 2018). Indeed, as sustainable means to provide maintainable social, ecological, and economic dimensions for present and future generations, it risks generalizability to create unresponsive terminologies for local use (Shi et al. 2019).

Hence, sustainability is a contested concept. Nevertheless, its inherent conceptual openness is a strength to unfold meanings ascribe to sustainability according to specific context and case (Hansmann et al. 2012). Therefore, sustainability is used in this research to conceptualize mobility integrating social-economic and ecological dimensions in complexity bounded to context-specific meanings (Chen et al. 2018, Laws et al. 2004)
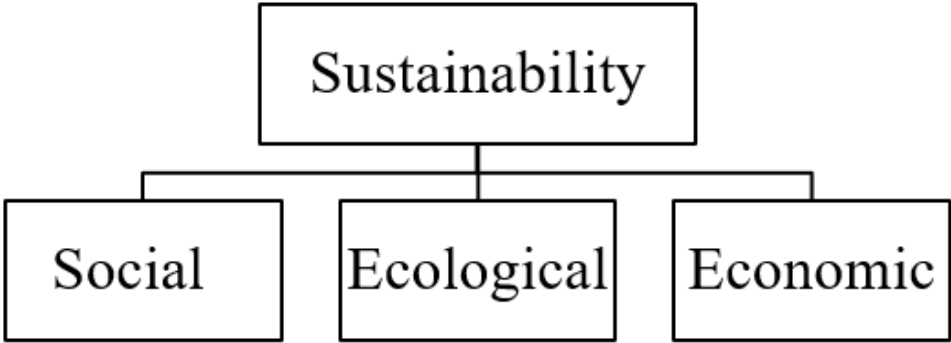

Figure 2: Factors of sustainability

4.3 From conceptual discourse to a theoretical framework

Feminist urban geography has been discussed as a lens of this research to understand findings from a feminist perspective focusing on urban space and gender interlinkages. Moreover, the concepts of sustainability and mobility were examined as conceptual pillars for this research.
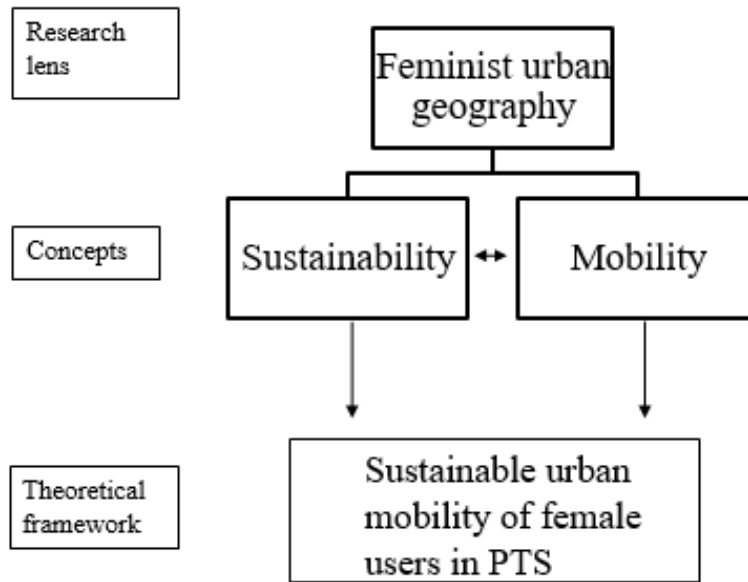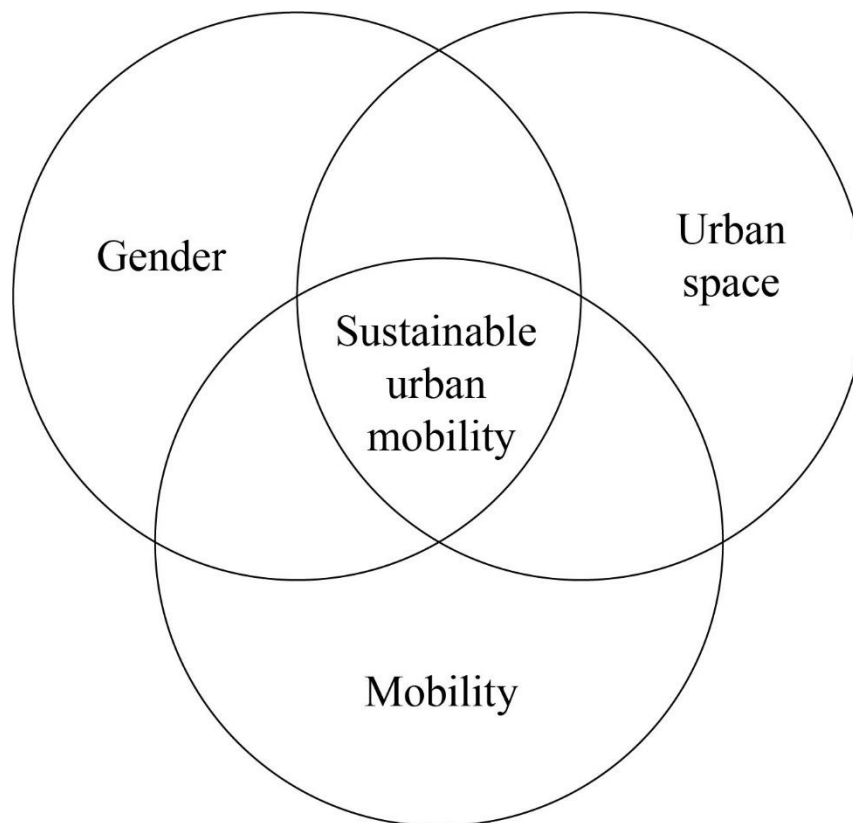

Figure 3: Evolving a theoretical framework

Taking an analytical lens of feminist urban geography while combining the concepts of mobility and sustainability derives a theoretical framework suitable for assessing the findings of this research. The framework integrates sustainability targeting a life-enhancing condition of all and mobility as a capability of free movement over urban space and time (UN 2015, Shah et al. 2017). Furthermore, it understands urban space, gender, and mobility as an intertwined framework relevant to understanding and conceptualizing sustainable mobility. Combining conceptual discourse with an analytical lens forms a framework to understand, reveal and conceptualize a condition of mobility in which female transport users meet their needs by moving freely in urban space. Thereby, the working definition developed by the author for this study, which is also visualized below, is as follows:

> *"Sustainable urban mobility of females is the perceived capability of females to meet their needs by moving freely in urban space and time"*
>
> (By author)

Figure 4: Theoretical framework of sustainable urban mobility for female public transport user

5. Methodology

5.1 Overall research strategy

This study applies a qualitative methodology, which supports the research objective to explore female perceptions and meanings ascribed to the phenomena of sustainable mobility in-depth (Lewis- Beck et al. 2003, p.61). It is chosen as an asset to this research to generate data that reveals and conceptualizes sustainable mobility in complexity and multidimensionality (Bryman 2016, p. 150). Tying into that, a single case study approach bounds the inquiry to the case-specific context, which is a highly responsive exploratory approach seeking to understand women's mobility in public transportation in the bounded urban space of Delhi. Approaching the research as a case study ensures an in-depth investigation acknowledging the natural setting and intrinsic complexity of studied phenomena (Punch 2008, p. 134). Hence, findings of the study are drawn from the chosen case by accessing the conditions, dynamics and meanings bounded to the particular time and

space. Thereby, the case study design delimits the study´s generalizability, while serving as an inspiration for other contexts (Bryman 2016, p.150).

Moreover, methodological principles of Participatory Research (PR) are applied throughout the investigation, which intends to center research around the participants and to seek involvement in defining and addressing solutions (Maguire 1987). Participatory research enhances involvement, self-reliance, empowerment, and the active contribution of participants (Cornwall and Jewkes 1995). Employing PR- principles seeks to look beyond understanding informants' perception and conceptualize future-oriented approaches to sustainable mobility from the participant's point of view (Scheyvens 2014, p.64).

The qualitative research design consists of two qualitative methods for data collection. First, semi-structured interviews are conducted with female students at the University of Delhi. Moreover, participatory mapping tools conceptualize perceptions in a visual and creative process (Pain and Francis 2003). Qualitative content analysis is applied for data analysis, which allows looking at individual sequences of data in-depth whilst acknowledging their complexity and diversity (Punch 2008, p. 46). The overall research strategy is used as a guideline throughout this research to ensure the coherent transfer of the proposed research question and specific aims.

5.1.1   Selection

The selection and sampling process are crucial determinants of the research results (Punch 2008, p. 34).

First, participants for this study are selected based on the criteria of describing themselves as women related to the definition of gender as in section 2.1 and being enrolled as a student at the University of Delhi. I choose to focus on female University students because I assume that this group is likely to use public transport as a service to access education in Delhi. Likewise, I assume a willingness to participate in the study and contribution to its objectives as students are a higher educated group while being more familiar with research methods than other city dwellers. Furthermore, the University of Delhi is chosen as an indicator delimiting a proximity spatial location within the chosen case of Delhi. Selecting participants from the University of Delhi provides a common urban destination of participants and hence, a structural baseline for data analysis relating to the mobility of females in the city. Both

selection indicators are applied to reduce socio-cultural, economic, and spatial factors differentiating between the complex and diverse group of "women" and the multidimensional space of "Delhi". Although female students are not a homogenous group, and the University of Delhi remains a complex urban location, this selection reduces external factors and provides a manageable framework for inquiry.

Based on the narrowed selection of female students at the University of Delhi, I spread participation in this study as much as practicability's allowed. Hence, safe selective/ convenience sampling was applied to select participants (Bryman 2016, p.155). Convenience sampling allowed to reach out to female students to select participants from the selection group through various tools such as email, official websites, and social media. However, applying safe selective/convenience sampling induced biases to the sample as I was not capable of spreading the information to all female students at the University. Besides, some students likely had better opportunities in terms of language, technical devices, self-confidence, previous participatory experience, and time to get back to me than others might have had. Hence, the selection is impacted by factors that hindered or promoted particular female students to participate.

Additionally, snowballing principles within the delimited scope of participants occurred after initial contact. Students and professors forwarded or recommended the opportunity to participate to further students, which then got back to me. Snowballing added a natural and coincidental selection out of the control of the researcher (Bryman 2016, p.155)

5.1.2   Limitations

This research faces limitations throughout the investigation that impact the outcome.

First, due to the Covid-19 situation, the data collection process was conducted entirely through online tools instead of inquiry in a natural setting. Potential participants without access to online tools could not be considered. Secondly, communication and interaction of researcher and participants impact the accuracy of data. As the chosen language for data collection was neither the native language of the researcher nor of the participants' meanings might be lost in translation. Moreover, information was transferred through the microphone of participants and recorded only as a second technical device on the smartphone, which leads to misunderstandings and missing data sequences. Thirdly, due to the scope and scale of this

research project, it only integrates female students at the University of Delhi, and further, only a sample of this group. Hence, due to practicability, the study selects students as in Chapter 5.1.1, acknowledging that this limits the representativeness of findings. Fourthly, my previous knowledge and background, and intentions of carrying out this research bias me as a researcher. Likewise, the relationship between myself as a researcher and the participants limit the data in its accuracy (Punch 2008, p. 41). As participants and researcher were both enrolled at university and similar ages, the behavior and hence, the data was affected by a familiar and rather informal inquiry. However, I intend to be aware of biases and reduce their impact on the findings as much as possible throughout the research.

5.1.3   Ethical considerations

This research integrates ethical consideration as a base of investigation.

 First, I point out ethical issues faced regarding my role as a researcher. I am aware of power structures resulting from global power gradients and socio-economic, historical, and cultural differences between researcher and participants of the study (Chambers 2008). Intending to avoid biases, I aim to constantly rethink my position and the research position while questioning my role and behavior as a researcher critically. Furthermore, I consider that personal interests in carrying out this research can result in pressure for participants of this study (Scheyvens 2014). Hence, I inform all participants that their contribution is voluntary and that their data is used anonymously. I offer the opportunity to withdraw any of the informants' contributions at all stages of the interview on request.

Secondly, I acknowledge that topics of study such as gender dimensions, sustainability, and mobility can relate to participants' overly sensitive and multidimensional conditions. To avoid ethical dilemmas, I am required to use the data consciously without compromising the dignity of participants or dishonor certain conditions that are described (Scheyvens 2014). Tying into that, I am aware that the qualitative research design may retrieve the participants' vulnerable and potentially personal information (Misturelli and Heffernan 2010). Hence, I honor the sensitivity of data and dignity of sources throughout the investigation as well as whilst using its findings.

Thirdly, I acknowledge that I am not familiar with all aspects relevant to study this subject, and further, I do not mean to represent the location, the subject, or the participants. I consider

that the conclusions of this study are based on my limited understanding of complex phenomena whilst acknowledging the variety of other realities that may exist. Hence, ethical considerations rethink my behavior and intentions, purpose, and process of research. Likewise, they support the values of transparency, equality, and dignity as core elements of the research process.

5.2 Data collection

A combination of two qualitative methods is applied for data collection. On the one hand, I conducted semi-structured interviews with female students at the University of New Delhi in Delhi, India. On the other hand, I integrate participatory mapping to conceptualize and visualize participants' experience of mobility with female students. First, participatory mapping integrates the creation of mind-maps of sustainable mobility by female students. Secondly, concept maps are an additional tool of participatory mapping integrating case-specific context by displaying participants' conceptualizations on sustainable mobility in linkage to their daily way from home to university. Hence, this study engages with multiple qualitative instruments of data collection that jointly serve a more profound understanding of the case in-depth and participatory research principle incorporating participants in the active investigation (Bryman 2016, p.70).

5.2.1   Semi-structured Interviews

Semi-structured interviews are used to retrieve data that reveals womens' perception of sustainable mobility in the context of urban New Delhi's PTS. Interviewing gathers data through accessing participants' experiences during a verbal interaction (Punch 2008, p. 34). It is used in this study to access female public transport users' experiences and meanings, intending to reveal their dimensions of mobility in the specific case of the PTS in Delhi. It enhances the research purpose of identifying gendered dimensions in public transportation and conceptualizing female users' perceptions of sustainable mobility in their bounded context. A non-hierarchical relationship between interviewer and participant was aimed for during data collection (see Ch. 5.1.3).

Furthermore, a semi-structured format of interviews was applied to provide a guideline that centers the verbal conversation on the RQ while ensuring flexibility and openness to an unfolding interaction (Bryman 2016, p.54). Semi-structured interviews remind of the boundaries of research while being open to participants' contribution in a multidimensional sense (Punch 2008, p.15). Hence, a pre-formulated interview guide was created to guide the interview. I have used the research question as a focus to phrase questions relatively openly to avoid biases of the interviewer to be replicated beforehand (Appendices B).

Using the selection criteria, I spread the interview request actively to female students at the University. For that purpose, I created a pdf- file with a detailed description of the research topic and contact information inviting female students to participate in the study. Publishing the request in the official Facebook student group of New Delhi and the student Union group kicked- off several contacts to female students. A breakthrough of contacts to potential participants was induced by a professor at the University of Delhi who saw the request in the official Facebook group and forwarded it via an email announcement to his current classes. Due to that, participants offered their participation via email, which kicked of a snowballing effect with further participants.

Due to the covid-19 pandemic, it was not possible to conduct the interviews in person, so all interviews were held as a video conference using the platform zoom. All interviews were scheduled for a maximum of 30minutes to provide a comparable base for later analysis. Date and time were agreed upon beforehand with each of the participants individually. The language of all interviews was English as it is the primary state language of the participants' country and used by the University of Delhi as the primary language of teaching. I asked for permission to record the conversation via phone and take notes alongside at the beginning of each interview. Moreover, the participants were informed that data is only used for the Bachelor thesis at Lund University and treated anonymously and confidentially. Names are replaced by letter- labels in analysis to ensure the anonymity of participants. A total number of five semi-structured interviews with each half-hour conversation was conducted

5.2.2   Participatory mapping

The qualitative tool of participatory mapping is instrumentalized for data collection to retrieve a visual conceptualization of participants' perceptions of mobility (Burke et al. 2005).

Participatory mapping integrates techniques combining various forms of spatial conceptual cartography with participatory principles. Participatory maps display relationships between descriptions and elaboration regarding topics (Cornwell and Jewkes 1995). Participatory mapping allows gaining an in-depth understanding of the spatial world of participants and meanings ascribed to a bounded context (ibid). This approach ties into the PR principles as it fosters the active participation of local individuals in the research process. Indeed, participatory mapping enhances the aim to centralize participants' perceptions on the studied subject and facilitate the active involvement of participants in the research process (Windsor 2013). The tool retrieves visual and conceptual data on the perception of sustainable mobility and their integration in the PTS through a visual and creative mapping process. Moreover, this integrates spatial factors and diverse socio-economic, cultural, and institutional factors linked to sustainable mobility from the female transport user's perspectives. Going beyond participants' perceptions of sustainable mobility, this tool shifts the research process towards improving current circumstances (Burke et al. 2005). Likewise, it naturally replicates gendered dimensions in PTS of Delhi by accessing female students' thoughts and meanings.

On the one hand, participatory mapping was applied in the form of mind mapping. Mind-mapping is an effective technique to brainstorm thoughts linked to a concept organically and intuitively in a visual structure that evolves during the mapping process (Chazdon et al. 2017). The core element of this research- "sustainable mobility," is used as a point of departure for the mapping process (Appendices C). Hence, mind mapping allows female students to evolve and visualize their perceptions of sustainable mobility and any meanings and thoughts attached to the concept. Likewise, it aligns with the research objective to discover female transport users' perceptions in a multidimensional and holistic sense. On the other hand, concept mapping was applied as a participatory mapping tool. Concept maps are a visual tool of cartography illustrating the relationships between different ideas and their connections (Miro 2021). The concept maps conceptualize a specific spatial path of participants in linkage to sustainable urban mobility, which helps to understand better relevant factors and females' experiences related to the path. Thereby, the way from home to University is chosen as a visual display of urban mobility as it is a spatial indicator of each participant's mobility while also a common urban destination. Hence, the chosen mobility pattern (home to university) reflects the urban mobility scheme in the chosen case organically as the students depart from different places in the urban space, however, moving to the same destination. Hence, each participant creates the concept map "home- university" thinking of a sustainable

mobility experience. Participants were requested to conceptualize their daily trip with public transport modes with thoughts that would improve their journey sustainably.

Due to the covid- 19 pandemic, it was impossible to conduct the participatory mapping in person. Hence, I used the online program "Miro" which is a collaborative whiteboarding platform, to work on digital mapping simultaneously with others (Miro 2021). The program integrates both mind-mapping and concept-mapping opportunities allowing users to conceptualize thoughts in a shared document. An access link to the designated digital working team was sent beforehand. Additionally, an explanatory guide of miro- help service was forwarded to the participants offering technical support and use of the program (Miro. 2021). However, by that point, a local professor noted that students are familiar with the program as it is commonly used for teaching purposes at the University of Delhi. The core elements of the maps were created beforehand to give a guideline and allow the participants to focus on filling in their perceptions (Appendice C). During the mapping process, participants were allowed to expand or narrow the initial format according to their needs. I chose not to be part of the mapping process to avoid biases and retrieve data reflecting the participants' perceptions as naturally as possible. Thereby, the participants could visually express their experiences and develop new ideas regarding the topic without external contribution. A total amount of 10 participatory- maps has been retrieved from the participatory mapping method.

5.3 Data analysis

5.3.1 Interviews

The data retrieved from semi-structured interviews during data collection are analyzed using qualitative content analysis (Bryman 2016, p.20). Thereby, themes are discovered in the data related to the research question and theoretical framework of this research (Punch 2008, p. 44). Qualitative content analysis provides a tool to analyze data in its diversity while looking at relevant sequences in-depth (ibid). Hence, the data is analyzed with a focus on content relating to the studied subject. Therefore, content analyses serve as a technique to extract data that serves to find female students' perceptions in the PTS of Delhi. During the content analysis, I used color-coding to make sense of the data in a structural way (Bryman 2016, p. 45). All transcripts retrieved from the interviews were color-coded to categorized them for coherent discussion related to the RQ, the theory of feminist urban geography, and the

concepts of sustainability and mobility focusing on economic, social, and ecological factors of sustainable mobility.

5.3.2 Participatory mapping

The final versions of the participatory maps are the most relevant data sources for this research purpose and an asset for answering the research question. According to Emmel and Clark, the process of creating participatory maps enables an insight into the behavior and meanings of participants (Emmel and Clark 2008, 2009). Nevertheless, I choose to base the analysis on the data displayed in the final maps instead of the transcript of the process as the research does not aim to understand participants' behavior. Moreover, to analyze the participatory maps, content analysis is applied, which is an asset to finding reoccurring themes in the maps and better understanding the relationship amongst them (Punch 2008, p.60, Windsor 2013).

6. Findings

The chapter presents findings retrieved from five in-depth semi-structured interviews, five mind-maps, and five concept maps. The structure of findings relates to the three previously identified elements of sustainability, which are social, ecological, and economic factors to provide a coherent base for the following discussion (Hansmann et al. 2012).

6.1 Interview findings

6.1.1 Social factors

Social factors of mobility are mentioned by all interview participants as linked to sustainability. As described by informant K, social sustainability means providing a condition of transport service that offers opportunities to participate, connect and interact in the city. According to her, it is about equality, interaction, and safety while moving into the city. Particularly, informant K points out that social factors are essential to women as they are more vulnerable to dire conditions in public transport. Informant N says that attention must be

drawn to the government on creating such a condition to achieve sustainable modes of transport.

> *"I think…it is important to make the journey for women in a way that they feel safe during their travels and that they feel as equal users and I guess that public transport becomes a good option for all in Delhi"* (Quote informant N)

This statement reoccurs in all conversations, pointing out various social factors relevant for achieving this perception on the participants' journey. Participant L mentions that safety is a significant issue hindering her mobility in the city. Informants L and K state that safety in public transport would increase their participation in activities further away from home. Participant N points out that safety in transport is relevant to access opportunities in the city such as jobs, networks, and other activities, which relates to less participation of women than men in activities, workforce, and society in Delhi.

Moreover, informant L states that public transport is unsafe, particularly for women in Delhi. All the interviewees mention women's safety explicitly related to public transport. Similarly, informant K states that women are cautious and even apprehensive of traveling with public transport. For instance, the crowd-induced risks would lead to fear of crime in public transport. Informant K states not to use transport a lot as busses and trains are unsafe due to big crowds. As busses are overloaded due to low frequency, it can be dangerous to pick-pocketed while standing in proximity to other passengers. Participant M adds that there is usually a high temperature and lack of hygiene inside due to crowds. From her point of view, hygiene is particularly relevant to ladies. She points out that Delhi's public transport is not designed for the growing population, causing her to rather not move around in the city than to take public transport.

Likewise, informant O describes that she used to wait for several busses on her way to school as she was scared to join the crowd inside of public transport. She mentions that women fear sexual harassment ranging from touches of other passengers to rapes in public transport facilities. Informant M states that she has had bad experiences in that regard and most of her female friends. Similarly, participant O states that multiple cases have been reported of sexual harassment in busses, so women tend not to use it as much. Participant N informs that since the rape of a student in 2016 the government is trying to increase safety in Delhi; however, it

is deeply rooted in society. For instance, participant L states that cultural norms are relevant to consider on women's journey. Wearing culturally inappropriate clothing will cause problems with male passengers as well as with other females in public spaces, notably public transport. Similarly, informant K states that using public transport alone at night is inappropriate for women and causes negative attention of other passengers. As a result, she tends not to participate in any activities in the evening to avoid being socially judged by others on the bus. Tying into that informant, O describes that men considered themselves as something superior in public transport. Participant L says that more men are using public transport and hence, usually male drivers control the transport modes.

> *"like men in busses consider themselves as... I don't know something better because there are more of them in these facilities"* (Quote informant L)

The informant underlines the relevance of social norms for mobility by stating that women must pay attention to behave socially acceptable to avoid facing problems or even danger in public transport. Similarly, participant M explains that societal norms impact her choice of transport in Delhi. For instance, cultural norms prevent her from taking the bike in Delhi as it is not appropriate for a woman to cycle.

> *"Cause I recently bought a cycle for myself. I love cycling, but whenever I go outside on roads there are so many men who start teasing and you know make noises and everything. I feel like I own my bicycle. And these roads are for everyone. Yet, I still feel bad as a woman to ride my bicycle on a public road. So, it is difficult for women to change transport modes just like that*" (Quote informant M)

The journey would improve with security standards and better education. For instance, participant L states that surveillance crowd control and cameras increase safety for women. All participants state that taking the metro is the best option for women. Participant M states that the metro is the safest public transport as it is under constant surveillance and maintained with police controls and regular check-ups on passengers. Moreover, participant N describes that women in the metro mainly the ones working and more educated.

> *"These women are capable of taking action in case some men misbehave and they will make sure that it gets punished"* (Quote informant N).

Furthermore, interviewees M, L, and N state that gendered compartments in public transport are the best option to improve the condition for women in public transport. Dividing men and women in public transport are stated to reduce their fear of crime and enhance perceived safety. Moreover, informant O states that it is less likely to risk problems with other passengers as a woman when traveling in a gendered compartment. The social network created amongst women is perceived as an informal safety net by the informant.

> *"I always try to sit in the ladies compartment or at least next to it because they will take care of me…also men do not dare to do anything bad in these areas as they will be in big trouble" (Quote informant O)*

The interviewees mention that it is an underlying structure that causes problems for women in public transport, such as the fact that they are more vulnerable to lack of frequency, lack of safety, lack of controls. Informant M states that she never experienced a female driver in public transport and that she fears drivers most as they control the bus. According to her, the journey goes according to the drivers' behavior as other passengers follow the drivers' rules. She perceives that the proximity to other passengers in public transport is the main problem because structures of society are so present there. This correlates with the assumption of informant L that as social factors are related to society's structures, public spaces make them visible.

6.1.2 Economic factors

Mobility relates to economic factors according to the perception of informants. Mobility is discussed as a means and end to access economic opportunities in Delhi. Informant K argues that sustainable mobility means providing transport facilities that allow citizens to access opportunities in the city equally. Moreover, sustainable development to her constitutes equal distribution of resources and, secondly, investment of capital into long-term projects that benefit all. Relating to that, she describes the introduction of a mass-rapid transit system in Delhi as an investment that will enhance the economic activities of citizens and increase economic growth sustainably. Beyond that, L and M describe differences in economic opportunities between men and women related to urban mobility. For instance, participant L elaborates that most passengers in public transport are men commuting to work while women

in India usually commit to housework. Hence, public transport is dominated by men reinforcing gender elusive structures such as employment gaps.

> *"Around the city, there is a huge gender gap in the employment also, so if women are not connected easily to transport, they cannot take any job opportunities, yeah definitely there is a relation"* (Informant L)

Similarly, participant N reports a gender gap in employment in India related to mobility as women are apprehensive about traveling by public transport. According to her, women tend not to take job opportunities or education further from their home due to cultural reasons, perceived safety, and different trip chains of women. Informant N states that women tend to organize child-care, household, and part-time jobs simultaneously, requiring mainly short trips and integrated connectivity of public transport. Informant O states that the last mile in public transport is especially relevant for women. Females tend to not take job opportunities or education further from their home as the system does not respond to the trip chains of women's daily routines.

> *"If there is no proper way of going and moving in the city for women, this leads to the fact that a lot of women you know do not move. They don't take the job opportunities far from their home. Or go for other activities. This explains the gender gap in the economy in Delhi and India in general. Again, this reinforces gender gaps and poverty traps in Delhi"* (Quote Informant O)

As informant K states, it must be more accessible for everyone to use public transport, which relates to frequency and availability. In this regard, interviewees elaborate that public transport pricing is an economic factor determining who can afford to move around the city.

> *"The condition of public transport is bad. I can say that my financial status allows me to choose private options, but of course, lots of people cannot do that. This is a problem for poverty in India when people cannot move from the location easily".* (Quote informant K)

Hence, participant N states that financial support by the government to purchase tickets would increase females' use of public transport. Similarly, investment in public transport

infrastructure is suggested to provide a higher frequency of busses, trains, and metro making it more accessible to the population. Particularly, frequency is mentioned to increase female travels. For instance, participant N states that she used to commute three hours by public transport every day on her way to University as the last-mile transit and connectivity of multi-modal trips is highly time-intensive in Delhi. Hence, she preferred not to take lectures at University in the evening as it implicated difficulties commuting back home late at night. Again, this relates to fear of crime and perceived safety. Similarly, participant O states that she would not choose the metro because it is complicated to get there by busses and other vehicles. Enhancing last-mile connectivity through increasing bus- stops, frequencies, and the reliability of drivers are perceived as an economic advantage to the labor market. Informant N states that most of her colleagues choose Uber or private cars as it is impossible to rely on public transport if they must appear at work at a specific time. Participant L adds to that by stating that the transport mode determines one's economic status in Delhi. Busses or trains are perceived as a bad economic situation, and hence, one must own a car to be considered suitable for a job. Informant N states that riding the bicycle is usually not perceived appropriate for higher-income classes as it is associated with poverty.

All informants relate economic factors to institutional action- taking by the government and local authorities. Capital investment into public transport by expanding the metro system and integrating last-mile transits, increasing frequency of busses and trains, and improving roads is suggested to contribute to the economic sustainability of public transport sector mobility. Moreover, interviewees relate mobility to the economic opportunities of females in the city and suggest public transport conditions as a factor to change their lives in the city.

6.1.3 Ecological factors

All the five interview participants perceive ecological factors of mobility. However, different participants mentioned diverse aspects leaving a multidimensional perception of ecological factors relevant to sustainable mobility. Informant K finds that sustainability means equal distribution of resources to society. Besides, current mobility in Delhi stands in linkage to transport-induced pollution that affects nature and ecosystems. Informant K finds it is necessary to renew mobility service to secure natural resources and society's environment. Achieving sustainable mobility relates to the distribution of resources that provide means and ends to environmentally friendly mobility service. For instance, the informant travels with

busses regularly in Delhi. However, she feels that mobility still accounts for high emissions impacting her ecological footprint crucially. Tying into that informant, L demands that the government in Delhi must become more conscious of transport-induced pollution. Informant N perceives the environmental consequences of public transport as an urban tragedy that substantially affects the planet and her personal life. Moreover, she points out that women are more vulnerable to environmental risks in Delhi, such as transport-induced pollution. She says that females tend to walk close to the streets on their way to grocery stores or other household activities, exposing them to transport-induced pollution. This perception shows that the transport sector of Delhi induces environmental risks and a lack of human security for females.

> *"In Delhi, pollution is very bad for the reason of transport, people don't think of the ecological consequences"* (Quote informant L)

This ties into the statement of Informant N pointing out that pollution is a significant problem in Delhi, resulting in the need to wear masks outside or not move around in the city for health reasons. Informant L highlights that the main obstacle of sustainable mobility is individual transport modes with private cars and motorized vehicles due to a lack of decent public transport in Delhi. This statement reoccurs in the information provided by informant M who states that most of her female colleagues drive to work by private cars as public transport is not available to their needs. This ties into the perception of informant O, who states that 90% of her trips are by private car since public transport is unacceptable to her. Informant O says that using public transport gives her as much anxiety that despite the ecological consequences of private car use, she always chooses to commute by private vehicles. Tying into that informant, L suggests that reducing private cars by increasing public transport is the foremost step towards ecological sustainability of the mobility sector.

> *"Sustainable mobility means to care for the environment whilst moving in the city and yeah also about the consequences of transport modes that we need to consider"* (Quote informant L)

For instance, the informant mentions that the metro in Delhi is the best thing for the city as it provides mass-rapid transit to all, which automatically reduces the impact of transport on the environment. Tying into that Informant M uses to commute to University every day by bus or

metro. She suggests focussing on eco-friendly modes of transport to achieve sustainable mobility. For instance, the expansion of metro and integrated bus systems is suggested as better options. Opposingly, informant O states that she would never suggest increasing the use of busses.

> *"They are even worse to the environment than most private cars I would never recommend increasing the busses that we have here even if it considered green transport internationally"* (Quote informant O)

Informant O elaborates that buses are low maintained in Delhi; hence, busses are mainly old, resulting in high emissions and environmentally damaging fossil fuels. She stresses that people should not use busses or public transport as a blueprint for places to become ecologically more sustainable. Tying into the reduction of transport-induced emissions, informant M suggests the use of bikes for nearby distances. Moreover, car-pooling and car-sharing are mentioned to reduce transport-induced CO_2- emissions, particularly in the city center. Car-pooling has increased in her point of view. Primarily, women use Uber and car-pooling increasingly as it provides convenient and eco-friendly service. Electric vehicles such as electric cars and e- rikshaws are mentioned as alternatives; however, not stated to be enough. Instead, a national shift from coal and petroleum to sustainable electricity generated through hydro or solar power is suggested. The informant says that she relies on public transport for all kinds of activities in the city but experiences a lack of ecological sustainability in public transport.

6.2 Participatory mapping findings

The findings present the finalized version of participatory maps, and hence, the section is not analyzing the process of mapping nor explaining each map individually to its full extend. The focus aims to present the most relevant findings to the research purpose by summarizing indicators related to social, ecological, and economic aspects. Moreover, a summary of factors displayed is attached in appendices D (p. 69), while all ten maps are presented below.

6.2.1 Social factors

The findings of the participatory mapping display social sustainability as a relevant factor of mobility perceived by the informants. A total amount of 29 indicators is related to social sustainability in mobility based on the mind- maps A to E. Moreover, 14 indicators are associated with improving social sustainability on the journey "home to university" of participants F to J. The findings of the participatory mind-mapping show that social sustainability is a factor mentioned by all participants yet associated with various indicators. The leading indicators of social sustainability in public transport relate to equality, networking, cultural norms, perceived safety, interaction with society, participation, and fear of crime. The maps display aspects of surveillance, gendered divisions in PTS, and education, which appear as the leading suggestions to improve social sustainability in public transport.
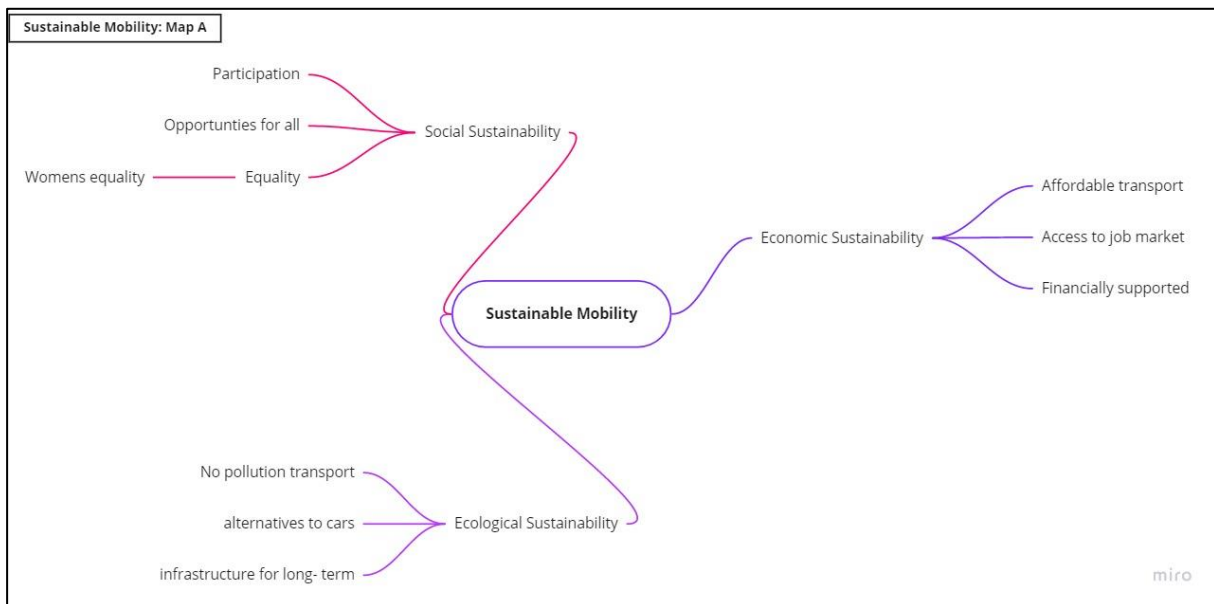
Figure 5: Map A
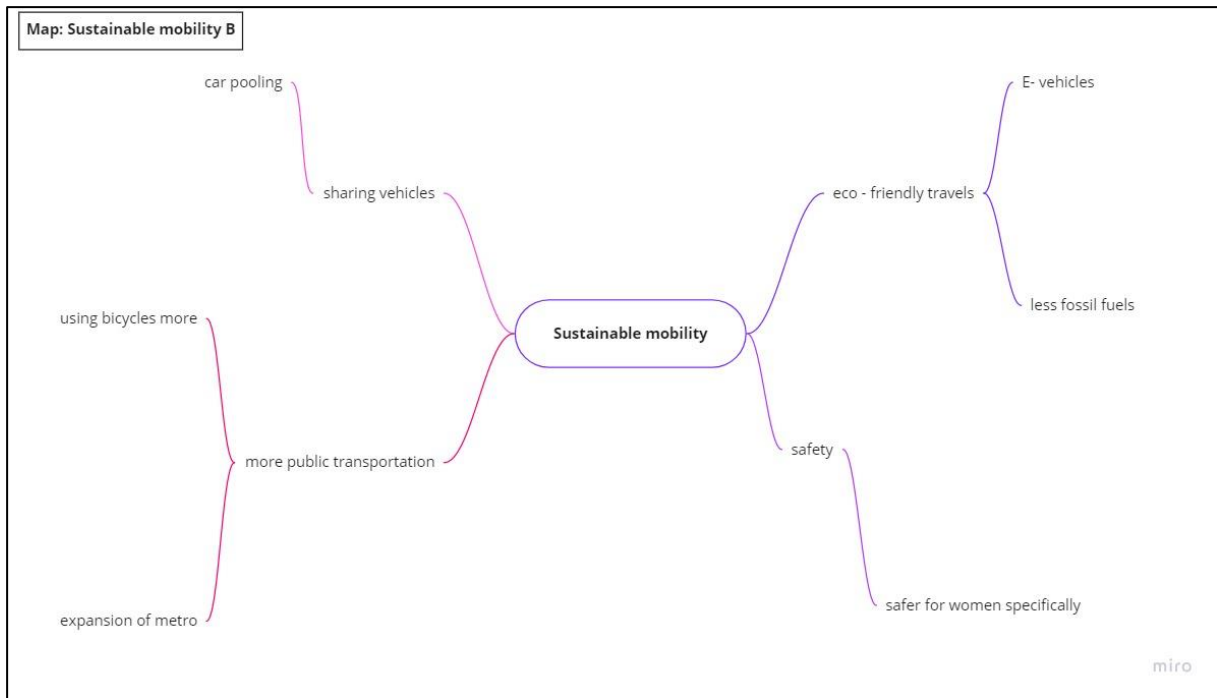
Figure 6: Map B

Furthermore, informants relate social sustainability to their journey from home to the university. Both map H and I suggest safety as an indicator that would make the journey socially sustainable. Tying into that, map J highlights that the safety of women is particularly relevant. Informants of Map G and F state that gendered division in the public transport on their way to university would increase safety. Participant G elaborates by stating the separation of men and women as an indicator of her safety. Moreover, her journey is described as most dangerous at night and while waiting times. Hence, cameras and increased surveillance in public transport are mentioned by map F, map j, and map G. This shows that the participants of the maps evaluate their trip to university not as safe on public transport while suggesting that their perception might change through increased cameras, controls, and surveillanc. Informant J further states that increased frequency of public transport would reduce potential waiting times that expose her to risks and danger. Moreover, improving the lights on bus stops the informant demonstrates as key for her feeling of safety. Map J elaborates on safety by stating that other passengers' touches, noises, and misbehavior are the leading indicators of limited safety perceptions. Participant F suggests improving drivers' behavior through education, which relates to better driving safety while standing for increased safety in the transport mode for all passengers. Based on map F, education is a relevant factor for social sustainability relating to transport users' behavior and perceived safety.
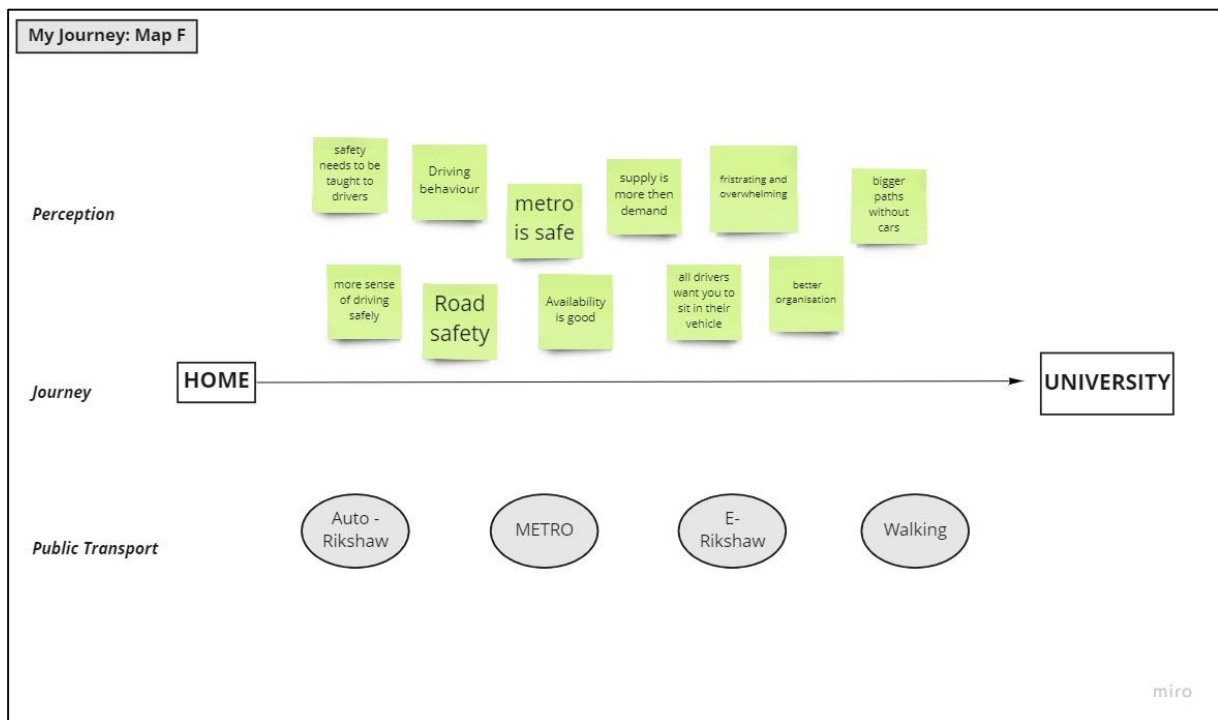
Figure 7: Map F

6.2.2   Economic factors

Economic factors are mentioned in maps A to F as relevant to sustainable mobility.
Furthermore, a total of 38 categories mentions economic aspects in linkage to the mobility of
the informants. Similarly, economic factors are perceived as impacting the journey from home
to work by five of the informants. The findings show that economic factors are perceived by
all informants as linked to sustainable mobility, which integrates the main aspects of
affordability, availability, frequency, accessibility, and action-taking.
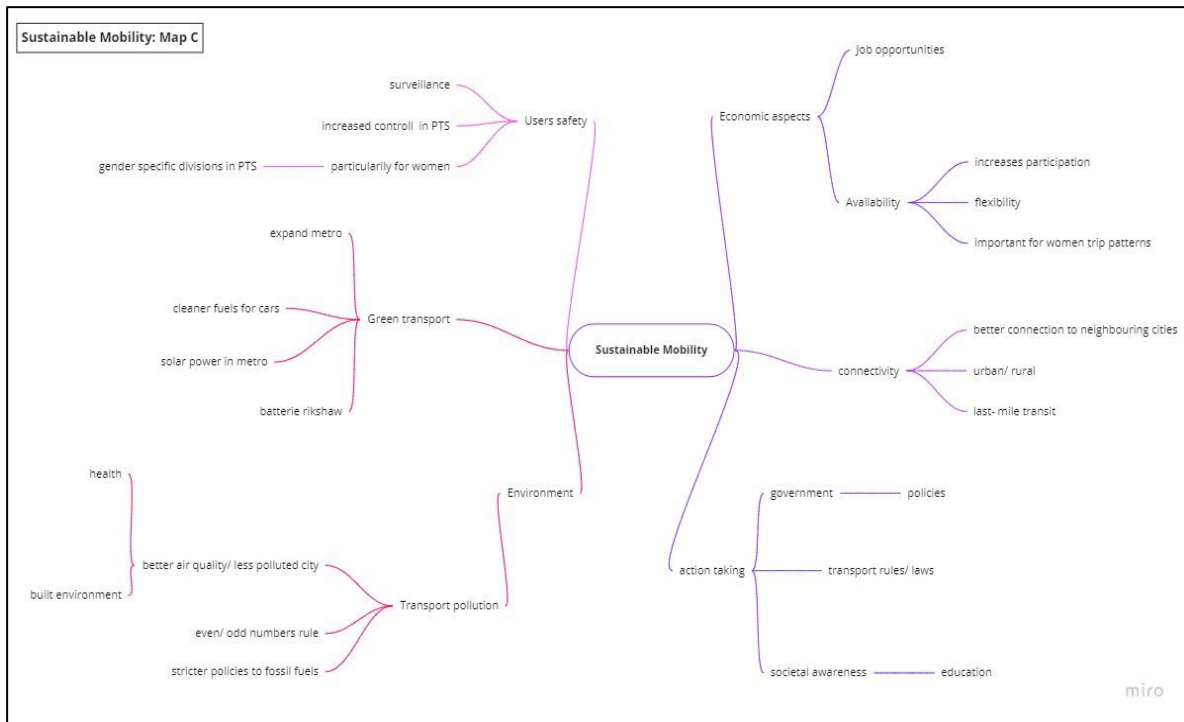
Figure 8: Map C
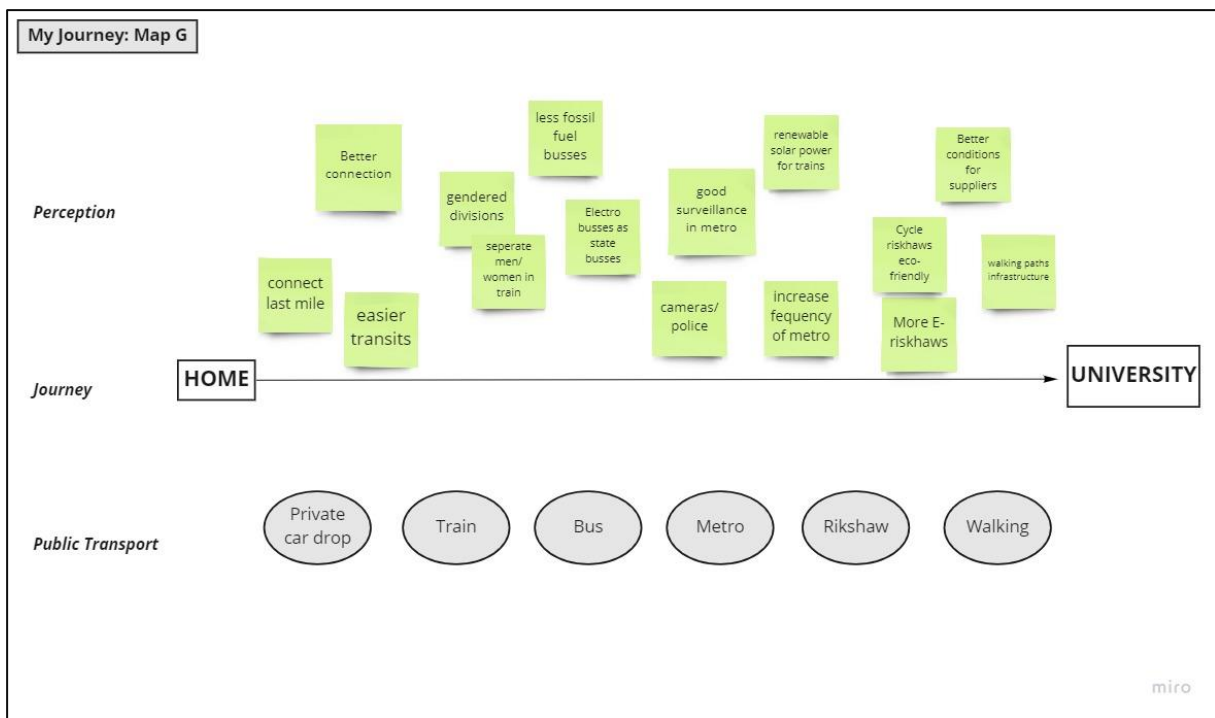
Figure 9: Map G

Related to the journey from home to work, all informants mention economic factors. Participant F states a good availability of rikshaws as supply is higher than the demand. Moreover, map F points out integrating different transport modes into a pricing system to gain

economic sustainability. As rikshaws, busses, trains, and metro have different ticketing systems; a multi-modal trip is financially more intensive. Participant H elaborates on economic aspects on her way to the university by pointing out the linkage of poverty to mobility. Connecting a category "no poverty" with sustainable mobility shows that the informant perceives mobility as an indicator of the economic conditions of individuals. Moreover, findings show that capital investment in infrastructure, mobility service, and integrative public transport systems would increase the journey of informant I and J.
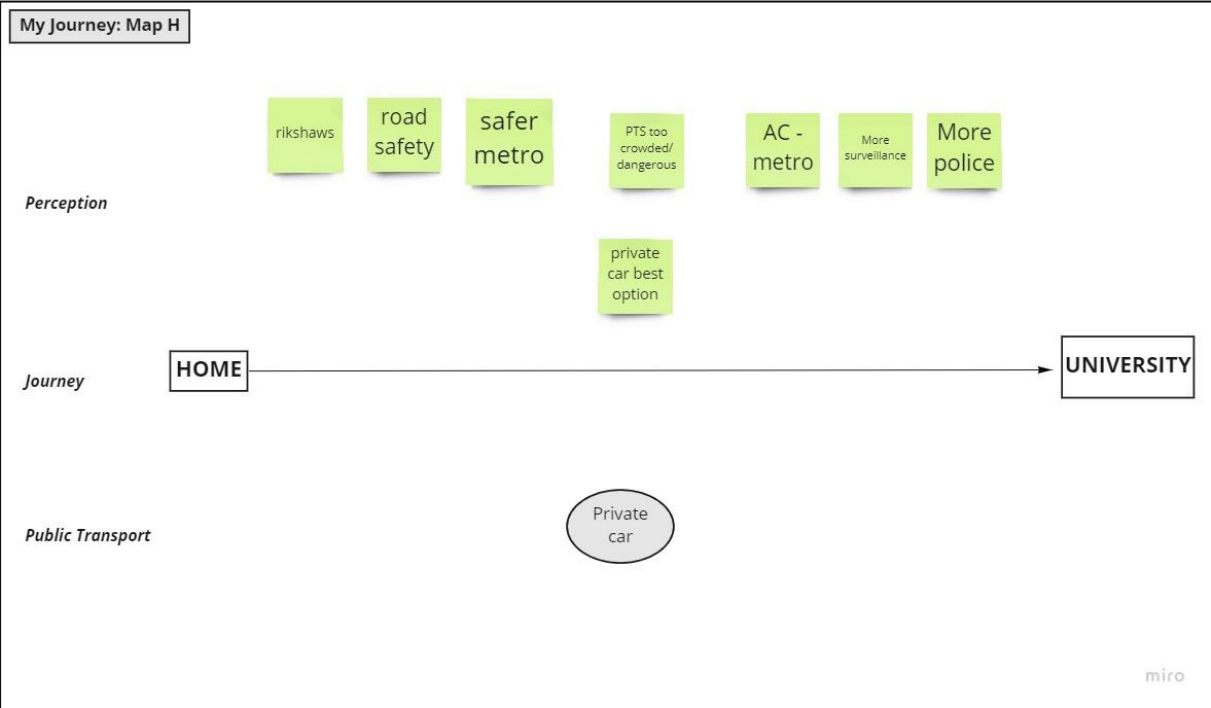
Figure 10: Map H

6.2.3 Ecological factors

Ecological factors are revealed as relevant for sustainable mobility by the participants. Informants of maps A display a total of 41 ecological indicators of sustainable mobility to E. Moreover, 12 ecological factors are displayed relating to mobility during the journey from home to work by informant F to J. The findings show that ecological factors play a role in the perception of sustainable mobility by the informants. The leading indicators related to ecological sustainability are transport-induced pollution, built- environment, and infrastructure of mobility services. All maps indicate that public transport should prioritize

urban mobility and that mobility is the main factor of environmental risks in Delhi. The maps demonstrate that informants are aware of environmental linkages to mobility while discovering that their journey within the city could be improved in an ecological dimension.
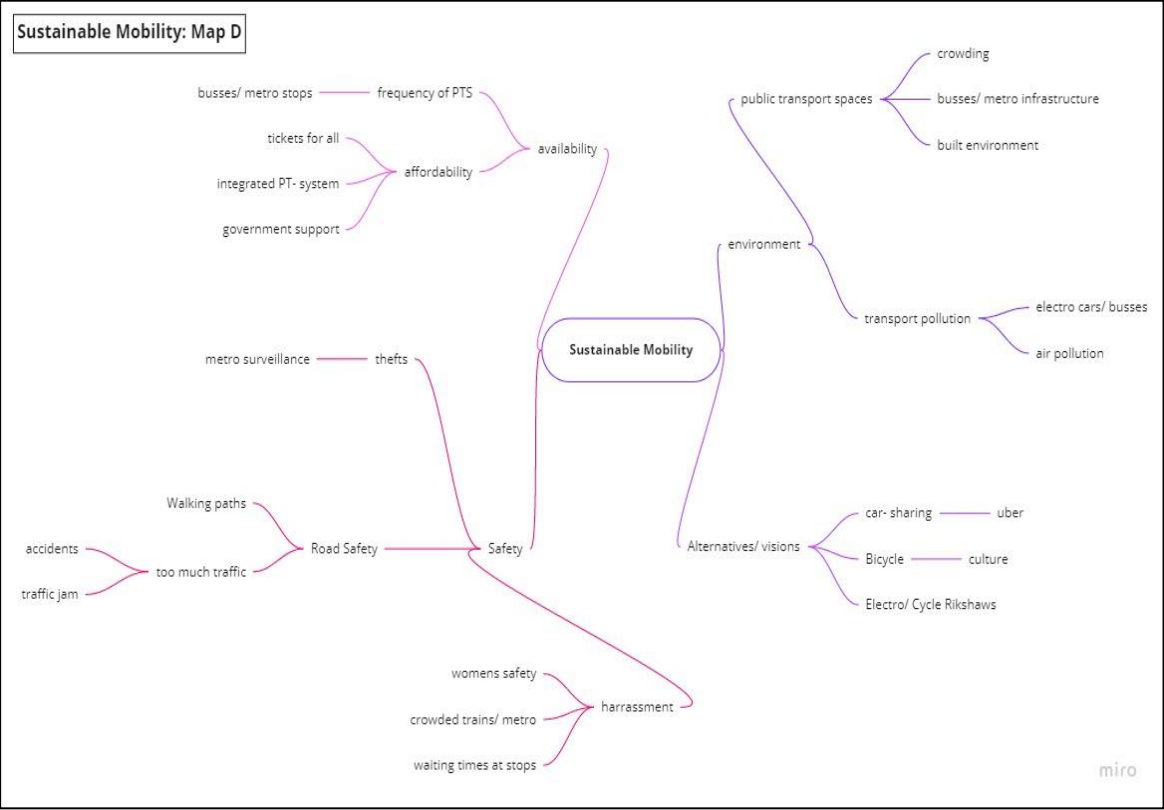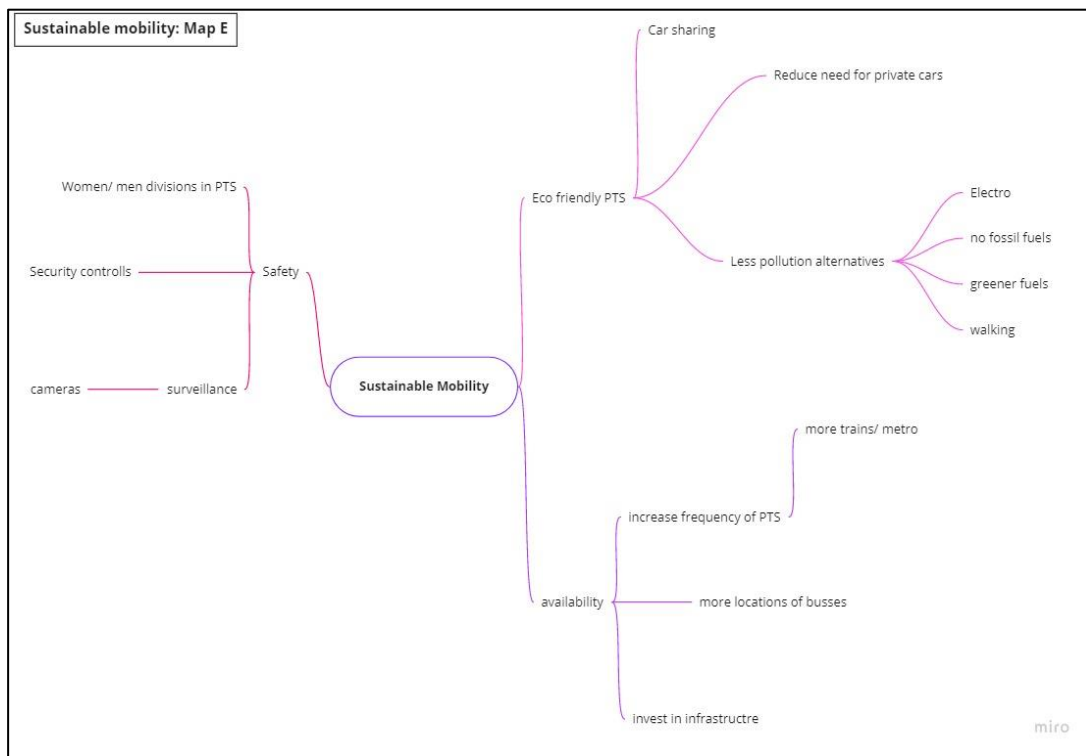

Figure 11: Map D

Figure 12: Map E

Ecological factors of mobility are integrated on the informants' way from home to work. Map F shows that the use of fossil fuel in busses reduces the ecological sustainability of her home from home to work. The informant captures that using solar power in trains could reduce her ecological footprint as the journey includes going by metro. Similarly, the informant agrees that she would improve her mobility in an ecologically sustainable way with better walking opportunities. Similarly, maps G and J point out to value less pollutive options such as walking, E- rikshaws, and better biking opportunities for the environment. Map H states that she would not change her journey to school despite the ecological aspects of private cars due to other factors such as comfort, safety, and habit.
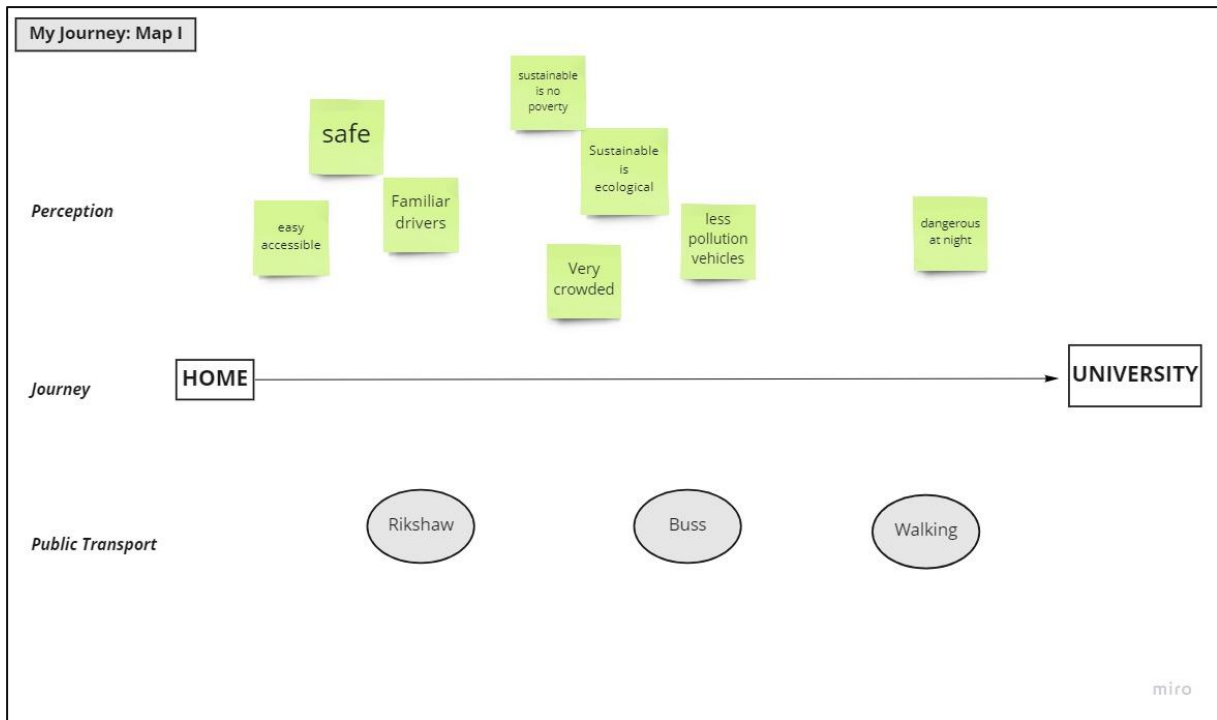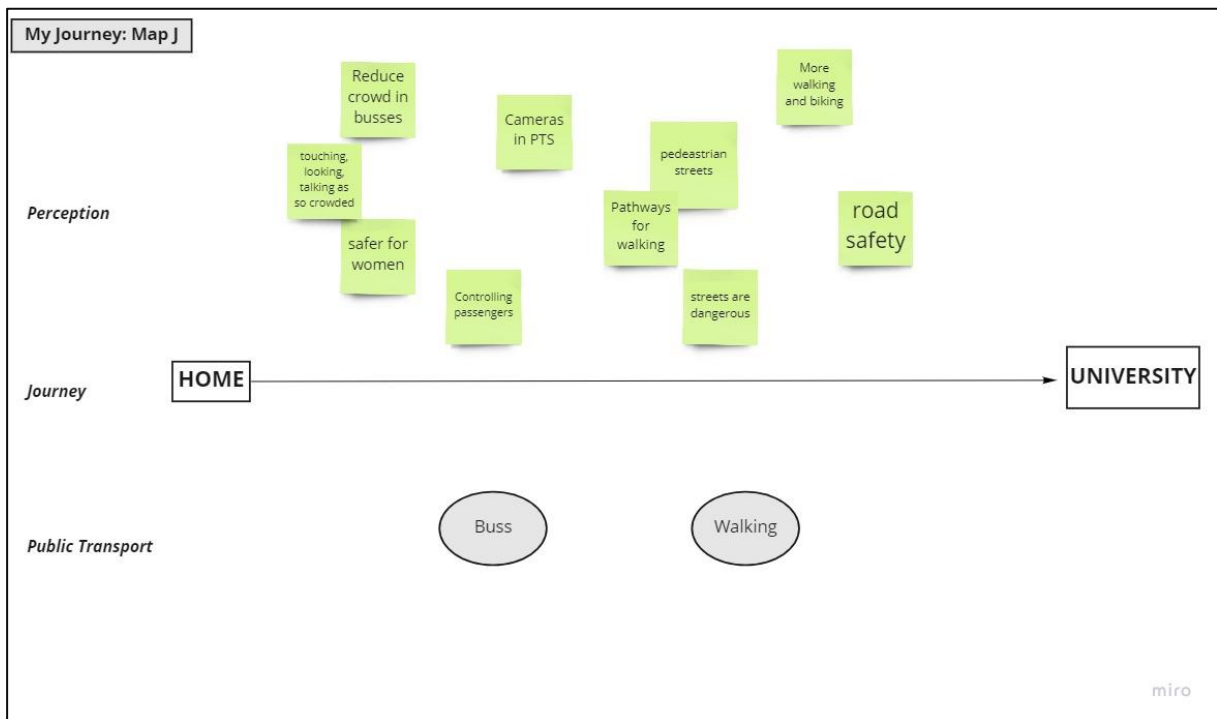
Figure 13: Map I

Figure 14: Map J

7. Discussion

This chapter discusses the case study's findings in linkage to previous research and theoretical framework to answer the initial research question: How do female public transport users conceptualize sustainable mobility in Delhi, India? What are the relevant factors of sustainable mobility perceived by female public transport users?

To do so, it discusses findings related to gender, urban space, and mobility discourse. It further considers the relevant social, ecological, and economic factors for sustainable mobility revealed by the experience of participants of the study. Moreover, a future-oriented scheme for urban mobility bound to this case study is conceptualized.

7.1 Integrating: Gender, urban space, and mobility

This case study suggests that sustainable mobility is the perceived capability of women to move freely over urban space and time (see Ch.4). The findings reveal that a connection of urban space, gender, and mobility is relevant to conceptualize this definition of sustainable mobility for women in public transport.

Urban dynamics matter for mobility. Urban dynamics such as social, economic, and ecological factors related to the bounded urban space of Delhi impact the mobility of female public transport users. Experiences of participants confirm that mobility expresses and reinforces factors relating to the societal and environmental structures of Delhi. For instance, informants stressing that their way of dressing determines levels of safety in public transport show that social norms inherent to the socio-cultural and historical circumstances of Delhi impact womens' experience and behavior in public transport. Thereby, it notably constrains their ability to move freely. Taking a feminist urban geography lens, this discovers the interrelatedness of human-environmental interactions with space and time (Sheller and Urry2006). It confirms that mobility is more than a physical movement for women as it is also intertwined within socio-economic, geographical, cultural, institutional, and spatial circumstances. (Adey et al. 2014). Likewise, it highlights the relevance to consider urban dynamics in future mobility governance, stressing alongside womens' experiences that mobility must be conceptualized case-specific to be responsive and sustainable.

Gender matters for mobility. Case-specific findings reveal that the socially constructed category of gender matters for the mobility of female public transport users. Moreover, it stresses that overlooking gender dimensions produces gender-blind mobility that constrains womens' life quality daily in Delhi. Thereby, all participants perceive gender as an underlying dimension in their experiences of public transport. Likewise, differences between mens' and womens' capabilities to move freely are discovered: "I cannot use public roads with my bike as a woman" (Quote informant M). Furthermore, results show that disadvantages in economic participation, social exclusion of networks and urban opportunities, and greater exposure to transport-induced environmental risks are related to gender-blind contemporary urban mobility governance. Womens' experiences stress that overlooking womens' needs relate to inherent patriarchal structures in Delhi (Esplen and Jolly 2006, Moss et al. 2002, Allen 2018). From a feminist urban geography perspective, this shows that gender dimensions are present in mobility whilst reinforcing their dynamics in societal structures (Hanson 2010, Kapoor 2019). Thus, case-specific findings shed light upon remaining power imbalances in the public transport sector of Delhi as well as unequal distribution of means and end to mobility due to underlying structures ascribed to gender. Besides, this confirms the relevance to understand the concept of gender for mobility governance to better approach womens' needs explicitly in conceptualizing public transport. The research revealed to mind gender dimensions in policies, laws, and planning to provide responsive and sustainable public transport.

Sustainable urban mobility matters for women. It is conceptualized by participants integrating both urban space and gender dimensions such as its interrelatedness. Hence, the research shows the interrelatedness of gender and mobility while capturing both stand-in linkage to sustainability in urban space. Gender dimensions are always present in society, yet, relevant to consider in conceptualizing responsive approaches of mobility to different social groups, spatial circumstances, and needs of society. Thus, theoretical framing of urban space, gender, and mobility allow understanding the connection of relevant mobility factors for female transport users. Likewise, it enhances the conceptualization of their needs, such as integrating multidimensional and various context-specific dynamics.

7.2 Revealing: social, economic, and ecological factors

This case study discovers that sustainable mobility is a multidimensional and complex condition relating to social, economic, and ecological factors perceived as relevant for public transport by the participants. It suggests critically examine the application of sustainability as a concept in various dimensions. Indeed, the perceptions of participants vary alongside their individual experiences and needs. Findings show that sustainability cannot be applied as a blueprint for urban mobility development. Hence, integrating perceptions from various groups enhances understanding of sustainable mobility. This research served informants to fill the concept of sustainability with their meaning ascribed to mobility which identified social, economic, and ecological factors as pillars.

First, social sustainability is discussed by participants as **social factors** relate to their journey in public transport, notably regarding equality, participation, safety, cultural norms, and social networks (Chen et al. 2018). norms Moreover, findings explicitly point out gender dimensions of mobility relating to these social factors. Other passengers' judgment, dress codes, dedicated compartments, or travel times are determinants of their trip patterns. Likewise, participants experience that public transport is a male-dominated sphere, so socio-cultural norms are made and controlled by them. Tying into that, social networks created amongst women in gender compartments of public transport are experienced to be an informal safety net for their travel. Thereby, the separation of men and women is stressed by all participants as a social factor enhancing the journey. Indeed, participants even tend not to take public transport without gender compartments, demonstrating that societal factors determine the mobility or immobility of women. Similarly, participants only use public transport at specific times and locations to reduce dangers such as crime and harassment in public transport. Again, the research shows that this continuously reinforces gender gaps and power dynamics producing gender elusive mobility schemes (Crang 2002, Chen et al. 2018, Adey et al. 2014). It stresses that females are more vulnerable in public transport than men due to the structural overlooking of inherent social factors replicated in transport facilities. The relevance of social factors, particularly related to the characteristic of gender revealed in the study, are strongly advised to be integrated into future-oriented sustainable mobility schemes for sustainable public transport. Likewise, the study points out that an equal share of women in urban planning, mobility governance, and transport stakeholder positions is essential to shift power imbalances that continuously reinforce the social limitations of women.

Secondly, participants reveal **economic factors** such as affordability, accessibility, and availability as critical determinants of sustainable mobility. On the one hand, women experience that missing availability, frequency, and affordability of public transport reduces their use of public transport and their overall mobility. For instance, informants state that women rely more on last-mile transit as common trip patterns combine child-care or household tasks. As public transport tremendously lacks an integrated public transport option, it becomes more expensive and time-consuming for women to use the facilities. Findings show that women tend to use private transport options or decide not to participate in activities in Delhi due to that. On the other hand, this highlights that lack of mobility reinforces socio-economic gender – gaps in Delhi. Indeed, mobility is discussed as means and ends to access job opportunities and education (Shah et al. 2017, Shaw and Sidaway 2011, Kapoor 2019). For instance, participant K states that she does not take evening classes at University due to lack of public transport service, although it would increase career chances. Economic sustainability means an equal distribution of resources such as capital investment into long-term mobility projects that benefit all (Chen et al. 2018). The results show that women experience the unequal distribution of public transport systems in Delhi and that the service does not respond to their needs sufficiently. Thus, the case-specific findings suggest crucially investing in public transport to achieve a trickledown effect on women's greater economic participation and, hence, promote gender equality. Likewise, it suggests more significant consideration of economic factors relevant to women in public transport within future mobility governance and policymaking and specific investment into transport infrastructure, frequency, financial support, last-mile transit, and integrated transport systems to combat gender- gaps in Delhi.

Thirdly, all participants of this study have discussed **ecological factors** in public transport, which shows that sustainable mobility requires securing environmental resources in Delhi (Klemes 2015). Findings confirm that women perceive exposure to transport-induced environmental risks. They perceive greater vulnerability to environmental risks of public transport compared to men. Likewise, Anthropocene impacts on the local ecosystem of Delhi are experienced as a threat to their life quality and a contributor to environmental degradation of the space. Transport-induced environmental risks are experienced by women, such as pollution, road safety, old transport infrastructure, and a traffic-constrained built-environment. Notably, air pollution-induced by transport emissions is experienced to limit

their interaction in urban space. Informant L used to stay home for a month in 2019 when the government announced one of the highest air pollution levels of all time in Delhi. Hence, lack of environmentally friendly public transport leads to immobility of women in the city. Likewise, results show that women are aware of the need to rethink mobility considering the ecological impact of mobility services. Moreover, they suggest shifting mobility services towards eco-friendly alternatives such as public transport. Opposingly to a consensus of contemporary environmental scholars suggesting public transport as a solution to combat mobility in megacities, the findings of this study suggest not using public transport as a blueprint for sustainable mobility (Amin 2006). Informants describe that busses in Delhi are not eco-friendly due to low maintenance by authorities, and hence, they only recommend expanding public transport when stakeholders from government and transport authorities shift the institutional and operational level. Sustainable mobility schemes are advised to integrate ecological factors in conceptualization while carefully assessing the opportunities within the built environment of urban space and its inherent institutional structures to transfer eco-friendly mobility alternatives to the city level.

7.3 Conceptualizing: sustainable mobility

The research puts forward an explorative and future-oriented conceptualization of sustainable mobility based on participants' experience, which integrates a range of future-oriented suggestions to improve public transport in Delhi according to the needs of women.

The research revealed that women are exposed to environmental risks, so female public transport users urgently suggest a shift to environmentally friendly alternatives in Delhi. Case study findings recommend stricter local policies for fossil fuel vehicles to reduce air pollution in Delhi. Besides, it shows that policies for vehicles are not enough as a national shift towards hydro and solar power is required. Moreover, investment in the infrastructure of roads, walking paths, and cycling systems are stressed by this study. Informants are exposed to high risks on roads in Delhi, so they are not capable of shifting to bicycles or walking to school. Likewise, an integrated public transport system is postulated as a future-oriented urban mobility scheme by the study. Notably, increasing frequency of busses and expanding the metro in Delhi is discovered to promote sustainable mobility.

Furthermore, the research stresses that women want to experience mobility as a means and end to provide access to all kinds of activities in Delhi without limitations. Thereby,

accessibility and availability are recommended as core elements for future policymaking in public transport. Reducing waiting times, increasing lights, and a shelter at bus stops is suggested to urban and transport planning. Moreover, investing in last-mile transport and integrated transport systems will allow women to combine several duties on their way. Similarly, increasing the frequency of public transport by introducing more busses and bus stops potentially increases their interaction in Delhi. Tying into that understanding the higher importance of crowd-control for women is essential to reduce vulnerability and exposure, which can be achieved through higher frequency and availability. Likewise, hygiene in public transport is discovered to impact their mental and physical health, which suggests that local municipalities invest in the maintenance of public transport to provide clean and decent vehicles.

The research further stresses targeting the safety of women as a core strategy for mobility governance. Participants demand action-taking by both the local government as well as society to improve their safety. They put forward a range of suggestions to improve safety, such as increased camera surveillance, higher police presence in public transport facilities, and intensified crowd control. Going beyond safety infrastructure discovers that Governmental support of safety training for everyone, including women and men, is suggested as a future-oriented action-taking to increase the civil courage in public transport and hence, reduce crime and harassment. Mainly providing self-empowerment and self-defense courses and safety apps are conceptualized as a support to their safety. The research suggests that it is not sufficient to provide women with tools to increase their safety by suggesting that underlying structures of society reinforce danger in public transport. Hence, informants suggest educational campaigns at Universities and schools regarding behavior in public transport and to promote civil courage through opening a medial discourse on transport-related crime and sexual harassment on the national level. Furthermore, education is stressed as a game-changer for females to increase the share of female actors in urban planning, governance, and policymaking, which in return is relevant to combat the continuous reinforcement of gender gaps in Delhi.

Based on the results of this study, a case study approach is recommended to investigate context-specific factors of urban mobility before introducing transport policies on the local level. The range of internal and context-specific factors revealed in this research recommends further research in the field to dedicate a rather in-depth focus on a bounded urban space or similar to compare several cases in their natural setting. Likewise, basing this research on

participatory research principles gained an insight into the gender dimension through womens' perspectives which helped to understand their needs better concerning the urban space. As women's immobility appeared to relate to the inherent structures of Delhi, the study underlined that their perspectives matter for policies, regulations, and investments in public transport. Hence, the results show that participatory tools are highly responsive to grasp womens' needs in public transports, notably through visualized processes and a dedicated focus to them in the research strategy. Tying into that contemporary mobility governance and local urban planning can be advised based on the findings to consider bottom-up approaches and localized research to find responsive solutions. Besides, action-taking is highly demanded to shifting internal structures. While this study did not manage to take action in the field, its findings still phrase that the participants strongly request local and the national government to mobilize increased action taking for their needs.

The explorative and future-oriented picture of sustainable mobility resulting from participants' experiences is multidimensional, abstract, and dynamic. While based entirely on the case-specific perceptions of participants of this case study in Delhi, it is not a blueprint for conceptualizing urban mobility. Indeed, it remains explorative and contributes only a glimpse of ideas and thoughts to a complex phenomenon. However, the findings provide an impression of what factors matter for womens' mobility in this case and context which allows integrating these perceptions and experiences better in the future. Thereby, it may inspire future-oriented integrative and sustainable approaches, planning, and policy development bound to this case. Likewise, it recommends conducting further research in the field to improve womens' mobility in Delhi.

8. Concluding remarks

This research aimed to investigate female public transport users' experiences and reveal relevant factors for conceptualizing sustainable mobility integrating gender dimensions. Five in-depth semi-structured interviews and ten participatory maps were conducted to conceptualize sustainable mobility with female students at the University of Delhi, India. A feminist urban geography lens placed gendered dimensions of urban space in the spotlight of inquiry. A theoretical framework has been developed to connect previous discourse on urban space, gender, and mobility as a guideline for analysis and discussion of findings.

The case study examined that participating woman perceive their mobility as limited in the urban space of Delhi. Likewise, the public transport sector is not experienced as a service that allows women to move freely in the city. Despite participants' varying and fluid experiences, perception of gender gaps in public transport appears to be a shared experience amongst women. It reoccurs in social, economic, and ecological factors associated with their journey in public transport. Taking a feminist urban geography lens demonstrated that gender dimensions are interrelated with urban spatial dynamics, and thereby, mobility cannot be viewed as exclusionary of space or gender. The experiences on womens' journeys appeared to be shaped by underlying social constructs ascribed to gender, reinforcing exclusion, unequal power dynamics, and inequality continuously. Thus, future-oriented strategies for public transport development are suggested to integrate women's experiences and perceptions to find more responsive public transport schemes. Likewise, context-specific factors are essential to conceptualize improvement according to the needs of city dwellers. Furthermore, a critical stance towards sustainability as a blueprint for mobility governance is suggested based on case-specific findings. Thereby, conceptualizing maintainable approaches to meet the needs of various generations nowadays and in the future requires a multidimensional and in-depth focus on context-related human-environmental linkages.

The scope and scale of this research did not allow to act in the field for a fundamental change or to integrate findings into a concrete policy paper. The author strongly hopes to use this case study as a departure for future research and elaboration of the complex discoveries of findings. However, for now, its case-specific findings can serve as an inspiration for better integration of womens' perspectives in public transport. Likewise, its case study design and participatory tools can be recommended to retrieve case-specific understanding and a range of future-oriented ideas to enhance social, economic, and ecological sustainability in urban

public transport. Thereby, it may serve local mobility governance to adjust public transport policies and create a more equal and socially just urban space. Likewise, as public transport appears to be more than just a physical movement while impacting multi-layered aspects of a women's life, the study strongly suggests immediate action to urban planning and transport stakeholders. Tying into that, it hopes to arouse further academic research to dedicate an in-depth focus to related subjects in Delhi and elsewhere. Thereby, it recommends the relevance of combining distinct theoretical concepts while thinking intersectional and multidimensional to investigate urban phenomena in complexity.

As this case study bases on the meanings of women ascribed to mobility, its ending must be owned by a final impression of a participant postulating the need to integrate her experience in public transport for a change of present conditions:

"This is something that must be done here,

and I really do not know why it has not been done before"

(Quote informant N)

Appendices

Appendices A: Interview request letter

Dear Students,

I am looking for female students to participate in a short online conversation with me to exchange thoughts and ideas!

I am a student at Lund University in Sweden and currently writing my Bachelor undergraduate thesis. The thesis aims to understand challenges and opportunities of achieving **sustainable development in the public transport** systems in New Delhi. Moreover, the research objective is to particularly investigate women`s ideas and opinions on using public transport systems (like busses, trains, shared vehicles, walking, biking) in New Delhi and what could be done to make the use of it better, easier and safer.

Therefore, I kindly invite you for a 15min conversation with me via online video conference as **your opinion would matter a lot** for my research. The conversation would be about your visions on how you would imagine transportation to be more sustainable and better for your personal daily routine. Hence, the interview is just around your impressions and thoughts about the topic. For instance, I would like to collect perceptions of how your way from home to university could be improved and what you would suggest for improvement.

The interview material would be used safely only for my bachelor thesis at the University, and you will be provided the opportunity to review your contribution at any time. The interview date and time will be scheduled **depending on your availability** and hence, please suggest a suitable timeframe of your choice in the upcoming weeks as a response to samirapfeiffer@outlook.de

Thank you very much in advance for your time and please contact me in case there are any further questions! Moreover, I would kindly again highlight that it would be my pleasure to include your ideas in my thesis and you would be a great support to the research process and outcome.

 I think that it is a great opportunity as students from around the world to share our ideas and thoughts to study and learn from each other.

I am looking forward to hearing from you soon,

Kind regards,

Samira Pfeiffer


Lund University

Email: samirapfeiffer@outlook.de

Facebook: Samira Pfeiffer

Appendices B: Interview guide

- Are you using public transportation modes in Delhi?
- What public transport are you using?
- How is public transport in Delhi?
- What public transport modes are you using for your way from home to University?
- How do you perceive your journey from home to University with public transport?
- How do you experience your journey as a woman in public transport?
- How do you perceive your mobility in the city?
- Can you imagine any improvement that would make your journey with public transport better?

- What would you improve in public transport in Delhi?
- Why would you want to improve the public transport in Delhi?
- What is sustainability for you?
- What is mobility to you?
- How would you define sustainable mobility of your journey?
- How do you think about your making the public transport sector more sustainable?
- What aspects would you integrate in sustainable mobility?
- What aspects are relevant for you to experience sustainable mobility in your daily- routine?
- How would you conceptualize sustainable mobility in the future?
- Think about your way from home to university. What would you conceptualize for it to be of a sustainable experience of mobility for you?

Appendices C: General format participatory map
Annex C1. General format mind- map: Sustainable mobility
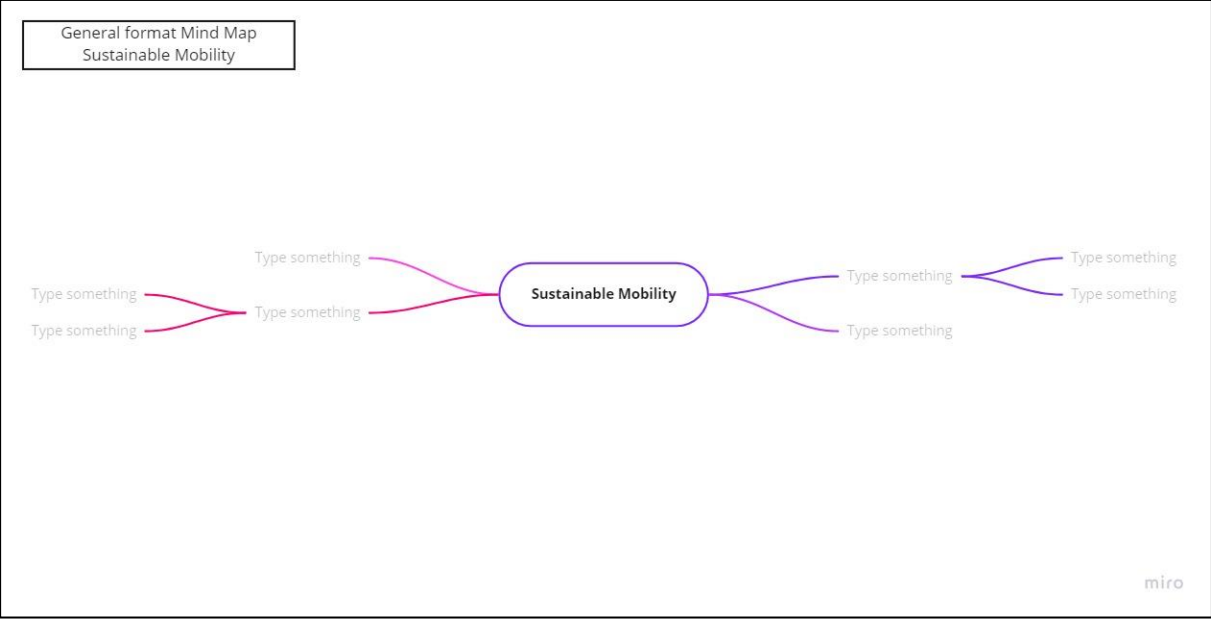
Annex C2. General format concept- map: My Journey
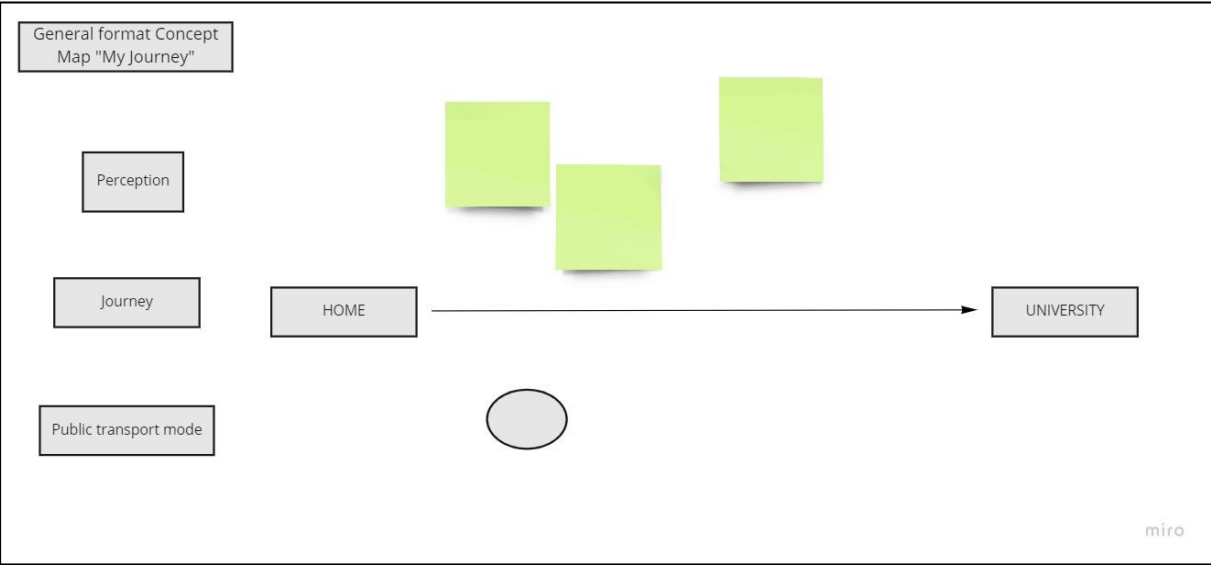
Appendices D: Summary participatory mapping

Table 1: Summary indicators mind- maps sustainable mobility

PR Maps	Social factors	Economic factors	Ecological factors
Map A	- social sustainability - participation - opportunities for all - womens equality - equality	- economic factors - affordable transport - Access to job market - financially supported	- ecologial sustainability - no pollution Transport - alternatives to cars - infrastructure for long-term
Map B	- safety - safer for women specifically	- sharing vehicles - car-pooling - more public transport - expansion of metro	- eco-friendly travels - -vehicles - less fossil fuels
Map C	- users safety - Surveillance - increased Control in PTS - prticularily safety for women - gender specific divisions in PTS - societal awareness - education	- economic aspects - availability - increases participation - flexibility - important for womens trip patterns - job opportunities - action taking - government and policies - even/odd numbers rule - stricter fossil fuel policies - transport rules/laws - connectivity - better connection to neighbouring cities - urban/ rural last-mile transit	- environment - transport pollution - better air-quality/ less polluted city - health - built environment - batterie rikshaw - cleaner fuels for cars - expand metro - solar power in metro -
Map D	- safety - road safety - walking paths - traffic - accidents and traffic jam - women's safety - crowded trains/ metro - waiting times at stops - thefts - metro surveillance - bicycle cultural norms	- availability - affordability - frequency - busses/ metro stops - tickets for all - integrated PTS - government support	- environment - public transport spaces - crowding - infrastructure and built environment - transport pollution - electro cars/ busses - air pollution - alternatives/visions - car sharing - uber - bicycle - electro/cycle rikshaws
Map E	- safety - women/men divisions in PTS - security controls - cameras and surveillance	- availability - increase frequency of PTS - more trains/ metro - more locations of busses - invest in infrastructure	- eco-friendly PTS - car-sharing - reduce need for private cars - less pollution alternatives - electro - no fossil fuels - greener fuels - walking

Table 2: Indicators summary of concept- maps "home to school

Maps	Social factors	Economic factors	Ecological factors
Map F	- Safety needs to be taught to drivers - driving behaviour - metro is safe - more sense of driving safely	- supply is more than demand of Rikshaws - all drivers want you to sit in their vehicle - frustrating and overwhelming transport market - better organization	- bigger walking paths
Map G	- gendered divisions - sperate men/ women in train - good surveillance in metro - cameras/ police -	- connect last mile - easier transit - increase frequency of trains and metro - better conditions for suppliers	- walking path infrastructure - cycle rikshaws eco-friendly - more e-rikshaws - renewable solar power for trains - electro busses - less fossil fuel busses - electro busses as state busses
Map H	- road safety - safer metro - PTS is crowded/dangerous	- rikshaw supply - more police	- private car best option
Map I	- safety - familiar drivers rikshaws - very crowded PTS - sustainable is no poverty - dangerous at night	- easily accessible metro - local rikshaw market	- less pollution vehicles - sustainable is ecological
Map J	- touching, looking talking as so crowded - safer for women -	- controlling passengers - cameras in PTS -	- pathways for walking - pedestrian streets - more walking and biking

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