Gender Analysis of Commuters Travel Behavior and its Impact on Environmental Emissions

ABSTRACT

In Mumbai, the expanding economy has intensified the demand for efficient public transportation. However, the prevalent dependence on private vehicles, persistent traffic congestion and severely low air quality continues to be significant challenges for the city's residents. This surge in private vehicles and decrease in the usage of public transportation is a result of several challenges that commuters face in accessing the public transport of which women are the primary users as per the recent data. This study systematically gathers insights from commuters, with a specific focus on women, utilizing participatory methodologies such as surveys and semi-structured interviews. These experiences shed light on the disparity between men and women travel patterns and their special needs. These experiences also lead to the selection of mode choice and the consequent environmental impact. The research calculates the emission factors based on the information collected from the respondents and disaggregate them based on gender and income categories.

Keywords: Gender, transport, accessibility, climate change, travel behavior.

Introduction

In Mumbai, transportation is integral to daily life, with the suburban train system catering to 46% of daily trips. Despite this, recent years have seen a 6% decline in train ridership, coinciding with a surge[1] in private vehicle ownership due to factors like easy auto finance and delays in public transport projects. This shift has notably impacted the quality of life, particularly for women who constitute 43% of Mumbai's commuters.

This research addresses the gap in understanding women's mobility experiences, aiming to answer key questions on how their travel experiences differ, how these experiences influence mode choices, and the resulting environmental impact of these choices.

Traditional methods of measuring mobility tend to focus on quantitative aspects such as the number of trips made, mode shares, and distances traveled. While these metrics provide valuable insights into overall mobility patterns, they often overlook the subjective experiences and challenges faced by women in their daily travels. By neglecting these subjectivities, we miss an opportunity to make public transport systems inclusive and ultimately reduce the reliance on private vehicles.

This research adopts a mixed-method approach, to document commuter choices and experiences across modes of transport and investigating how these experiences influence mode choices. By embracing this perspective, a more comprehensive examination of mobility challenges emerges, encompassing factors such as domestic responsibilities, lack of last mile connectivity, gender dynamics, marital status, economic class, and the interplay between job and family obligations. These multifaceted factors intricately influence individuals' choices, including the mode of transport, commuting times, residential locations, travel companions, and the utilization of multiple modes of transport within a single trip.

. Building upon this comprehensive dataset, the research also delves into the environmental impact of these mode choices, specifically examining emissions across gender and income categories. By combining qualitative and quantitative approaches, this study aims to shed light on the complex interplay between individual experiences, mode choices, and their environmental consequences.

It is important to note that this study employs a gendered lens, focusing on two genders—male and female. However, the responses received included participation from three genders—male, female, and one transgender response. This approach is not intended to enforce a binary perspective but rather to work with the predominant genders that have participated in the survey, as a certain sample size is necessary for reliable results. Furthermore, it is essential to acknowledge that studying the travel experience of transgender individuals necessitates an alternative framework, as the visibility

[1] has been a 55% rise in the number of vehicles in the city since 2006-07 how much percentage surge in the ridership of private vehicles in Mumbai, Economic times.

of being transgender in public transport can significantly impact their experience. This acknowledgment underscores a limitation within the research methodology.

Literature Review

Gender based Inequalities

Variation in travel patterns and behaviors among men and women in cities often depends on the kinds of activities they perform. This is largely governed by the triple burden of women's responsibilities as income earners, homemakers, and community managers (Economic and Social Council, 2008). Women make more complex trips with multiple stops, often for reasons other than work, such as picking up children from school (Ma et al., 2014; Scholl, 2002). Other factors such as concerns about personal safety and security (Borjesson, 2012; Delbosc and Currie, 2012; Loukaitou-Sideris, 2014; Schmucki, 2012; Shirgaokar, 2018; Stradling et al., 2007) and harassment experienced by women in public spaces (Stark and Meschik, 2018) have direct implications on the choice of mode, trip timings, distance travelled and frequency of trips made, which fundamentally change the practical needs of women while they travel. In Mumbai, it was seen that women were more likely than men to work from home and, for those that did have to go out, were more reliant on public transport than their male counterparts (Alam et al., 2021).

Income based Inequalities

According to research that examines gender and income- based variability in travel choices, in Visakhapatnam, India[2], women are more likely to use public transport modes than men with 68% of women using public transport compared to 57% of men. However, women's travel behaviour is influenced by their income levels, with low-income women more likely to use walking and cycling modes. The fear of harassment and violence in transit environments is another factor that can affect women's travel behaviour. Loukaitou-Sideris (2014) argues that women's fear and sense of safety in transit environments are shaped by their experiences of harassment and violence, as well as the design and management of transit infrastructure. This can limit women's access to public transport, particularly at night or in areas perceived to be unsafe and reinforce gendered divisions of labour and space in the city.

Personal and household incomes play a significant role in determining the choice of mode of transport made by commuters regularly. Commuters with lower incomes will have fewer resources to spend on transport. As a result, the dependency on walking, non-motorized, and slower modes of transport increases among these groups (Cheng et al., 2013; Murakami and Young, 1997; Srinivasan and Rogers, 2005). With the rise in income levels, there is a gradual increase in the use of two-wheelers and personal cars (Ananthapadmanabhan et al., 2007).

Women, particularly those from lower-income families, are burdened with more domestic responsibilities and less access to household resources, forcing them to use less expensive and slower modes of transportation, often while hanging out on the train[3]. As per the World Bank report[4] in Mumbai female commuters rely more on public transportation and walking than men and account for 20% of the suburban modal share, while men account for 17%. For the bus, women account for 12 percent while men at 8 percent, and for walking, it was 38 percent versus 28 percent.

Environmental Impact

A study in Sweden, commissioned by Vinnova, Sweden's innovation agency, and conducted by Trivector, revealed that if everyone in Sweden traveled the way women do, "the energy use and emissions from passenger transport in Sweden would decrease by almost 20 percent."

[2] Gender and income-based variability in travel choices in Vishakhapatnam, India

[3], Alam, Muneeza Mehmood; Cropper, Maureen; Herrera Dappe, Matias; Suri, Palak. 2021. Closing the Gap: Gender, Transport, and Employment in Mumbai. Policy Research Working Paper;No. 9569. © World Bank, Washington, DC. http://hdl.handle.net/10986/35248 License: CC BY 3.0 IGO.

The preliminary interviews for this study suggest that the trends in Sweden and Mumbai are comparable, with women trip-chaining more and men traveling farther distances by private transport.

According to the field and studies of sustainability, men and women have different values regarding travel. The disparity in environmental impacts between men and women has been well documented in various sectors. Men seemingly contribute more to carbon emissions than their female counterparts while contributing less to mitigation efforts (Vajjarapu & Verma, 2022). Within lifestyle choices made by individuals in India, it was found that, with rising income, the increase in CO2 - emissions from personal transport has been very pronounced (Ananthapadmanabhan et al., 2007).

Methodology

The literature review, secondary data and the primary data collection are used to qualitatively analyze the experience of commuters and calculate the environmental impact of their mode choice. In qualitative analysis, key themes are identified using Atlas ti where a list of words from the interview were coded against a broad theme, for example:

Health - "sugar" "blood pressure" "anxiety" "anger" "stress" "heart" "legs" "old" "pregnant" "pain" "ache" "breathe" "sprain" "operated" "doctor" "hectic" "stressful."

In the same way, 408 words coded against 13 themes and key themes were identified.

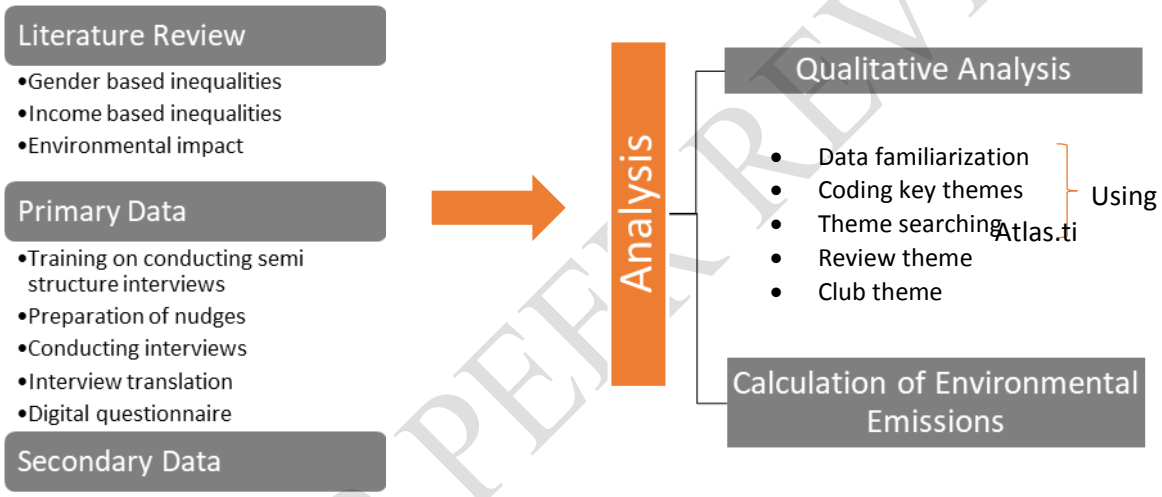

Figure 1. Diagram illustrating the research methodology.

Data Collection

This research used a mixed method technique to gather data such as gender, income, relationship with the city, distance travelled in each mode, combination of modes, age, income, relationship with the city, purpose of travel, level of exhaustion through online questionnaire and semi-structured interviews through *random sampling technique*. Semi-structured interviews also used *nudges* to uncover nuanced experiences, providing a comprehensive understanding of participants' travel histories. Key prompts included, daily travel routines; information on specific routes; timings of commute; details about workplace; commuting duration; mode of travel beyond daily commute; reflections on challenges during daily commutes, such as walking route comfort, rickshaw availability, rush hour congestion, emotional states, seat availability, and unpleasant experiences; views on safety, particularly at night-time travel; and evening and morning routines to capture the context of daily lives and commuting's role.

The predefined data set on emission standards was then cross referenced to estimate the CO_2 emissions for each respondent.

Qualitative Analysis

Demography

The survey conducted among 514 respondents of which 74.22% of respondents were female. The age distribution reveals that 73.40% fall within the 18-25 age bracket, and 14.98% in the 25-40 group. Transportation choices varied among women, with a majority opting for a combination of walking, private autorickshaws, and local trains. Respondents with an income less than 10 lakhs predominantly chose shared rickshaws and local trains/metro, while those with an income exceeding 10 lakhs leaned towards private options like two-wheelers, private rickshaws, taxis, or cars. The main themes that were identified after analyzing the interviews were: triple burden, health and hygiene, triple burden, and last mile connectivity.

Triple burden

The division of household, and commuting responsibilities was one of the primary differences that was highlighted in the data. As one interviewee points out, "the stress faced by women is compounded by the dual responsibilities of work and household chores." Women often find themselves managing both physical and mental stress, which can become overwhelming. Studies such as Hanson and Hanson (1981), Lu and Pas (1998), and Pas (1984) have shown that women tend to spend more time on household maintenance activities and less time on leisure than men. This pattern results in women making more frequent but shorter trips. Kwan (1999) reinforces this evidence, highlighting the restricted space-time accessibility that women experience compared to men.

Furthermore, women's responsibilities often extend beyond commuting. They are often responsible for domestic chores, childcare, and meal preparation before and after their daily journeys.

"I try to reach home as early as possible. After reaching home, I cook and finish some household chores. I have to wake up at 4:30 am daily, and then I cook and finish all the chores before leaving for work. I must leave home at 6:30 a.m. so there is no time to waste. It leaves me too exhausted to do anything else during the week", (Interviewee 42, female).

The complex juggling act of managing their commute, childcare, and domestic labor results in more intricate and chained travel patterns for women, limiting their participation in the public realm (Gordon, Kumar, and Richardson 1989) and can deplete their health.

Amongst the participants early morning commutes were a common occurrence requiring them to wake up well before dawn to finish household chores before commuting. This can disrupt their sleep patterns and daily routines.

Another 35-year-old woman shares "I reach home around 8 pm, and then I prepare meal for the entire family. I live with my husband and two children." When asked about how she spends her time post commute she exclaims "I do not get to do anything else. After reaching home I quickly prepare the meal for all, by the time I eat and clean up it's already 11 pm."

When comparing within households, male contemporaries often experience minimal disruptions to their travel patterns, while women must accommodate full-time employment and domestic labor. Furthermore, while women may be more willing to adjust their travel patterns, they often find themselves unable to make these adjustments (Rosenbloom & Burns, 1994), reinforcing the inflexible nature of post-commute experiences for women.

A 42-year-old male commuter who travels from Badlapur, one of the farthermost hinterlands of Mumbai to the city center, traveling more than 90 minutes each way shares his post commute routine as "After reaching home, I freshen up and then watch some television. I also spend some time with my children, oversee their homework. I like to go to bed early to prepare for the next day's commute."

Several female interviewees mentioned their dual roles as professionals and caregivers, necessitating the delicate balance between work and household responsibilities, "before going to work, I need to prepare breakfast for the entire family" as expressed by a 36-year-old working mother.

In specific instances, the societal practice in India of residing within joint family structures, coupled with assuming collective responsibilities for the care of extended family members, also resulted in additional responsibilities for women. A 32-year-old female, interviewee mentions that

"After my daily commute and work, I help my mother with cooking and look after my brother's children."

Managing tight schedules, including household chores, and caring for family members alongside work commitments, influences their commuting choices. They seek transportation modes that save time and are efficient even if it entails standing at the edge of the train during peak hours from Andheri, situated in the Central Business District (CBD).

Commuting patterns can significantly impact mode choice, with women facing added pressure to balance work and family responsibilities. "I travel with my husband in the car to work in the morning. In the evening, since I have to rush back home early to prepare dinner, I do not wait for him and take the suburban train", a 38-year-old working mother.

Some single women mention that being unmarried allows them to focus more on their careers without additional domestic duties. This plays a significant role in their access to jobs.

As per the Periodic Labour Force Survey Reports, by Ministry of Statistics and Program Implementation, Maharashtra's urban female labour force participation rate is at 24.9%, which means, of all women above the age of 15 years, only a quarter either work or are looking for work. There is a significant gender disparity in labor force participation in urban Maharashtra. The participation rate for men is much higher, with 73.4% of men being part of the labor force. The data specifically highlights the situation in Mumbai, where the female work participation rate is even lower at 18.8%.

A recently married 27-year-old working woman who commutes 30 km each way everyday exclaims, "There are days I wonder if all this is even worth it". According to a report by Asian Development bank, women may turn down better employment opportunities further away from home in favor of lower-paid local opportunities when the public transport system is unreliable and unaffordable. Additionally, some respondents who participated in this research mentioned that working in male-dominated professions, such as being self-employed in a workshop, can further impact their work-life dynamics due to extended working hours and a perceived lack of understanding or empathy.

Health and Hygiene

The quality and accessibility of public transportation play a crucial role in influencing the health of women, as reliable and well-designed transit systems can contribute to reduced stress, increased physical activity, and improved overall well-being. The provision of public toilet is pivotal to safety, comfort, and health aspects of public transportation. Based on 1000 surveys conducted by St. Xavier's College in Mumbai, over 50% of respondents reported avoiding public train station toilets, with only 8.5% considering the facilities to meet hygiene standards. Notably, 32.5% reported the absence of essential amenities, such as water, dustbins, sanitary napkins, and soap, indicating a lack of necessities for passengers.

A 28-year-old banker shared, "Women's washroom is the main problem. If there are washrooms, they are not at all clean. Hygiene is not maintained. Many ladies avoid using them despite their desperation." Lack of hygienic toilets disproportionately affects women and compounds their challenges in daily commuting. Women frequently experience health issues such as Urinary Tract Infections (UTIs), gastrointestinal discomfort, and mental stress attributable to the inadequate access to clean restroom facilities.

Another 24-year-old private sector employee shared, "So many times I have returned halfway from the train station because I needed to use the toilet in emergency. I have missed my train quite a few times because of this reason causing increased waiting hours."

Women also shared about the increased stress levels while commuting. Mumbai suburban trains experience super dense crush load of 14-16 passengers per sq[5]. A 28-year-old architect shared about the travel anxiety she experiences during her commute, "Everyday it feels like I am going on a war. I start planning my commute from the previous night. I try to sleep early so that I can catch an early train on time. But that's too idealistic of me. My working hours are late and hence I must bear the brunt of the rush the next morning. I get pushed inside the train and then travel for at least an hour standing with a heavy bag." Another 35-year-old commuter shares "I plan my day around the commute. To avoid the rush hour, I try to leave by 5:00 pm. Leaving early has had an adverse effect

[5] Gender study, MMRDA

on my career as I was absent from some very crucial meetings. When I was not married, I used to wait for the rush to subside and leave by 8pm. Now I have children. I cannot reach home late."

Some interviewees recount instances where they were unable to find seats and even witnessed physical altercations among female passengers due to overcrowding.

This enduring long waiting times and extended commutes raises potential health implications, including stress and fatigue. It is crucial to contemplate the potential health impacts of commuting, particularly for women who already juggle multiple responsibilities. A 26-year-old corporate employee exclaims, "I would also like to go for a movie after working hours, or go out for dinner, sit casually at a park, or just enroll myself into a new activity like pottery. But I get so tired by the end of the day, that I go home which is an hour and a half long commute. By the time I cook and clean, it's too late and I am too exhausted to do anything else."

Some interviewees have also shared instances of high blood pressure, headache, and experiences of physical discomfort, such as pain in her heels, following the commute. This experience underscores how long commutes and overcrowded conditions can give rise to physical and mental health issues. In such circumstances, travel becomes challenging for an average healthy individual, and for commuters requiring special care, it becomes impossible, limiting their movement and making them consistently reliant on others.

One interviewee draws attention to the lack of provisions for pregnant women's needs, remarking, "How will a pregnant lady travel in trains? During the rush hour, the ladies asked me to go to the handicap compartment—people in the handicapped compartment asked me to go to ladies' compartment—a pregnant women can't remain standing for 1-1.5 hours in this rush."

The interviews underscore the urgency of exploring alternative public transportation options that can alleviate the strain on Mumbai's suburban trains and reduce the crush load, but mere provision of infrastructure is not enough. The infrastructure must add comfort and convenient and should be able to accommodate special needs.

A 68-year-old woman expresses, "Following a recent knee surgery, boarding buses and trains poses challenge due to their elevated platforms. Although Andheri station provides an elevator for accessibility, its recent malfunction caused a considerable delay of at least 20-30 minutes. Travelling from Andheri to Lower Parel, where there is no lift available, I alight one station earlier at Prabhadevi, use the elevator there, and subsequently take a taxi to Lower Parel".

Through several interviews it was found that this arduous nature of commute via public transport had caused women to switch to private modes such as- autorickshaws, cars and taxis. This was subject to the rise in income. As one of the interviews highlights-

"I am a strong advocate for public transport but during the rush hour it is impossible to board the suburban trains. First the ride to the station itself is arduous. You cannot walk or cycle- you must wait in long ques for a sharing rickshaw or the bus. Then at the station, a swarm of passengers push you into the compartment. Then once inside, everyone competes for a seat. Such travel conditions are horrifying and severely impacts my health and quality of life. It's best that I travel in my car or uber. If I leave very early in the morning, I also beat the traffic saving plenty of time."

Safety and Security

The interviews reveal the pivotal role feeling safe and secure play in shaping commuting patterns and overall well-being of women. As one interviewee remarked, "after 11 PM, concerns arise, particularly regarding train travel". This sentiment echoes the apprehensions shared by many women when contemplating nighttime journeys on public transportation.

The latest National Crime Records Bureau (NCRB) data has revealed that Mumbai had reported the maximum number of cases of sexual harassment against women in public transport system. According to a study conducted by the World Bank[6], as part of its 2022 research report

[6] Sood, M., & Gwalani, P. (2023, December 5). *Crimes against women rise in Mumbai, second only to Delhi, reveal NCRB stats*. Hindustan Times. https://www.hindustantimes.com/cities/mumbai-news/crimes-against-women-rise-in-mumbai-second-only-to-delhi-reveal-ncrb-stats-101701753669449.html

indicates that only two per cent of female commuters reported instances of harassment to the police, 75 per cent of women who rely on train commutes are unaware of the dedicated helpline numbers established to assist them in times of distress.

During interviews with commuters, it became evident that there was a prevailing perception of Mumbai as a safe city. However, when specifically asked about venturing out at night, women exhibited hesitation, revealing a paradox where despite a perceived safety, women are reluctant to travel during nighttime.

Women's mobility faces further restrictions due to concerns of nocturnal safety, resulting in what researchers have termed "women's fear-induced time-sensitive immobility" (Zhang et al., 2022). Zhang et al. also posit that this fear constricts women's mobility further, aggravated by a drastic decrease in human activity around transport terminals during the night. As one woman corroborates, "I aim to be within the station premises before 11 PM. This specific timing is crucial because, after 11 PM, many shops and vendors around the station close and it gets very isolating, also the rickshaws become less available during these late hours". This reveals how interconnected land use and public transport infrastructure are, and the gendered nature of temporal transport accessibility. Consequently, she often relies on her family to pick her up by car, highlighting the vital role of familial support in ensuring her safety. This immobility also spills onto nocturnal last-mile connectivity issues. The non-availability of auto-rickshaws, coupled with a lack of pedestrian infrastructure especially suited for nighttime lead to a further constriction of commuters with limited means.

Another 24-year-old expressed "Mumbai is a very safe city, but I have never travelled alone at night. I feel fearful because I do not know the intention of people around me in the bus. If required, women in Mumbai travel with confidence but sometimes a look from the other end of the bus is enough to frighten you. We do not show that fear on our faces, but we do feel fearful from inside."

Uteng et al.'s research highlights the profound impact of safety issues on women's mobility, emphasizing the self-imposed precautionary measures adopted by women that significantly limit their mobility. As they point out, "Poor infrastructure, which is of a more systemic nature where the case of poor physical infrastructure provision (absence of footpaths, unfavorable location of bus stops, malfunctioning street lightings etc.)" is one of the key factors affecting women's safety and mobility.

The second scale of violence and safety breaches, which concerns "sexual harassment on public transport services or walking down poorly lit streets, subways, connecting path between the slums and bus stops etc.," remains a common theme in many developing countries, as Anand and Tiwari's research supports.

Changing perceptions of safety are also evident among the interviewees. Some participants noted a shift in how they view Mumbai's safety over time. This shift in perception is often linked to economic conditions, with middle to higher-income respondents having more alternatives for transportation and greater coping strategies in dealing with unreliable transport.

While Mumbai's public transportation system remains a vital service, safety, and security concerns, especially at night, act as significant deterrents for women. As one interviewee pointed out, "In railways, it's safe because at nighttime a CRPF officer is present in the ladies' coach." This quote emphasizes the importance of enhanced security measures during late-night travel, particularly in mixed-gender compartments.

Safety remains a complex issue, with some women expressing a mix of fear and carefree attitudes. Personal responsibility is emphasized, as one interviewee stated, "When we talk about safety, it depends on ourselves." She also cautioned against unsafe practices, saying, "For example, standing next to the train door, should not be done. You can lose your life."

Last mile Connectivity

Last mile connectivity is a constant point of contention among the respondents, with most highlighting issues in accessing reliable options to reach locations such as bus stops and railway stations. Options such as auto-rickshaws and walking are particularly popular among the female respondents. According to the National sample survey office, auto-rickshaws are used by around 38% and 40% of the households in rural and urban areas in India in the year June 2014–2015, respectively (NSSO, 2016). However, reliance on rickshaws often comes with its own set of caveats. Some respondents lament their conditional availability, remarking, "If the station is nearby, we get autos quickly, but if it is farther, we don't get as many autos."

Another commuter reflects on the issue of auto-rickshaw refusals, highlighting their frequency in certain areas like Masjid and JJ Hospital (Sandhurst Road). She further articulates, "If there is a medical emergency and we have to go to the hospital, sometimes taxis and auto-rickshaws refuse to go." Such situations often render commuters as captive transit users (Krizek & El-Geneidy, 2007), where they are willing to compromise on time and capital due to their dependence on a single mode of transport. In cases where the rickshaw ride to the station is relatively brief, taking approximately 10 minutes, one respondent notes, "While going back sometimes I have to wait at the station for as long as an hour." This emerges as a greater hindrance to accessibility especially for women who may have domestic responsibilities awaiting them. Prolonged waiting times can therefore disrupt their work-life balance and restrict their transportation options.

The prevalence of shared rickshaw monopolies introduces complexity, with fixed routes, predetermined origin and station stops, and a requirement to share with two other passengers. This arrangement is pocket friendly but compromises comfort. In many cases rickshaws break the law and carry more than 3 passengers causing grave risk to passenger safety. One of the female commuters recounts her experience, stating, 'I often encounter rejection from shared rickshaws due to my plus size. They perceive that I occupy space equivalent to two passengers, leading to a loss of revenue for them.” Another commuter shares, “I do not feel comfortable sharing a rickshaw with other passengers especially men. However, I must wait for at least an hour to find a rickshaw that agrees to take a single passenger”.

Statistics show 1.5 crore[7] commuters use walk as one of the modes to work. However, the lack of last mile infrastructure creates several hurdles and increases the dependency on the three-wheeler auto rickshaws. One of the students shared, “My home is at 15 minutes walking distance from the suburban train station but there is no place to walk. The footpaths are discontinuous, and half the time occupied with vendors. It’s better to quickly hop into a bus or a rickshaw and reach the home in 5 minutes.” Another female commuter states, “I walk from Churchgate station to my place of work, because the walk is very pleasant, but I cannot do that from Kandivali station (in the northern suburbs) because the walk is dreadful”. The unreliable nature of the buses has also been addressed by the interviewees as one shares, “The bus is never on time. I wait for 10 minutes at the Bandra bus depot. If it does not show up, then I take the rickshaw. It is not very affordable but saves time.” Such examples clearly emphasize the role of last mile network in mode choice. The unreliable network results in many individuals to opt for a more convenient and comfortable private mode.

Environmental Emissions

As a part of the questionnaire, 515 participants were asked the combination of modes they choose and the distance they travel. These two inputs were used to calculate the emissions for each participant.

Carbon Emissions= emissions factor[8] x vehicle kilometer travelled (VKT)

The emission factors for various modes of transport were used as follows:

Mode	**Emission factor-CO(g/km)**
2-Wheeler	0.619

[7] CitizenMattersIn, A. V., & CitizenMattersIn, A. V. (2020, August 29). *Nearly 1.5 cr people walk to work in Mumbai, but metropolis doesn’t prioritise pavements*. Firstpost. https://www.firstpost.com/india/nearly-1-5-cr-people-walk-to-work-in-mumbai-but-metropolis-doesnt-prioritise-pavements-8767771.html

[8] Emission Factor development for Indian Vehicles " by The Automotive Research Association of India

Table 1. Emission factor for different modes of transport

Car	0.332
3-Wheeler	0.154
Bus	0.195
ICV	0.109
HCV	0.03

The emission factor calculated for each respondent is plotted in the graph as shown in figure. This data was then segregated as per income and gender categories for analysis.

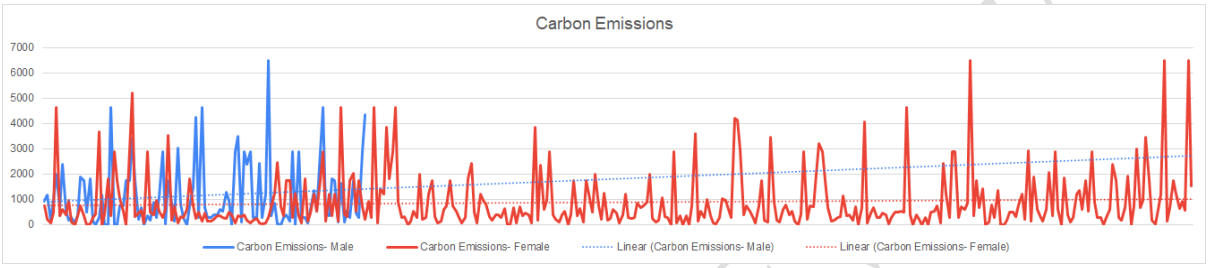

Figure 2. Plots the carbon emission of each participant in the survey

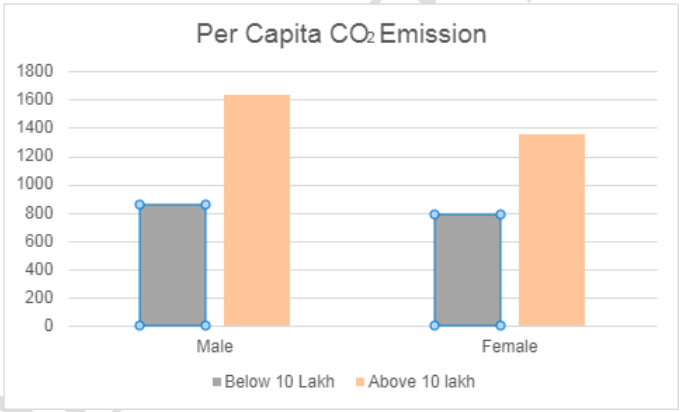

Figure 3. Plots the carbon emission segregated as per income and gender categories.

Result

According to the findings, the research deduces that within the cohort of study participants, women exhibited a higher reliance on public transportation, and this dependence demonstrated an inverse correlation with their income levels. Even with an increase in income, women continued to favor public transportation over private alternatives when compared to their male counterparts. This choice was influenced by various factors, including domestic responsibilities and vehicle ownership. Consequently, women contributed significantly lower levels of CO2 emissions compared to their male counterparts. Table 2 details the per capita CO2 emissions relative to income. Despite the heightened use of public transportation, the experiences of women underscore an uncomfortable commuting pattern that demands immediate interventions.

Table 2. Per capita carbon emission generated in a single journey

Per capita carbon emissions		
	Income below 10 lakhs	Income above 10 lakhs
Female	787.75	1632.55
Male	859.39	1353.48

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