



IMPACT OF SAFETY CONCERNS ON WOMEN'S MOBILITY IN SMART TRANSPORTATION SYSTEM: NOVEL APPROACH.

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Abstract— The world population consists of 49.58% of the women community. About 18% of the total world population uses public transport. Public transport is recognized as a sustainable means of transport in terms of space and energy efficiency, and environmental and social benefits. It is said that public buses can be considered the lifeblood of the national economy, as most of the urban and rural residents, especially women, rely on public buses for transportation. In addition, women often travel more and in more sophisticated ways than men. However, women generally have less access to private and public transportation in metropolitan cities. This article discusses about the problems faced by women in society while traveling through public transportation, their solutions and additional suggestions to improve them for better use.

Index Terms—: **Keywords: Public transport, Women safety, Harassment cases, Logistic regression analysis, Factors associated with accidents, Women empowerment, etc.**

I INTRODUCTION

On public transportation, many women expose themselves to physical violence, sexual harassment, or other types of abusive behaviour. It also has negative economic and social effects. The authors focused primarily on cities where women use public transportation more than men and rely heavily on these systems for their public transportation needs. Women's mobility preferences and habits are largely influenced by transportation security and safety issues.

Past research examples show that a significant proportion of women around the world experience anxiety when using public transport and experience various types of physical or verbal harassment as well as other forms of violence in open areas. For this reason, given the choice of a specific type of transportation, women often choose driving over walking,

biking, or public transportation. Action to keep public spaces safe and secure, including improved reporting mechanisms and zero-tolerance harassment policies. While some of these changes are time-consuming and costly, very small changes in the travel environment, such as better lighting, can have a big impact on people's perception of safety and security.

Millions of women and girls worldwide experience discomfort every day in public settings, including transportation. One in four American women have experienced harassment or assault on public transportation, according to a recent national poll on rape culture from Stop Street Violence. According to a French survey, all women in the Paris region have encountered sexual harassment on public transportation. According to a Reuter's assessment of 16 major cities worldwide, cities in Latin America had the greatest incidence of physical harassment towards women, with nearly six out of ten of these incidents occurring on public transport services. More than 1,000 interviews conducted at seven railway stations in Mumbai, 54 percent of respondents reported being victims of sexual harassment. 88% of them were women. 83% of women said they were unaware of their legal rights and 94% said they did not report the incident to the police. In fact, many of those who reported being Harassed during Safe city audits refused to disclose it, even on Safe city's mapping platform, claiming it was just a normal part of their daily lives. Sexual harassment often goes unreported.

Lack of reliable transportation decreases employment possibilities, worsens poverty, and expands economic inequality. In light of this, we challenge choice and urban planners to evaluate the ways in which these efforts support women as equal citizens and their freedom to move about freely and safely in cities as members of those cities, neighbourhoods, communities, and society at large. Men and women travel in ways that are different from one another. Around the world, women use public transportation more often than males. Less distance travelled overall, but more each day.

This is because most women tend to have jobs closer to home, low-paying jobs, and part-time jobs. In some countries, you are less likely to have a driver's license. Women are still the primary caregivers, accompanying their children to school, doctor's appointments, and other appointments, making them more likely to travel together. The survey included information on "commuting patterns" for people who did not work in agriculture or the household industry. In their Policy Brief on Women and Transport in Indian Cities, ITDP India and Safety pin found that 73% of business trips to cities are made using sustainable transport, while women and girls make up 14% of these business trips. Form. %. This may be due to telecommuting and low labor force participation among women in urban areas. For work-related trips, more than 30 percent walked, only 3 percent biked, and 22 percent took the

bus, train, or transit. Urban women made 84% of all work trips using public, medium, and non-motorized transportation.

When one woman makes arrangements, transportation is planned for all." All participants were inspired by this powerful statement. The application of gender-based design in access, gender inequality and violence, health, and transportation was discussed during the discussion. Many speakers emphasized the need for more women to enter this industry. This can be achieved through education, particularly by encouraging women to pursue careers in the STEM (Science, Technology, Engineering, and Mathematics) sector where it interests them. Role models are particularly important as they can increase the confidence and

II. ROLE OF TRAVEL SAFETY IN PUBLIC TRANSPORT

- Jaipur is the one of the most attractive towns in India, was built in the 18th century and is now the largest city in the Rajasthan region as a result of its development.
- While Jaipur is not particularly risky for foreign visitors, its safety ranking makes you consider your security when you arrive.
- Even experienced visitors will be impressed by the Royal Gardens. The only issue is that because violent crimes are uncommon, pickpockets may be more prevalent.
- Petty crimes like stealing and armed robberies do happen occasionally.
- Visitors can travel to this miraculously rich nation, but they should be aware that not everyone will enjoy India.

ISSUES OCCUR IN PUBLIC TRANSPORT WITH WOMEN

Most citizens of major cities can remember at least one instance in which they felt uncomfortable in gated communities. While some of these tales have been lost to time and forgotten, others have purposefully penetrated people's memories only to later reappear. The privacy rights and the ability to move freely are rapidly being violated. Due to packed public transportation and the presence of many unfamiliar people on the streets, many of these events "run" quietly and without much attention. But the discomfort and embarrassment persisted. The culprit would feel so bad about themselves, which is quite unhelpful. Avoiding the eye of the crowd is the definition of abstinence. One lovely evening as I was returning from work, I discovered myself standing in front of bus's final window as it was beginning to fill up. After some

while, a young woman hurried over and approached the window. A man with a sparkling shirt was standing behind him. Later, I saw a man approaching the girl even while smelling of alcohol. He was eyeing at the girl.

III. RESEARCH OBJECTIVES

- To analyses the safety factor in public transport of Jaipur.
- To gather information for surveys from public opinion.
- To identify issues with the government's public transportation regulations.
- To get women's point of view on public transport in Jaipur.

IV. RELATED WORK:

Verma et al. (2020), The role of women has changed in the fastest growing economies like India. In recent years, women's employment and education have increased which has increased their outdoor activities. With traffic congestion increasing in a cosmopolitan city like Bangalore, where women dominate and frequently travel by bus, necessary safety measures need to be taken. This article attempts to examine the various service gaps that may exist and to provide answers to research questions such as: B. the types of problems faced by women on buses and women's perceptions of bus safety. The goal of this article is to examine various issues with women's safety and what is expected of female drivers. The technical woman, who is in charge of overseeing safety at the bus stop and who enjoys excellent karma with the bus driver, feels safe on the bus. Bus travel for older working women is more secure and comfortable. One of the key elements affecting how women perceive travel safety is infrastructure. Bright automobiles, nice roads, and police surnames make women more secure.

Choudary et al. (2018), India does have the world's smallest economy. Women are now more educated and empowered as a result of significant changes to the Indian educational system in recent decades. Women now want more protection as outdoor activities among women rise. In order to address study topics including the kinds of issues women encounter in public transportation and how women feel in public transportation and at bus stops, we used a questionnaire. Let's examine many claims to determine how they relate to women's safety in bus stations and on public transportation. This study was done to determine how using several public transportation options including Nagar Seba, City Bus, and i-Bus while driving affects safety in Indore. A survey that asked the questions about women's socio-demographics, safety and security, issue aid programmes, and other topics was conducted after this one.

Rasool Heydari Soorshejani (2018), Men concentrate on job contributions like reliability, uptime, and travelling time, while women focus on comfort factors like automobile ownership, boat location, and structural strength, according to numerous research. Car, security, and safety and crowded. Since the relevant data that was analysed did not offer sufficient support, more study is required. Furthermore, because it sheds light on more complicated situations, the role of gender should be investigated in multimodal.

R, Krainer et al. (2019), while few studies have looked at the explanatory power of gender on travel satisfaction, gender is frequently utilised as an explanatory variable in studies of travel. We investigate the effects on identity, meaning, and general well-being. Develop a line view. The study revealed that gender significantly impacted overall satisfaction. Women, meanwhile, frequently criticise what is required of them and what they accomplish. Future research may look at how gender affects happiness in a multimodal setting. From a decision-making perspective, it is important to understand how various aspects affect satisfaction with public transportation. In order to help government organisations better define their objectives and make other significant investments, this information can be utilised to make better decisions for market segmentation research.

Daniela et al. (2022), the use of public transportation (PT) during the COVID-19 pandemic in Turin, Italy, is examined in this study along with the relationship between risk perception and trip satisfaction. Between January 2021 and March 2021, an online survey with a total of 448 participants was conducted. The Travel Satisfaction Scale (STS) was employed in the study to gauge how users felt about their personal experiences with danger and safety when using public transportation. These ideas are being contrasted at three different specific moments: prior to an illness, during a pandemic, and after an upcoming outbreak. The findings demonstrated that COVID-19, particularly for women, had an impact on respondents' perceptions of risk during sickness and their expectations for the future. On public transportation, as compared to nearby regions or waiting spaces, there is thought to be a higher chance of getting COVID-19.

IV. RESEARCH METHODOLOGY:

In India now, 92% of working women report feeling unsafe in Bangalore, the nation's financial hub, especially at night, and 85% of women in Bangalore believe travelling is not dangerous. (India 2012). According to a Chennai poll, 66% of respondents had been sexually harassed while travelling. Numerous indirect causes, in addition to direct ones, contribute to the possibility of female insecurity when taking public transportation.) One of the more subtle aspects influencing their level of safety while travelling can be their various employment. Women worry about being assaulted and about crime. Almost all research on the fear of crime reveal that women are more afraid of crime than men. Main reason, frequency, and length of the trip, men and women have different travel behaviours. Women travel farther than males

would, both in urban and rural areas. Although women should use public transportation since it is generally considered to be safe, they are increasingly choosing private transportation. Previous research has demonstrated that travellers' decisions are influenced by their concerns and worries.

V. RESULT ANALYSIS:

Structural Equation Modeling (SEM) is a statistical methodology that allows researchers to examine complex relationships among variables. It combines the principles of factor analysis, regression analysis, and path analysis to evaluate causal models and test hypotheses about the relationships between variables. At its core, SEM involves constructing a model that represents the theoretical relationships between multiple variables. These variables can be observed or latent (unobserved), and they are linked by arrows or paths that indicate the direction of the relationship between them. The model can then be tested using statistical methods to see how well it fits the observed data.

The model is typically represented as a set of linear equations, which describe how the variables are related to each other. The equations can include both measured variables (such as survey responses) and latent variables (such as personality traits or latent constructs). These equations can be used to estimate the strength and direction of the relationships between the variables in the model. SEM is a versatile methodology that can be applied to a wide range of research questions and data types. For example, it can be used to study the relationships between different aspects of a psychological construct, such as depression or anxiety, or to test the effects of different interventions or treatments. It can also be used to study the relationships between variables in other fields, such as economics, marketing, and social sciences.

The popular software programme AMOS (Analysis of Moment Structures) is one that is used to carry out SEM analysis. It offers a simple user interface for developing and testing SEM models, as well as a number of statistical tools and graphical displays to aid in the interpretation of the data. Figure 3.1 displays the variable's structural model. In this model, there are three main factors that are identified as having an impact on women's safety in public transportation. These factors are measured by a set of variables that are related to different aspects of the public transportation system. The results of the path analysis indicate that all five factors related to satisfaction with the public bus service (S1-S5) have a significant positive effect on F1 (public bus service satisfaction). The coefficients for these paths range from 0.822 to 1.165, all significant at the $p < 0.001$ level, indicating that higher levels of satisfaction with the public bus service are indeed associated with higher levels of overall satisfaction with public transportation in the city. Similarly, both factors related to the likelihood of using public transportation over a two-wheeler (SBS1 and SBS2) have a significant positive effect on F2 (likelihood of using public transportation over a two-wheeler). The coefficients for these paths are 1.192 and 0.993, respectively, both significant at the $p < 0.001$ level,

indicating that a higher likelihood of using public transportation over a two-wheeler is associated with higher levels of overall satisfaction with public transportation in the city.

In terms of the relationship between perceptions of safety, while using public transportation (F3) and the frequency of accidents reported while using F2 for commuting, the results show that all three factors related to perceptions of safety (SPTB1, SPTB14, and SPTB29) have a significant positive effect on F3. The coefficients for these paths range from

0.510 to 1.037, all significant at the $p < 0.001$ level, indicating that higher perceptions of safety are associated with higher overall levels of perceptions of safety while using public transportation. Furthermore, the results indicate that F1 has a significant positive effect on F2, with a coefficient of 0.672, significant at the $p < 0.001$ level. This suggests that higher levels of overall satisfaction with public transportation in the city are associated with a greater likelihood of using public transportation over a two-wheeler for commuting.

Finally, the results also indicate that F3 has a significant positive effect on F1, with a coefficient of 0.721, significant at the $p < 0.001$ level. This suggests that perceptions of safety while using public transportation have a significant influence on overall satisfaction with public transportation in the city. Overall, these results provide support for all three hypotheses and suggest that satisfaction with the public bus service, perceptions of safety while using public transportation, and the likelihood of using public transportation over a two-wheeler are all important factors in promoting the use of public transportation in the city.

We researched and did survey related on SEM applications in women safety in public transportation in recent times and summarized the potential of SEMs, with a special focus on unexplored errors and troubles caused in various terms. We also analyzed and discussed the common issues or factors with SEM applications in previous publications and presented our view for its future applications.

These equations indicate that customer satisfaction is influenced by the three factors, which are in turn influenced by their respective variables. The error terms in each equation represent the unobserved factors that may affect the relationship between the variables. By using SME, researchers can estimate the strength of the relationships between the variables and determine which variables have the most significant impact on women's safety in public transportation. This information can then be used to develop strategies to improve public transportation services and increase women's safety.

We searched and found several relevant publications on SEM applications in public transportation services. We found that basic/essential SEM variants are missing. We identified several common issues in SEM applications

including strength of causal assumption, specification of feedback loops, selection of models and variables, identification of models, methods of estimation, explanation of latent variables, selection of fit indices, report of results, estimation of arrival time, and the safety and security measurements.

In previous related studies, measurements of latent variables, explanations of model parameters, and reports of key statistics were commonly overlooked, while several advanced uses of SEM had been ignored overall. With the increasing availability of data, the use of SEM holds immense potential in public transportation services sector in the future.

VI. CONCLUSION WORK:

The path analysis results provide support for the three hypotheses tested in this study. First, higher levels of satisfaction with the public bus service in the city are associated with a greater likelihood of using public transportation over a two-wheeler for commuting. Second, perceptions of safety while using public transportation are negatively correlated with the frequency of accidents reported while using a two-wheeler for commuting. And third, perceptions of safety while using public transportation have a stronger influence on overall satisfaction with the service than the convenience and accessibility of the service. The results suggest that satisfaction with the public bus service, perceptions of safety while using public transportation, and the likelihood of using public transportation over a two-wheeler are all important factors in promoting the use of public transportation in the city. These findings have implications for policymakers and transportation planners who aim to increase the use of public transportation and improve overall transportation safety in urban areas.

VII. REFERENCES

- [1] Verma, M., Rodeja, N., Manoj, M. and Verma, A., 2020. Young Women's Perception of Safety in Public Buses: A Study of Two Indian Cities (Ahmedabad and Bangalore). *Transportation research procedia*, 48, pp.3254-3263.
- [2] Bose, J. and Jones, J.T., 2004. Travel Characteristic of Native-and Foreign Born Women in the United States. *Research on Women's Issues in Transportation*, p.3.
- [3] Li, H., Guensler, R. and Ogle, J., 2004. Comparing women's and men's morning commute trip chaining in Atlanta, Georgia, by using instrumented vehicle activity data. *Research on Women's Issues in Transportation*, p.14.

- [4] McDonald, N.C., 2004. Does Residential Density Affect the Travel "Gender Gap"? Research on Women's Issues in Transportation, p.68.
- [5] Weston, L.M., 2004. Gender Differences in Travel Behavior of 13-, 14-, and 15-Year-Olds and Role of Built Environment. Research on Women's Issues in Transportation, p.76.
- [6] Helling, A., 2004. Connection between travel and physical activity differences by age and gender. In Proceedings of Research on Women's Issues in Transportation Report of Conference, Chicago, Illinois, Washington DC (pp. 76-77).
- [7] Acar, B.S. and Weekes, A.M., 2004. Safety of Pregnant Drivers in the United Kingdom. Research on Women's Issues in Transportation, p.127.
- [8] Srinivasan, S., 2005. Influence of residential location on travel behavior of women in Chennai, India. In Research on women's issues in transportation, report of a conference (Vol. 2, pp. 4-13).
- [9] Gossen, R. and Purvis, C.L., 2005. Activities, time, and travel: changes in women's travel time expenditures, 1990-2000. Research on Women's Issues in Transportation, 2, pp.21-29.
- [10] Dau, T.M., 2005. Do High-Occupancy Toll Lanes Serve Women's Travel Needs?. Research on Women's Issues in Transportation, p.30.
- [11] Krizek, K.J., Johnson, P.J. and Tilahun, N., 2005. Gender differences in bicycling behavior and facility preferences. Research on Women's Issues in Transportation, 2, pp.31-40.
- [12] Mohammadian, A., 2005. Gender differences in automobile choice behavior. Research on women's issues in transportation, pp.41-48.
- [13] McGuckin, N. and Nakamoto, Y., 2005. Differences in trip chaining by men and women. In Conference proceedings (Vol. 35, pp. 49-56).
- [14] Vance, C., Buchheim, S. and Brockfeld, E., 2005. Gender as a determinant of car use: evidence from Germany. In Transportation Research Board Conference Proceedings (No. 35).
- [15] Clifton, K.J. and Livi, A.D., 2005. Gender differences in walking behavior, attitudes about walking, and perceptions of the environment in three Maryland communities. Research on women's issues in transportation, 2, pp.79-88.
- [16] Carter, M., 2005. Gender differences in experience with and fear of crime in relation to public transport. Research on women's issues in transportation, 2, p.100.
- [17] Bomar, M.A., 2005. Technology as a strategy for addressing personal security concerns of women on public transit. In Research on Women's Issues in Transportation. Report of a Conference (Vol. 2, p. 101).
- [18] Nobis, C. and Lenz, B., 2005. Gender differences in travel patterns. Research on Women's Issues in Transportation, 2(3), pp.114-123.
- [19] Boumans, A. and Harms, L., 2005. Part-time employment and travel patterns of women in the Netherlands. Research on Women's Issues in Transportation, 2, p.113.
- [20] Nobis, C. and Lenz, B., 2005. Gender differences in travel patterns. Research on Women's Issues in Transportation, 2(3), pp.114-123.
- [21] Beck, L.F., Shults, R.A. and Gilbert, B.C., 2005. Pregnant Women and Safety Belts: What Do We Know? In Transportation Research Board Conference Proceedings (No. 35).


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