

# **An Investigation into the Usage Patterns and Safety Perceptions of the Users of Electric Rickshaws in Indian Cities: Case Studies from Patna and New Delhi**

**Shiv Priye (2016CEZ8148)**

## **ABSTRACT**

In the context of rising oil prices and deteriorating air quality in urban areas, the Indian government promotes electric vehicles to secure sustainable mobility. There is enormous potential for electrification of intermediate public transport (IPT) given its conventional-fuel dependency and contribution to citizens' daily mobility. The electrification of IPT could have a positive impact on sustainability goals in the long-term. Many state governments in India plan to deploy electric rickshaws (ERs) (a kind of electric IPT mode) in urban cities. In turn, this movement calls for more extraordinary efforts by transportation planners to achieve sustainability in ER services. Although ERs have certain advantages over conventional paratransit modes, they present some significant challenges to planners and policymakers regarding transportation systems and road safety. Therefore, in light of the potential of ERs for local emission reductions and sustainable mobility, and the absence of knowledge about ER travel, this study aims to understand the usage patterns and safety perceptions of the users of ERs in Indian cities. This research utilizes primary data collected from ER users in Patna (a medium-sized city) and New Delhi (a megacity). Both cities have been selected for the proposed "100 Smart Cities" under the "Smart Cities Mission" of the Government of India, and the deployment of ERs as an affordable and environmentally-friendly alternative to the IPT is one of the essential aims of the "Smart Cities Mission" project. In this research, various hypothesis testing techniques and multivariate data analysis techniques have been used to achieve the objectives of the study.

The results show that in Patna (a medium-sized city), ER is primarily used as the main mode of travel (rather as an access/egress mode), and it is replacing a majority of the trips made by conventional fuel-based auto rickshaws. In Patna, ERs are found to be more popular among women and students as they frequently use the mode. The trend shows that in Patna, the share of upper income households is significant, apart from middle income categories. The gender-based study in Patna shows women are making more family-and household-related trips on ERs, whereas men use the mode mainly for work and education-related trips. Further, the safety perceptions study in

Patna yielded two latent factors: the unsafe structure and the unsafe dynamics of ERs. These two factors increase the safety risk of the passengers of ERs (most notably, small children, females, and older people) in mixed traffic flow conditions prevailing in Patna. Overall safety perceptions reveal that the people of Patna, in general, are not satisfied with the present structure and design of ERs and there is a particular need to enhance the safety levels of ERs to attract car users (in view of the aim of achieving a sustainable transport system). The structural equation model showed that men, compared to women, are more likely to discontinue using ERs if they perceive the vehicle to be unsafe from a structural viewpoint. Women are more likely to discontinue riding ERs if they find that the rickshaws are unsafe from dynamic perspectives. However, women showed a higher likelihood than men of using ERs in the future if the mode's overall safety improved.

In the case of New Delhi (a megacity), the results show that ER is primarily used as an access/egress mode or as a first-and-last mile connector, and it is replacing a majority of the trips made by manually-pulled pedal rickshaws. It is found that the share of upper-income families in New Delhi is not as substantial as in the case of Patna. However, regardless of the city, there is a high concern about safety when using ER services, especially in mixed traffic conditions. Binary logistic regression models suggest that users of both cities, who perceive certain aspects of ER design, such as the light body, absence of solid coverings and railings, and unprotected rear-end, to be critical, are less likely to continue the use of ERs. Women users, in general, are less inclined to continue the use of ERs in its present form and structure, in both cities, all else being equal. The grey relation analysis (GRA) highlights that women in both cities are more concerned than men about issues such as threat of snatching, robbery, etc., at signals, and night journeys in ERs. This research, the first of its kind in the literature, explored ER users' profiles, their travel characteristics, and their safety perceptions of ERs in India by taking the case studies of Patna and New Delhi. The study's findings are intended to help develop plans and policies for improving ER services in India and other developing countries to have a socially sustainable and safer transportation mode that is less dependent on conventional fuels.