

# Enhancing Governance in the Electric Rickshaw Market

## *A Case Study of Jaipur*



# Enhancing Governance in the Electric Rickshaw Market

*A Case Study of Jaipur*

*Published by*

**CUTS**<sup>®</sup>  
International

**Consumer Unity & Trust Society**

D-217, Bhaskar Marg, Bani Park, Jaipur 302016, India

Tel: +91.141.2282821, Fax: +91.141.2282485

Email: [cuts1@cuts.org](mailto:cuts1@cuts.org), Web site: [www.cuts-international.org](http://www.cuts-international.org)

*Citation:*

CUTS International (2024), Enhancing Governance in the Electric Rickshaw Market: A Case Study of Jaipur

*Authors:*

Shivani Ilangovan, Research Associate; Akash Sharma, Associate Fellow, CUTS International

#2403



# Contents

<b>Acknowledgement</b>	<b>4</b>
<b>Abbreviations</b>	<b>5</b>
<b>Executive Summary</b>	<b>7</b>
<b>Introduction</b>	<b>9</b>
<b>Methodology</b>	<b>12</b>
<b>Research Insights</b>	<b>14</b>
Literature Review	14
Case Studies	15
Survey Findings	18
• <i>Profile of E-Rickshaw Operators and Commuters</i>	19
• <i>Expenditures of an E-Rickshaw Operator</i>	22
• <i>Specifics of E-rickshaws</i>	24
• <i>Gender Inclusivity</i>	27
• <i>Perspective of E-Rickshaw Operators, Commuters and Stakeholders</i>	28
Policies for the Promotion of E-rickshaws	31
<b>Way Forward</b>	<b>33</b>
• Recommendations for Central Government	33
• Recommendations for the State Transport Department and Traffic Police	34
• Recommendations for Insurance Agencies	35
• Timeline Determination	35
<b>Conclusion</b>	<b>38</b>
<b>References</b>	<b>39</b>



## Acknowledgement

This report is the culmination of ideas, efforts and support of numerous individuals. The contributions of all those who participated through direct inputs, brainstorming sessions, continuous guidance, support and encouragement and timely review meetings have been invaluable in the development of this report.

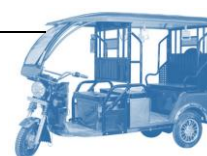
First and foremost, CUTS International extends its sincere gratitude to all the stakeholders whose critical inputs that have shaped this study and report. We are especially thankful to Pradeep S Mehta, Secretary General, CUTS International, Bipul Chatterjee, Executive Director, CUTS International and Ujjwal Kumar, Associate Director, CCIER, CUTS International, for their unwavering guidance and encouragement throughout the study. Additionally, we would like to express our gratitude to Siddharth Banerji, Associate Director – Advocacy, Battery Smart for his guidance during this study.

We also acknowledge the editorial contributions of Madhuri Vasnani, as well as the efforts of Mukesh Tyagi and Rajkumar Trivedi in designing the layout of this report. A special thanks goes to Akash Sharma for coordinating the e-rickshaw operators and passengers survey, as well as facilitating stakeholder engagement. Finally, we appreciate the valuable support provided by Atul Sharma, Pracheta Acharya and Sanobar Imam in shaping the study and designing the survey questionnaires.



## Abbreviations

CGFMU	Credit Guarantee Fund for Micro Units
CMVR	Central Motor Vehicles Rules
CNG	Compressed Natural Gas
CO2	Carbon dioxide
CSR	Corporate Social Responsibility
e-2W	Electric Two Wheeler
e-3W	Electric Three Wheeler
e-4W	Electric Four Wheeler
EV	Electric Vehicle
EVSE	Electric Vehicle Supply Equipment
FAME	Faster Adoption and Manufacturing of (Hybrid &) Electric Vehicles
FY	Fiscal Year
GDP	Gross Domestic Product
ICE	Internal Combustion Engine
ITI	Industrial Training Institute
JMRC	Jaipur Metro Rail Corporation
KM	Kilometre
kWh	Kilowatt-hour
LCV	Light Commercial Vehicle
LMV	Light Motor Vehicle
LPG	Liquefied Petroleum Gas



MIS	Management Information System
MSMEs	Ministry of Micro, Small & Medium Enterprises
NCAP	National Clean Air Programme
NCGTC	National Credit Guarantee Trustee Company
NEMMP	National Electric Mobility Mission Plan
NOx	Nitrogen Oxides
OEM	Original Equipment Manufacturer
PM10	Particulate Matter 10 micrometres or less
PMMY	Pradhan Mantri Mudra Yojana
PPP	Public Private Partnership
PUC	Pollution Under Control
RANC	Research, Advocacy, Networking & Capacity Building
R&D	Research and Development
RSLDC	Rajasthan Skills & Livelihood Development Corporation
W	Watt



## Executive Summary

The Internal Combustion Engine (ICE) vehicles have been a traditional component of last-mile connectivity in the Indian subcontinent. However, the development and deployment of electric vehicles (EVs) and the EV industry have gained momentum as part of climate change mitigation measures. India has set an ambitious target of achieving 30 percent EV penetration by 2030. Among the ICE alternatives, e-rickshaws have emerged as a popular option for last-mile connectivity. They represent a green, easily rechargeable technology with zero direct emissions.

The e-rickshaw market ecosystem has created significant job opportunities, particularly for women and marginalised communities often overlooked by employers. In FY2023, e-rickshaws achieved a 53 percent penetration rate, driven by their lower operational and maintenance costs compared to diesel or CNG auto rickshaws.

Enhancing Governance in the Electric Rickshaw Market: A Case Study of Jaipur by CUTS International explores the evolving rules and regulations governing the e-rickshaw market and the challenges posed by these ambiguities. The study emphasises the inclusion of voices of all stakeholders of the e-rickshaw market and offers tailored recommendations that prioritise sustainable and inclusive growth of this sector.

The post-pandemic period has witnessed a substantial increase in e-rickshaw movement on the roads of Jaipur, providing an alternate source of employment for many. While gender inclusivity in the e-rickshaw domain remains low, it is gradually improving. E-rickshaws have also contributed significantly to pollution reduction due to their zero emissions.

Most e-rickshaw operators fall within the age group of 25 to 35 years and report increased income from operating these vehicles. The majority of operators use lead-acid batteries, which are typically charged once daily. The charge per trip is comparatively lower in crowded places due to high competition. The lack of adequate infrastructure, such as charging points and designated parking stations, pose additional challenges for operators in Jaipur.

Unclear and evolving regulations for e-rickshaws further complicate the working conditions for operators. Key recommendations from operators include the creation of parking stands, better dissemination of updated rules and regulations, and the introduction of a comprehensive scrapping policy to manage the saturation of e-rickshaws.



Effective governance of the e-rickshaw market requires addressing the needs of operators, commuters, dealers, and manufacturers while also managing the traffic and congestion caused by e-rickshaws. The initiative highlights the critical role of governance in promoting last-mile connectivity and sustainable transportation, particularly in Jaipur, a city undergoing rapid urbanisation.

The research provides an in-depth overview of the e-rickshaw market in Jaipur, examining the roles of various stakeholders and their contributions to the sector's growth. This study represents an effort to develop a nuanced understanding of the e-rickshaw market administration in Jaipur, with the aim of fostering its sustainable and inclusive development.





## Introduction

The internal combustion engine (ICE)-driven automotive market is rapidly transforming into an EV ecosystem, driven by global efforts to mitigate climate change. Economies worldwide have already developed plans to move towards clean mobility networks. One of the foremost motivations of the EV movement is to decarbonise the transport sector to keep climate change in check.

Central Motor Vehicles Rules (CMVR) defines an e-rickshaw to be a special purpose battery-operated vehicle having three wheels and intended to provide last-mile connectivity for the transport of passengers for hire or reward, provided:

- (i) Such vehicle is constructed or adapted to carry not more than four passengers, excluding the driver, not more than 40 kilograms of luggage in total
- (ii) The net power of its motor does not exceed 2,000 W
- (iii) The maximum speed of the vehicle does not exceed 25 kilometres per hour (Government of India, The Central Motor Vehicles Rules, 1989, 2016)

India's vision for EVs aligns well with global aspirations. Electric rickshaws have long been the mainstay of the three-wheeler market. According to data from the VAHAN dashboard, the share of electric (EVs) in total sales of three-wheelers was 53 percent in FY2023. Corresponding figures for the two-wheeler and passenger vehicle markets are only 5 percent and 1 percent, respectively.

E-rickshaws accounted for over 90 percent of the 3.9 lakh electric three-wheelers sold in FY2023. While e-autos offer better load-carrying capacity, speed, ranges and lower total operational costs, the lower upfront cost of the e-rickshaws has driven their higher rate of adoption in the three-wheeler segment. Compared to diesel and CNG three-wheelers that cost around ₹2.5 to 3.5 per km, e-rickshaws cost only ₹0.3-0.5 per km.

The Government of India's Make in India initiative has significantly reduced the cost of e-rickshaws by encouraging a rise in the number of domestic manufactures producing them. Resultantly, due to this production boom, many novel designs that attempt to improve the dependability of e-rickshaws have also been introduced. E-rickshaws offer several advantages when considering their future possibilities:

- **Eco-friendly:** As much as vehicles are sources of pollution, e-rickshaws have one advantage. They are easily charged and run without emitting any hazardous emissions.



- Affordable: Since e-rickshaws run on batteries, it gives rise to much lesser operational costs as compared to fossil fuel.
- Recyclable: Another major advantage of e-rickshaws is their recyclable batteries which lead to sustainable resource use (Kokate, Bankar, Vispi, & Karandikar, 2018).

The shift to e-rickshaws has significant implications for stakeholders in the existing last-mile connectivity ecosystem. This transition offers the potential to provide sustainable livelihoods in the future. A research study was conducted to explore these dynamics.

A report by Kanuri et al., (2023) highlights that over 71 lakh passenger auto rickshaws are registered in India; of them, 44.5 percent are powered by diesel, 17 percent by petrol, 7.8 percent by CNG, and 1.5 percent by LPG. Switching to EVs could reduce emissions by 0.45 million tonnes annually. Besides, it could help reduce NOx and PM10 emissions by 1,445.3 and 164.6 tonnes, respectively.

Despite higher procurement and replacement costs of batteries, e-rickshaws have an economic benefit compared with ICE autorickshaws since the monthly running costs are about a third of those. As a result, this increases the take-home wages for drivers (Kanuri, Gounder, Sandhu, & Laroija, 2023).

The shift could mean better inclusion of women, transgender people, and other underrepresented groups within the workforce in transport because e-rickshaws seem to be easier to handle, with less maintenance and less noise.

This shift in the dynamics of electric vehicles provides scope for organised changes in the informal paratransit industry to work toward better socioeconomic and environmental outcomes. Societal goals such as livelihood improvement and easily accessible urban transport are as important as reduced emissions and pollution.

This change can offer better road safety and can foster inclusiveness, especially concerning women in this transportation profession. A pragmatic approach is urgently called for, including planning and policy interventions of multi-modal integration, purchase incentives, charging infrastructure building, and others. Indian cities have been leading workforce diversification and improving the quality of employment and have become models for integrating socioeconomic factors into e-mobility projects.

The 15<sup>th</sup> Finance Commission and the National Clean Air Programme (NCAP) have provided extensive funding, over ₹16,400 crores, to improve the air quality of cities in India. These may be incentives and subsidies for states to provide e-friendly public transport and e-autos.



States can also finance from various sources, including grants from bilateral and multilateral organisations, CSR projects, environmental cess collections, PUC fines, green funds, PPPs, and local tax revenue. These actions are taken to support the growth of the EV industry and promote initiatives for environmentally friendly transport.

This project aims to inform regulations in the e-rickshaw market that ensure the growth of the stakeholders as well as the greening of last-mile connectivity without overburdening the city transport infrastructure. The focus is developing a case study for Jaipur City that recommends that stakeholders and local authorities introduce effective regulations while keeping the interests of commuters and operators intact.

Enhancing Governance in the Electric Rickshaw Market: A Case Study of Jaipur will aid in regulating e-rickshaw registration and forming parking, battery swapping and charging stations with a scope for generating revenue for the government.

This report presents an in-depth analysis of the potential of electrifying last-mile transportation to create better jobs. It also assesses the potential for promoting social inclusivity through the creation of equal opportunities for women across Jaipur.



## Methodology

This study aims to bring forth regulations in the e-rickshaw market that promote sustainable growth for stakeholders while enhancing the greening of last-mile connectivity without overburdening the city transport infrastructure. It will focus on the city of Jaipur, construct a comprehensive case study, and provide recommendations to keep all the interests of stakeholders and local authorities intact.

These recommendations will emphasise the introduction of effective regulations that balance the interests of commuters and operators. They aim to create an environmentally and economically sustainable e-rickshaw market in Jaipur to ensure its benefits are equitably distributed among all the stakeholders.

The Research, Advocacy, Networking, and Capacity Building (RANC) model was followed for the study's implementation. The following are the broad activities that were carried out over 16 weeks.

### Literature Review

This literature review studied various central, state, and city-level policy documents related to e-rickshaws. Diverse publications, scholarly articles, and news items were reviewed to understand and explore probable interventions. This study, thus, attempts to summarise the current legal regimes and challenges besides the best industry practices of e-rickshaws.

The effectiveness of policies, their impacts on the environment, economic viability, and stakeholder engagements are some themes worthy of attention. The review has been structured with the help of relevant resources to obtain an overview of the Jaipur e-rickshaw industry so that it may make way for well-informed and contextual recommendations.

### Stakeholder Mapping and Engagement

A detailed stakeholder mapping and engagement exercise was conducted to understand how e-rickshaws are used in Jaipur. The exercise also covered the regulatory frameworks and ongoing initiatives of government agencies. Identified stakeholders included the transport department, e-rickshaw dealers' associations, and e-rickshaw manufacturers. Stakeholder engagement gave huge insights into the present scenario of the e-rickshaw markets *vis-à-vis* challenges and opportunities in them. Data collection from relevant government databases added and enhanced the insights gathered from stakeholder consultations.



## Primary Data Collection

A survey of 76 e-rickshaw operators was carried out to collect primary data to draw a detailed case of Jaipur city. This survey focused on the regulatory and operational obstacles e-rickshaw operators face daily. The gathered information became very useful in understanding the challenges they face in practice: infrastructural inadequacies and poor economic growth.

Alongside the survey, targeted stakeholder engagement was conducted to gather existing concerns from various stakeholders about e-rickshaw regulation. Thus, the case study adopted a dual approach by accurately representing the local difficulties and the larger framework of regulatory and policy issues at large, giving rise to well-informed, practical recommendations.

## Data Analysis and Report Writing

Based on valuable insights and quantitative and qualitative data from the survey of e-rickshaw drivers and stakeholder engagement using relevant methodologies, 'Enhancing Governance in the Electric Rickshaw Market: A Case Study of Jaipur' was developed. The study findings were consolidated to construct actionable recommendations tailored for specific stakeholders.

The study gave rise to actionable recommendations according to the stakeholders involved in introducing a regulatory framework that promotes environmental and economic sustainability and improves efficiency in the e-rickshaw market. The final report represents a detailed case study of the state of e-rickshaws in Jaipur and offers a strategic way forward to achieve sustainable growth in the sector.



### Literature Review

According to Vijaykumar et al. (2021), the acceptance of electric vehicles, more precisely e-rickshaws, is correlated with various variables like real-world performance, affordability and an enabling environment of strong infrastructure for EV charging. While it provides economic viability for commercial operators by way of reduced vehicle operation costs, for e-rickshaw owners, the upfront fee and irregular construction of vehicles are issues that impact safety and quality norms (Vijaykumar, Mulukutla, & Hemalatha, 2021).

Although e-rickshaws have the potential to mitigate last-mile connectivity problems, they do not adhere to regulations and follow hazardous charging methods. In this situation, both the drivers and commuters are at risk. It is quite difficult for the regulators and industry to encourage drivers while maintaining safety standards without undermining their pay.

Governments can support this by standardising safety and performance criteria and providing financial and infrastructural support. Subsidies and depot locations for battery swapping or charging can foster transition and expansion. Indeed, subsidies for EVs can also induce organic growth and improve public transport for the good of commuters and drivers, in addition to reducing carbon emissions.

There is a poignant opportunity for institutionalised transformations in the informal paratransit sector to improve socioeconomic and environmental outcomes through the transition to electric vehicles, as shown by Kanuri et al., 2023. It includes socioeconomic objectives: enhanced livelihoods and convenient urban transport are as relevant as reduced emissions and other forms of pollution. It can bring the latest technologies and help improve road safety, besides making the transport profession more inclusive for women.

Therefore, a programmatic approach that embeds planning and policy measures within it — multi-modal integration, purchase incentives, and building charging infrastructure—is urgently required to ensure this change. The case studies from Indian cities further elucidate how socioeconomic factors can be integrated into e-mobility projects for better workforce diversification and enhancement in employment quality (Kanuri, Gounder, Sandhu, & Laroija, 2023).

Thakur and Pal (2019) have delved into some regulatory aspects of the EV sector in India.



1. Many large cities grant closed permits to autorickshaws to decongest traffic; smaller towns and areas with scanty public transport adopt an open permission system. The licenses for ICE autorickshaws are usually renewed annually. However, a vague nature persists among regulators regarding the rules and regulations that should be adopted while issuing licenses to e-rickshaws. Although at the central level, it was announced that no licenses would be required for clean fuel-based e-rickshaws, the timeline remains blurred. While some state policies exempt fees or follow an open permit system for e-rickshaws, permits are still needed.
2. Most state EV policies provide subsidies, but most drivers have no idea how much subsidy they are entitled to or how to claim it.
3. Many variants of e-rickshaws that do not qualify for the L5 three-wheeler category are already dominating the market. To prevent this, thorough safety scrutiny needs to be carried out before certifying such vehicles.
4. Besides regulatory hurdles, charging infrastructure is acting as a drag on the spread of e-three-wheelers. There should be charging stations within the parking lots located in office buildings, shopping centres, and markets, other than the public charging stations. Cooperative pilot initiatives with public transport authorities can also facilitate the provision of the necessary infrastructure for charging in support of first and last-mile connectivity (Thakur & Pal, 2019).

## Case Studies

Within the recent past, most state governments have brought in policies and legislation that include EVs, including e-rickshaws:

A) **Tripura:** Implemented the "Tripura Battery Operated Rickshaws Rules, 2014" for regulating the licencing, registration, permits, and standards of e-rickshaws plying in urban areas.

B) **Delhi:** The E-Rickshaw Sewa Scheme, subsidies, authorisation of residential charging, and the Delhi Electric Vehicles policy were approved to reduce carbon emissions by increasing EVs.

C) **Karnataka:** The "Karnataka Electric Vehicles and Energy Storage Policy 2017" aims to attract investments into the State and smooth the growth of EVs, especially electric autorickshaws and retrofitting EVs.

D) **Kerala:** An ecosystem for manufacturing electric vehicle components has been built, as the state has a "Policy on Electric Mobility" that favours shared mobility and sustainable transport.



E) **Uttar Pradesh:** "Uttar Pradesh Electric Vehicles Manufacturing Policy 2018" is designed to make the state a great destination for EV-related investments. This provides tax breaks and interest-free financing and places special emphasis on the growth of the EV industry, thereby including e-rickshaws within its ambit.

F) **Andhra Pradesh:** The "AP Government Electric Mobility Policy 2018-2023" envisions large investments in EVs and battery production facilities.

G) **Telangana:** The "Telangana Electric Vehicle Policy" focuses on transitioning completely to electric vehicles by 2030. It has also provided a subsidy for the local growth of manufacturing, corporate control of the manufacturing industries, and infrastructure creation, including e-rickshaws.

H) **Uttarakhand:** "Electric Vehicle Manufacturing, EV Usage, Promotion and Related Services, Infrastructure Policy" aims to create and promote an ecosystem for EV manufacturers and to ensure benefits for early movers and enterprises.

In addition to these state-level efforts, Goa waived road tax for electric cars, and Maharashtra provides tax breaks and subsidies to EV makers and consumers. Gujarat focuses on charging infrastructure development and supporting infrastructure while incentivising students to purchase two-wheeler electric vehicles.

State regulations and incentives overall have the aim of hastening EV uptake—e-rickshaws not excluded—by way of changes in the legal regime, financial incentives, infrastructure construction exhortations, and support to the growth of the EV ecosystem as a whole (Shandilya, Saini, & Ghorpade, 2019).

The Rajasthan Skills & Livelihood Development Corporation (RSLDC) is carrying out skill development initiatives, including short-term training in electric mobility and EVSE and courses for maintenance and repair through polytechnics and ITIs. At least five establishments would be chosen as "Pilot Skilling Institutions" to impart training regarding electric vehicles. These will be located in areas adjoining the industrial clusters (Government of Rajasthan, 2022)

A study by Mishra et al. (2022) investigates the viewpoints of Bhubaneswar passengers, e-rickshaw drivers, and autorickshaw operators. Auto rickshaw operators oppose route limitations, but voice concerns about increasing traffic and pollution if more rickshaws are added. They draw attention to issues including infrastructure for charging, component availability, and maintenance. Passengers usually prefer e-rickshaws due to their affordability and environmental advantages.

While e-rickshaw owners point to cheaper operating expenses, autorickshaw drivers benefit from their vehicles' pre-existing infrastructure and faster refuelling. Policy interventions are essential to overcome deployment problems, such as registration procedures, subsidy awareness, and charging infrastructure. Challenges related to





battery disposal, vehicle design, and safety regulations must be resolved to ensure the sustainability of e-rickshaws.

E-rickshaws are acknowledged as a viable way to lessen the impact of urban mobility on the environment and the amount of gasoline used (Mishra & Rout, 2022).

A study on the city of Bardhaman by Roy (2016) provides several suggestions to incorporate e-rickshaws into Bardhaman's transportation system successfully:

- A) Recognise e-rickshaws as a vital part of urban travel, not a nuisance.
- B) Strengthen safety protocols and service quality while focusing on passenger-driver interactions.
- C) Limit registration to stop the number of unregistered e-rickshaws from growing.
- D) Use colour coding and set routes to control the movement of e-rickshaws while considering passenger demand and road capacity.
- E) Keep lanes and roads small to ensure the safety of e-rickshaw operations.
- F) Better signalling systems and scientific methods should be used to improve traffic management.
- G) Set aside dedicated parking spaces to avoid congested streets.
- H) To ease traffic, restrict the use of e-rickshaws on major thoroughfares such as G.T. Road.
- I) Launch the "Dial-a-ride" service and set up channels for handling complaints to increase public involvement and improve the system (Roy, 2016).

The e-rickshaw project aims to enhance public transport and make a difference in the lives of the cycle rickshaw vendors at Kakinada, an Andhra Pradesh Smart City. The major targets of the e-rickshaws are commercial centres, civic centres, and educational institutions for fast-tracking cleaner modes of transport. This would augment the existing auto rickshaw services at low usage and short distances. The routing was optimised after considering various parameters like traffic patterns and street gradients, ensuring the inhabitants had effective and convenient travel options (E-Rickshaw Operational and Deployment Strategy: Case of Kakinada, 2017).

E-rickshaws in Delhi have become an important paratransit connection between residential areas and main public transport points with a high usage factor. They particularly meet the need left by the Commonwealth Games, and legislation is changing to facilitate their growth together with hybrid and electric vehicles.



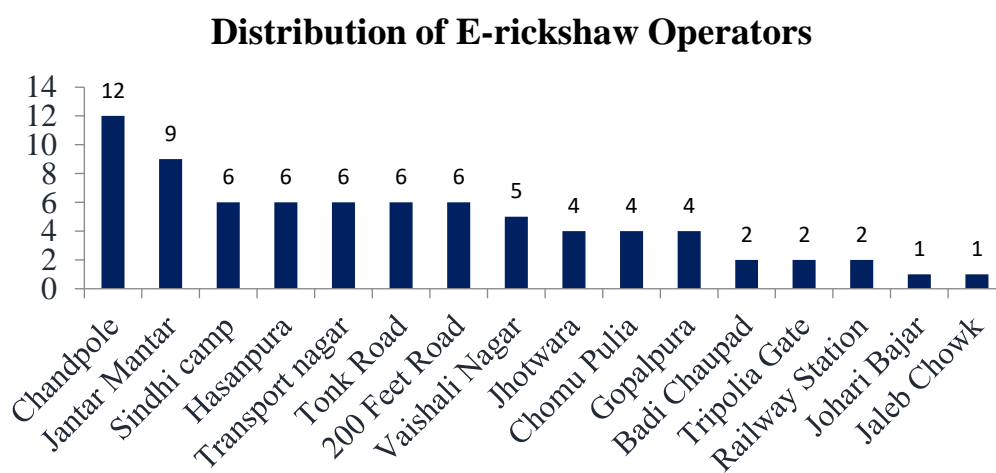
Most e-rickshaw drivers, who are mostly low-income colony residents, use informal charging points at commercial locations, even though they could easily be charged at residential spaces because of the complex regulations being managed by various government bodies. The absence of proper registration, licenses, repair facilities, and charging infrastructure for e-rickshaws makes them safety hazards on the roads, besides the denial of access to arterial roads, their costly insurance and fitness certificates, and the challenge in transitioning to a safer technology with lithium-ion batteries because of the expense (Sandeep Gandhi Architects, 2022).

## Survey Findings

A survey of e-rickshaw drivers was conducted from May 21 to June 10, 2024, across 16 locations in Jaipur. It covered multiple aspects, including age, gender, monthly income, maintenance and parking charges, working days and hours, the type of battery used in e-rickshaws, and other challenges the surveyed 76 operators faced.

Driving an e-rickshaw for a livelihood does provide the e-rickshaw operators with economic growth, as many experienced an increase in their income levels, especially the ones who had to go through job loss because of the COVID-19 pandemic. Still, the potential for job growth is decreasing day by day due to the competition caused by the high number of e-rickshaws already plying the roads of Jaipur.

**Figure 1: Distribution of E-rickshaw Operators**



Chandpole and Jantar Mantar showcased a high density of respondents due to their market and tourist areas, respectively. These two places always have a multitude of passengers waiting to use e-rickshaws for their end-to-end or intermediate commutes, which gives rise to a high density of e-rickshaws in these areas to fulfil the demand of passengers.



Other areas with high passenger and e-rickshaw operator density were Sindhi camp, Railway station, and Badi Chaupad, but the respondents from these areas were comparatively few due to the shorter waiting time for e-rickshaw operators to get a passenger, which is why they were not interested in engaging with us. Areas like Jhotwara, Chomupulia, Gopalpura, and Jaleb Chowk did not have a high density of passengers or e-rickshaws.

A total of 21 e-rickshaw commuters were surveyed across four locations in Jaipur. The survey covered multiple aspects, including but not limited to age, gender, type of preferred commute and the reason behind choosing e-rickshaws for their commute to gain a holistic understanding of the perspective of e-rickshaw commuters.

**Table 1: Distribution of E-rickshaw Passengers**

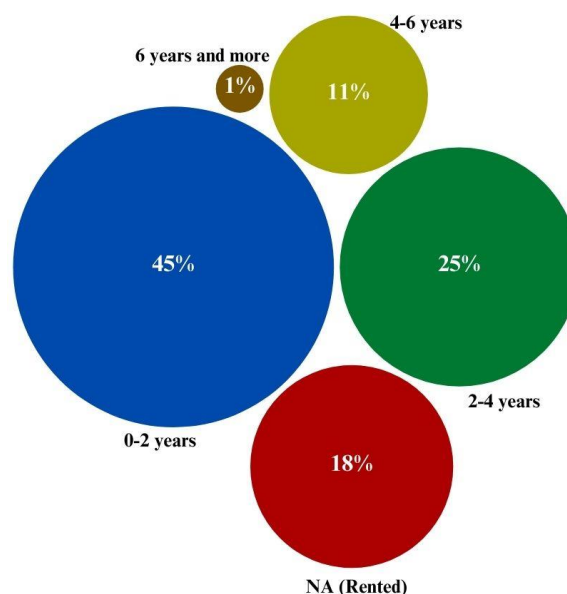
Location	No. of passengers	Percentage value
<b>Pani Pech</b>	<b>1</b>	<b>5</b>
<b>Jagatpura</b>	<b>1</b>	<b>5</b>
<b>Bani Park</b>	<b>5</b>	<b>24</b>
<b>Chandpole</b>	<b>14</b>	<b>66</b>

Chandpole showcased a high density of respondents because it is a marketplace that always offers many passengers waiting to use e-rickshaws for their end-to-end or intermediate commutes. Areas like Pani Pech, Jagatpura and Bani Park did not have a high density of passengers or e-rickshaws.

## ***Profile of E-Rickshaw Operators and Commuters***

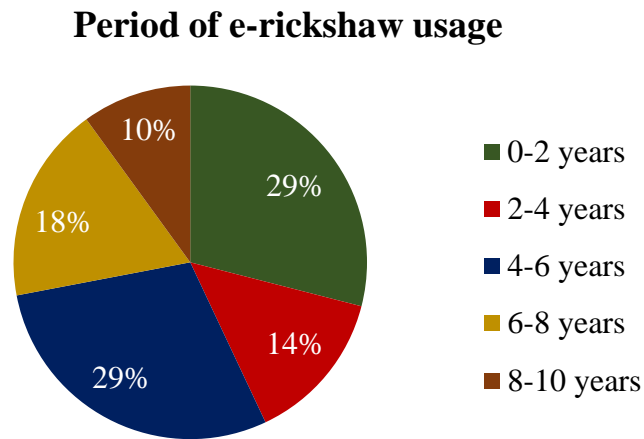
### **Age of E-rickshaws**

**Figure 2: Age of E-rickshaws**



64 percent of the surveyed e-rickshaw drivers were owners, while 36 percent had rented their e-rickshaws. 45 percent of e-rickshaws have been bought in the last two years.

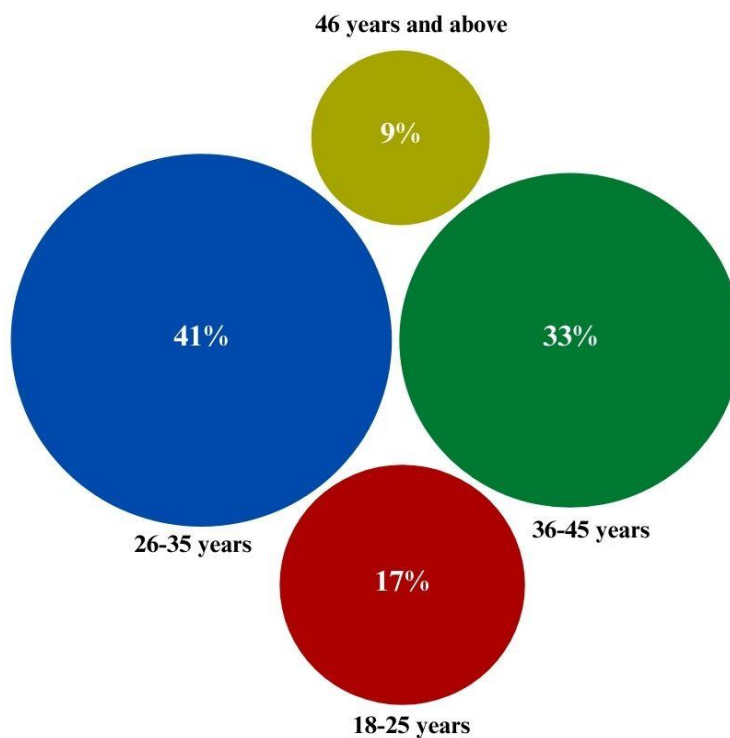
**Figure 3: Period of E-rickshaw Usage**



Most commuters have been using e-rickshaws for the past 2 years or 4-6 years. Only 10 percent have been using them for the past eight to ten years. The majority of the commuters we surveyed were engaged in private jobs.

### The Age Group of the E-Rickshaw Operators

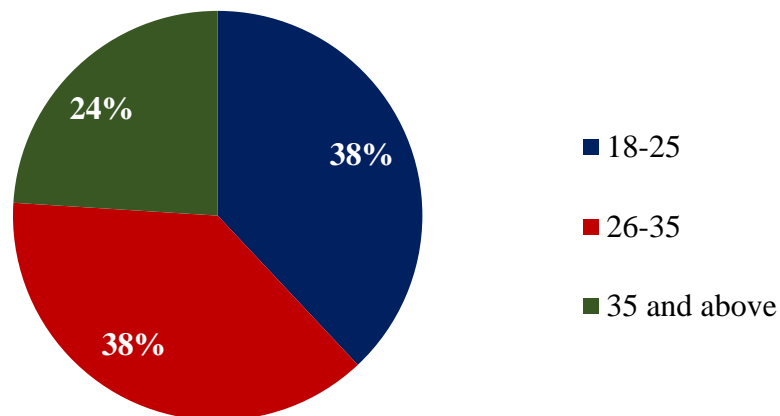
**Figure 4: Age Group of the E-Rickshaw Operators**



Most e-rickshaw drivers fall within the 26 to 35 age group. 12 percent of the drivers we surveyed had taken up driving an e-rickshaw as their first job, while 88 per cent were engaged in other occupations before driving e-rickshaws. Their previous work engagement were private jobs (14 percent), taxi driver (13 percent), labourer (9 percent), farming (5 percent), a helper at a department store (5 percent), vegetable vendor (4 percent), painter (4 percent), auto driver (4 percent) and others.

**Figure 5: Age Group of Commuters**

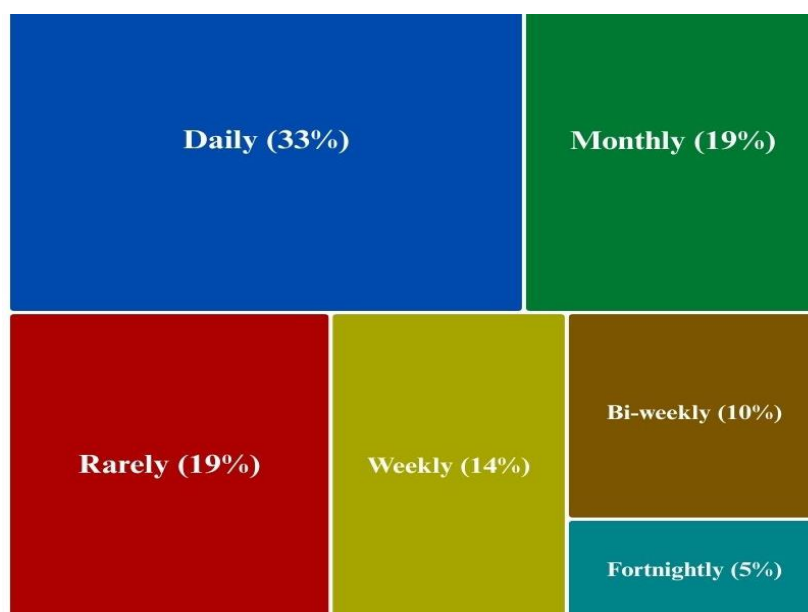
**Age Group of Commuters**



The majority of the e-rickshaw commuters are between 18 and 35 years old. Commuters of age groups 18-25 and 26-35 occupy a similar number of commuters in our sample size.

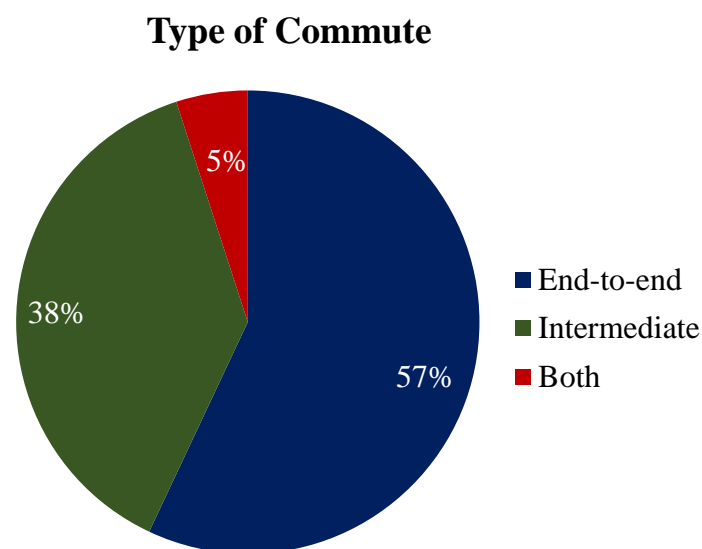
**Frequency of E-Rickshaw Usage**

**Figure 6: Frequency of E-Rickshaw Usage**



Daily usage of e-rickshaws was the most common frequency at 33 percent, and fortnightly commuters used e-rickshaws at the least, at 5 percent. E-rickshaw commuters travelled monthly and rarely at 19 percent each. 10 percent of commuters used e-rickshaws bi-weekly, and 14 percent of commuters used e-rickshaws weekly. The monthly expenditure on e-rickshaws for most commuters we surveyed was around ₹1000 - comprising non-daily users for the most part. Daily e-rickshaw users incurred an expense of around ₹1000-2000 on average

**Figure 7: Type of Commute**



57 percent of e-rickshaw commuters chose e-rickshaws for end-to-end commutes, 38 percent travelled in e-rickshaws for intermediate commutes, and 5 percent used e-rickshaws for both.

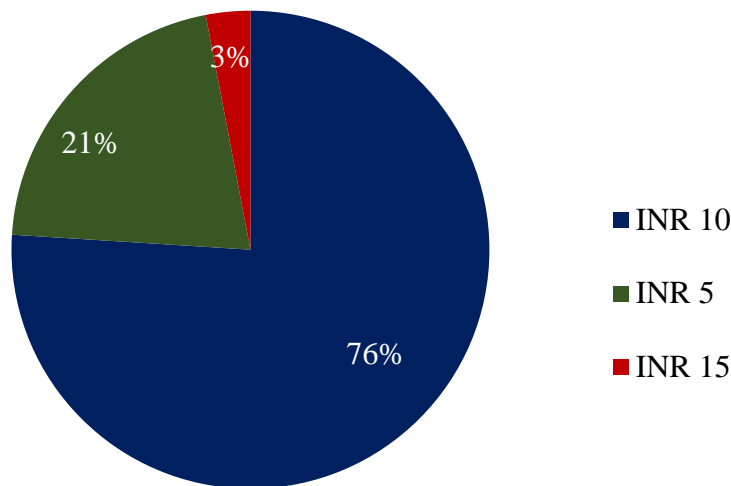
### ***Expenditures of an E-Rickshaw Operator***

Around 50-55 manufacturers and 102 dealers operate in the Jaipur region. Jaipur City administrators have been working on developing ten parking zones for e-rickshaws since 2018-19, but very limited progress has been made in this regard. To avoid 6,000 e-rickshaws from the streets, the city requires at least 300 parking stands with a capacity of twenty e-rickshaws. None of the e-rickshaw drivers surveyed had access to parking spots.



**Figure 8: Charges for Shared Rides**

**Charges for Shared Rides**



21 percent of drivers charge a minimum of ₹5 per trip, 76 percent charge a minimum of ₹10 per trip, and 3 percent charge a minimum of ₹15 per trip. E-rickshaw drivers operating in areas of high demand are prone to charge less than those operating in comparatively low demand to keep up with the market competition.

Sachan & Singh (2022) state that EV owners experience "charging point anxiety" because of the scarcity and lack of standardisation of charging infrastructure in metropolitan areas, which makes them anxious about locating suitable stations. An uneven distribution of EVs adds complexity. To allay these worries and provide easy access to charging stations, a comprehensive strategy is required, highlighting the significance of appropriate and standardised charging locations for the broad adoption of EVs.

**Table 2: Charging Technology in EV Ecosystem**

Charging Technology				
Conductive charging			Inductive charging	Battery swapping
Alternating current		Direct current		
Level 1	Level 2	Level 3	Plugin	Pantograph

The average income can reach up to ₹800 per day. E-rickshaw drivers in high-demand areas earn less due to greater competition. 64 percent of e-rickshaw drivers work throughout the week, with 25 percent working 6 days a week. Those who work 5 days a week often work part-time on their off days. 16 percent of the e-rickshaw operators were engaged in part-time occupations, while 84 percent of the drivers were engaged



only with driving e-rickshaws for a living. 70 percent of e-rickshaw drivers experienced increased income after switching jobs.

**Table 3: Income and Savings per Month for Self-Owned E-Rickshaw Operators**

Earnings and expenditure per month	Own e-rickshaw
Income	24,000
Maintenance	1,000
Fine by police	3,000
Charging	3,000
Savings	18,000

Most e-rickshaw drivers spend around ₹1,000 monthly on maintenance, and some owners include maintenance charges with rent. 47 percent of drivers pay up to ₹100 per day for parking and charging, while 14 percent charge their e-rickshaws at home. Additionally, 15 percent pay up to ₹200 for parking and charging, which is included in the rent for 22 percent of drivers.

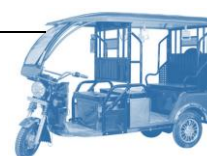
**Table 4: Income and Savings per Month for Rented E-Rickshaw Operators**

Earnings and expenditure per month	Rented e-rickshaw
Income	24,000
Maintenance	1,000
Rent	9,000
Fine by police	3,000
Charging	3,000
Savings	9,000

In the end, the e-rickshaw operators who own their vehicles are left with ₹18,000 for household expenses, and the e-rickshaw operators who rent their vehicles are left with ₹9,000 to run their households. The savings of the e-rickshaw operators who rent their vehicles come down to half of those who own their e-rickshaws.

### ***Specifics of E-rickshaws***

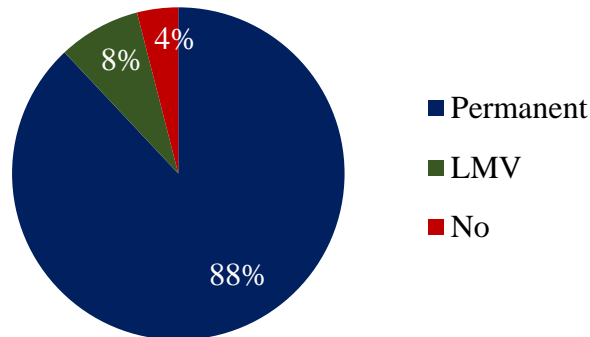
The Jaipur Metro Rail Corporation (JMRC) has played a key role in pushing for the registration of e-rickshaws and mandated licences for e-rickshaw operators in Jaipur since 2015 (JMRC's firm stand mandated RTO registration for e-rickshaws, 2015).





**Figure 9: License of E-Rickshaw Operators**

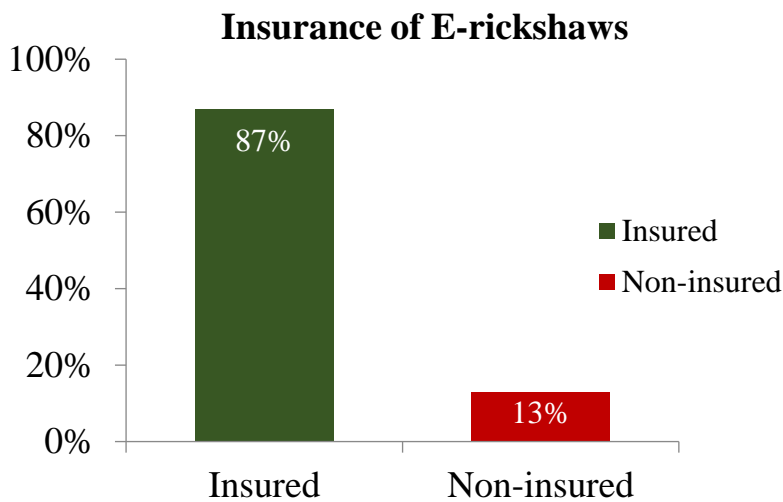
**License of e-rickshaw operators**



88 percent of drivers have a permanent license, 8 percent have an LMV permit, and 4 percent do not have any license.

E-rickshaw dealers and associations provide training certificates based on which the Transport Department can issue a learning license. Guidelines for an e-rickshaw driving license are yet to be issued, and traffic police levy fines on rickshaw operators without the license.

**Figure 10: Insurance of E-rickshaws**



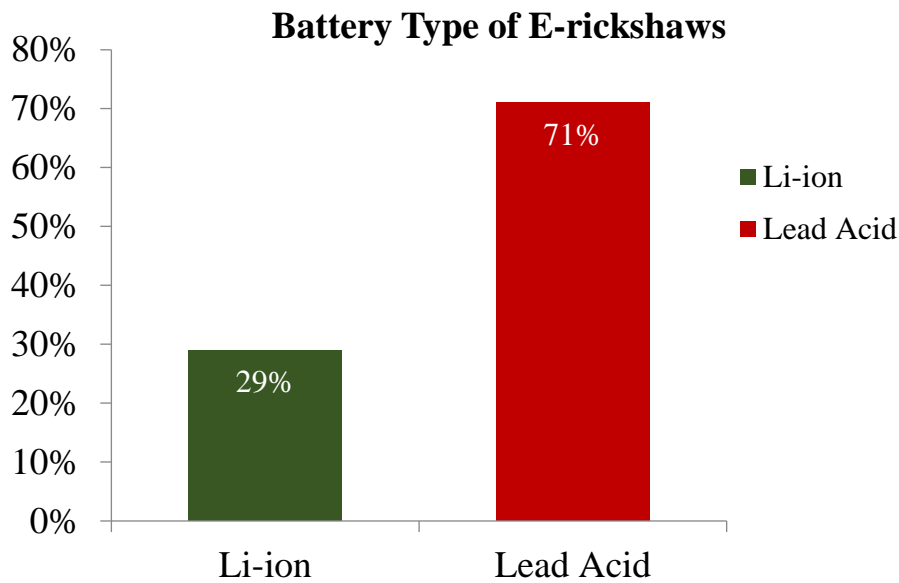
The majority of e-rickshaw operators (87 percent) had insured their vehicles, while very few had not (13 percent).

68 percent of operators are involved in both end-to-end and intermediate commutes. 26 percent of e-rickshaw drivers operate only in end-to-end commutes, and 5 percent of drivers operate only in intermediate commutes. Most passengers were working men, followed by working women and then students and the elderly. People opted for



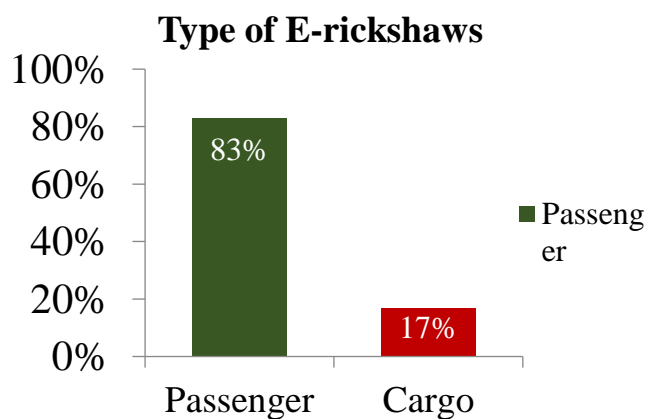
e-rickshaws based on the distance they had to travel and according to the availability of e-rickshaws in their area.

**Figure 11: Battery Type of E-rickshaws**



Lead-acid batteries (71 percent) are the most prevalent batteries in e-rickshaws, followed by lithium-ion batteries (29 percent). Ten percent of e-rickshaw drivers opted for battery swapping.

**Figure 12: Type of E-rickshaws**



Most e-rickshaw drivers charge their vehicles once daily (83 percent), while the rest charge them twice daily (17 percent). The peak passenger hours are from 8 to 10 a.m. in the mornings and 6 to 8 p.m. in the evenings. The majority of the time, e-rickshaws function without any issues. If any arise, it is regarding breakdown and battery charging time, followed by range. 83 percent of e-rickshaw operators carried only passengers, while 17 percent carried cargo.

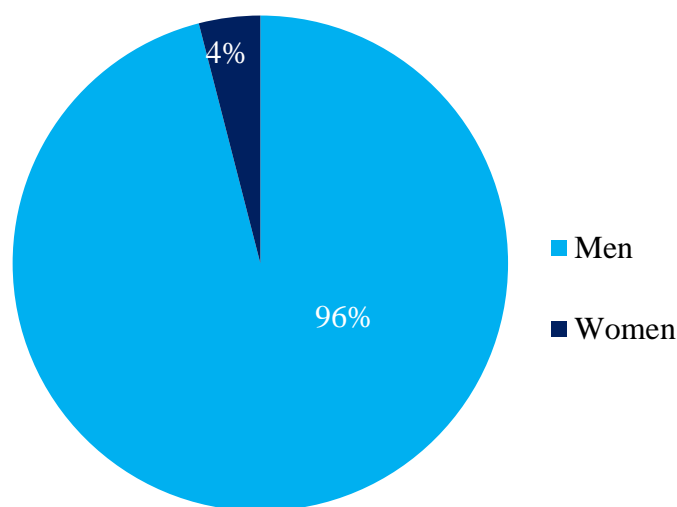


Earlier, an LMV license was sufficient to drive an e-rickshaw, but this rule changed in February 2024. Since then, 8,000-10,000 rickshaws have gone off-road in fear of challans. The process of obtaining permanent licensing is slow, and the volume of e-rickshaws is high. Only 317 permanent licenses have been issued since the change of rule.

## Gender Inclusivity

**Figure 13: Ratio of Men and Women E-rickshaw Operators**

### Ratio of Men & Women E-rickshaw Operators



96 percent of the e-rickshaw operators surveyed were men, while 4 percent were women. The old city area showcased a higher participation of women as e-rickshaw operators due to the high concentration of tourists in the area to provide additional financial support to the family and increase the standard of living. Male e-rickshaw operators were observed throughout the city.

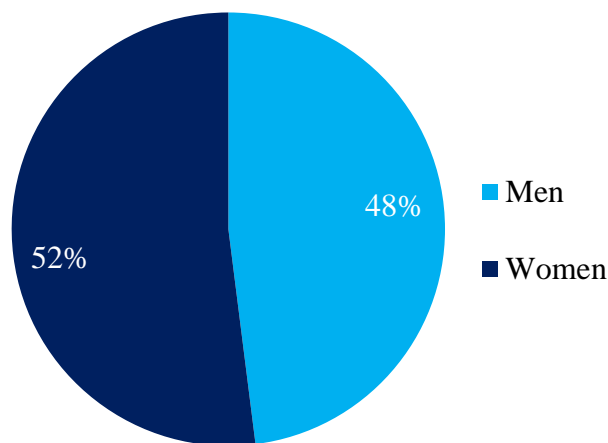
The women respondents we interviewed were all from Jaipur, while the male respondents we interviewed were mostly from Jaipur, some from surrounding areas, and a few from other states.

Regarding women's safety in driving e-rickshaws, 88 percent mentioned it is safe for women to drive e-rickshaws, with only 1 percent of those responses coming from women. 12 percent of respondents said it is unsafe for women to drive e-rickshaws, with 9 percent being men and 3 percent being women, due to the low frequency of women drivers compared to men drivers.



**Figure 14: Commuting Frequency of Men and Women in E-Rickshaws**

**Commuting frequency of Men & Women in E-rickshaws**



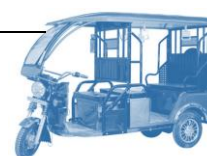
52 percent of all e-rickshaw commuters surveyed were women, and 48 percent of the commuters were men. Women preferred e-rickshaws to a large extent owing to their sense of safety given their open structure.

***Perspective of E-Rickshaw Operators, Commuters and Stakeholders***

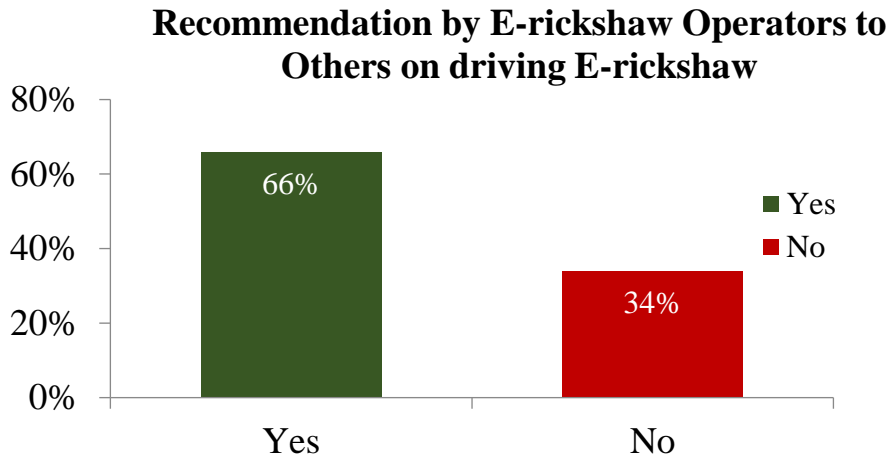
When asked about the initiatives that local administration could take to improve the working environment of e-rickshaw operators, many respondents seemed apprehensive of the local authorities. Some shared their experiences of being harassed by the police, while others spoke about the need for parking stands and improved communication of information about route restrictions. Old vehicles are parked or abandoned on the roadside, and the police or traffic department is taking no action.

Yet, no parking fines are levied on e-rickshaws often. 34 percent of drivers said they would recommend others to become e-rickshaw drivers, while 66 percent mentioned they would not recommend others due to police harassment (43 percent), poor income (10 percent), high numbers of existing drivers (6 percent), and other reasons.

The traffic police frequently stop 89 percent of drivers for various reasons. The most common reasons include document verification and violations related to parking and route restrictions. Many drivers also face issues for not wearing uniforms and exceeding passenger limits. Most drivers receive information regarding route restrictions and regulation changes through fellow drivers (35 percent), followed by police when they stop the e-rickshaw drivers (21 percent).



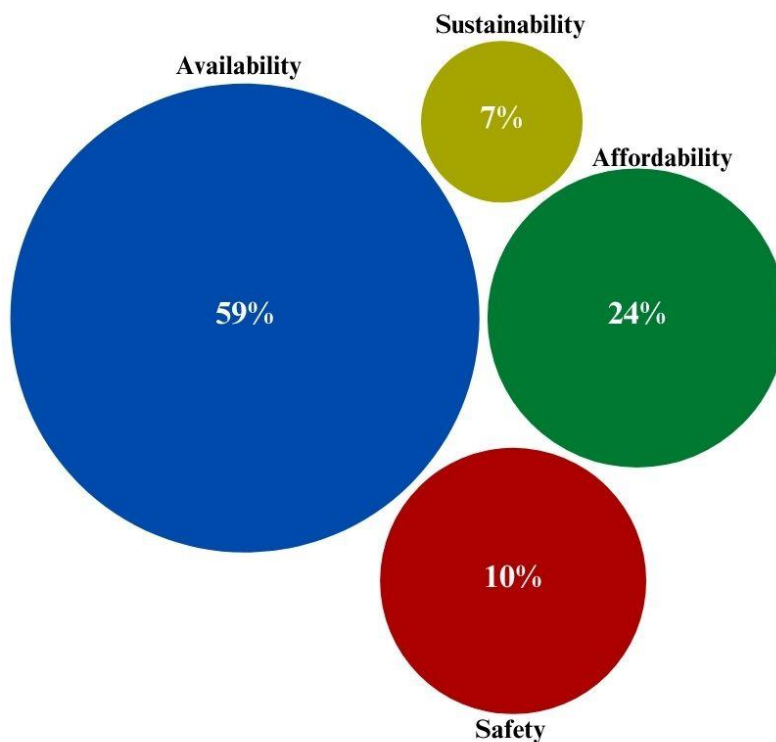
**Figure 15: Recommendation by E-Rickshaw Operators to Others on Driving E-Rickshaw**



Each time the police stop an e-rickshaw, they impose fines ranging between ₹100 and ₹5,000, with ₹500 being the most common fine amount. Sometimes, the e-rickshaw is also confiscated until the challan is paid. Challans based on the operator's native place are common. Operators with identity documents from other states are frequently reprimanded since their documentation is often incomplete.

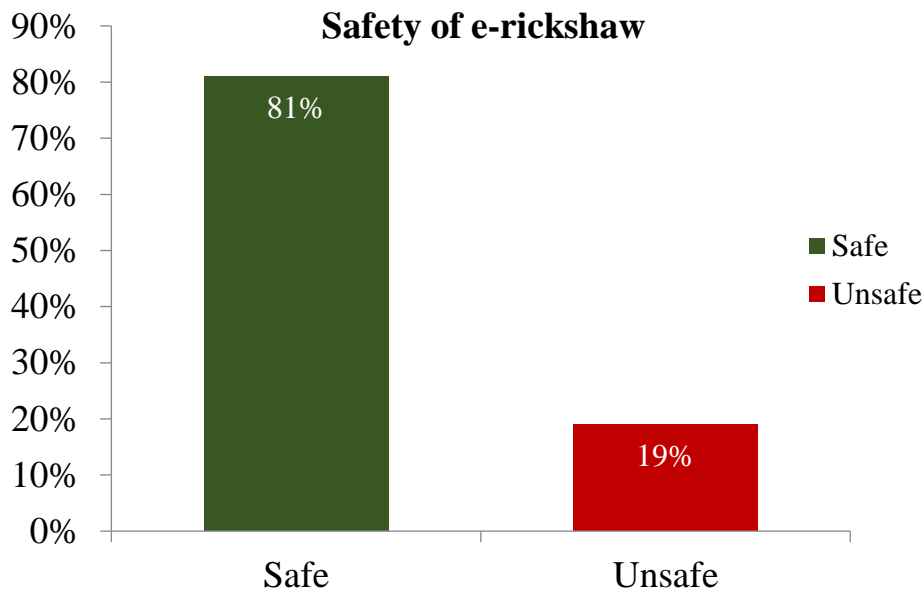
**Reasons Commuters Choose E-Rickshaws**

**Figure 16: Reasons Commuters Choose E-Rickshaws**



59 percent of commuters choose e-rickshaws for their ease of availability, 24 percent for their affordability, 10 percent for their safety and 7 percent for their sustainability. Almost all the passengers we surveyed were aware of the environmental benefits of e-rickshaws.

**Figure 17: Safety of E-rickshaw**



81 percent of commuters find e-rickshaws safe, while 19 percent of e-rickshaw commuters find e-rickshaws unsafe. One of the common reasons commuters find e-rickshaws unsafe is their lightweight and a high chance of getting into accidents as they may get toppled easily.

There is an urgent need for a scrapping policy for e-rickshaws to recycle e-rickshaws older than four years. This would generate employment in the recycling sector.

Some of the common remarks from operators:

1. The transport department has not recently issued route permits. Traffic police issue fines for not having all the required documents.
2. There is a need for an e-rickshaw drivers' union.
3. E-rickshaw driving is taken up often because of the lack of other work and self-employment opportunities.



## Policies for the Promotion of E-rickshaws

The roadmap for electric vehicles in India was led under the National Electric Mobility Mission Plan (NEMMP), 2020. The idea has been supported by the Faster Adoption and Manufacturing of (Hybrid &) Electric Vehicles (FAME) scheme from 2015, whose agenda is demand generation, technology advancement, charging infrastructure, and pilot projects. Intending to popularise EV adoption and reduce petrol consumption, FAME offers financial incentives based on total ownership cost, payback duration, and fuel savings (Singh, Singh, & Vaibhav, 2021).

To improve fuel security, the Indian government launched the National Electric Mobility Mission Plan (NEMMP) in 2013 to sell 6-7 million hybrid and electric vehicles annually by 2020. With an initial investment of ₹75 Crore, the FAME programme was launched under NEMMP in the 2015–16 Union Budget.

As per Shukla & Pathak (2016), India's transport sector, with its 6.4 percent GDP contribution, mainly depends on oil and accounts for 13 percent of its energy-related CO<sub>2</sub> emissions. The NEMMP looks toward manufacturing, R&D, and construction of recharging infrastructure to spur green growth. It also aims to spur environmental innovation, develop a competitive domestic market for EVs, create green jobs, and improve local air quality.

With the initial EV cost, making the switch is still economically viable since there will be considerable savings in reducing oil consumption. The NEMMP sets out phased activities to establish a direction and long-term scaling targets for EV adoption against the background of India's fast-changing urban transport scene (Shukla & Pathak, 2016).

### FAME I

The FAME India Scheme aimed to promote reliable and affordably priced electric and hybrid vehicles. The first phase, launched in 2015 and later extended, provided demand incentives for different kinds of vehicles, such as plug-in hybrids and fully electric cars. Executed by the Department of Heavy Industry's National Automotive Board, the programme monitors CO<sub>2</sub> emissions daily and overall for thirty Original Equipment Manufacturers (OEMs) and 137 models. Integrated Management Information System (MIS) reports aid in management and oversight.

### FAME II

Launched in April 2019, the FAME Scheme's Phase II dedicated 86 percent of its funding to demand incentives to increase the countrywide adoption of electric vehicles. Support was also given to the construction of charging infrastructure. The programme prioritised public transportation by targeting commercial electric vehicles in classes such as e-3W, e-4W, and e-buses while providing reasonably priced and



environmentally responsible solutions. To further expand the target audience, privately held registered e-2Ws were also included in the programme (Government of India, About FAME II, 2022).

While the first phase of FAME was originally scheduled to last two years, from 2015 to 2017, it went into action in April 2015 and got extended until March 31, 2019. It was India's first green transport policy; all types of electric vehicles, like e-2W, e-3W, e-4W, Light Commercial Vehicle (LCVs), and e-buses, could have been bought with incentives under it.

In April 2019, the Department of Heavy Industries revised FAME II and continued it for two more years up to March 31, 2024. The incentive available under the demand contour was increased to ₹15,000/kWh in June 2021 and reduced to ₹10,000 in June 2023. Riding on the success of FAME I and II, the EV sector in India has grown significantly, wherein EV sales have crossed one million units in FY 2022–2023, equivalent to almost 6 percent of all vehicle sales.

The Pradhan Mantri Mudra Yojana (PMMY) offers up to ₹10 lakh loans for the manufacturing, commerce, and services sectors involved in microenterprises. There are three categories of loans: Shishu, up to ₹50,000; Kishor, from ₹50,000 to 5 lakh; and Tarun, from ₹5-10 lakh.

Moreover, microenterprises can get collateral-free financing up to ₹10 lakh because of the fact that loans are covered under the Credit Guarantee Fund for Micro Units (CGFMU), which is administered by the National Credit Guarantee Trustee Company (NTGTC) (Government of India, Coffee Table Book MUDRA, 2015).

**Table 5: Category of Loans under PMMY**

Sl No	Category	Amount
1	Shishu	Up to ₹50,000
2	Kishor	₹50,000 and up to ₹5 lakh
3	Tarun	Above ₹5 lakh and up to ₹ 10 lakh

*MSME Development Centre, Government of India, 2015*





## Way Forward

The study by Kokate et al. (2018) assessed the new trends in e-rickshaws in India, their prospects, and some significant challenges they must overcome to exploit the potential benefits. Upon examining the past, present, and future of e-rickshaws alongside their benefits, certain issues have emerged, including slow speed, disposal challenges of lead-acid batteries, and limited seating capacity.

Several of these limitations can be overcome by introducing a few developments. They include integrating photovoltaic panels or wind energy systems that can charge the batteries and increase the driving distance range, replacing lead-acid batteries with lithium-ion batteries for enhancing performance and designing better weight distribution by placing various components judiciously. Also, using carbon fibre in body construction can leverage its higher tensile strength, high stiffness, and low weight. Moreover, a balanced structure of five wheels would bring more excellent stability, allow more people, and reduce the potential for rollover.

Even though e-rickshaws are widely used, there are still issues with their regulation and implementation. Problems related to poor quality of vehicles, frequent change of batteries, improper licensing of drivers, and power pilferage due to lack of adequate numbers of approved charging stations are being raised. Standardisation of battery technology is seen as a way to avoid uncertainty for investors and to ensure that the EV sector develops sustainably. This would involve promoting the scientific disposal of lead-acid batteries and incentivising a transition to lithium-ion e-rickshaws. It could also provide for buyback schemes from manufacturers for lead-acid e-rickshaws instead of discounts on brand-new lithium-ion vehicles. All these comprehensive steps could be taken to ensure long-term growth in the electric rickshaw market of India (Gupta, 2021).

### Recommendations for Central Government

#### Stakeholder Engagement

When designing the last-mile connectivity options, the government should consult with different stakeholder groups, including Residents' Welfare Associations. These last-mile connectivity options should be eco-friendly, convenient, financially viable, and useful for the end users.



## **Establish and Enforce Recycling Regulations for E-Rickshaw Batteries**

It falls on the central government to put in place and enforce elaborate regulations regarding e-rickshaw battery recycling to avert the chaotic dumping of hazardous waste. Proper disposal and recycling of e-rickshaw batteries are important to safeguard the environment and public health from the hazardous contents in the batteries. The regulations should have provisions for collecting, transporting, and delivering recycling used batteries to accredited facilities with the infrastructure for handling hazardous waste. Regular monitoring and evaluation must be performed to ensure they are followed.

Moreover, public awareness campaigns should be initiated to inform the e-rickshaw operators and the common people in general regarding the importance of handling the batteries properly and the environmental dangers that could be inflicted by improper disposal.

## **Incentivise and Expedite the Increase of Battery Swapping and Charging Stations For E-Rickshaws**

The government should promote and accelerate the expansion and development of charging and battery-swapping stations for e-rickshaws. This can be achieved through several incentives, such as grants for the installation, tax benefits, and subsidies for installing the infrastructure by businesses and local governments. It can also speed up the execution by making provisions for a smooth and fast-tracked approval procedure for installing battery swapping and charging infrastructure.

Not only this but to further expand the charging network, public-private partnerships that use capital and knowledge from the private sector are the need of the hour. Therefore, the central government should work with the local governments to ensure that the battery swapping and charging stations are stationed and located at places of easy access and maximum convenience.

## **Recommendations for the State Transport Department and Traffic Police**

### **Development of E-3W Depots**

The Municipality should earmark places for the development of mini-depots, which will have charging, battery swapping, and parking facilities. These places could be near metro stations, circles, bus stops, railway stations, or outside the city where provision for electricity connection is well placed.

### **Clarification on Route Restrictions**

To ensure clarity and smooth operation of e-rickshaws, the State Transport Department and Traffic Police should issue a detailed directive outlining specific route restrictions for e-rickshaws. This should include time-based restrictions, out-of-bound



areas, particularly in high-traffic zones, and clearly marked locations where e-rickshaws can ply. Other than avoiding confusion among e-rickshaw drivers, a clear display of signage along the roads and regular announcements about any change to these restrictions will facilitate smooth traffic management and ensure all road users' safety.

### **A Fine Reduction on Offences Related to Minor Traffic Violations**

The State Transport Department and Traffic Police can retain a reduced fine for petty offences. That would reduce the economic burden on the e-rickshaw owners while upholding law and order and safe driving. Revising the fine structure and ensuring transparency in enforcement authorities can foster improved compliance and public trust in regulatory measures.

Awareness campaigns regarding revised fines can enhance people's understanding of them and lead to an improved sense of acceptance.

### **Recommendations for Insurance Agencies**

Insurance agencies should offer policies to cover damage to batteries, which are of a high price and are considered one of the most essential parts of the vehicle. Insurance policies should account for any damage, malfunctioning, or even battery replacement to ensure comprehensive protection on the part of the vehicle owner. Besides, there must also be comprehensive theft coverage to protect from growing vehicle theft cases and financial loss.

With these elements included, the agencies could offer a more customised product according to the e-rickshaw operator's needs, spurring a more significant shift towards electric vehicles for more wide-ranging sustainable transportation goals.

### **Timeline Determination**

#### **Immediate Measures**

1. **Stakeholder Engagement:** Initiate consultation meetings with various stakeholder groups to gather input and foster collaboration in designing last-mile connectivity options that are environmentally friendly, convenient, and financially viable.
2. **Clarification on Route Restrictions:** State Transport Departments and Traffic Police should issue clear directives on route restrictions for e-rickshaws, including designated areas, time-based limits, and prohibited zones, with clear signage and regular updates.
3. **Reduction of Fines for Minor Traffic Violations:** To ease the financial burden on e-rickshaw operators while maintaining traffic discipline, reduce fines for minor traffic violations. Launch awareness campaigns to inform the public about the revised fine structure and promote safe driving practices.



## Medium-term Measures

1. **Increase Battery Swapping, Charging, and Parking Stations:** Encourage and fast-track the establishment of additional battery swapping and charging stations for e-rickshaws with subsidies, tax incentives, and public-private partnerships around metro stations, bus stops, and train stations. These stations could also double up as parking stations, thus serving a dual purpose and adding support for EV infrastructure expansion.
2. **Insurance Coverage Enhancement:** Insurance companies include coverage for e-rickshaw batteries and theft in the policy schedule, which would give an e-rickshaw owner complete coverage.
3. **Recycling Regulations:** Detailed e-rickshaw battery recycling rules like safe collection, transportation, and how they are recycled should be published. Mandatory periodic inspections through public awareness programmes in public would enforce the rule and help them learn and consequently comply with normal practices towards keeping the environment healthy.
4. **Defining the Lifespan of E-3Ws:** With due consultation with concerned stakeholders, the life of E-3Ws should be defined and enforced. This will enable the control of the number of e-rickshaws plying the city roads, ensuring that optimum income accrues to the operators at all times without leading to saturation in the respective markets.

## Long-term Measures

1. **Expand Recycling Facilities:** Existing and upcoming recycling facilities need routine checks and monitoring to ensure compliance with the recycling rules and regulations for e-rickshaw batteries. Given the expected rise in demand, periodic upgradation and capacity-building programmes should be installed.
2. **Sustainable Charging Network:** Work with the local administration to install a robust, widespread charging infrastructure network at appropriate places to access quickly and make the best use of. Develop long-term roadmap plans for the continued expansion and upgradation of this network to support the growth of e-rickshaws. Streamline permissions, promote public-private partnerships, and work with a view of attracting investment in this sector.
3. **Comprehensive Insurance Coverage:** Persuade insurance agencies to provide for battery damage, malfunction, replacement, and theft as part of comprehensive insurance policies for e-rickshaws. Spread awareness among the operators about the existence of such insurance schemes and their benefits.



- 4. Periodic Reviews and Adjustments:** The policies and measures should be regularly monitored, reviewed, and adjusted according to feedback and data analysis to ensure continuous improvement in the deployment and governance of e-rickshaws and address emerging challenges and opportunities.

With this, the authorities of central and state governments can enhance the deployment and governance of e-rickshaws and design sustainable and efficient transportation solutions while at the same time contributing to sustainable urban mobility and environmental conservation through interventions by other stakeholders in some of these immediate, medium, and long-run measures.



## Conclusion

The study provides critical insights into the evolving e-rickshaw ecosystem in Jaipur, emphasising its role as a sustainable and inclusive mode of transport. E-rickshaws have significantly contributed to the livelihoods of operators, particularly during the COVID-19 pandemic, offering economic growth opportunities. However, challenges such as inadequate parking infrastructure, lack of standardised charging points, and inconsistent regulatory enforcement hinder the sector's full potential. Addressing these challenges strategically can improve the working conditions for drivers and enhance the commuter experience. The findings highlight that commuters prefer e-rickshaws for their availability, affordability, and safety, making them an essential part of Jaipur's last-mile connectivity.

E-rickshaws also empower women by creating new opportunities for income and providing a pathway for underprivileged groups, particularly from a gender perspective. A collective effort from policymakers, transport authorities, and other stakeholders is needed to ensure the sustainable growth of the sector. Establishing designated parking zones, standardising licensing procedures, forming a union for drivers, and raising awareness about route regulation can address many operational challenges for operators and commuters. Addressing these issues holistically can make Jaipur's e-rickshaw ecosystem a model for sustainable urban transport.

Additionally, the Indian government's promotion of electric vehicles through initiatives such as NEMMP and the FAME scheme has accelerated the growth of EV adoption, positioning India towards a greener, more environmentally conscious transport system. In conclusion, these policies are vital in addressing environmental challenges as the country scales up EV adoption, driving economic growth through green innovation.



## References

(2017). E- Rickshaw Operational and Deployment Strategy: Case of Kakinada. ICLEI – Local Governments for Sustainability, South Asia. Retrieved from <https://shaktifoundation.in/wp-content/uploads/2018/02/E-Rickshaw-Kakinada.pdf>

Government of India. (2015). Coffee Table Book MUDRA. Retrieved from Pradhan Mantri MUDRA Yojana (PMMY): <https://www.mudra.org.in/>

Government of India. (2016). The Central Motor Vehicles Rules, 1989. Retrieved from <https://morth.nic.in/sites/default/files/CMVR-chapter1.pdf>

Government of India. (2022, March 28). About FAME II. Retrieved from Ministry of Heavy Industries: [https://fame2.heavyindustries.gov.in/content/english/13\\_1\\_brief.aspx](https://fame2.heavyindustries.gov.in/content/english/13_1_brief.aspx)

Government of Rajasthan. (2022). Rajasthan Electric Vehicle Policy (REVP) 2022. Jaipur, Rajasthan, India: Transport and Road Safety Department. Retrieved from Government of Rajasthan, Transport and Road Safety Department Jaipur, Rajasthan, India.

Gupta, S. (2021, March 4). Why e-rickshaws have emerged a winner in transition to electric mobility race. Retrieved from Down To Earth: <https://www.downtoearth.org.in/air/why-e-rickshaws-have-emerged-a-winner-in-transition-to-electric-mobility-race-75767>

Kanuri, C., Gounder, K., Sandhu, B., & Laroia, A. (2023). Enabling the Shift to Electric Auto-rickshaws: A Guidebook for Electrification of Auto-rickshaw Fleets in Indian Cities. WRI India and the National Institute of Urban Affairs (NIUA). Retrieved from [https://wri-india.org/sites/default/files/E-auto-guidebook\\_WRI-India.pdf](https://wri-india.org/sites/default/files/E-auto-guidebook_WRI-India.pdf)

Kokate, V. L., Bankar, D. S., Vispi, R. H., & Karandikar, P. B. (2018). E-Rickshaw Present Past And Future With Reference to Current Transportation in India. International Conference on Recent Innovations in Electrical, Electronics & Communication Engineering-(ICRIEECE), Kalinga Institute of Industrial Technology (KIIT), 1(1), 1-15.

Mishra, S. P., & Rout, D. R. (2022). Analysing The Sustainability of E-Rickshaws in Indian



Cities. International Research Journal of Modernization in Engineering Technology and Science, 4(8), 23-30. Retrieved from [https://www.irjmets.com/uploadedfiles/paper/issue\\_8\\_august\\_2022/29061/final/fin\\_irjmets1659518606.pdf](https://www.irjmets.com/uploadedfiles/paper/issue_8_august_2022/29061/final/fin_irjmets1659518606.pdf)

Roy, A. (2016, September). E-Rickshaw Service in Barddhaman Town: Importance,. International Journal of Scientific and Research Publications, 6(9), 702-706. Retrieved from <https://www.ijsrp.org/research-paper-0916/ijsrp-p5795.pdf>

Sandeep Gandhi Architects. (2022). Way forward for streamlined e-rickshaw operations Learnings from Delhi. Retrieved from <https://southasia.iclei.org/publication/operational-assessment-e-rickshaw-ecosystem-in-delhi/>

Shandilya, N., Saini, V., & Ghorpade, A. (2019). E-Rickshaw Deployment in Indian Cities-Handbook (Supporting Sustainable Mobility under Smart City Mission). ICLEI-Local Governments for Sustainability, South Asia (ICLEI South Asia). Retrieved from <https://shaktifoundation.in/wp-content/uploads/2022/01/Handbook-ERickshaw-deployment-in-Indian-Cities.pdf>

Shukla, P., & Pathak, M. (2016). Low-Carbon Transport in India. In S. Nishioka (Ed.), Enabling Asia to Stabilise the Climate (pp. 153-175). Springer Singapore. Retrieved from [https://doi.org/10.1007/978-981-287-826-7\\_8](https://doi.org/10.1007/978-981-287-826-7_8)

Singh, V., Singh, V., & Vaibhav, S. (2021, September). Analysis of electric vehicle trends, development and policies in India. Case Studies on Transport Policy, 9(3), 1180-1197. Retrieved from <https://doi.org/10.1016/j.cstp.2021.06.006>

Thakur, P., Pal, S. (2019). Regulatory Mechanisms for Electric-Three Wheelers. The Energy and Resource Institute (TERI). Retrieved from <https://www.teriin.org/sites/default/files/2020-02/Policy%20brief%20-%20EV%20Three-wheelers.pdf>

Vijaykumar, A., Mulukutla, P., & Hemalatha, K. (2021, June 14). Why electric rickshaws need better regulation in India. Retrieved from Down To Earth: <https://www.downtoearth.org.in/energy/why-electric-rickshaws-need-better-regulation-in-india-77440>







D-217, Bhaskar Marg, Bani Park, Jaipur 302 016, India

Ph: 91.141.228 2821, Fax: 91.141.228 2485

Email: [cuts1@cuts.org](mailto:cuts1@cuts.org), Website: [www.cuts-international.org](http://www.cuts-international.org)

Also at Delhi, Kolkata and Chittorgarh (India); Lusaka (Zambia); Nairobi (Kenya); Accra (Ghana); Hanoi (Vietnam); Geneva (Switzerland); and Washington DC, (USA).