

TRANSFORMING THE ADOPTION OF E-RICKSHAWS IN INDIAN CITIES



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Disclaimer : This document is developed on the learnings from the reports developed for Kochi (Financial Feasibility for Electric 3 Wheelers & Charging Infrastructure in Kochi developed by Dr. Ravikant Joshi) and Delhi (Way forward for Streamlined E -Rickshaw Operations -Learnings from Delhi by Sandeep Gandhi Architects, with support from People’s Resource Centre (PRC)) based on the interactions, fieldwork and background research conducted in Kochi and Delhi under the initiative “Transforming the Adoption of E-rickshaws in Indian Cities”.

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Executive summary

In India, share of electric three wheelers specially registered e-rickshaw is about 46% of the total EVs registered, while a large percentage of unregistered e-rickshaws also operate in majority of cities, be it the crowded roads full of various of modes of public and private transport or the vacant roads in the suburban areas of a city, one can easily find an e-rickshaw carrying people or transporting goods, fulfilling the mobility demands of the consumers at an affordable rate. These operate as a shared mode of transport mostly on fixed routes connecting the residential/ commercial/ institutional areas with public transport access points.

According to the projections by P&S Intelligence (2022)¹, Indian e-rickshaw market size is expanding and further expected to reach USD 456.2 million in 2030 (from USD 273.6 million in 2022) with a growth rate of 6.6% during this duration. The major factors driving this growth includes the government incentives, reducing cost of batteries, and availability of unregistered (low cost) e-rickshaws due to lack of strict regulations for e-rickshaw standards compliance and monitoring.

Although, e-rickshaws cater to the first/ last mile connectivity and address the service gaps of public transport for the commuters in Indian cities, ad-hoc growth in e-rickshaws which are not approved by ARAI/ICAT and **unregistered**, result to various negative externalities. These include, informal charging infrastructure resulting in electricity thefts, issues due to inferior batteries, sub-par driving, rise in informal financing market, conflict with other vehicles which higher speed, safety hazard during operation, electricity theft for unorganised bulk charging facilities and at the end of life when its parts and battery waste is not handled properly, lack of information and awareness among operators and limited institutional capacity. The key challenges of e-rickshaw operating in Indian cities is lack of formal financing options and regulatory ecosystem. Thus, if a planned approach is followed to introduce and operate e-rickshaws in a city with a focus on **regulatory ecosystem and financing sector**, it will result in effective operation, this requires transforming the current operational model into more sustainable model.

In the same context, ICLEI South Asia held a series of consultations with the stakeholders related to e-rickshaws in Delhi and Kochi including the city government officials, private and other related stakeholders in the two cities to understand the major challenges of regulatory and financial gaps, develop an understanding of e-rickshaw operations and demonstrate the possibility and potential of e-rickshaws through planned operations, under an initiative **Transforming adoption of E-Rickshaws in Indian Cities**, which is a part of a larger initiative by Climate Works Foundation to promote sustainable growth of E-Rickshaws in Indian cities. The initiative included, existing landscape assessment and multi-stakeholder engagement (government and private) followed by the financial feasibility assessment of electric 3 wheelers and charging infrastructure in **Kochi, best suitable business models** were suggested related to e-rickshaw procurement, charging infrastructure and integration of renewable energy for charging, as a part of recommendations.² In Delhi, surveys and interaction with more than 150 e-rickshaw operators and other stakeholders including manufacturers, regulators and charging operators and repair shop owners were interacted to understand the existing operational model, gaps and further develop an **operational approach/ policy intervention to regularise e-rickshaws in Delhi**.³

This report presents the key learnings from the engagement and documentation which includes 'Financial feasibility assessment of electric 3 wheelers and charging infrastructure in Kochi' and 'Operational approach/ policy intervention to regularize e-rickshaws in Delhi' and also builds on the learnings from the previous publication '[Handbook- E-rickshaw deployment in Indian cities](#)'. This document focuses on the e-rickshaw life cycle and challenges in pre-procurement, procurement and operation and post-operation stage followed by the opportunities and way forward for a city through addressing the financial and regulatory gaps.

¹ (Prescient & Strategic Intelligence, January 2023)

² Details of this assessment and recommendations is available in the report 'Financial Feasibility Assessment of Electric 3 Wheelers and Charging Infrastructure in Kochi'.

³ Details of this assessment and recommendation report related to Delhi is available in 'Develop Operational approach/ Policy intervention to regularize E-rickshaws in Delhi'.



In Kochi, EV policy by the Government of Kerala, envisaged deployment of 50,000 electric three wheelers in the state. However, there is need for official charging stations to target wider shift from internal combustion engine-based auto rickshaws. Therefore, the project team supported Kochi Municipal Corporation and Kochi Metropolitan Transport Authority to demonstrate the financial feasibility of e-rickshaws/e-IPT and Charging solutions.

In Delhi, surveys were conducted⁴ to understand the present status of operations, socio-economic profile of e-rickshaw drivers and related challenges, the number of unregistered e-rickshaws were substantially high posing numerous challenges to government of efficient operations, safety as well as seamless integration with other modes (especially public transport and metro system). Therefore, policy and regulatory interventions related to the same were suggested, which identified various challenges and mitigation measures.

The implementable actions related to policy and regulatory interventions at pre operation stage, operation stage and post operation stage are discussed briefly in this report, with details in the report developed for Delhi. The actions at pre-procurement stage includes improved vehicle design approved by ARAI/ICAT for secured battery compartments, reduced possibility of overturning of vehicle, risk sharing mechanism, development of a regulated second-hand market and ownership/ ownership transfer. Actions including monitoring of vehicle standards, maintenance and operation, development of charging infrastructure and repair facilities, are part of the operation stage, while the post operation actions include regulated battery waste handling solutions, scrapping of vehicles. There is potential for innovation in EV financing through programs like interest subventions, guarantee schemes, risk sharing mechanism, second hand market development and exploring options like MUDRA loan and NULM.

⁴Details of survey locations provided in Appendix 2



1. E-rickshaw as a driver of electrification in Indian cities

E-Rickshaws are a form of **first/ last mile connectivity mode** driving electrification of vehicles in Indian cities. These operate as a shared mode of transport mostly on fixed routes connecting residential/ commercial/ institutional areas with public transport access points and are usually expected to address the service gaps of public transport for the commuters. These are allowed to operate on the local roads/ collector roads and not the arterial roads, as the absence of a protective shell raises the risk of injury in the event of an accident. E-rickshaws are welcomed by the commuters and operators due to their characteristics of being demand responsive, affordable, flexible, and convenient.

1.1. E-rickshaw adoption and operation in India

E-rickshaws were first introduced in 2010 ahead of Common Wealth Games, as an alternative to cycle rickshaws to cater to the first and last mile connectivity in the National Capital Region. Within a short span of 3 – 4 years between 2010 and 2014 the number of e-rickshaws drastically increased 25 folds⁵ as these were not regulated under the Motor Vehicles Act, of 1988, were much cheaper and required no formal documentation as compared to auto-rickshaws. These gained prominence in the urban and suburban areas of Uttar Pradesh, Bihar, West Bengal along with Delhi NCR.

With the evident increase in the number of e-rickshaws operating unregulated on the roads, the need for a policy framework was addressed through the Central Motor Vehicle Rules (Amendment) 2015, approved by the national government for including e-rickshaws and e-carts under the purview of CMVR and mandate the safety compliance specified by Automotive Research Association of India (ARAI)/ International Centre for Automotive Technology (ICAT) for regulating e-rickshaws. Delhi is one of the frontrunners in e-rickshaw regulation ecosystem and has developed regulations specifically related to e-rickshaw operations including licensing, permits, charging infrastructure and safety standards or integrated these aspects in their EV Policy, yet a focused regulation and implementation at the local level is still missing in majority of cities and required.

1.2. E-rickshaws as a major EV share of India

E-rickshaws contribute to about 46% of the total share of EVs registered in India, while these figures could be much higher as a large percentage of e-rickshaws are still unregistered. As per the information from VAHAN dashboard, e-rickshaw contributed to about 80% of EVs registered in 2019 which has reduced to 32% in 2022 but the number of registrations of e-rickshaws is still rising over years (0.7% in 2021 and 1.2% in 2022) except in 2020 when the operation and sales were impacted due to COVID-19 pandemic. E-rickshaw is a driver of electrification in Indian cities due to its positive externalities including environmental aspects i.e. no noise pollution, reduced air pollution and GHG emissions along with its socio economic benefits i.e. low upfront and running cost as compared to its ICE counterparts⁶, providing livelihood to unskilled workforce with initial driving training.

⁵Increased from 4000 to approximately 100000 (Singh, 2014)

⁶Upfront and running cost- E-rickshaw INR 0.75 to 1.5 lakhs, INR 0.4/km and ICE auto rickshaws-INR 1.5 to 3 lakhs, INR 2.1 to 2.3/km running cost.



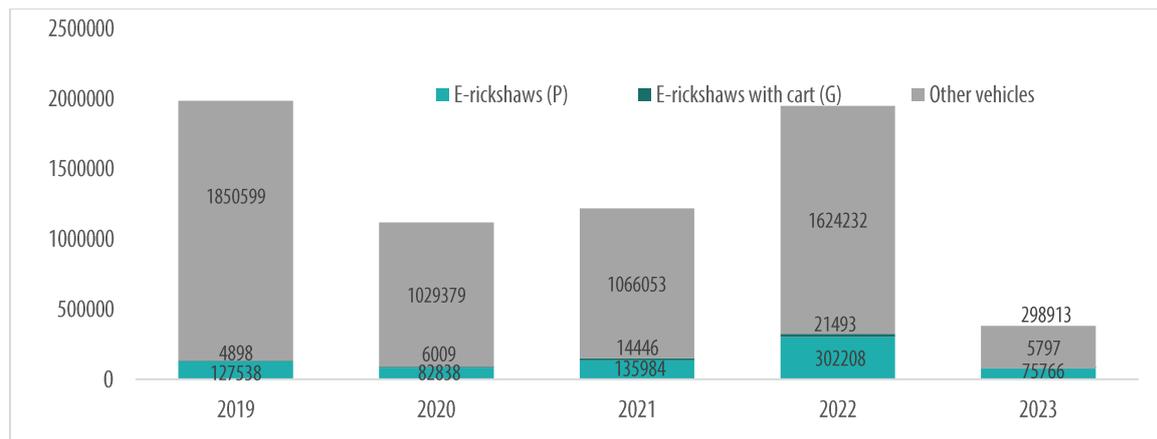


Figure 1: E-rickshaw registered in India (2019-2023)⁷.

2. E-rickshaw growth and ecosystem

2.1. Ad-hoc growth of unregistered e-rickshaws

Although, e-rickshaws cater to the first/ last mile connectivity and address the service gaps of public transport for the commuters in Indian cities, ad-hoc growth in e-rickshaws which are not approved by ARAI/ ICAT and **unregistered** and result in various negative externalities which include informal charging infrastructure resulting in electricity thefts, rise in informal financing market, safety hazard during operation, electricity theft for unorganised bulk charging facilities and at the end of life when its parts and battery waste is not handled properly. Other negative externalities valid in the case of registered e-rickshaw also include the conflict with other vehicles with higher speed, sub-par driving due to lack of awareness/willingness to follow the rules, lack of information and awareness among operators. The key challenges of e-rickshaw operating in Indian cities is lack of formal financing options and regulatory ecosystem which is further leading to more unregistered e-rickshaws and ad-hoc growth.

2.2. Existing financial ecosystem

NITI Aayog estimate regarding required cumulative investment in India’s electric vehicle (EV) transition of INR 19.7 lakh crore (US\$266 billion) between 2020 and 2030, The projected size of the annual loan market for EVs is INR 3.7 lakh crore in 2030. These figures clearly highlight the enormous size of funding requirements and the need for higher liquidity and lower cost of capital for EV assets and infrastructure. Thus, financial ecosystem is an important aspect in the deployment and operation of e-rickshaw and e-auto deployment and operation along with the regulatory ecosystem.

E-rickshaw buyers/ operators usually have low income and low paying capacity leading them to secure financing to procure the vehicle. The existing financing options are limited and are available for ARAI/ICAT approved models, the NBFCs have a high rate of interest (16-18%) and some banking institutions which give loans under MUDRA/NULM scheme and reduction of upfront cost of EVs through government subsidies and incentives. As a result, the buyers consider procuring the cheaper unregistered e-rickshaws with non-standard parts, through private loans or starts operating on rental basis, or turn to the OEMs/ private/ informal financing options in case the e-rickshaws are not registered or when the buyer is unable to procure a loan from the formal system due to lack of documentation/ any other reason. Currently, e-rickshaws get financing at high interest rates, short tenures on low loan-to-value ratios.

⁷ Information source- VAHAN Dashboard, accessed on 17 March 2023



Further, NITI Aayog and the World Bank are setting up a \$US300 million first-loss risk-sharing instrument which is intended to act as a hedging and guaranteeing mechanism that banks and NBFCs can access in the event of payment delays on EV loans and is expected to bring down the financing costs by 10-12%. Apart from this, some OEMs, startups and financing institutions have also announced and investing in EV, EV components, battery, manufacturing, charging infrastructure and R&D.⁸

2.3. Existing regulatory ecosystem

The regulatory system is pivoted on EVs in general, autorickshaws or other modes with a limited focus on e-rickshaws. Existing national level regulations and schemes related to e-rickshaws and its ecosystem includes the following⁹:



State level regulations and schemes in Kerala and Delhi includes the EV policies- Kerala EV Policy 2019 and Delhi EV Policy 2020 along with other supporting schemes and incentives.

The Delhi EV policy, 2020 was approved and notified by the Govt. of NCT of Delhi on 7th August 2020 and defined a target for rapid adoption of EVs by ensuring that 25% of all new vehicle registrations by 2024 is EV. Although the city has registered the highest number of EVs in the country yet its penetration is still only 11.53%¹⁰ of total registered vehicles and has achieved 7.17%¹¹ of its charging infrastructure target of 30,000 charging stations by 2024. Other schemes/incentives in Delhi include the e-rickshaw sewa scheme, subsidy scheme (2016), initiative allowing domestic charging of e-rickshaws, plan to develop charging stations and discontinuing the registration of e-rickshaw models with lead acid battery¹²

The EV Policy adopted by the Government of Kerala vide Department of Transport GO (Ms) 24/2019/Trans dated 10th March, 2019 to have 1 million EV by end of 2022, but like all India picture, Kerala state has also missed its EV Policy target by very huge margin with only 5% of the target EVs.¹³ EV policy of GoK has proposed exemption from road tax to EV for initial period of three years, capital subsidy for electric three-wheelers and for setting up public charging stations (PCS) and bulk charging stations (BSC). Beside these other incentives provided are exemption from state tax, free permits to fleet drivers, toll charges and free parking.

2.4. Need for a planned approach with a focus on regulatory and financing sector

E-rickshaw's offers huge potential as an electric first/ last mile connectivity mode but only if operated in a regulated ecosystem. Currently, inspite of the presence of the regulations and schemes at the central and state level, e-rickshaw segment is largely

⁸ OEMs (Ashok Leyland, Mahindra & Mahindra, Tata Motors, Omega Seiki Mobility, Simple Energy) have announced to invest INR 48000 crores in EVs, its components, battery manufacturing and R&D; startups (including Hero Electric, Ola Electric, etc.) have raised funding of INR 3307 crores for EV and battery manufacturing and financing institutions have announced a capital guarantee of INR 1500 crores towards manufacturing, distribution, charging infrastructure and repair of EVs and its parts.

⁹ Mentioned in detail in Annexure 1 of this document

¹⁰ (MoRTH, 2023), Data as per April 2023

¹¹ (BEE, 2023),Data as per April 2023

¹² Details of e-rickshaw scheme/incentives in Delhi and Kochi is provided in Annexure 1 of this document.

¹³ (MoRTH, 2023), Total 50086 EVs registered from 2019 to 2022



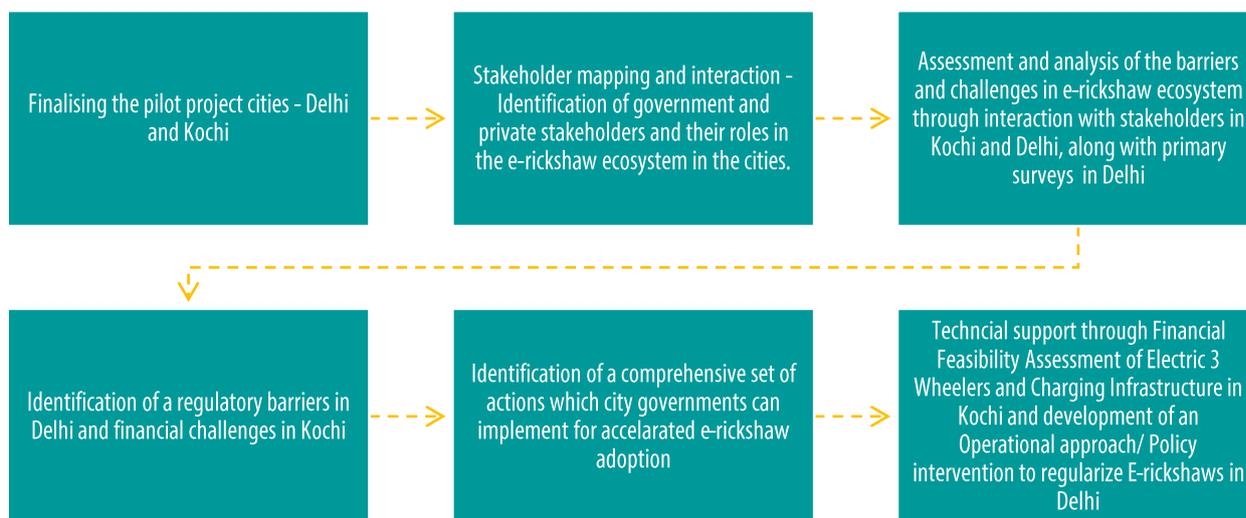
unorganized and unregulated being controlled by the informal sector as majority of operators are from informal sector and implementation is a challenge.

Thus, if a planned approach is followed to introduce and operate e-rickshaws in a city with a focus on **regulatory ecosystem and financing sector**, it will result in effective operation. This requires transforming the current operational model into more sustainable model, ensuring implementation of regulations/ actions at local level and improving the awareness among EV operators and regulators. Therefore, ICLEI South Asia embarked on an initiative to develop and implement a pilot in two Indian cities i.e. Kochi and Delhi, through technical support for the financial feasibility assessment of electric three-wheelers and Charging Infrastructure in Kochi, and develop an operational approach/ policy intervention to regularize E-rickshaws in Delhi.



3. Approach for planned adoption of E-Rickshaws in Indian cities –Methodology

Addressing the regulatory and financial challenges will address other linked challenges also and lead to safer e-rickshaw operations, electricity theft reduction, pollution reduction and improvement in socio-economic status of operators. The methodology to address these challenges and further support the Indian cities to implement short term measures (demonstration project) for achieving the desired e-rickshaw transformation is illustrated below:



In Delhi, primary surveys were conducted (as a part of study conducted to develop the Operational approach/ Policy intervention to regularize E-rickshaws in Delhi) during May to June 2022 at 16 locations covering routes of e-rickshaws in those locations as illustrated below:

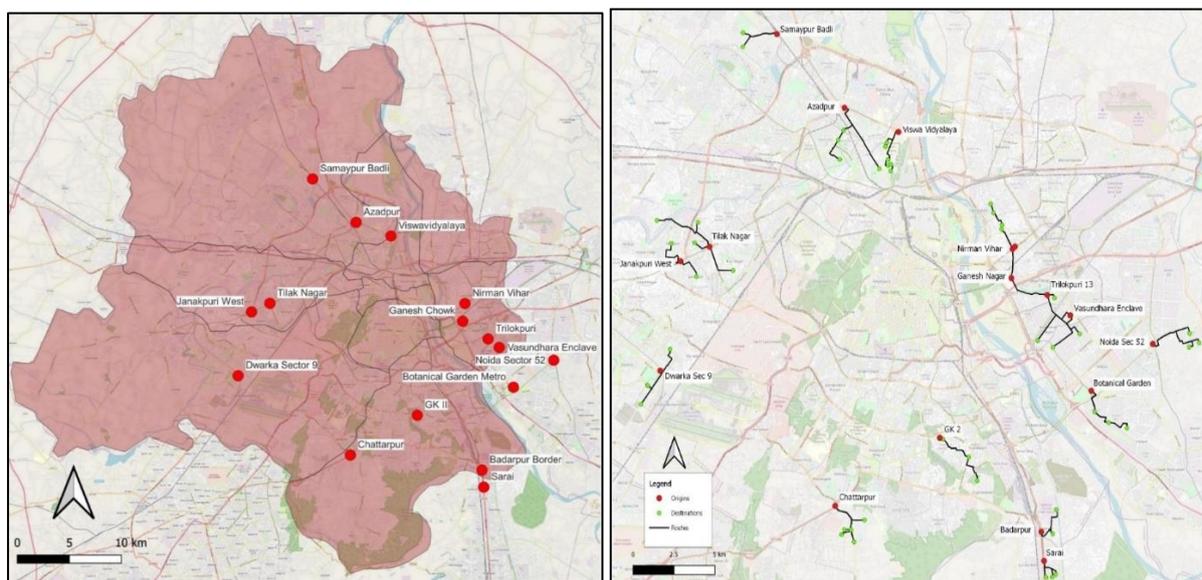


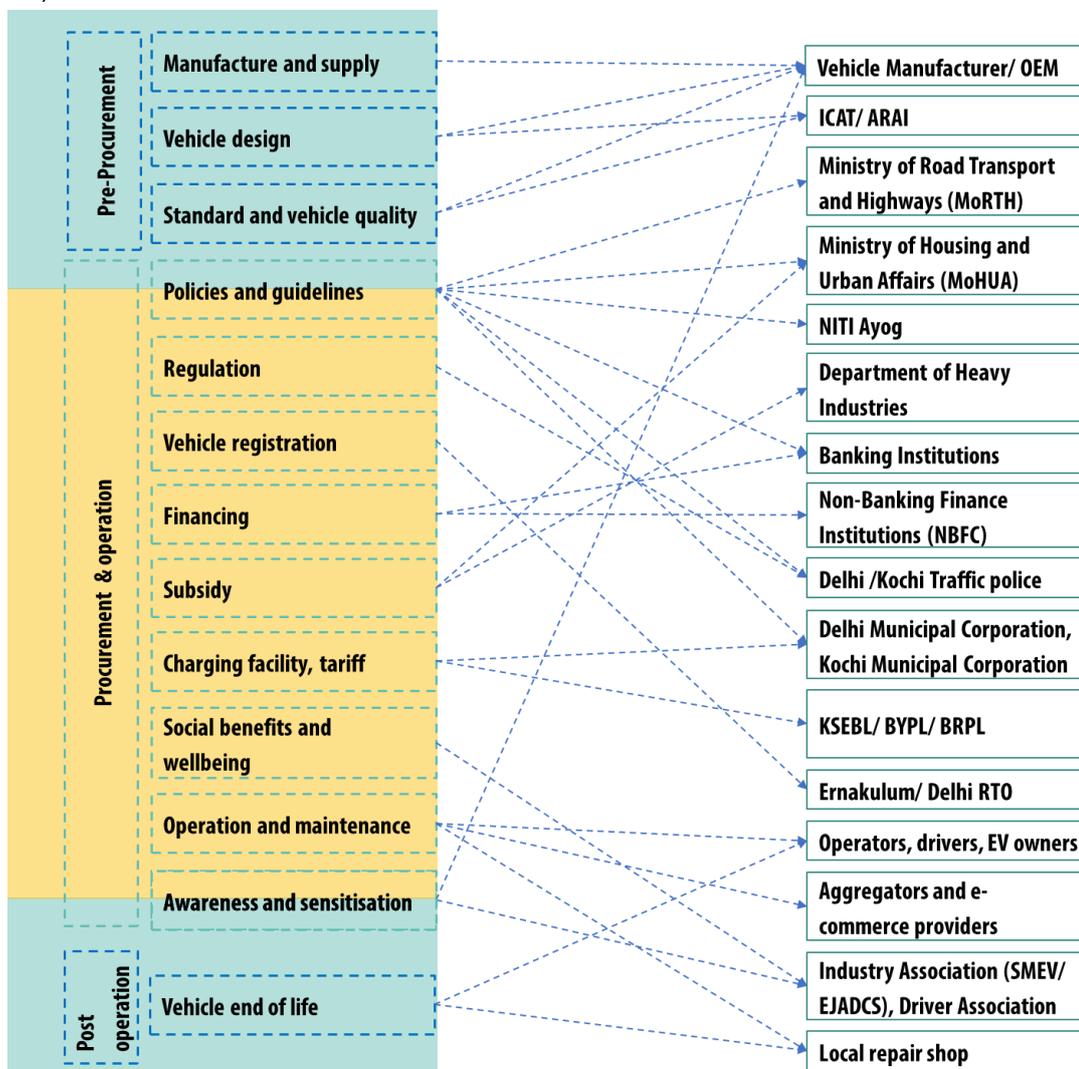
Figure 2 : Origin, destination, and routes of e-rickshaw from survey locations in Delhi

The stakeholders included in surveys were e-rickshaw drivers, operators, traffic police officials, informal charging service providers, swapping station operators, e-rickshaw manufacturers, and commuters along with some cycle-rickshaw operators.



4. Stakeholders

In India, e-rickshaw ecosystem involves various actors as stakeholders with their roles. The stakeholders at central, state and city level with their existing roles in e-rickshaw ecosystem in Delhi and Kochi are illustrated below (detailed roles are discussed in annexure 2 of this document):



5. E-rickshaw life cycle and challenges

The life cycle of an e-rickshaw can be categorised under three phases, as illustrated below. The details of existing status and challenges in each stage is discussed briefly in this section. These include the observations from the city of Delhi and Kochi.

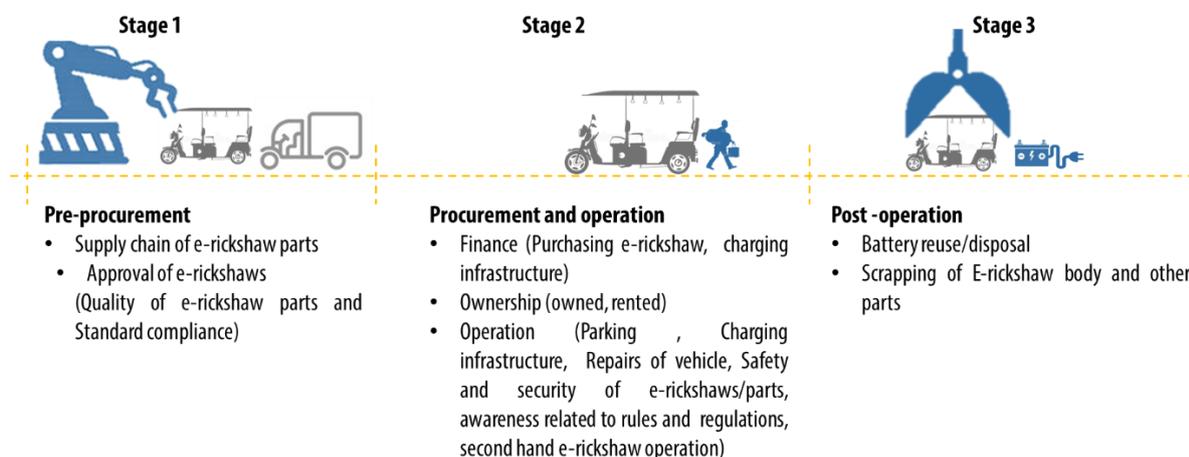


Figure 3: E-rickshaw life cycle

5.1. Stage 1 - Pre-procurement

E-rickshaws are usually assembled in India in the organised sector, using parts imported (controller, motor and Li-ion batteries majorly) from other countries and other parts from India (chasis, body, tyres and tubes, seats, mirrors, head light, horns and other non electric parts). The upfront cost of these e-rickshaws range between INR 1.14 lakhs to INR 1.73 lakhs. Some local assemblers also import completely knocked down (CKD) units from other country and assemble them in India (unorganised sector) which are usually cheaper than the standard e-rickshaws and range between INR 40000 to INR 75000.

The supply chain of these e-rickshaws in the unorganised and organised sector is illustrated in the table below:

Sector	Parts	Manufacturing	Market
 Organised sector	Imported from China <ul style="list-style-type: none"> Axle Controllers Li-ion batteries 	Formal e-rickshaw manufacturing companies manufacture these vehicles complying with the ARAI/ICAT standards	Cost – INR 125000 to 185000
 Unorganised sector	Low quality, cheap parts Imported from China- <ul style="list-style-type: none"> E-rickshaw outer body Controllers Motors Locally procured (India) <ul style="list-style-type: none"> Headlights and horns Seats and mirrors Batteries & chargers Tyres & tubes 	Assembled locally with low quality parts Often assembled by the former cycle rickshaw manufacturers or local manufacturers	Cost of e-rickshaws ranging between INR 40000-75000 Consumer group Low disposable income Rural migrant

These units assembled in the organised sector are tested by the International Centre for Automotive Technology (ICAT)/ Automotive Research Association of India (ARAI) and approved to be operated on road, while the CKD units are of very low quality and difficult to

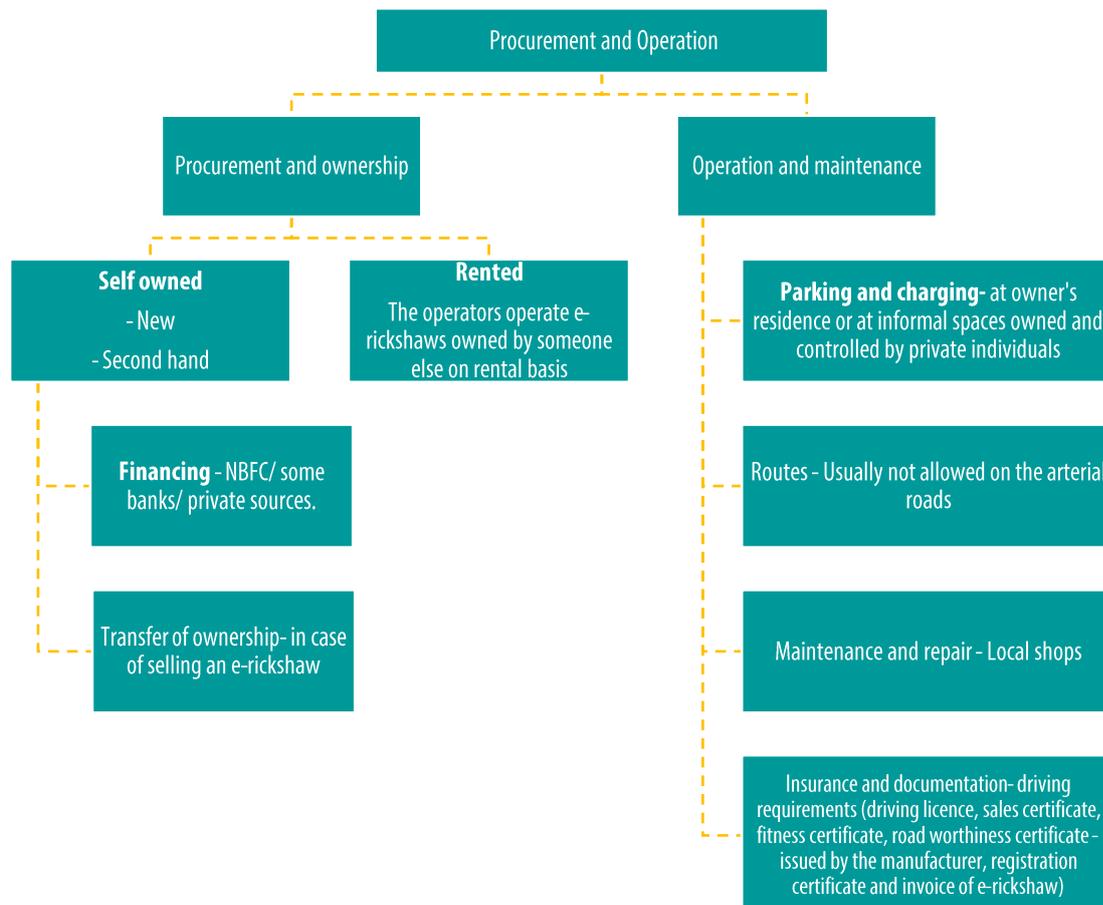


distinguish leading to various safety and security concerns when all of these e-rickshaws are operating on roads. Also, the model of e-rickshaws are not tested on a random sampling basis due to which the model sent for approval is according to the standards and the other vehicles are modified/ altered according to the demand and sold. In some cases, this alteration in vehicles is done after they are sold. Challenges in this stage is summarised as follows:

<p>Sub-standard quality vehicles</p>	<ul style="list-style-type: none"> •E-rickshaw components are imported from countries outside India but are assembled in India, usually assembled in local workshops without complying with standards resulting in substandard quality e-rickshaws which are prone to accidents.
<p>Illegally assembled e-rickshaws more popular</p>	<ul style="list-style-type: none"> •The e-rickshaws assembled at local workshops without considering the safety standards cost less than the standard ones and usually sell about 40,000 e-rickshaws a month against 10,000 to 15,000 e-rickshaws a month in case of organized players selling e-rickshaws complying by the safety standards. This further increases the regulatory challenges
<p>Standard and compliance</p>	<ul style="list-style-type: none"> • Lack of Continuity of production (CoP) standard certificate • E-rickshaw models approved by ARAI/ ICAT are modified/ altered as per the demand after approval and are difficult identify and regulate when operating on roads.

5.2. Stage 2 - Procurement and operation

This stage is briefly summarised in the illustration below:



In case the operator lacks any of the documents required for operation or is not following the driving rules/operating on restricted roads then a challan is generated by the traffic officer or the e-rickshaw is impounded and released only after the challan is paid. In case of e-rickshaws purchased from unauthorised dealers, the vehicle model is not approved by ARAI/ICAT and is impounded and not returned to the operator. Further, the e-rickshaw operator needs parking and charging space and service centres/local repair shops. E-rickshaws are usually parked and charged at home (if there is space) or at the informal bulk charging and parking areas.

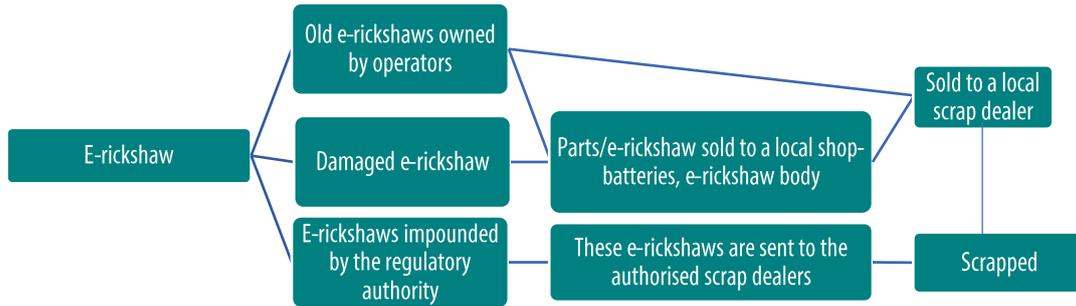
Major challenges, as observed during interaction with the stakeholders related to e-rickshaws during the phase of e-rickshaw procurement and operation are as follows:

Lack of formal finance	<ul style="list-style-type: none"> • Few dedicated EV loans are available for the buyers to procure e-rickshaws leading to low confidence of financing. Informal finance market and NBFC charges high interest rate with short loan tenure and low loan to value ratio which forces drivers to rent out illegal. E-rickshaws on daily 300 to 400 INR rent instead of buying a e-rickshaw through loan.
Unregulated routes and fares	<ul style="list-style-type: none"> • In an unplanned deployment and operation, the routes are decided by the operators and associations which result in unregulated routes i.e., some areas are overserved while some are underserved and also the per km fare is higher in some areas than in the suburban areas leading to shift of operations towards areas which has higher profits.
Regulation in operation of e-rickshaws	<ul style="list-style-type: none"> • Lack of strict enforcement of regulations related to overloading of passengers, violation of traffic norms, maintenance and standard compliance of e-rickshaws leading to various safety hazards. The operators also lack awareness about the rules and regulations leading to more defaults.
Charging facilities by unorganised sector- Power theft	<ul style="list-style-type: none"> • Currently, e-rickshaw charging infrastructure is largely owned, operated and managed by the unorganised sector and the e-rickshaw owners pay fixed money (INR 100 to 150) for parking and charging at these facilities. These usually do not have commercial electricity connection for bulk charging leading to power theft resulting to huge financial losses (INR 150 crore losses in Delhi in 2018) and fire safety hazard.
Regulation of modified and unregistered e-rickshaws	<ul style="list-style-type: none"> • The e-rickshaws are modified after being approved by ARAI/ICAT and when these e-rickshaws operate on roads with registered e-rickshaws, unregistered e-rickshaws and other modified versions, it is difficult for the regulators to regulate them
Unregistered e-rickshaws	<ul style="list-style-type: none"> • Lack of clear estimate of the number of unregistered e-rickshaw operating impact the planning for support infrastructure, analysing the electricity requirement for charging and other aspects. Thus, estimation of these unregistered e-rickshaws is required.
De-registering e-rickshaws	<ul style="list-style-type: none"> • At present, there is no provision for de-registering an e-rickshaw. In case the vehicle is stolen, then the owner can't de-register his vehicle and buy another e-rickshaw under his name.

5.3. Stage 3 – Post-operation

The post operation stage includes the end of life of e-rickshaws, i.e. after the e-rickshaw loses its operational usability. At the end of operation, e-rickshaw owner sells the batteries and other usable parts in the informal market or sells the entire e-rickshaw to a local shop from where the usable parts are extracted and the remaining parts/body is sent to the local scrap dealer/authorised scrap dealer.





The major challenge is due to unregulated market of e-rickshaw end of life, summarised as follows:

<p>Lack of organised battery waste handling facilities</p>	<ul style="list-style-type: none"> •Lead acid batteries in e-rickshaws require replacement at every 8 to 12 months, the old batteries are given to the local shopkeepers for a specific discount in the new batteries. •These batteries leak and cause environmental hazard if not handled properly.
<p>Lack of rules related to end of life of e-rickshaws</p>	<ul style="list-style-type: none"> •Since e-rickshaws are largely owned and operated by private individuals in unorganised sector, end of life of e-rickshaw and its parts is required to be focused.



6. Way forward

E-rickshaws have become a popular shared last-mile connectivity option in the Indian cities. Whether it successfully replaced cycle rickshaws easing the life of rickshaw drivers or became an alternative mode of transport and created its own identity can be debated but it can be stated that e-rickshaws are successfully filling the gaps of last-mile connectivity and public transport with their affordability, availability, and flexibility. E-rickshaws also an important source of income and self-employment for unskilled and semi-skilled workers. The upcoming technological and infrastructural advancements like battery swapping, integration of renewable energy with battery swapping, and its integration with renewable energy storage will result in regularization of e-rickshaw charging and reduce the dependency on fuel based generated electricity.

Since, the role of ULB is very important in deployment of e-rickshaws, a planned formal institutional arrangement is necessary for an effective e-rickshaw operation in a city. The city government/ULB plays an important role in promoting e-rickshaws as a last mile connectivity mode. In case of a regulated market, in tier 1 cities, ULB plays the role to regulate the operation of e-rickshaws to avoid conflict with other vehicles, or deploy and operate in case of a planned e-rickshaw operation. ULB should play the role of a combination of regulator, promoter and facilitator in case the e-rickshaws are owned and operated by the unorganised sector.¹⁴

Further, actions for improving of e-rickshaw pre-procurement, procurement and operation, post-operation stages in Indian cities are:

6.1. Pre-procurement

The regulators should ensure standardisation of the vehicle body and update the manufacturing standards for better quality and design of vehicles. The OEMs should focus on improving the **e-rickshaw design** with more secure battery compartment to prevent theft, better underbody design and motor protection to prevent damage and water ingress and increase stability to prevent toppling over. Vehicle design should be modified in a way that the local shops should not be able to assembled/ de-assembled the vehicle. The design should be ARAI/ICAT approved and the adherence of the vehicles to these standards should be ensured through regular checking of e-rickshaws operating on roads.

6.2. Procurement and operation – Explore financing options, revision in rules and regulations and strict implementation

6.2.1. Financing

There is potential for innovation in EV financing through programs like interest subvention and first loss guarantee schemes and exploring the existing options of MUDRA loan, NULM, etc. Loans can be provided under DAY- NULM for e-rickshaws, which is not only non-collateral loan with lower interest rate due to interest subvention but it will address non-willingness of banks to provide loans. Banks can approach Credit Guarantee Fund Trust for Micro and Small Enterprises (CGYMSE) or any other appropriate Guarantee Fund for the purpose of availing guarantee cover for SEP loans as per the eligibility of the activity for guarantee cover. Such a guarantee covers to loans given for e-rickshaws will take away non-performing assets (NPA) apprehension of the banks in giving loans for e-rickshaws and will motivate banks to provide such loans. Further, e-rickshaws buyers should be provided loans through State Financial Agencies (Kerala Government has proposed this, and there is a need to actualise it)

RBI should provide priority sector status to EVs to popularise the formal financing market for e-rickshaws. Further, actions like interest rate subvention will reduce the interest rate on loans for procuring e-rickshaws, product guarantees and warranties by manufacturers

¹⁴The details of city's role as a promoter, regulator and a facilitator is discussed in detail in the Handbook – E-rickshaw deployment in Indian cities (Ghorpade et al., 2019)



and risk sharing mechanism (government and multilateral and fleet operator led) will support in improving the confidence of banks and create a second-hand market in long term.

There can be three broad business/finance models for financing EVs, electric vehicle supply equipments (EVSE) and charging infrastructure, categorised by the stakeholder group responsible, as follows:

The Government – Driven Model – Provisioning of EVs, EVSE and public charging infrastructure can be led by government agencies such as municipal corporations, urban transport authorities, State Electricity Boards/DISCOM, State Transport Corporations, etc in several ways – owning and operating by the government agencies or owning by government agencies and operation by private agencies or owning and operating by government and private sector under various forms of PPP. For example, Central and various state EV policies have given clear mandate to its agencies to set up, own and lease EVs and EV charging facilities on self-owned basis and on revenue sharing basis (PPP basis).

The Consumer-Driven Model - This model is employed for private and semi-public EVs, EVSE and EV charging facilities at malls, commercial or institutional establishments, retail shops, restaurants etc., and by private EV owners and fleet operators that have space available to run EVs or have parking available on their premises to host EV charging facilities. These institutions will most commonly partner with a Charger Point Operator (CPO).

The Service Provider Model – The EVs, EVSE, Charge Point owner who drives EVs, EVSEs and charging provision for public and semi-public charging. Under this model, the private enterprise owns and operates EVs, EVSE and EV charging stations.

6.2.2. Regulations

Traffic police face lot of difficulty in regulating e-rickshaws on roads, mandatory awareness sessions for the drivers/ operators should be organised for the driving requirements, documents, road safety rules and regulations and other important issues, through the e-rickshaw driver association/ associations in each area of e-rickshaw operation. **Monitoring of safety standards** for e-rickshaws operating on roads should be more stringent, with impounding of unregistered e-rickshaws to discourage more buyers/ drivers/ operators to opt the unregistered e-rickshaws.

In some cities, (including Delhi) e-rickshaw operation is restricted on some routes, these routes should be reviewed and revised as per need basis at every five years. This will address the illegal operation of e-rickshaws on routes on which these are not allowed, to some extent.

There is a need to develop the second-hand market and streamline the re-sale of e-rickshaws/ change of ownership after assessing the vehicle fitness certificate. This will address the issue of lack of confidence among the financial institutions.

Further the unregulated charging facilities can be controlled by attracting e-rickshaw drivers/ operators towards authorised/ regulated market of battery swapping facilities. The business model for integration of renewable energy to power the charging/swapping stations should be explored¹⁵. In such a case, parking spaces for e-rickshaws must demarcated as the e-rickshaws currently charge and park overnight at the informal charging facilities.

6.3. Post-procurement- Strict rules and compliance, provision of de-registering

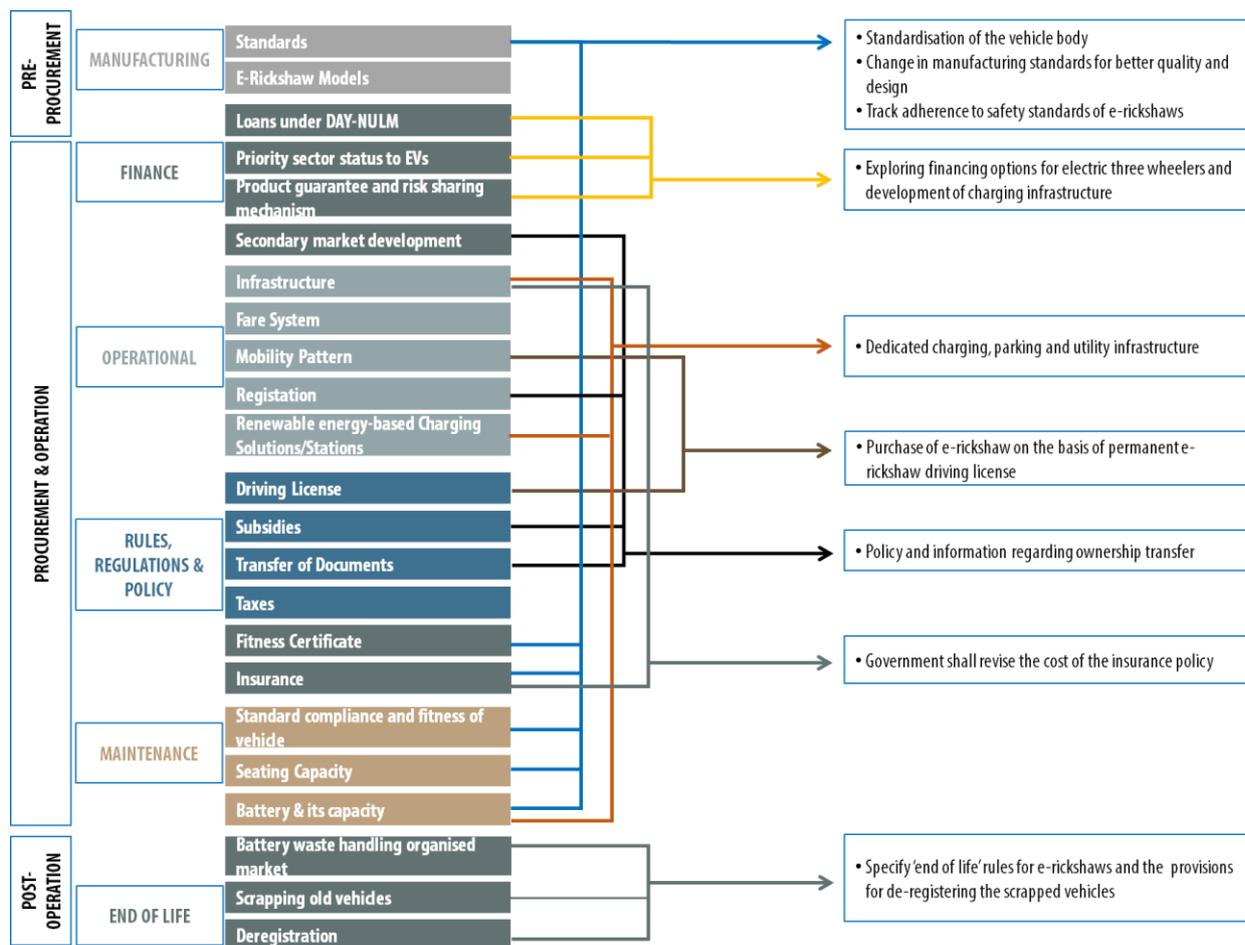
An organised market for battery waste handling is required which can be developed through strict rules and ensuring compliance of the same. Provision for de-registering is also required so that e-rickshaw operators are encouraged to scrap their old vehicle in organised market and can buy a new e-rickshaw in their own name after de-registration.

Thus, a strategic mix of e-rickshaw and e-auto deployment is required in a city. E-rickshaws has a speed limit of 25kmph and can be operated on secondary roads for last mile connectivity to the public transport modes while e-autos should be used to fill the gaps of

¹⁵ Discussed in detail in Annexure 3 of this document



public transport and can be operated on arterial roads of a city. The summary of way forward for the cities is illustrated in the figure below:



Further, the **framework for standardisation of e-rickshaw operations** and the stakeholders along with the actions required, is summarised as follows:

		Monitoring of unfit/illegal e-rickshaw	Organisation (Association, social benefits, etc.)	Deployment of Infrastructure, tariff finalisation	Finalising the routes, fares, etc.	Updation of regulation/rules and policies	Regular revision of certification & standards	Financial Incentives	Buy back
National level	MoRTH								
	MoHUA								
	NITI Ayog								
	DHI								
	RBI								
State level	Power distribution company/ DISCOM								
City level	ULBs								
	Traffic Police								
	RTO								
	Owners, Operators, Drivers								
0	Banking institutions								



	OEMs								
	Aggregators and e-commerce providers								
	Charging station developers/operators								
	Industry Association Driver Association								
All	ARAI/ICAT								



Annexure 1 – Regulations and initiatives related to electric three-wheelers and charging infrastructure

The Central and the state governments (Delhi and Kerala) have formulated several supporting/incentivising schemes and policies to promote sustainable transport through e-rickshaws and to regulate their functioning in Delhi. These include:

National level

1. **National Electric Mobility Mission Plan (NEMMP 2020)**- It was launched in 2013 to promote manufacturing and use of electric vehicles in India. It aims to achieve national fuel security by promoting hybrid and electric vehicles. It focuses on two, three and four-wheeler vehicles but mentions nothing specifically about e-rickshaws.
FAME India - Faster Adoption of Electric/Hybrid Vehicles (FAME) was announced on 8 April 2015 by the Government of India to be implemented in phases. It was introduced by Ministry of Heavy Industries and Public Enterprises under National Electric Mobility Mission Plan (NEMMP). Detail of FAME I and II is as follows:
FAME I: It aimed at market creation through incentives (subsidy outlay of Rs.795 crore) across segments of vehicles.³⁶ It provided subsidy on the purchase of e-rickshaws (INR 25,000 – INR 61,000 depending on the model)³⁷. FAME scheme also included details of registration of Original Equipment Manufacturer (OEMs) and vehicle models.
FAME II was also announced on 28 February 2019 by the Government of India, proposed to be implemented from 1 April 2019. It has total outlay of INR 10,000 crore for 3 years. About INR 1000 crore out of total are sanctioned for setting up charging stations. It aims to support vehicles of all categories; 5 lakhs are allocated for 3 wheelers to be used as public transport modes or registered as commercial vehicles.
2. **Motor Vehicles (Amendment) Act, 2014**- This notification was issued on 8 October, 2014, by the Ministry of Road Transport and Highways, Government of India. This is also known as the Central Motor Vehicles Sixteenth Amendment (Govt. of India 2014a) Rules and the e-rickshaws and e-carts were categorized as a separate category of transport vehicles. It defines e-rickshaws and provides their specifications as:
 “E-rickshaw” means 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, and not more than 40 kilograms of luggage in total.
 - (ii) The net power of its motor is not more than 2000 watt.
 - (iii) The maximum speed of the vehicle is not more than 25 kilometres per hour.
 It also stated that the driving license issued or renewed by the licensing authority for the operation of e-rickshaws will be valid only for three years or till its expiry date, whichever is earlier.
3. **Central Motor Vehicles Rules (CMVR Amendment, 2015) (Ministry of Law and Justice, 2015)**- It can also be referred to as The Motor Vehicles Amendment Act, 2015. It stated that e-rickshaw models must be approved by the International Centre for Automotive Technology (ICAT) at Manesar, Vehicle Research and Development Establishment (VRDE) Ahmednagar, Automotive Research Association of India (ARAI) in Pune or the Indian Institute of Petroleum (IIP) in Dehradun. CMVR (Amendment) 2015 was implemented on January 7, 2015 to clarify the procedure for obtaining driving licenses, related permits and other formalities required to drive an e-rickshaw, and provide the definition of e-rickshaws. It also stated that the specifications for the speed and dimensions can be regulated through rules that can be made under The Motor Vehicles Act, 1998.
4. **Pradhan Mantri Mudra Yojana (PMMY), 2015**- The scheme was launched by the GoI¹⁶ on April 8, 2015 with an aim to “fund the unfunded”, enabling small borrowers to take loans from PSUs¹⁷ and to return the amount within five years at very low rates of interest. There were three categories of loans - “Shishu” (up to Rs 50,000), “Kishor” (from Rs 50,000 to Rs 5 lakh) and “Tarun” (from Rs 5 lakhs to Rs 10 lakh) (Micro Units Development and Refinance Agency Limited, 2015)

¹⁶ GoI: Government of India

¹⁷ PSUs: Public Sector Undertakings



5. **Central Taxi Policy-** This was introduced by MoRTH in December 2016. It provides provisions related to e-rickshaws which should be allowed to ply on the city roads to provide last-mile connectivity to major public transport modes as they are a low-cost and zero-pollution option. The states may restrict the movement of e-rickshaws in certain areas in view of traffic conditions or their differential speeds.
6. **Model Building byelaws 2019** - In February 2019, Ministry of Power issued guidelines and standards for setting up charging infrastructure for electric vehicles as an amendment of the Model Building Byelaws 2016, supporting long term India's vision on implementing electric mobility
7. **Production-Linked Incentive (PLI) scheme** – PLI Scheme worth INR 18,100 crores (US\$2.4 billion) was approved in June 2021 for investments in advanced chemistry cell (ACC) battery manufacturing and worth INR 26,058 crore (US\$3.5 billion) approved for automotive manufacturing focusing on EVs and hydrogen fuel cell vehicles.¹⁸

State level

1. **Kerala EV Policy 2019** - Transport department of Kerala Government drafted a 'Policy on Electric Mobility' for the state of Kerala and issued the order on 29 September 2018. Its vision is to promote shared mobility and clean transportation. It aims to ensure environmental sustainability, pollution reduction, energy efficiency and create an ecosystem for manufacturing EV components in Kerala. It proposed exemption from road tax to EV for initial period of three years, capital subsidy for Electric 3-Wheelers and for setting up public charging stations (PCS) and bulk charging stations (BSC). Beside these other incentives provided are exemption from state tax, free permits to fleet drivers, toll charges and free parking. Electric auto rickshaws are specifically focused in 3-wheeler category.
2. **E-Rickshaw Sewa Scheme, Delhi-** The scheme permits vehicles bought before October 2014 to get a certificate of road worthiness from their manufacturer or registered e-rickshaw association, and allows plying of e-rickshaws in the NCT of Delhi, provided they comply with certain specified conditions (GNCTD 2014).
3. **Subsidy scheme (2016) Delhi-** The Delhi Government has launched a scheme that provides Rs.15000 as subsidy to a total of 6000 owners of registered e-rickshaws; the amount is Rs 30000 for registered e-rickshaws bought after 2016. The subsidy is provided by the Delhi Pollution Control Committee, an autonomous body under the administrative control of the Department of Environment, GNCT Delhi.
4. **Initiative allowing domestic charging of e-rickshaws-** Delhi Government allowed domestic charging of e-rickshaws on 31st August 2017. In 2018, a separate tariff was created for e-rickshaw charging station with a flat rate of INR 5.50/KWh.
5. **Delhi EV Policy 2020** – GNCT of Delhi approved the Delhi EV Policy on 27th November 2018 which was further updated on 7th August 2020. The primary objective was to reduce the emissions from the transport sector through rapid adoption of EVs.
6. Plan to develop charging stations
7. **Registration of e-rickshaw models with lead acid battery discontinued** - The order from the Transport Department, Government of Delhi first stated that the e-rickshaw models other than lithium ion battery will not be registered after 31st July 2022, which was further extended till 31st October 2022 and the registration of lead acid battery models of e-rickshaws was discontinued in Delhi.¹⁹

¹⁸ "Government has approved Production Linked Incentive (PLI) Scheme for Auto Industry and Drone Industry to enhance India's manufacturing capabilities," PIB, September 15, 2021. <https://pib.gov.in/PressReleasePage.aspx?PRID=1755062>.

¹⁹ (Transport Department, Government of Delhi, 1 September 2022)



Annexure 2- Stakeholders and their existing and expected roles

Level	Stakeholder	Existing roles and expected future actions to improve e-rickshaw ecosystem
Central level	Ministry of Road Transport and Highways (MoRTH) Ministry of Housing and Urban Affairs (MoHUA) NITI Ayog	<ul style="list-style-type: none"> Develop policies and guidelines for efficient integration e-rickshaws as last mile connectivity modes with other modes of public transport in the city
	Department of Heavy Industries	<ul style="list-style-type: none"> Provide subsidy through FAME scheme
	Reserve Bank of India	<ul style="list-style-type: none"> Take complementary regulatory measures that support the risk-sharing instrument Provide an incentive for FIs to finance EVs that is providing Priority Sector Lending (PSL) status to EVs (this has a potential to institutionalize the role of finance in India's EV transition).
State level	Power distribution company/ DISCOM	<ul style="list-style-type: none"> Analyse and approve the charging facility locations for e-rickshaws Approvals for electricity facility for developing the charging stations
City level	Urban Local Bodies (ULBs)	<ul style="list-style-type: none"> Decision on deployment of e-rickshaws Finalise the locations for developing regulated charging facility for e-rickshaws Regulate and monitor the operations of e-rickshaws
	Traffic Police	<ul style="list-style-type: none"> Route rationalisation Initiatives for awareness of e-rickshaw drivers/operators and users
	RTO	<ul style="list-style-type: none"> Registration of e-rickshaws
	Owners, Operators, Drivers	<ul style="list-style-type: none"> Operation of e-rickshaws Ensuring the safety compliance of the vehicle and its renewal as required. Abide by the rules and regulations related to e-rickshaw operation
Others	Banking institutions	<ul style="list-style-type: none"> Provide credit to manufacturers, distributors, retailers, buyers of EVs
	Non-banking financial institutions (NBFC)	<ul style="list-style-type: none"> Provide credit mainly to the buyers of EVs
	OEMs	<ul style="list-style-type: none"> Manufacture and supply quality and standard vehicles Provide guarantees for product quality and performance Buyback programs by OEMs will help in defining a resale value and creating regulated second-hand market Battery OEMs can initiate battery repurposing and recycling programs
	Aggregators and e-commerce providers	<ul style="list-style-type: none"> Operate fleet for delivery of goods and services Credit guarantees and utilization guarantees to driver partners can enhance the confidence of financiers in providing loans for this use case.
	Industry Association/ Driver Association	<ul style="list-style-type: none"> Ensuring social benefits Awareness among the drivers Ensuring wellbeing of e-rickshaw operators
All the above levels	ARAI/ICAT	<ul style="list-style-type: none"> Provide safety certification and standard compliance certificate to the e-rickshaws to ensure the safety of drivers/operators and users of e-rickshaws Control the approval of assembly lines and vehicle design permit



Annexure 3- Priority business models for E-Auto and charging infrastructure

Business cum Life Cycle Cost Model of E-Auto

Based on all primary and secondary information collected for E-Auto models of Piaggio and Mahindra a business cum life cycle cost model has been worked out based on following assumptions.

- Assumptions –
 - 100 kms running per day or 200 kms running per day
 - Charging one a day / charging twice a day – 330 days working per year
 - Battery life 1000 cycles, replacement of batter after 1000 cycles
 - Down Payment Rs. 30000 Loan Assumed Rs. 260000 for purchasing E- Auto
 - Loan @ 10 % to 14 % interest for period of 36 months
 - Loan of Rs. 100000 for battery replacement
 - Fare charged Rs. 10 per km.
- Per day net earning @ 100 kms running self-driving by owner Rs. 560 to Rs. 580 in first three years
- After Battery replacement in next three years per day earning could be Rs. 670 to Rs. 680
- Per day net earning @ 200 kms running self-driving by owner could be 1320 to Rs. 1390

Business cum Life Cycle Cost Model of E-Auto with swappable battery

- Assumptions –
 - 150 kms running per day or 225 kms running per day
 - Charging twice a day / charging thrice a day – 330 days working per year
 - Charging twice a day cost Rs. 320 / Charging thrice a day cost Rs. 480
 - Down Payment Rs. 30000 Loan Assumed Rs. 200000 for purchasing E- Auto
 - Loan @ 10 % to 14 % interest for period of 36 months
 - Fare charged Rs. 10 per km.
- Per day net earning @ 150 kms running self-driving by owner Rs. 740
- Per day net earning @ 225 kms running self-driving by owner Rs. 1200

Business Model for EV charging stations 21 to 30 kWh

- Assumptions –
 - Cost of Charger Rs. 600000 + Other Capital Cost Rs. 500000 = total Rs. 1100000
 - No loan assumed
 - 16 hours working assumed
 - A car takes 60 to 90 minutes for charging, consume average 25 to 30 units.
 - In 16 hours 10 to 12 Vehicles get charged.
 - 30 kWh charger will dispense 30 kWh power in one hour that is 30 electric units
 - Purchase price Per electric units Rs. 6, Sales price per charging unit Rs. 20
 - Payment Gateway transactions, software cost @2.5 % of the total income
- Annual Net Profit Rs. 700000 to 1200000 depending on land rent or revenue sharing model
- Payback period 11 to 20 months

Business Model for EV charging stations 50 to 60 kWh

- Assumptions –
 - Cost of Charger Rs. 1000000 + Other Capital Cost Rs. 700000 = total Rs. 1700000
 - No loan assumed
 - 16 hours working assumed
 - A car takes 60 to 90 minutes for charging, consume average 25 to 30 units.



- In 16 hours 20 to 24 Vehicles get charged.
- 60 kWh charger will dispense 60 kWh power in one hour that is 60 electric units
- Purchase price Per electric units Rs. 6, Sales price per charging unit Rs. 20
- Payment Gateway transactions, software cost @2.5 % of the total income
- Annual Net Profit Rs. 1350000 to Rs. 2400000 depending on land rent or revenue sharing model
- Payback period 9 to 15 months

Business model for EV Bulk Charging Station

- Assumptions –
 - Cost of Charger Rs. 1200000 + Other Capital Cost Rs. 1200000 = total Rs. 2200000
 - Cost of investment assumed @ 12 % per annum
 - BCS of 14 + 1 batteries - 16 hours working assumed
 - A swappable battery of 1.5 kWh needs 60 minutes for charging and temperature control.
 - In 16 hours, 180 batteries can be charged and replaced.
 - Purchase price Per electric units Rs. 6, Charging price of one battery Rs. 53
 - Two employees – eight hours shift
- Annual Net Profit Rs. 1400000
- Payback period 19 months.

Business model for Solar Powered E-2/E-3 Charging Station

- Assumptions –
 - 3.3 kWh X 3 – AC Type II 10 kWh Charger with 1.3 kWh Solar Panel on grid system
 - Cost of Charger Rs. 50000 + Solar panel Cost Rs. 150000 = total Rs. 200000
 - Three Charging points, 16 hours working assumed , 24 E-Auto can be charged
 - Total electricity units generated by Solar Panel in a month 158 – 160 / 1900 to 2000 units per annum = annual electricity cost saving of Rs. 12000
 - Purchase price Per electric unit Rs. 6, Charging price per electric unit Rs. 12
 - Payment Gateway transactions, software cost @2.5 % of the total income
- Annual Net Profit Rs. 264000 without solar panels / Annual Net Profit of Rs. 276000 with Solar
- Payback period 4 to 5 months without solar panels / 9 to 10 months with solar panels solution
- Additional investment of Rs. 150000 in Solar Panel add profit of Rs. 12000 only
- Increasing system to 4 kWh Solar Panel would mean payback period of 19 months so point in increasing solar panel capacity as it does not lead to better performance or better profit.
- Beside lack of financial viability issue of space constraints and lack of adequate subsidy are the issues
- The technology has not arrived yet - companies and start-ups are experimenting but no country around the globe has succeeded a fully-fledged solar power charging station





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