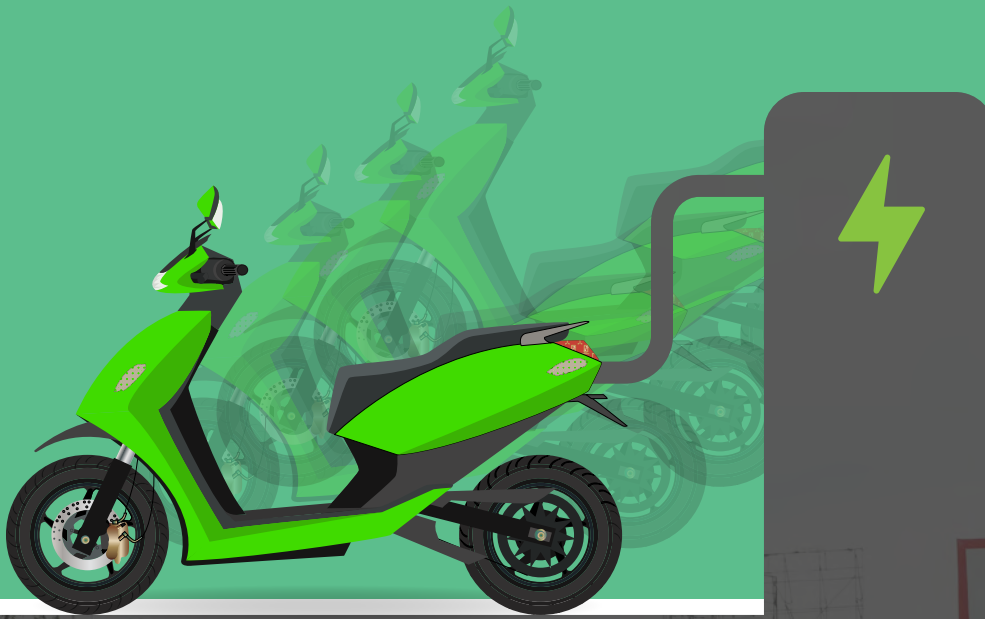




CATALYSING THE MARKET TRANSFORMATION OF ELECTRIC 2-WHEELER INSIGHTS FROM CONSUMERS AND STAKEHOLDERS



2023

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EXECUTIVE SUMMARY



Electric two-wheelers (E2Ws) are becoming increasingly popular as an eco-friendly mode of transport. They provide a convenient and efficient option for short-distance travel, particularly in urban areas. However, the widespread adoption of E2Ws in India still faces several challenges. In order to address these issues, the Alliance for an Energy Efficient Economy (AEEE) and International Copper Association India (ICA India) have teamed up to identify the key barriers hindering the adoption of electric two-wheelers in the market. The joint research project aims to identify effective pathways for a market transformation for E2Ws in India and promote the widespread adoption of E2Ws as a sustainable and efficient mode of transport.

The goal of the study is to facilitate the increased adoption of E2Ws in India by examining the perspectives of various stakeholders, including consumers, fleet operators, financial institutions, dealerships, and service centers. The study was conducted in three zones - North Zone (Delhi, Lucknow), West Zone (Mumbai, Jaipur, Ahmedabad, Rajkot), and South Zone (Bangalore, Coimbatore, Hyderabad, Chennai). The study collected 1159 responses from both E2W users and internal combustion engine (ICE) users across India, as well as E2W dealers, in order to gain a more comprehensive understanding of the E2W market across the country. The survey results revealed key insights about the prevalence of E2W users, their awareness of ICE options, and their willingness to adopt more eco-friendly modes of transport. The report covers key aspects of E2Ws, including purchase, charging, performance, aftersales, safety, retrofitting, etc. Chapter 1 introduces the E2W ecosystem and sets the background and need for the study. Chapter 2 details the scope and methodology adopted for the research. Various barriers and motivating factors and their role in attracting or deterring consumers from or towards EV adoption, like charging practices, usage behaviour, ownership cost, purchase experience, etc., were delved into. The chapter also details the respondents' profiles and the surveying techniques incorporated for the study, i.e., face-to-face interviews with E2W users and In-person qualitative discussions with the E2W dealers. It was found that the younger generations had an equal propensity towards both ICE and E2Ws. Also, the average income of EV owners was found to be higher than the average income of ICE two-wheelers. Chapter 3 discusses the findings and key insights from the consumer survey. It examines the key perceptions of customers regarding E2W and ICE vehicles and their purchase and usage practices. The chapter discusses important current and future triggers and barriers to EV adoption. Access to charging stations, Safety concerns, high upfront costs, long charging times, etc., were found to be the major deterrents towards EV adoption. Chapter 4 presents the key insights from the dealer consultation and discusses the various obstacles, including warranty and battery replacement costs, low margins, the lack of supplier credit facilities, battery backup, the high price of E2Ws, and low speed. These obstacles impede their ability to sell electric vehicles and compete with other types of vehicle dealers. Nonetheless, as the EV market grows and develops, manufacturers and dealers will be able to overcome these obstacles and establish a more sustainable and competitive EV industry. Chapter 4 presents the key insights from the dealer consultation and discusses the various obstacles dealers face, including warranty and battery replacement costs, low margins, the lack of supplier credit facilities, battery backup, the high price of E2Ws, and low speed. These obstacles impede their ability to sell electric vehicles and compete with other types of vehicle dealers. Nonetheless, as the EV market grows and develops, manufacturers and dealers will be able to overcome these obstacles and establish a more sustainable and competitive EV industry. Chapter 5 provides recommendations to address the different barriers to E2W adoption in India, like high upfront costs of E2W, charging stations, safety issues, battery issues, etc.

The whitepaper provides recommendations to address the challenges and barriers hindering the adoption of E2Ws in India. These recommendations cover various topics such as consumer perceptions, demand incentives, and product-related issues like servicing, safety, and performance. To encourage

the wider adoption of E2Ws, the whitepaper proposes several measures, including improving the availability of charging infrastructure, regular maintenance of charging points, and investment support to charging and swapping players. Additionally, partnering with financial institutions to offer affordable loans is recommended to make E2Ws more accessible to consumers. These measures are critical to overcoming the challenges faced by E2W users and promoting the adoption of eco-friendly transport options in India. To achieve the target of increasing energy efficiency and reducing carbon emissions by 33-35% by 2030, as set by the Indian government, it is crucial for the various stakeholders in the electric vehicle ecosystem to implement the strategies outlined in the whitepaper. The aim is to accelerate the adoption of E2Ws and support the government in achieving its goals.



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ACRONYMS



2W – Two-wheeler
3W - Three-Wheeler
ACC - Advanced chemistry cell
AEEE - Alliance for an Energy Efficient Economy
ARAI - Automotive Research Association of India
BAAS - Battery-As-A-Service
BIS - Bureau of Indian Standards
CEA - Central Electricity Authority
DC - Direct Current
E2W - Electric Two-Wheeler
E3W - Electric Three-Wheeler
EMI - Equated Monthly Instalment
EV - Electric Vehicle
FAME - Faster Adoption and Manufacturing of Electric and Hybrid Vehicles
GOI – Government of India
HSC - Higher Secondary Certificates
ICA - International Copper Association India Limited
ICE - Internal Combustion Engine
INR - Indian Rupee
kg - Kilogramme
km - Kilometre
kW - Kilowatt
LEV - Light Electric Vehicle
Li-ion - Lithium-Ion
MNCs - Multinational corporations
MoP – Ministry of Power
NAB - National Automotive Board (NAB)
NAMSP - National Advanced Battery Storage Program
OEM - Original Equipment Manufacturer
PCG - Partial Credit Guarantee
PLI - Production Linked Incentive
R&D - Research & Development
SMEs - Small and medium enterprises
SSC - Secondary School Certificates

CHAPTER 01

INTRODUCTION



India is one of the fastest-growing markets for electric two-wheelers (E2Ws) in the world. With a large population, increasing environmental concerns, and rising fuel prices, there is a growing demand for affordable and sustainable transport options, and E2Ws fit the bill perfectly. The Indian government has been promoting the adoption of electric vehicles (EVs) through various policy initiatives, such as tax incentives, subsidies, and the development of charging infrastructure. As a result, several Indian and international companies have entered the Indian E2W market, offering various models across different price points.

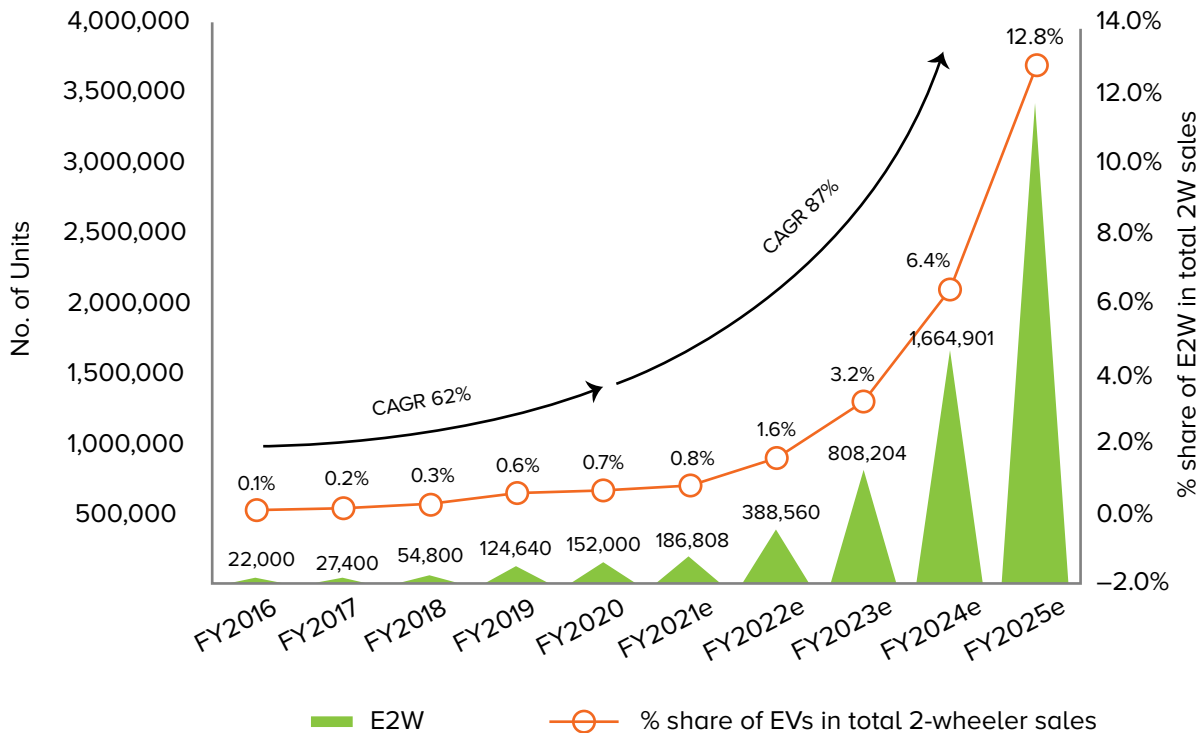


FIGURE 1: E2WS IN INDIA

(Source: <https://jmkresearch.com/electric-2-wheelers-to-clock-sales-of-34-lakh-units-by-2025/>)

The most popular E2Ws in India are electric scooters and electric motorcycles. Electric scooters are especially popular among commuters in urban areas, as they are affordable and easy to ride, and require minimal maintenance. On the other hand, electric motorcycles offer higher speeds and longer ranges, making them suitable for longer commutes and intercity travel. The Indian E2W market is expected to grow significantly in the coming years as the government continues incentivising electric vehicle adoption and more companies enter the market. This growth is likely to lead to a reduction in air pollution and lower dependence on fossil fuels and provide affordable and sustainable transport options to a large number of people.

This whitepaper builds on a previous whitepaper published by Alliance for Energy Efficient Economy (AEEE), in collaboration with International Copper Association India (ICA India), on the topic of E2W adoption in India. The previous whitepaper dealt with the broader issues related to adopting E2Ws in India by interacting with consumers and other stakeholders. This whitepaper aims to expand on the previous work by adopting a systematic pan-India approach to understanding the consumers' and dealers' perspectives and dilemmas regarding the advantages and challenges of E2W adoption in India. The whitepaper delves deeper into the specific challenges and opportunities across India and provides insights into the factors that drive or hinder the adoption of E2Ws in the country. It includes detailed analysis and recommendations on consumer preferences, pricing, financing, availability of charging infrastructure, regulatory frameworks, and marketing strategies.

Overall, this paper aims to provide a more comprehensive and nuanced understanding of the E2W market in India, with the ultimate goal of promoting the wider adoption of this sustainable and energy-efficient mode of transport.



CHAPTER 02

RESEARCH SCOPE AND METHODOLOGY



In order to get a better understanding of the E2W market in India, a study on EV adoption has been conducted by AEEE and ICA India. The study aims to identify potential barriers to adoption and any factors that may motivate consumers to consider purchasing an EV. The target segments of the study include traditional two-wheeler buyers, food delivery associates, E2W users, and E2W dealerships. The research methodology involves a mixed methodology comprising different surveys and one-on-one interactions to gather information about the propensity for EV adoption. An internal combustion engine (ICE) customer survey provides insights into traditional car buyers' current preferences and perceptions towards EVs. The food delivery associates survey provides information about how E2Ws are used in a commercial setting and the challenges these drivers face when using an EV. This survey aims to identify commercial drivers' specific challenges when using EVs, which can help in designing infrastructure and policies to support their needs.

The E2W user survey provides a different perspective on EV adoption, as E2Ws are becoming increasingly popular in certain regions. This survey provides insights into the user experience, charging infrastructure, and overall satisfaction with E2Ws. Discussions with E2W dealerships provide additional information about market trends, consumer demand, and E2W availability in a specific region. This helps identify any challenges dealerships face in promoting and selling E2Ws. Overall, a mixed methodology involving different types of surveys and discussions provides a comprehensive understanding of the propensity for EV adoption and helps identify potential areas for improvement in infrastructure, policy, and consumer education.

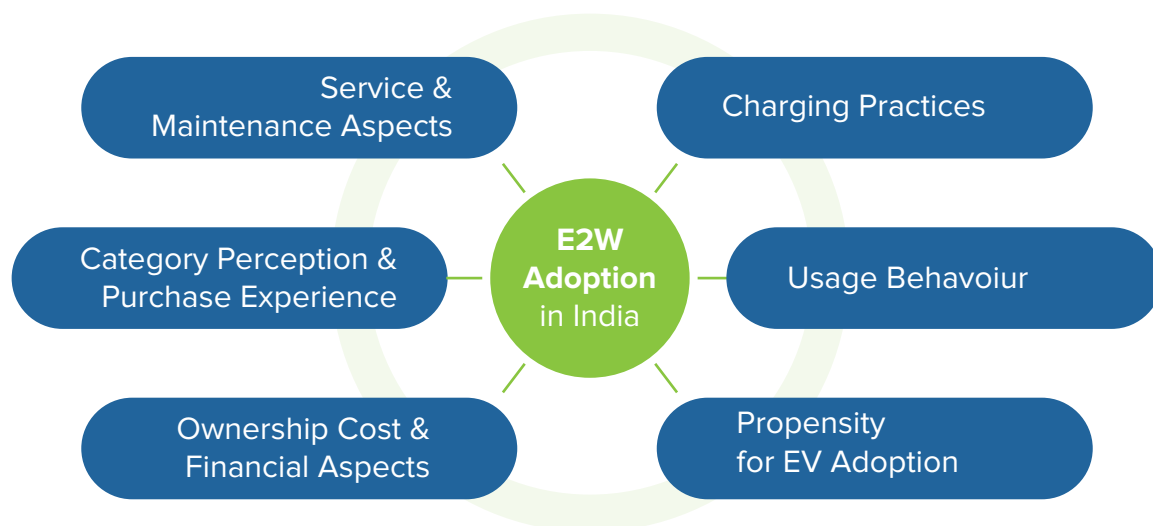


FIGURE 2: STUDY OBJECTIVES

The major topics covered in the surveys are summarised below:

Category perception & purchase experience - EVs are gaining popularity due to their environmental benefits and lower operating costs. While EV perception and purchase experience are improving, there are still challenges that need to be addressed to make them more accessible and attractive to buyers, including a lack of understanding of the technology, range anxiety, limited availability of models, high upfront costs, and a lack of charging infrastructure. To overcome these challenges, automakers and governments are investing in education and awareness campaigns, expanding the availability of different models, and working to make EVs more affordable. Efforts to expand charging infrastructure are also being made, such as installing more public charging stations.

Ownership cost & financing - EV ownership cost and financial aspects depend on factors like make and model, electricity cost, and government incentives. Lower operating costs and maintenance are advantages of EVs, and many governments offer incentives to offset their higher upfront cost.

However, EVs' upfront cost is still high due to batteries and charging equipment, and the resale value may be lower. As technology improves and economies of scale take effect, the cost of EVs is expected to decrease. It is important for buyers to carefully consider the costs and benefits of EVs and take advantage of any available government incentives.

Service & maintenance - EVs have different maintenance requirements than ICE vehicles, with no need for regular tasks like oil changes or exhaust system repairs. However, EVs have other components that require regular maintenance, such as the battery and charging system. Regular battery maintenance and avoiding extreme temperatures can help prolong battery lifespan, and charging infrastructure and associated costs should be considered. Regular software and firmware updates are also necessary. EV maintenance is generally less frequent and expensive than traditional ICE vehicles but requires regular attention and care.

Usage behaviour - EV usage behaviour can vary depending on factors such as the availability of charging infrastructure, electricity cost, and vehicle range. EV owners generally tend to charge their vehicles at home overnight and may also use public charging stations during the day for longer trips. They also tend to drive more efficiently and plan their routes to avoid running low on battery power. Additionally, the use of EVs tends to increase in areas with government incentives and regulations to promote the technology.

Charging practices - EV charging involves using electricity from the grid, and there are three types of charging systems. Level 1 uses a standard household outlet and is the slowest, taking 8-12 hours to charge a vehicle fully. Level 2 uses a 240-volt outlet and charges the EV in 4-8 hours, while Level 3 (direct current (DC) fast charging) uses a 480-volt outlet and can charge the EV in as little as 30 minutes. Most EV owners charge at home with Level 1 or Level 2, while public charging stations offer Level 2 and Level 3 options. Smart charging can help EV owners save money on electricity bills by making charging cheaper.

Propensity for EV adoption - Factors like the availability of charging infrastructure, electricity cost, and government policies affect the likelihood of EV adoption. Consumer preferences, awareness, & education, along with vehicle range, cost, & incentives, are also significant factors. Adoption rates differ by country, with national goals to phase out petrol and diesel vehicles in the future, further increasing the potential for EV adoption.

The study was conducted across ten cities in three different zones in India, providing a comprehensive overview of the E2W market in different regions across the country. Delhi National Capital Region (NCR) and Lucknow represented the North Zone; Mumbai, Jaipur, Ahmedabad, and Rajkot represented the West Zone; and Bangalore, Coimbatore, Hyderabad, and Chennai represented the South Zone. This approach enabled comparisons of the E2W market and adoption rates across different cities and regions. For example, the study compared the level of charging infrastructure and government incentives for E2Ws in cities such as Delhi NCR and Lucknow in the North Zone, Mumbai and Jaipur in the West Zone, and Bangalore and Coimbatore in the South Zone. Furthermore, the study compared the perceptions and attitudes of E2W users in different cities and regions in order to identify regional variations in consumer preferences and attitudes toward E2Ws.

The study entailed conducting 1159 individual surveys, out of which 658 were with E2W users across India and 400 were with ICE users. Additionally, 101 E2W dealers were interviewed to gain further insight into the E2W market across India. The survey results provided key insights into the prevalence of E2W users, their awareness of ICE options, and their willingness to adopt more eco-friendly modes of transport. The feedback given by the dealers provided a better understanding of the various advantages and disadvantages of E2Ws and the challenges that dealers face in the current market.

This information is crucial to developing a successful E2W industry in India. In the North Zone, 145 E2W users, 103 ICE two-wheeler users, and 20 E2W dealers were interviewed. Similarly, 235 E2W users, 152 ICE two-wheeler users, and 41 E2W dealers were interviewed in the West Zone. In the South Zone, 278 E2W users, 145 ICE two-wheeler users, and 40 E2W dealers were interviewed

TABLE 1: ZONE-WISE NUMBER OF RESPONDENTS

Zone	Current Owners & Users		E2W Dealers
	E2W users	ICE users	
NORTH (Delhi NCR, Lucknow)	145	103	20
WEST (Mumbai, Jaipur, Ahmedabad, Rajkot)	235	152	41
SOUTH (Bangalore, Coimbatore, Hyderabad, Chennai)	278	145	40
TOTAL	658	400	101

2.1. Target Segment and Respondent Profile

Faster E2W adoption will not only help India achieve emission reduction targets but also help the country achieve energy security and reduction of energy imports & the fossil fuel subsidy burden. This study's focus on potential and current E2W users is aligned with the Government of India's (GOI) target to electrify 80% of the country's two- and three-wheelers by 2030.

A target segment is a group of consumers based on criteria like age, gender, income, location, and interests. Understanding the respondent profile in a target segment entails compiling detailed information on attitudes, behaviours, and purchasing habits. This knowledge helps optimise marketing campaigns, messaging, and product/service offerings to meet specific needs and identify growth opportunities. Identifying the target segments interested in E2W products helps tailor the approach, maximising impact, and driving conversions. The target segments identified for the study are the following:

Current ICE two-wheeler owners and users: This segment includes individuals who currently own and use traditional ICE two-wheelers. Surveying this group can provide insights into their perceptions and attitudes towards E2Ws and any factors influencing their decision to switch to an E2W.

Current E2W owners and users: This segment includes individuals who currently own and use E2Ws. Surveying this group can provide information about their satisfaction with the product, charging infrastructure, and the overall user experience.

Existing E2W dealerships: This segment includes businesses selling E2Ws. Discussions with these dealerships can provide information about market trends, consumer demand, and any challenges they face in promoting and selling E2Ws. This can also help identify potential areas for improvement in terms of infrastructure, policy, and consumer education.

The two main interview techniques used in this study were face-to-face interviews with users using semi-structured questionnaires and qualitative discussions. The face-to-face interviews were in-person interviews with current ICE and E2W owners and users. The interviews were conducted using a semi-structured questionnaire that included a set of predetermined questions but also allowed for follow-up questions and open-ended responses. This technique provides detailed information about the users' perceptions, attitudes, and experiences.

In-person qualitative discussions were held with E2W dealers. The interviews were conducted in an open-ended, conversational format. They focused on market trends, consumer demand, and challenges the dealers face in promoting and selling E2Ws. This technique provided valuable insights into the current state of the E2W market and the perspectives of the dealers on what is required to achieve India's 2030 target for two- and three-wheelers.

Respondent Profile

It was observed that women used E2Ws more than ICE two-wheelers. E2Ws are often perceived as more environmentally friendly, quieter, and easier to operate than ICE two-wheelers. Moreover, E2Ws may be more accessible to women in terms of price, maintenance, and usage. There could also be cultural or societal factors that influence women's preferences for E2Ws over ICE two-wheelers. The 21-35 age group stands out as the group with the highest ownership of electric or ICE two-wheelers. It is not uncommon for this age group to be a significant demographic among two-wheeler owners. Respondents of this age are often in the early stages of their careers and have a relatively high disposable income, which may allow them to afford either type of vehicle.

Furthermore, individuals aged 21 to 35 may have a higher inclination toward new technologies such as EVs. This age group may also be more environmentally conscious and keen on minimising their carbon footprint. Moreover, due to their mobility needs, they may be more likely to possess electric and ICE two-wheelers compared to older age groups. The survey findings reveal that many electric and ICE two-wheeler users are salaried employees working in multinational corporations (MNCs) or private companies. This is likely because salaried employees in these organisations typically have a stable income, making purchasing and maintaining either type of vehicle feasible. Additionally, urban areas where these companies are usually located have a high concentration of two-wheeler riders. This may increase the need for employees in these jobs to have a two-wheeler. Moreover, MNCs and private companies are likely to offer their employees more professional and personal growth opportunities, which may translate into more disposable income to invest in electric and ICE two-wheelers.

The respondents in this scenario are probably both the owners and users of electric or ICE two-wheelers and the decision-makers for purchasing these vehicles. This indicates that these respondents have the financial means and desire to own and use these vehicles. Moreover, decision-makers have the flexibility to select the type of vehicle they want to purchase based on their preferences, requirements, and budget. The monthly household income of respondents who own and use E2Ws is slightly higher than that of respondents who own and use ICE two-wheelers. Since E2Ws are generally pricier than ICE two-wheelers and require different types of maintenance and charging infrastructure, individuals with higher household incomes are more likely to be able to afford the expenses associated with owning and operating an E2W. Furthermore, E2Ws are relatively new to the market and not as prevalent as ICE two-wheelers, which means they may be considered a luxury item and, therefore, more likely to be owned by people with higher incomes.

A considerable number of respondents who used either E2Ws or ICE two-wheelers were graduates, as well as holders of Secondary School Certificates (SSC) or Higher Secondary Certificates (HSC). This could be due to the fact that SSC/HSC passed respondents make up the majority of the population and can afford these vehicles. Moreover, individuals with higher education tend to have better access to information and resources, making them more likely to be interested in and aware of new technologies like EVs. Furthermore, it was noted that both E2W and ICE two-wheeler users had suitable home parking amenities, including a secure and covered parking space, like a garage or carport. This is critical to ensure their vehicles are kept safe and protected from environmental or external damage. Having appropriate parking amenities at home also enables convenient E2W charging and maintenance.

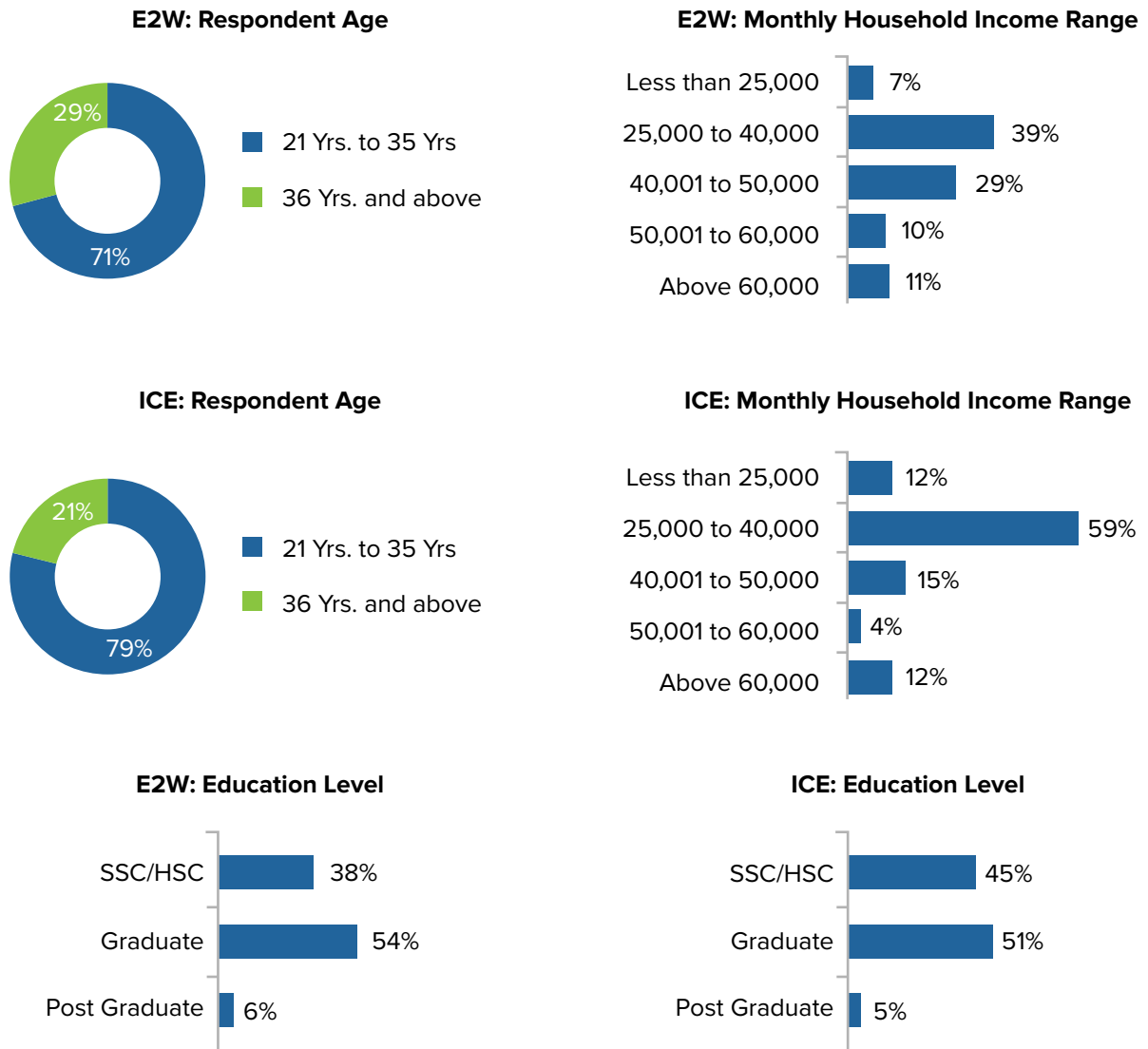


FIGURE 3: RESPONDENT PROFILE

CHAPTER 03

INSIGHTS FROM CONSUMER SURVEY



3.1. Consumer Perspectives: E2W vs. ICE Usership

The E2W market has rapidly transformed in recent years, experiencing significant growth thanks to advancements in battery technology and increased government support for clean energy initiatives. Many major players in the two-wheeler industry have launched electric models, and startups have entered the market, creating competition and driving innovation. Furthermore, the pandemic has contributed to a shift in consumer preferences towards E2Ws, with many individuals seeking more sustainable and cost-effective transport options. As the demand for E2Ws continues to increase, the market is expected to expand further, offering new opportunities for growth and innovation in the coming years.

3.2. Preferences and Usage Patterns of ICE and E2W Users in the Indian Two-Wheeler Market

The survey results indicate that ICE users preferred owning bikes, whereas E2W users preferred owning scooters/mopeds. This observation suggests a difference in the preferred mode of transport for ICE and E2W users. This could be due to various factors, such as cost, convenience, or personal preferences. Most users in both the ICE and E2W categories were first-time buyers of a two-wheeler vehicle, meaning they were purchasing their first motorcycle or scooter. This could be due to various reasons, such as a growing need for personal transport or increased two-wheeler affordability.

The different preferences of ICE and E2W users may also motivate first-time buyers to opt for a specific type of vehicle. Many E2W users were observed to have vehicles with a battery capacity of 2.1 to 3 kilowatt-hours (kWh). This could be due to various factors, such as the availability of vehicles with this battery capacity, vehicle cost, the range of vehicles with this battery capacity, or personal preferences. 2.1-3 kWh is a common battery capacity range for e-scooters and mopeds and provides a good balance between range and cost. Most E2W users preferred fixed batteries, which are permanently attached to the vehicle and cannot be removed. However, some exceptions exist, as a preference for removable batteries was observed in certain cities such as Rajkot, Delhi NCR, Lucknow, and Mumbai. This could be due to various factors, such as the availability of vehicles with removable batteries in these cities or personal preferences. Removable batteries can be convenient, as they can be easily swapped and charged separately.

A large number of users preferred lithium-ion (Li-ion) batteries. Li-ion batteries are rechargeable batteries that use lithium ions as the charge-carrying medium. They are known for their high energy density, low self-discharge, and low maintenance. This battery type preference could be due to the availability of vehicles with different types of batteries in different regions, cost, and/or personal preferences. Most respondents who are E2W users use them as their primary mode of transport. This means they use E2Ws to get around and rely on them for daily transport. This could be due to various reasons, such as cost-effectiveness, environmental concerns, convenience, or personal preferences.

With the continual improvement in the E2W range and charging infrastructure, an increasing number of individuals are opting for E2Ws as their primary mode of transport. There is low penetration of removable batteries in the E2W market, possibly due to the late entry of removable batteries in the EV market. Removable batteries can be removed from the vehicle for charging or replacement. They are not as common in E2Ws as fixed batteries permanently attached to the vehicle. This may be because removable batteries were not widely available or developed for E2Ws until recently. As the technology for removable batteries continues to improve, more manufacturers will likely start offering E2Ws with removable batteries, and the use of this type of battery will increase.

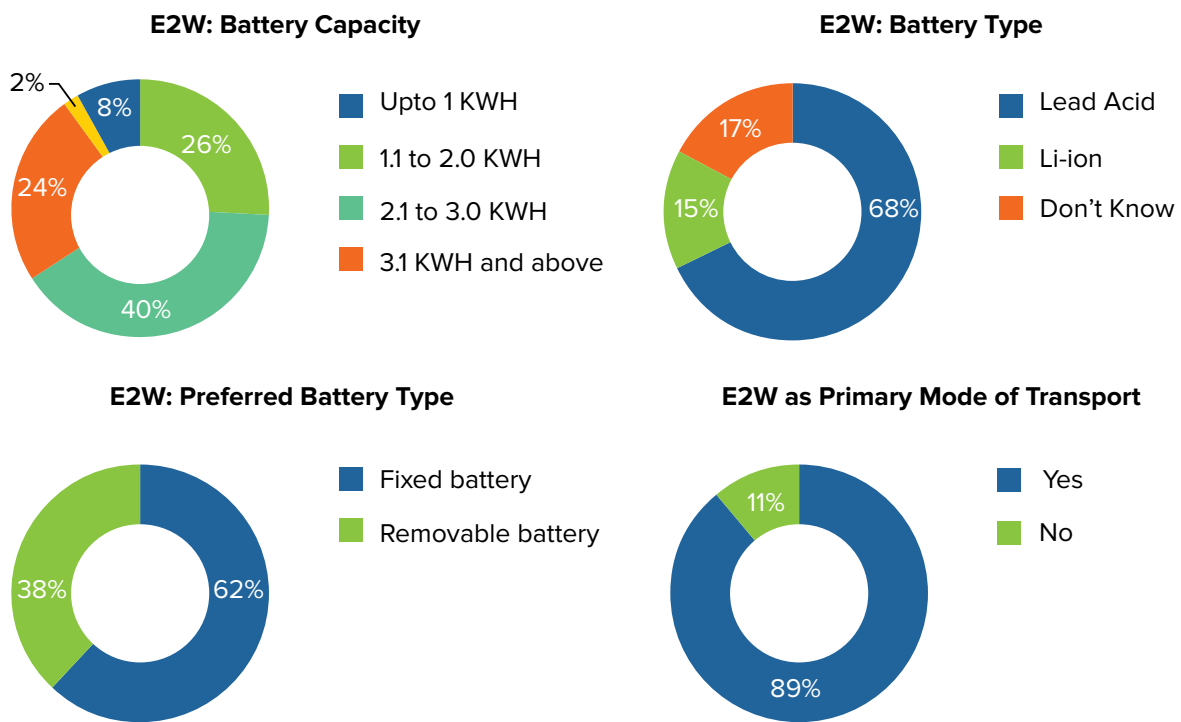


FIGURE 4: OWNERSHIP PROFILE

3.3. Available E2W Models for Current Users

In the Indian E2W market, there are an estimated 15-20 major players. These players include both domestic and international manufacturers that produce and sell electric scooters, motorcycles, and mopeds in India. However, this number may vary depending on the market definition and the source of information. As E2W demand grows, it is expected that more manufacturers will enter the market to meet this demand.

Most of the respondents own a Hero Optima E2W, followed by the TVS iQube. The Hero Optima is a scooter model produced by Hero Electric, which is a leading Indian E2W manufacturer. The TVS iQube is a scooter model produced by TVS Motor Company, another prominent Indian E2W manufacturer. The study also found that a considerable number of respondents own other E2W models, such as the Ather 450X and Ola S1 Pro. As the E2W market continues to grow and more players enter the market, it will be interesting to see how brand preferences evolve.

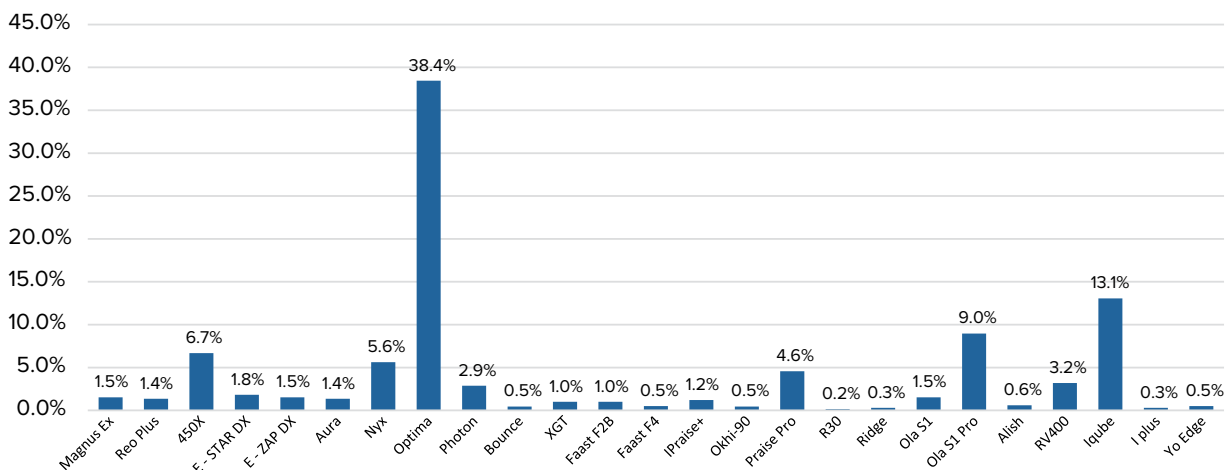


FIGURE 5: MAKE AND MODEL OWNERSHIP: COVERED SAMPLE

TABLE 2: E2W MAKE AND MODEL SPECIFICATIONS

Make	Model	Indian OEMs Vs Foreigner OEMs	FAME approved Vs Non-FAME	Ex Price (INR)	Showroom	Battery (kWh)	Capacity	Battery Type	Top Speed (KM / Hrs)	Driving Range(km)	Charging time(hours)
Ampere	Magnus Ex	Indian	FAME II	81,900		60V, 38.25Ah		Lithium-ion	50	80-100	6 to 7 Hrs
Ampere	Reo Plus	Indian	NON FAME	61,999		48V, 28Ah		Lithium-ion	25	55 - 65	5 to 6 Hrs
Ather	450 Plus	Indian	FAME II	1,34,147		3.7 kWh		Lithium-ion	80	85	5 h 30 min
Ather	450X	Indian	FAME II	1,55,657		3.7 kWh		Lithium-ion	80	105	5 h 30 min
Avon	E - STAR DX	Indian	NON FAME	60,000		48 V 20Ah LA		Lead Acid	24	65	7 to 8 Hrs
Avon	E - ZAP DX	Indian	NON FAME	62,500		Lead Acid (48V-60V 24Ah), Li-ion (60V 20Ah, 48V 25Ah)		Lithium-ion / Lead Acid	24	65	4-5 Hours Lithium , 7-8 Hours Lead Acid
Benling	Aura	Indian	FAME II	77,500		72V/40Ah		lithium-ion	60	120	5 to 6 Hrs
Hero	Nyx	Indian	FAME II	86,540		51.2V / 30Ah		Lithium-ion	42	138	4 Hrs & 30 Min
Hero	Optima	Indian	FAME II	85,190		51.2V / 30Ah		Lithium-ion	45	140	4 Hrs & 30 Min
Hero	Photon	Indian	FAME II	86,391		72V / 26Ah		Lithium-ion	45	90	5 Hrs
Infinity	Bounce	Indian	NON FAME	59,999		51.2V / 30Ah		Lithium-ion	65	85	4 to 5 Hrs
Komaki	XGT KM	Foreigner	NON FAME	82,000		60 V / 28 Ah		Lithium-ion	80	130 - 150	6 to 7 Hrs
Okaya	Faast F2B	Foreigner	FAME II	95,000		72 Volt 30 Ah 2.2 kWh		Lithium-ion	70	70-80	5 to 6 Hrs
Okaya	Faast F4	Foreigner	FAME II	1,15,000		4.4 kWh		Lithium-ion	70	160	5 to 6 Hrs
Okinawa	IPraise+	Foreigner	FAME II	1,45,965		72V , 3.6 kWh		Lithium-ion	50	137	4 to 5 Hrs
Okinawa	Okhi-90	Foreigner	FAME II	1,86,006		72V , 3.6 kWh		Lithium-ion	80-90	160	5 to 6 Hrs
Okinawa	Praise Pro	Foreigner	FAME II	99,645		72V , 2.08 kWh		Lithium-ion	50	81	2 to 3 Hrs
Okinawa	R30	Foreigner	NON FAME	61,998		1.25 kWh		Lithium-ion	25	60	4 to 5 Hrs
Okinawa	Ridge	Foreigner	FAME II	74,741		60V , 3.12 kWh		Lithium-ion	50	149	5 to 6 Hrs
Ola	Ola S1	Indian	FAME II	99,999		4.5kWh		Lithium-ion	76	101	4 Hrs & 30 Min
Ola	Ola S1 Pro	Indian	FAME II	1,39,999		3.97kWh		Lithium-ion	116	170	6 Hrs & 30 Min
Oreva	Alish	Foreigner	NON FAME	43,000		48V,12Ah		Lithium-ion	35-40	60-80	4 Hours
Revolt	RV400	Indian	FAME II	1,24,000		3.24 kWh		Lithium-ion	85	150	4 Hrs & 30 Min
TVS	Iqube	Indian	FAME II	1,18,383		3.04 kWh		Lithium-ion	78	100	4 Hrs & 30 Min
Victory	I plus	Indian	FAME II	72,999		35Ah		Lithium-ion	65	120	2 to 3 Hrs
Yo bike	Yo Edge	Foreigner	NON FAME	50,999		0.6 kWh		Lithium-ion	25	60	7 to 8 Hrs

3.4. User Perceptions - E2W vs. ICE

E2W users initially pay more for their vehicles than they would for traditional ICE two-wheelers. However, they save money on fuel, maintenance, and spare parts costs over time. Table 3 shows the cost comparison of E2Ws and ICE two-wheelers. The higher initial E2W cost may be due to the cost of the battery and other components, but the lower maintenance and fuel costs can offset the higher initial cost over time. Furthermore, E2W spare parts are less expensive than those for traditional ICE vehicles. Due to these lower operational costs, if one compares the 10-year cost of an E2W to that of a traditional ICE two-wheeler, the E2W is slightly less expensive. Moreover, as E2W technology improves, the cost of these vehicles is likely to decrease, making them even more affordable. This makes E2Ws a cost-effective option for those looking for an environmentally-friendly two-wheeler that saves on transport costs in the long run.

TABLE 3: COMPARISON OF ELECTRIC TWO-WHEELER AND ICE TWO-WHEELER

PARAMETERS v/s Type of two wheeler	Electric Two-Wheeler	ICE Two-Wheeler
Make & Model	Revolt RV 400 (Battery Capacity : 3.24 kWh Lithium-Ion	Hero Moto Corp Xtreme 200S
Top Speed	85 KM/Hrs	115 KM/Hrs
Average Purchase price of the vehicle (in Rs.)	1,24,000	1,25,000
Life of the Vehicle (Yrs.) [As stated by OEMs]	2 Lakhs KM / 12-15 years	3 Lakhs / 15 Years
Fuel Efficiency (KM / Litre) / (KM / Full Charging)	150	40
Cost of (Rs. / Litre Petrol) / (Rs. / Electricity cost on Full charging)	42	104
Cost/KM	0.28	2.6
Average Run Per day	40	40
Average Run per month	960	960
Total Run Per year	11520	11520
Total Cost of Fuel / Electricity per year	3226	29952
Average Service frequency in a year	2 times	3 times
Maintenance + Repair cost (Annually in Rs.)	1800	5500
Yearly Cost (Cost of fuel/electricity + Maintenance / Repair Cost)	5026	35452
Battery replacement Norms [As stated by both OEMs & Dealers]	6 years (If within 1 lakh KM & Under 6 years battery was facing issue than freely replacement) After 6 years or 1 Lakh replacement	NA
Average Battery replacement cost (INR)	50000	NA
RTO Cost	NA	2000
Tire cost (Average replacement after 15K – 20K Kms+ or 4 to 5 years) - 3 times change the tire in 8 years	3300	4500
PUC Charge (INR 60 / Year)		480
Total 8 Years cost (Battery cost + Maintenance + Electricity/Fuel cost + Vehicle + Vehicle cost + Tire + RTO + PUC)	2,17,508	4,15,596
Total 8 Years cost of operation (per km)	2.36	4.5

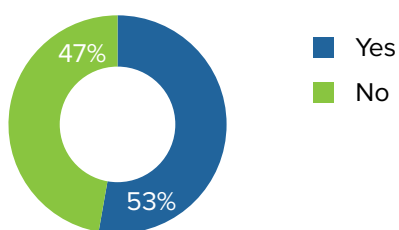
3.5. Purchase Practices

Respondents reported purchasing both E2Ws and ICE two-wheelers from exclusive dealers rather than other types of retailers, such as independent dealers or online sellers. This suggests that exclusive dealerships are popular places for consumers to purchase two-wheelers, regardless of whether they are E2Ws or ICE two-wheelers. This could be because such dealerships often offer a wide range of options, competitive prices, financing options, and good customer service. They also provide warranties and after-sales services, which help ensure buyers have a hassle-free experience with their vehicles. While many buyers are self-financing their EV purchases, many buyers in the West Zone are obtaining financing through banks such as ICICI, HDFC, and Kotak. This could indicate that these banks offer competitive financing options for EV buyers in the West Zone. To continue supporting EV adoption, banks can provide attractive financing options for EV buyers, such as low-interest rates, long-term loan tenures, and flexible repayment options. They can also work with original equipment manufacturers (OEMs) and dealers to develop innovative financing options that make EVs more affordable for buyers. To address these challenges, financial institutions can streamline the loan application process by requiring minimal documentation and providing quick loan approvals with the help of electronic document submission and automated underwriting systems. They should also provide clear guidelines, offer flexible loan terms, and train buyers on battery usage, switching, and charging options.

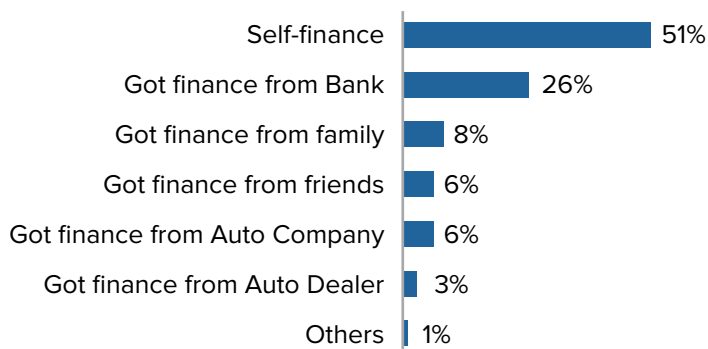
Furthermore, OEMs and dealers can offer incentives and subsidies to make EVs more accessible and offer comprehensive financial support such as financing, leasing, and trade-in programmes. OEMs can also collaborate with the government to offer subsidies and tax benefits to EV buyers to encourage adoption. The responses also suggest that a lack of information about battery usage and charging options may impact the purchasing decisions of EV buyers. Government agencies and financial institutions can increase outreach and education efforts in underserved regions and provide targeted financial support programmes to meet the needs of the local population.



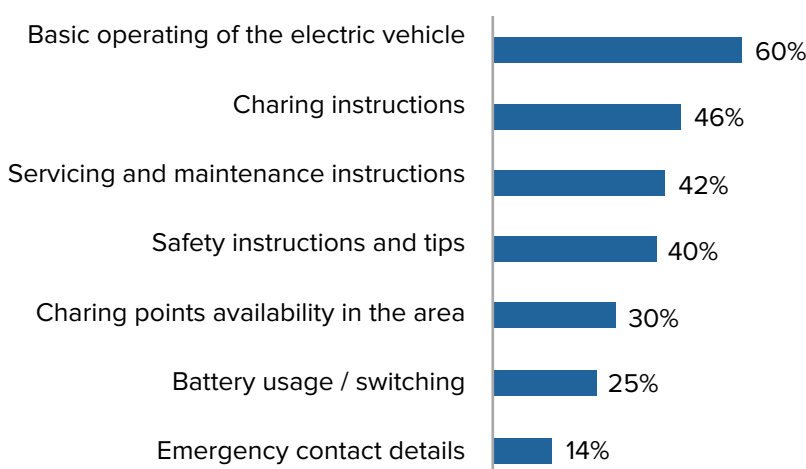
E2W: Received Any Financial Support from OEM or Dealer



E2W: Source of Finance for E2W Purchase



E2W: Type of Information Provided by Dealer at Time of Purchase



Avg. Finance Rate from Banks

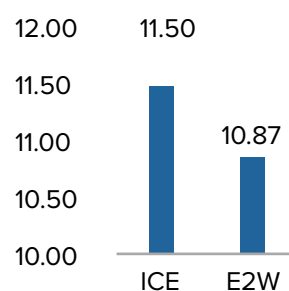


FIGURE 6: PURCHASE PRACTICES

3.6. Usage Practices

Most E2W users are new private vehicle owners who use the vehicles daily. Previously, they preferred public transport to travel. This suggests that E2Ws are becoming a popular mode of transport among users who previously relied on public transport, indicating that E2Ws are becoming a viable alternative to traditional transport for daily commuting. Regarding batteries, there are concerns among E2W users about the safety and potential damage to the vehicle caused by battery swapping techniques. This could be a barrier to the adoption of battery swapping as a means of extending the E2W range. There is a preference among E2W users in Coimbatore, Chennai, and Mumbai to use the same batteries in different vehicles. This could be due to various factors, such as cost savings, convenience, or a lack of alternative options. There is also a preference among most E2W users for servicing and maintenance at dealers' service stations rather than company-authorized service stations. This could be due to various factors, such as proximity, cost, or the quality of service dealers offer. However, most respondents in Rajkot, Delhi, Lucknow, and Hyderabad prefer servicing and maintenance at company-authorized service stations. The reasons for this preference could be related to trust in the quality of service provided by authorized service stations, warranty issues, and the confidence that the service will be provided according to the manufacturer's standards.

To address these issues, manufacturers and battery swapping service providers can educate

users about battery swapping safety, provide warranties and guarantees, invest in research and development (R&D) to develop more reliable systems and standardise batteries for easy compatibility. Furthermore, they can create a network of company-authorized service stations, train and certify dealers, and create awareness about the benefits of servicing and maintenance.

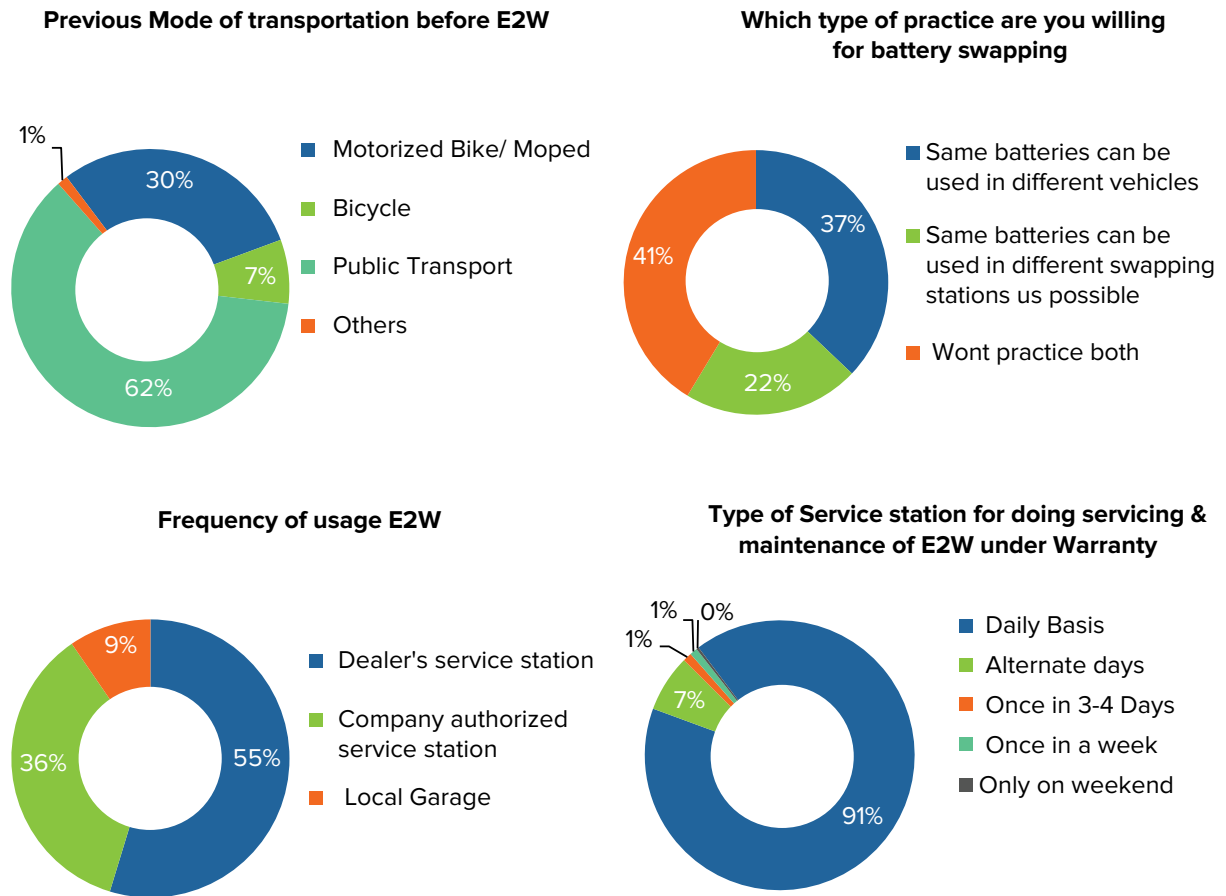
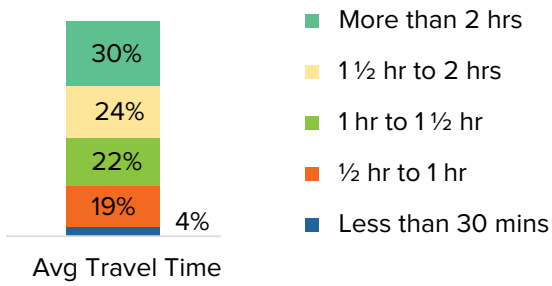


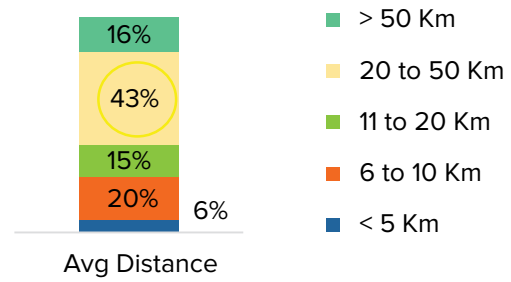
FIGURE 7: USAGE PRACTICES (A)

The responses suggest that E2W users use their vehicles similarly to ICE two-wheelers. Most respondents use their E2Ws for more than 2 hours per day, covering an average of 20-50 kilometers (km) per day. Furthermore, the majority of respondents charge their E2Ws at night. This indicates that E2W users find that E2Ws meet their transport needs similarly to ICE two-wheelers. The average E2W charging time varies by region, with respondents in the North Zone reporting an average charging time of 3-4 hours, while those in the West Zone reported an average charging time of 5-6 hours. These variations could be due to differences in the availability of charging infrastructure or the type of E2W being used. To minimise charging time, manufacturers and charging infrastructure providers can invest in creating a network of conveniently located charging stations, offering fast charging options, and creating awareness about the benefits of E2Ws. This can also be achieved by promoting E2Ws as the best alternative to ICE two-wheelers.

Average Travel time of E2W per day



Average Kilometers runs of E2W per day



Average charging time of the E2W

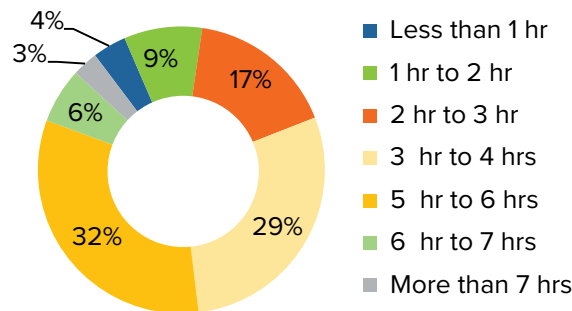


FIGURE 8: USAGE PRACTICES (B)

The graphs in Figure 9 below indicate that many E2W users are facing challenges in accessing charging facilities, with the majority of respondents stating that charging facilities are not accessible and not available. Many respondents do not use public charging stations, which could be due to a lack of trust in the reliability and quality of these charging stations. Furthermore, 90% of respondents in Mumbai travel 3-10 km for charging, and 80% travel 5-10 km in Coimbatore. This highlights the need for more charging infrastructure in these cities.

On the other hand, cities like Jaipur, Rajkot, Lucknow, and Chennai have a majority of respondents with charging facilities at home/in their society premises, which suggests that the charging infrastructure in these cities may be more developed than in other cities such as Ahmedabad, Mumbai, and Bengaluru. Manufacturers can invest in developing domestic charging solutions, such as portable charging stations, that can be easily used at home or on societal premises to make charging more convenient for E2W users.

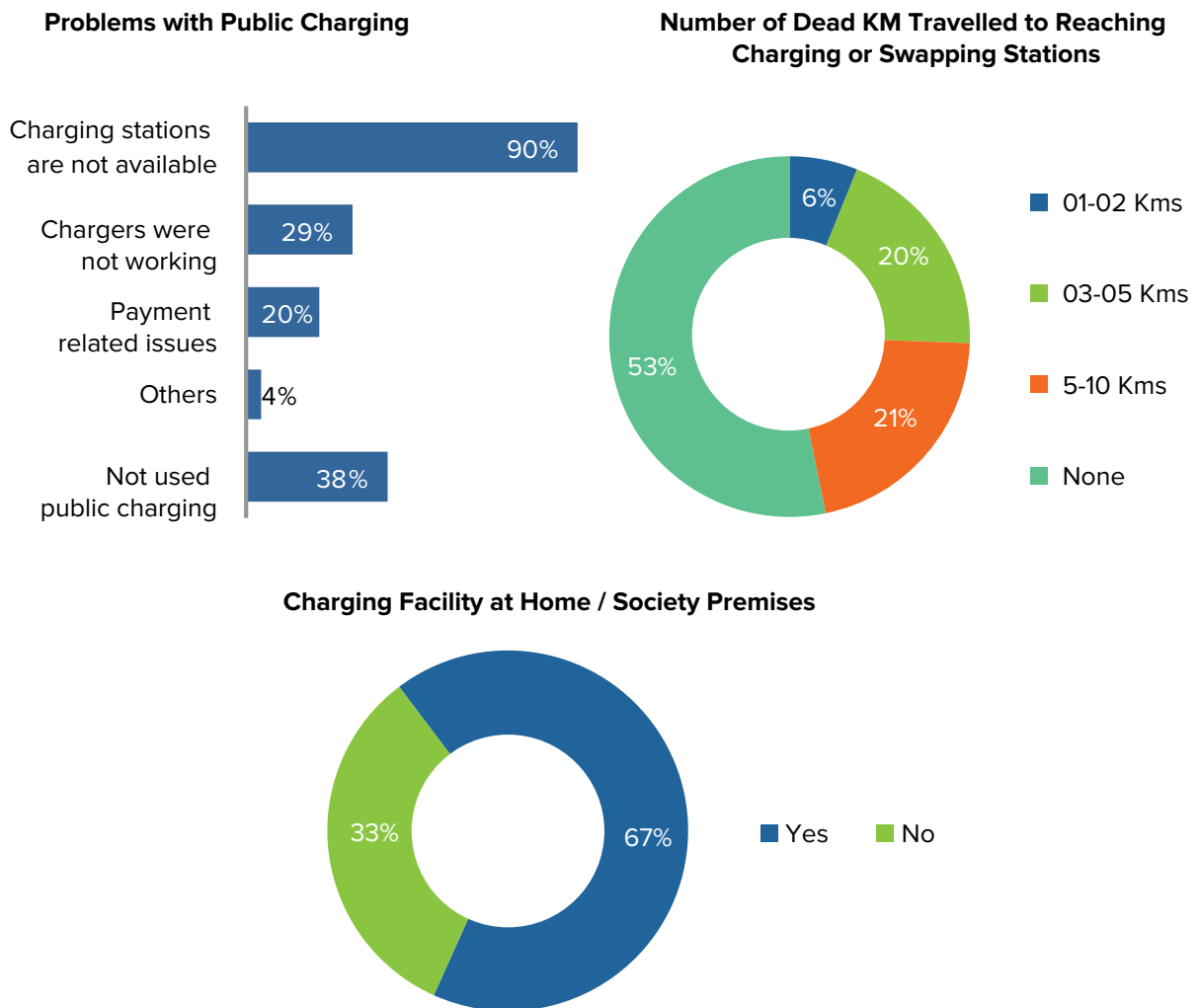
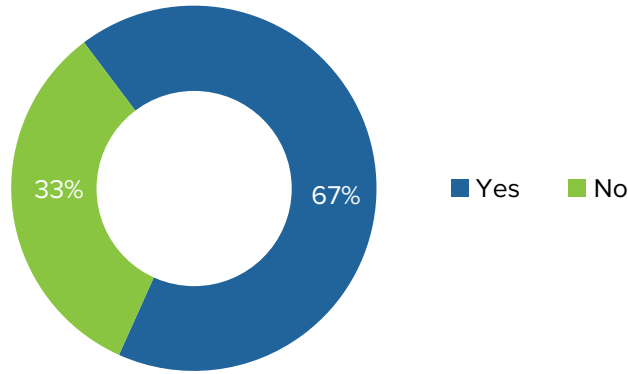


FIGURE 9: USAGE PRACTICES (C)

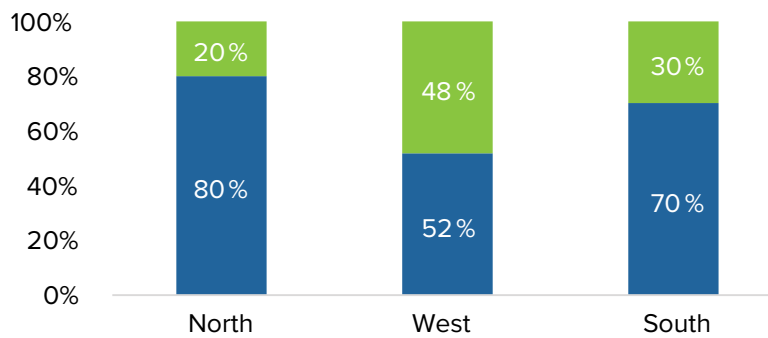
A majority of the survey respondents have installed charging stations in their homes. This suggests that people are increasingly taking steps to make it more convenient to charge their EVs or other devices that require charging. The distribution of the respondents across different geographical zones shows that in the North Zone, almost 80% of respondents reported having domestic charging stations, with a higher number of charging stations in this region compared to the overall average. Similarly, in the South Zone, 70% of respondents reported having domestic charging stations, also a higher number than the overall average. In contrast, in the West Zone, only 52% of respondents reported having domestic charging stations, with a lower number than the overall average in the other regions. This suggests that there may be less of a focus on installing charging stations in the West Zone or that other factors are at play in impacting the prevalence of charging stations in this region.

In terms of having domestic charging stations, Jaipur and Rajkot had the highest percentage of respondents who had them. This suggests that in these cities, a larger number of people have EVs or plug-in hybrids that require charging, and they have installed charging stations in their homes to cater to this need. On the other hand, the survey found that Mumbai and Bengaluru had the lowest percentage of respondents with charging stations at home (35% and 49%, respectively). This suggests that in these cities, fewer people have EVs or plug-in hybrids, or they rely on public charging infrastructure instead of installing a charging station in their homes. This implies that there is still room for improvement in terms of promoting and adopting EVs and related infrastructure in these cities.

Charging Facility at Home / Society Premises



Charging Facility at Home / Society Premises: By Zone



Charging Facility at Home / Society Premises: By Centre

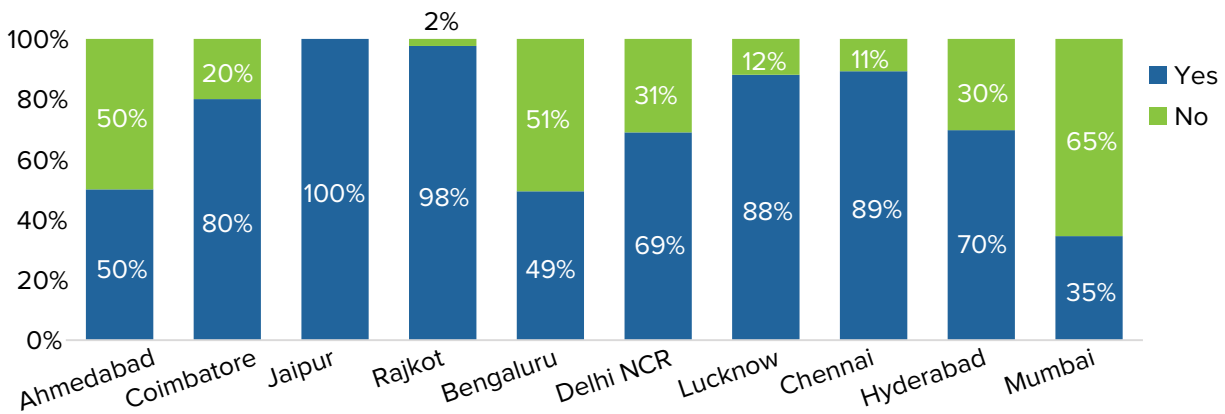


FIGURE 10: USAGE PRACTICES (D)

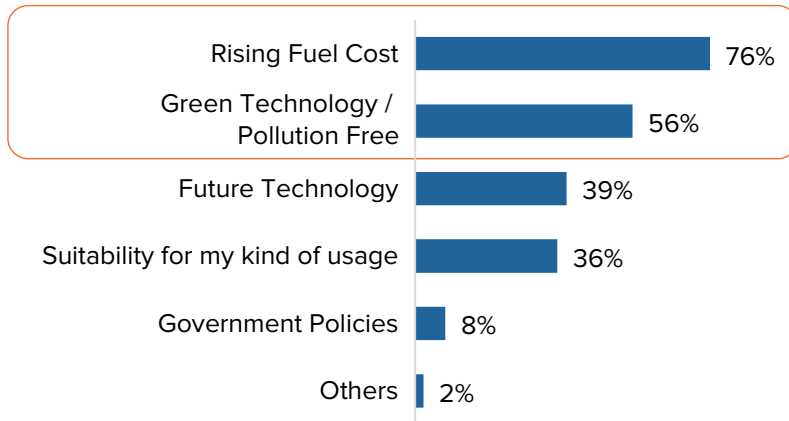
3.7. Consumer Perspectives: Triggers & Barriers to E2W Adoption

3.7.1. Category Triggers

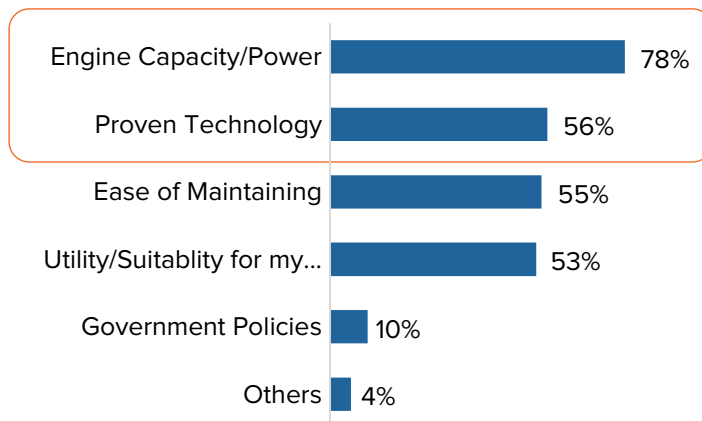
The respondents in this study stated that they do not pre-decide on buying a vehicle and only consider purchasing one a few months before the actual purchase. The majority of respondents from cities such as Coimbatore, Rajkot, and Chennai had considered buying a vehicle since E2Ws were introduced in India. The main triggers for purchasing an ICE two-wheeler were good engine capacity and proven technology. In contrast, respondents cited rising fuel costs and the desire to be pollution-free as the main reasons for purchasing an E2W. The main influencers in purchasing an E2W were

friends and family, with a significant number of respondents highlighting their impact on their E2W purchase decisions. This suggests that an overall rise in awareness would propel the adoption of E2W. Therefore, manufacturers should also focus on creating awareness about E2W's convenience, reliability, and performance to increase E2Ws' appeal to potential buyers.

Key trigger to buy E2W



Key trigger to buy ICE 2W



Most influenced by whom to buy the E2W

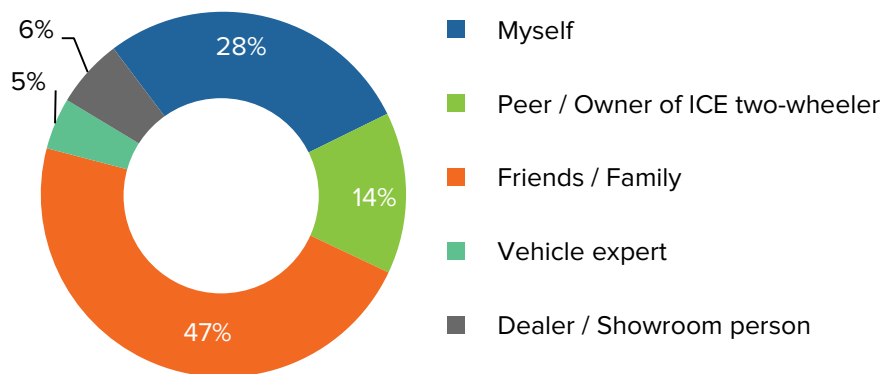


FIGURE 11: KEY TRIGGERS

3.7.2. Perceived Barriers

According to this study, both ICE and E2W users were firm in their decisions when purchasing 2-wheeler vehicles. Rising fuel costs and the desire to be pollution-free were cited as the main barriers to not buying an ICE two-wheeler. This suggests that respondents are turning towards going green and adopting the new technology available to them. On the other hand, the high price of E2Ws and lack of charging infrastructure were the main barriers to not buying an E2W, along with other barriers such as low pickup and less safety. Overall, it can be inferred that consumers are willing to switch to E2Ws, but the high prices and lack of charging infrastructure are deterring them.

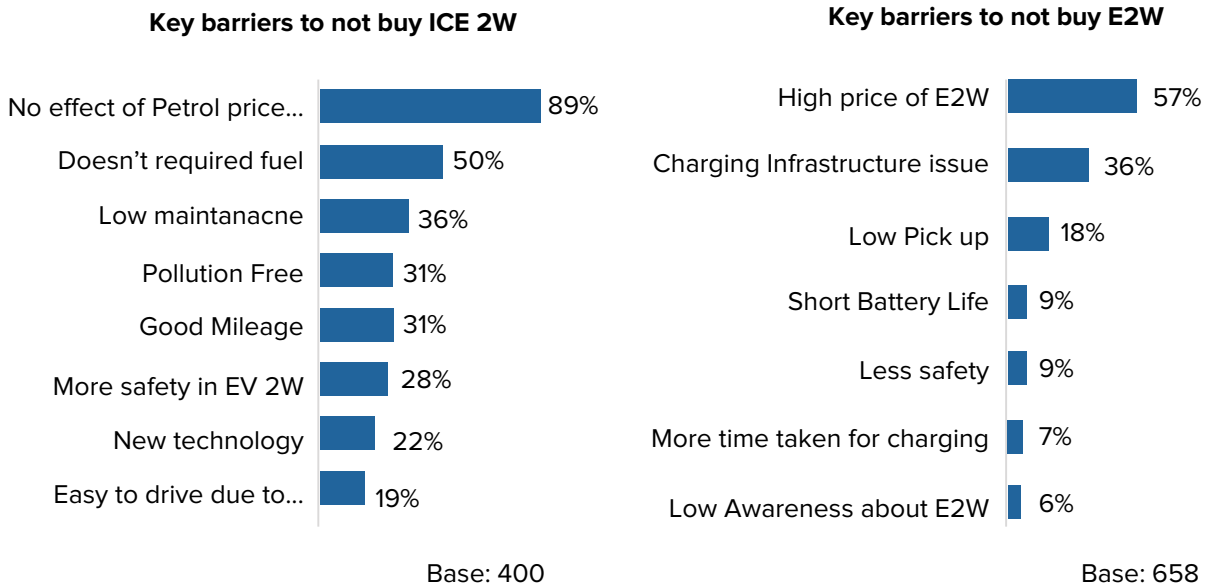


FIGURE 12: KEY BARRIERS

Based on the survey results, rising fuel and maintenance costs are a major factor in consumers switching from ICE 2Ws to E2Ws. **The study results showed that rising fuel costs and the desire to be pollution-free were the main barriers to not buying an ICE two-wheeler, indicating that cost savings and environmental considerations are key drivers for consumers considering purchasing E2Ws.** The majority of respondents stated that the saved petrol cost is the reason for buying an E2W, with other reasons including the lack of need for fuel, low maintenance, and pollution-free.

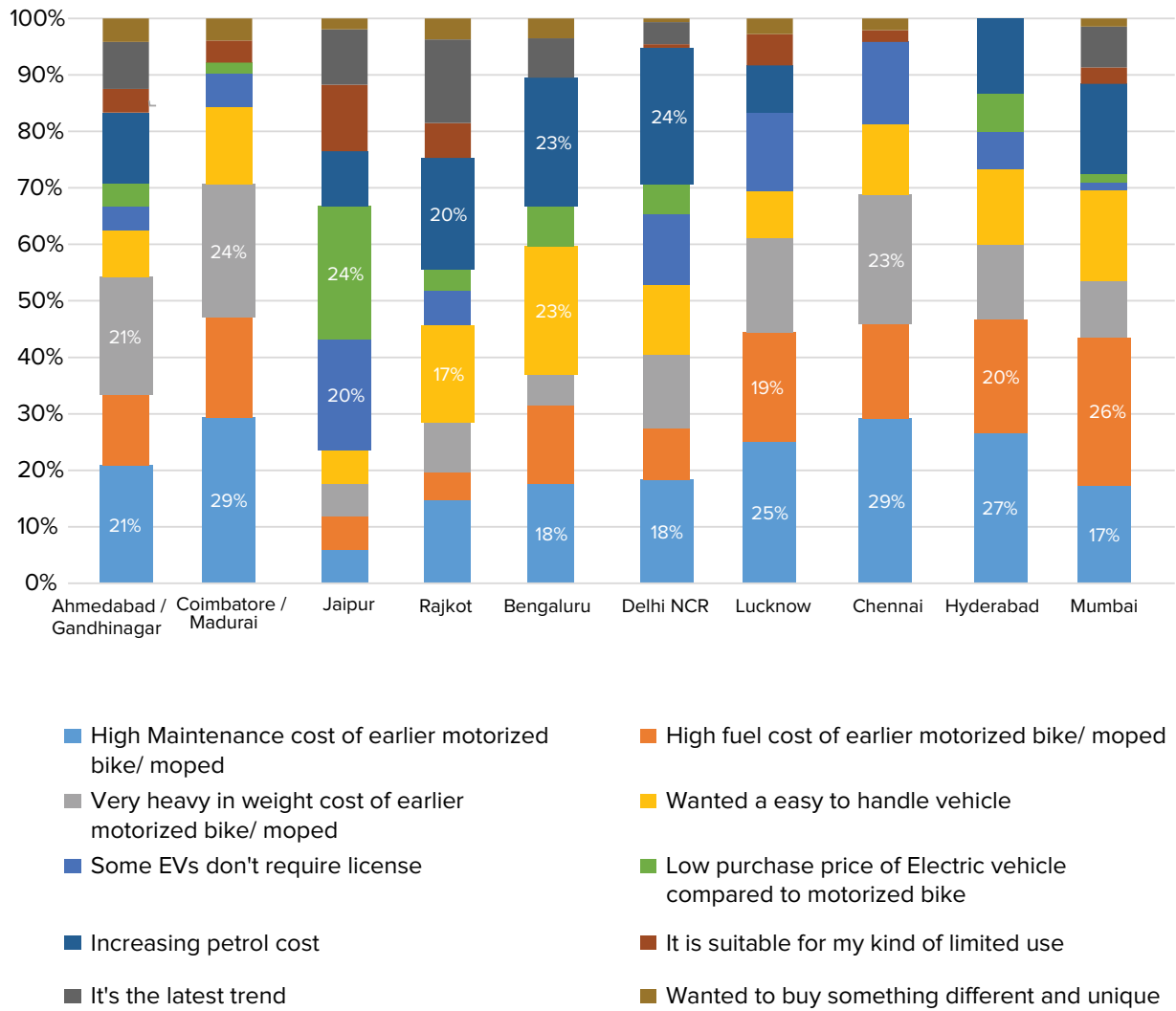


FIGURE 13: REASONS FOR SWITCHING FROM ICE TWO-WHEELERS TO E2WS

OEMs (Original Equipment Manufacturers) should target the abovementioned points as plus points for E2Ws to attract more customers. On the other hand, the study found that low speed, lack of charging infrastructure, less battery backup, and less pickup are the reasons for consumers not adopting E2Ws. OEMs should focus on these parameters to address consumers' concerns and increase E2W adoption. By addressing these barriers and highlighting the benefits of E2Ws, OEMs can convince more customers currently using ICE two-wheelers to switch to E2Ws.

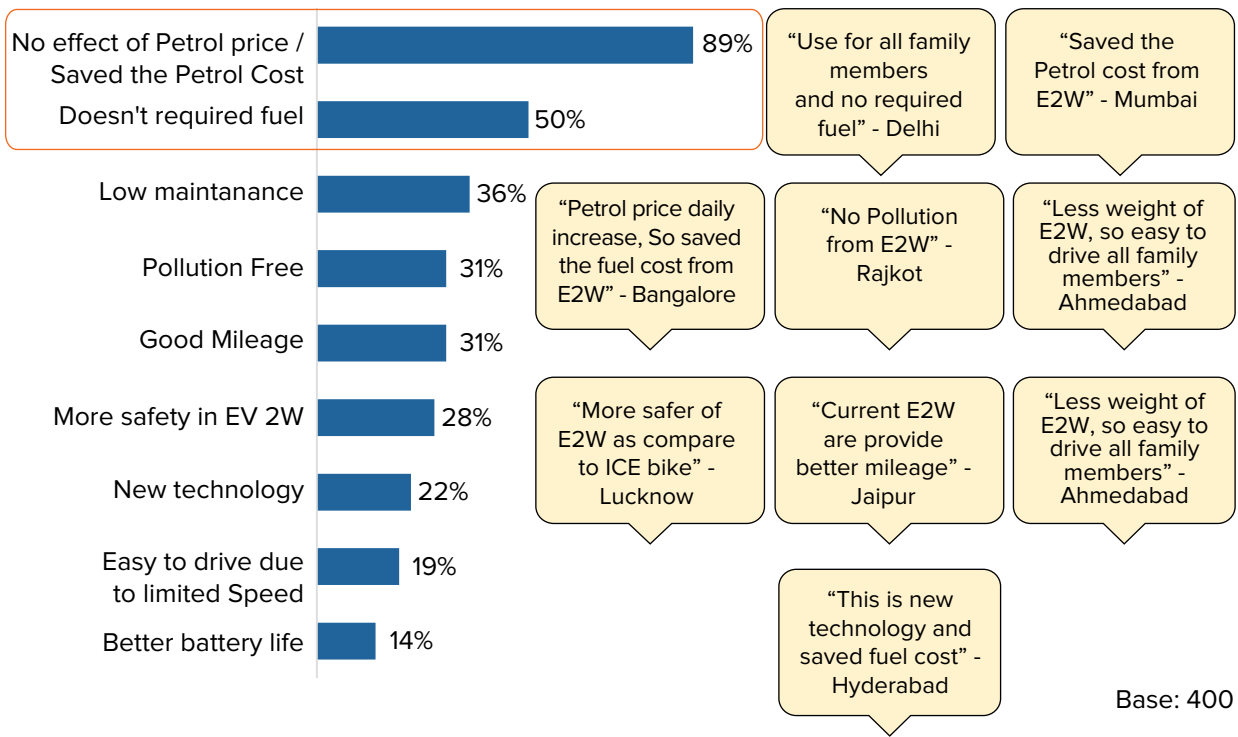


FIGURE 14: REASONS FOR ADOPTING E2WS

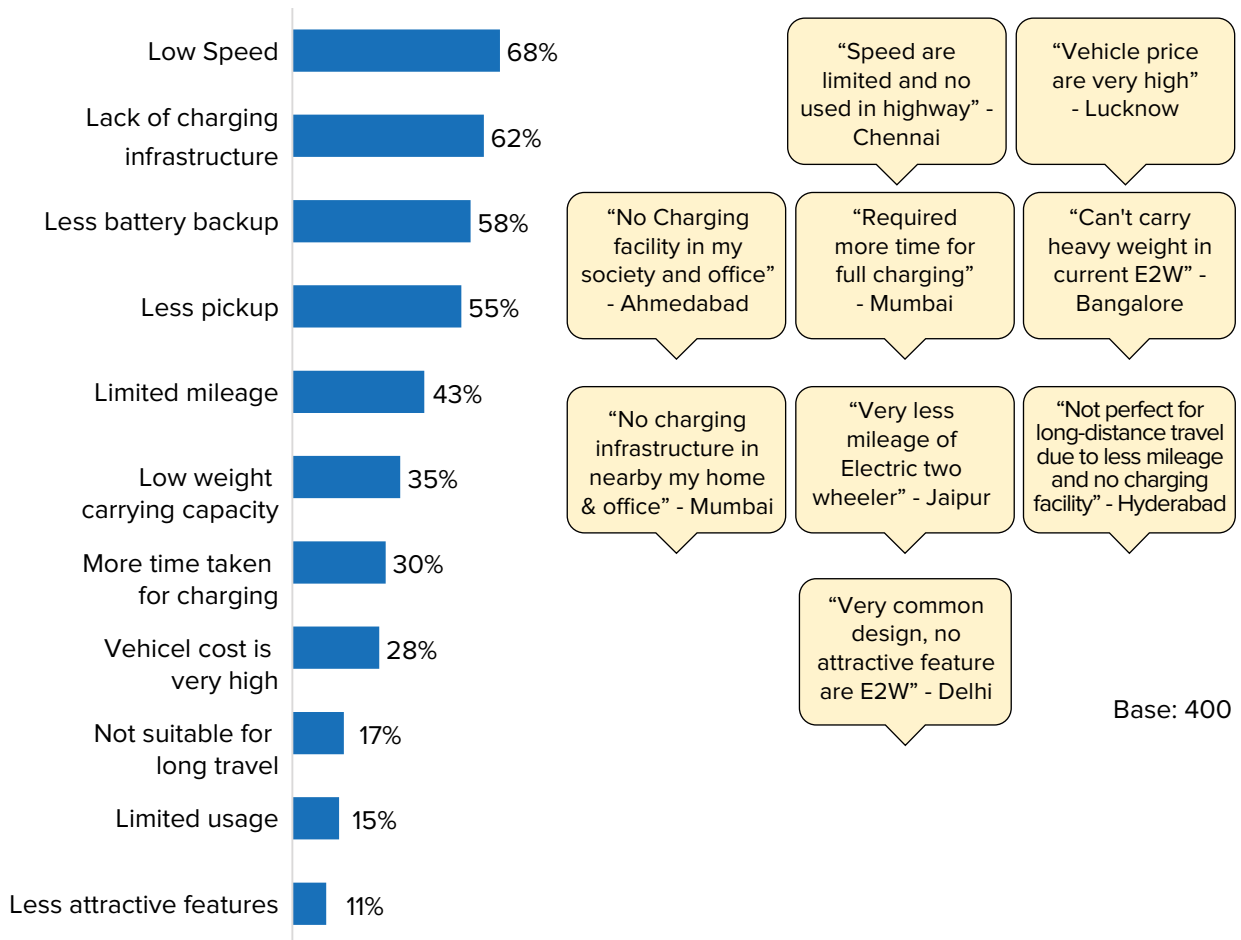


FIGURE 15: REASONS FOR NOT ADOPTING E2WS

3.8. Consumer Perspectives on Future E2W adoption

3.8.1. Readiness for EV Adoption- Considering Purchasing E2Ws in the Future

The pie charts in Figure 16 indicate that people who did not buy an E2W in the last 1-2 years bought an ICE two-wheeler instead, citing low pickup, high cost, and charging issues as reasons. However, those who plan to purchase an EV after a year wants to switch to green technology due to pollution and environmental concerns. This suggests that although some people are hesitant to buy an EV, many are still interested in green technology for environmental reasons.

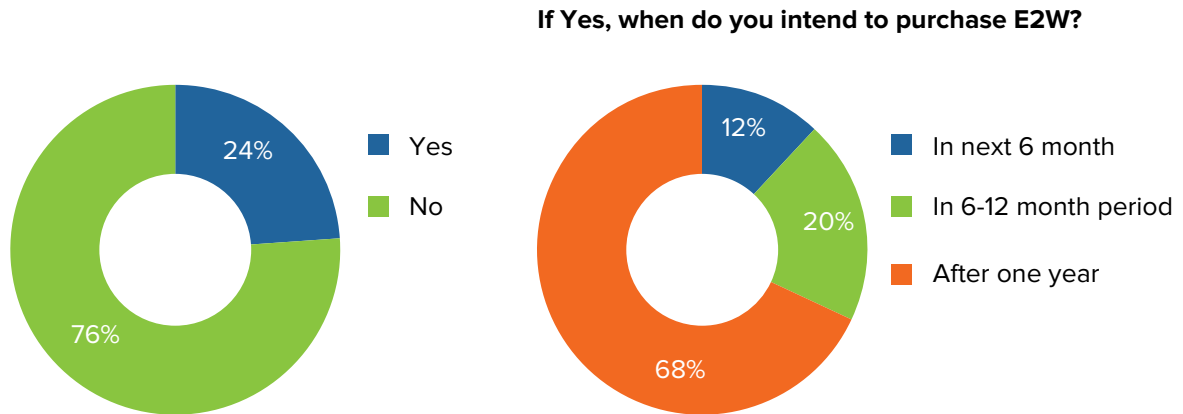


FIGURE 16: PERCEPTION OF FUTURE EV PURCHASE

The main barriers to EV adoption include the lack of charging infrastructure, long charging times, speed and acceleration issues, range anxiety, high purchase costs, and limited storage space. The lack of charging infrastructure makes it hard for individuals to rely on their EVs for daily transport and plan long trips. However, the government, private players, and automobile manufacturers are working to develop this infrastructure. Long EV charging times are also a concern, but fast-charging technologies are helping reduce charging times. The speed and acceleration of EVs can also be an issue, particularly for those used in traditional ICE vehicles. However, many modern EVs are designed to deliver high performance with instant torque and quick acceleration, thus overcoming this challenge. Furthermore, with technological advancements, EVs' top speed and acceleration continue to improve, making them increasingly competitive with ICE vehicles.

Range anxiety, i.e., the concern that an EV will not have enough power to reach its destination before the battery gets discharged, is another barrier to EV adoption. This can make individuals hesitant to purchase or use an EV for fear of getting stranded with a dead battery. To mitigate range anxiety, manufacturers are developing longer-range EVs, and the government and private players are working on developing the charging infrastructure in the country. In addition, most modern EVs are equipped with range-estimation technology that helps drivers plan their trips. Various apps and websites also provide information on the location of charging stations.

Limited boot space can also be a challenge for E2W adoption, as it limits the vehicle's ability to carry heavy luggage or cargo. This can make E2Ws less suitable for certain use cases, such as delivery or commuting with many items. However, several manufacturers are designing E2Ws with larger cargo spaces and more storage options to address this issue. Aftermarket solutions are also available, like attachments and racks that can be added to E2Ws to carry the additional load.

3.8.2. Financial Support

Insights from customer surveys reveal that respondents feel they can easily get financial support from banks, dealers, and auto companies when purchasing an E2W. Many financial institutions and auto companies offer financing options and incentives to encourage E2W adoption. This can make it easier for customers to cover the higher upfront cost of an E2W. Furthermore, interest rates in E2W financing are often lower than in financing for ICE two-wheelers. This can make E2Ws more affordable in the long run, as the lower interest rates can offset the higher upfront cost. However, the actual rates, terms, and conditions may vary from bank to bank, dealer to dealer, and company to company, so checking before opting for any financial support is always advisable.

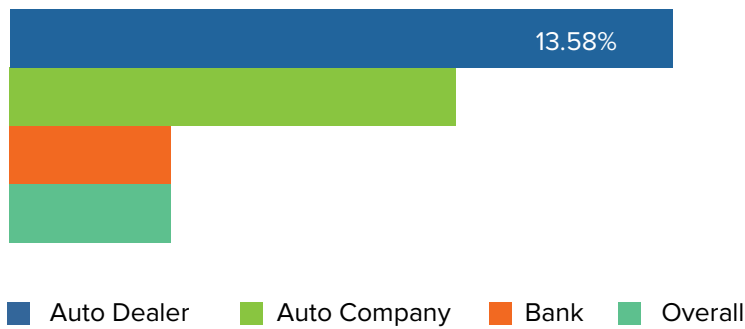


FIGURE 17: INTEREST RATES PROVIDED BY DIFFERENT CHANNELS FOR E2W PURCHASE

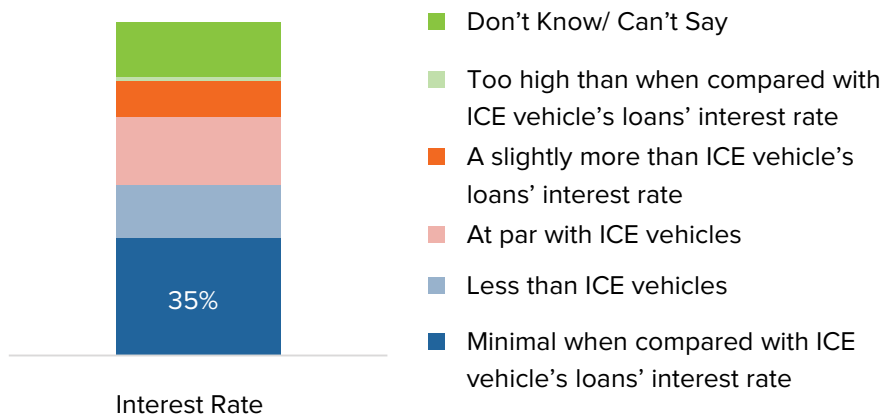


FIGURE 18: COMPARISON OF E2W & ICE TWO-WHEELER INTEREST RATES

Customers who own E2Ws are very satisfied with the service provided by the E2W service centers. This means that they feel that their E2Ws are being serviced and maintained properly, and that any issues or problems are being resolved effectively. This indicates that the E2W manufacturers and service providers are delivering good quality service to their customers, resulting in high customer satisfaction. In addition to good service, the E2W manufacturers also provide roadside assistance in the case of a breakdown, meaning that customers can get timely help and support if their E2W breaks down while on the road. This provides the customers with an added sense of security, contributing to their overall satisfaction with their E2W ownership experience.

Furthermore, E2W maintenance and servicing costs are low, which means that customers do not have to spend a lot of money to keep their E2Ws in good condition. This makes e2Ws more affordable to own and maintain, which is a significant factor for customers. All of these factors have contributed to the customers seeing E2Ws as the future of mobility and transport. This is a positive sign for the E2W industry, as it indicates a growing acceptance and adoption of E2Ws as a viable mode of transport.

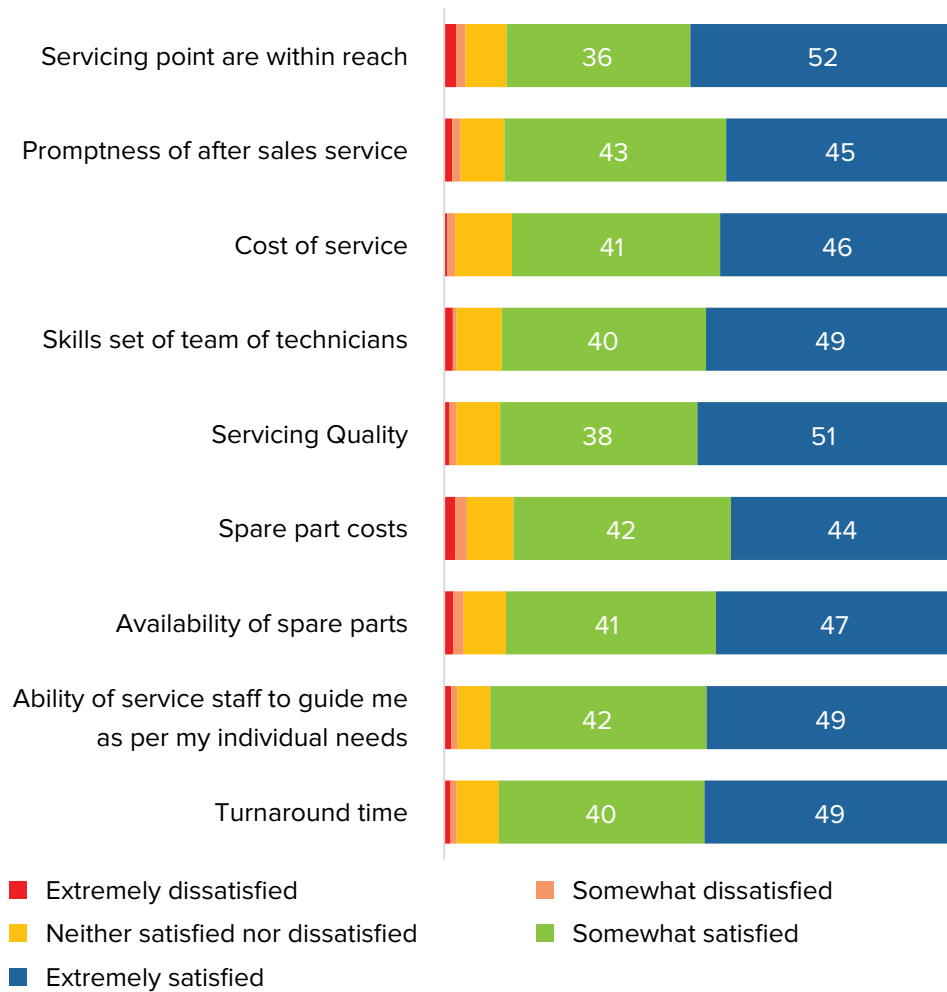


FIGURE 19: SATISFACTION WITH CURRENT E2W SERVICE CENTERS

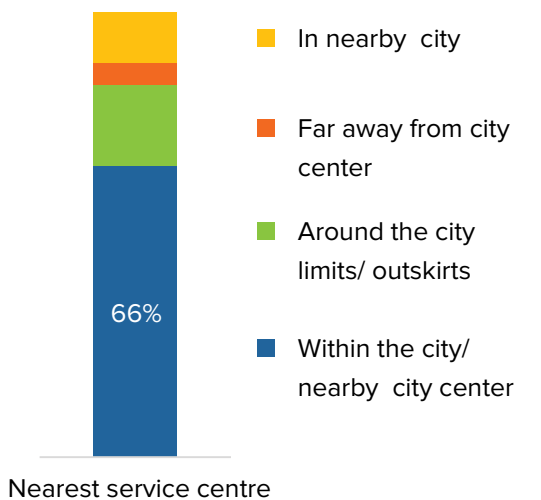


FIGURE 20: DISTANCE FROM THE NEAREST AUTHORISED SERVICE CENTRE

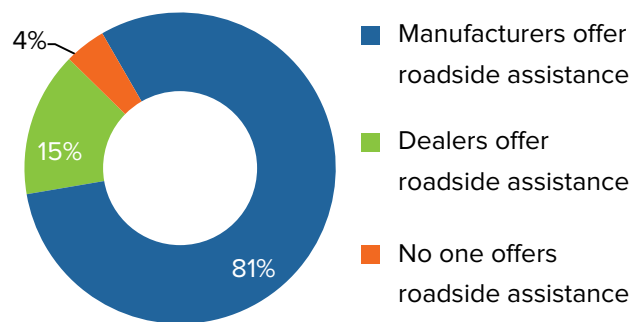


FIGURE 21: PROVISION OF ROADSIDE ASSISTANCE

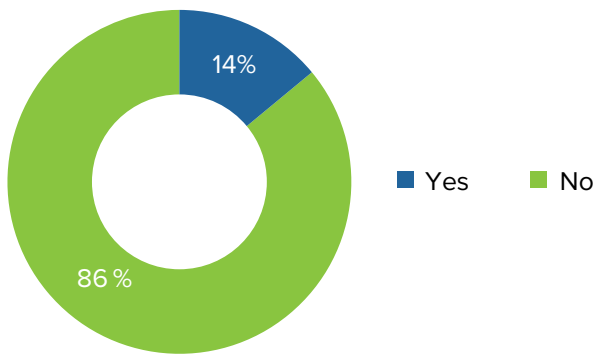


FIGURE 22: EXPERIENCE WITH E2W BREAKDOWN

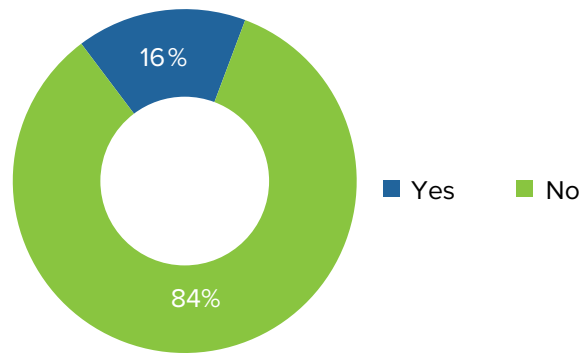


FIGURE 23: ISSUES WITH GETTING E2W SPARE PARTS

3.9. Understanding the Needs and Expectations of E2W Users and Dealers

The E2W market is rapidly growing, but users' expectations and unmet needs heavily influence the adoption of these vehicles. One of the most crucial factors is the availability of charging infrastructure. Users expect charging stations to be conveniently located and easily accessible, especially those who rely on E2Ws as their primary mode of transport. Access to charging infrastructure reduces range anxiety and allows users to charge their vehicles conveniently. Furthermore, users expect E2W charging time to be as short as possible to minimise waiting time and reduce the inconvenience of planning their trips around charging stops. The distance traveled to find a charging station should be minimal, ideally less than 2 km, to reduce the extra time and effort required to find a charging station.

For E2W users, speed and acceleration are crucial factors that contribute to a more satisfying riding experience and better maneuverability in traffic. Moreover, lower interest rates and minimal documentation and processing time when financing an E2W can significantly reduce the financial burden for users. Safety features are also a top concern; manufacturers must provide robust safety features that can protect riders in the event of an accident. These features include anti-lock brakes, airbags, and other measures that ensure maximum safety.

Overall, E2W users expect the experience of owning and using an E2W to be at least as good, if not better, than that of an ICE two-wheeler. This includes factors such as cost, convenience, and performance. With a growing demand for E2Ws in India, it is imperative that manufacturers continue to prioritise these factors and meet the expectations of their users.

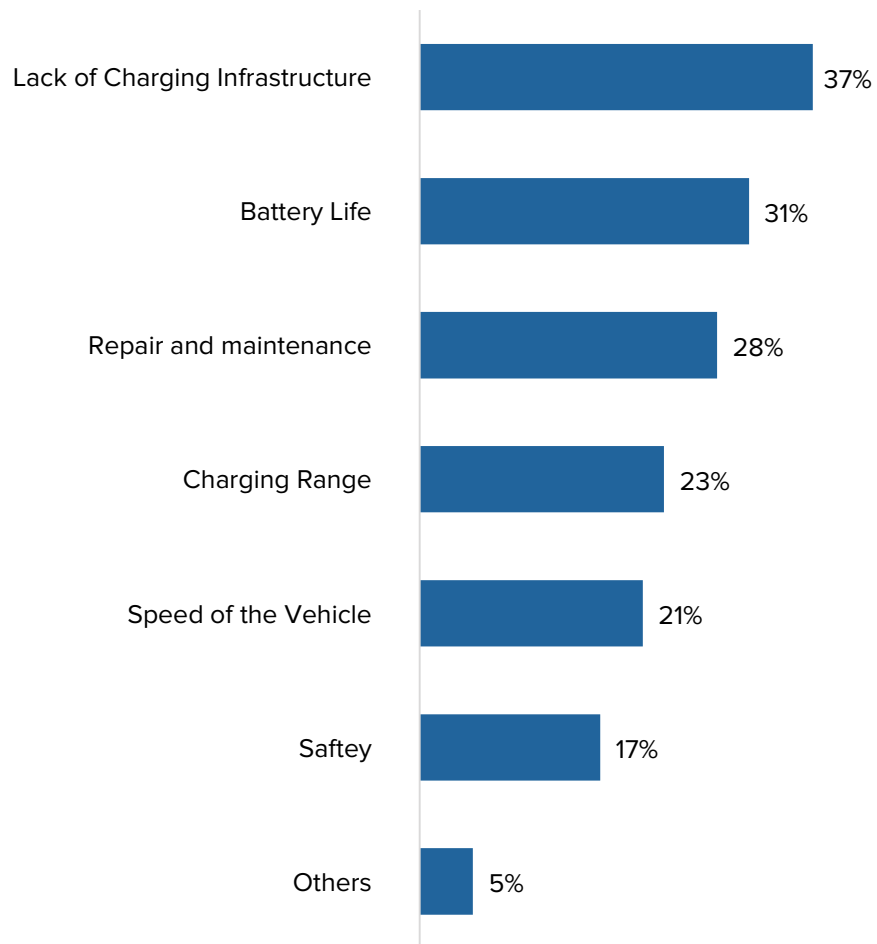


FIGURE 24: UNMET NEEDS OF USERS & DEALERS



CHAPTER 04

INSIGHTS FROM DEALER SURVEY



4.1. Disadvantages of Electric Two-Wheelers

According to the dealer survey, **high initial investment, limited range, long charging time, and maintenance challenges are the major barriers to E2W adoption in India.** OEMs should focus on addressing these barriers to increase the adoption of E2Ws. The study suggests that E2Ws are known to be more expensive than ICE two-wheelers that provide similar performance, even after the provision of various state subsidies. The biggest issue with E2Ws in India is the range; even though many manufacturers claim the range to be 150 km, the real-world figure is lower. On average, the range is around 100 km on a single charge, which is far less than a typical scooter's range on a full tank. This limits day-to-day activities, especially for people who live far from their offices or often travel during the day.

The study also highlights the fact that charging time is another issue with E2Ws; on average, an EV has a charging time of at least 4-4.5 hours from the supplied charger, which means if one forgets their charger or the battery runs out, they will have to spend a long time waiting. Maintenance is another challenge, as E2Ws, although quite common now, are still fairly new to the market. Most of their crucial components are electronic and not analog, so local mechanics may be unable to fix them easily with the tools available. Furthermore, the study indicates that the battery replacement cost is another concern for consumers. Even though most companies offer three or five-year warranties on the battery, it is still a cost that needs to be accounted for.

4.2. Common E2W Problems/Issues Raised by Dealers

Warranty and battery replacement cost: EV dealers face warranty and battery replacement challenges. EV batteries typically last 4-5 years, requiring users to purchase a new battery at around Indian Rupee (INR) 30,000-40,000, leading to dissatisfaction and significant expense for buyers. Battery warranty coverage can be a critical selling point, but some manufacturers offer limited coverage, making it difficult for dealers to sell the product. Lack of standardisation among manufacturers can also cause problems, with varying warranty periods and claims procedures that can be difficult to navigate.

Low margin: EV manufacturers typically offer dealers low margins of around 8-10%, making it challenging for them to achieve a good return on investment (ROI) and compete with other dealers. The nascent EV market and low demand result in low sales volume, and dealers must bear the costs of running the showroom and maintaining inventory, further reducing ROI. Low margins also hinder investment in infrastructure and marketing campaigns and make it difficult to offer competitive prices, reducing sales and customer satisfaction.

No credit facility from suppliers: The absence of credit facilities is a major challenge for EV dealers. Suppliers' lack of credit facilities can make it difficult for EV dealers to purchase inventory, manage cash flow, make bulk purchases, and compete with other dealers. Some new entrants, like Ampere and other small companies, do not offer credit facilities to dealers, requiring them to pay for inventory upfront. This hinders cash flow management and reduces flexibility for investments or bill payments. The lack of credit facilities also makes it hard for dealers to make bulk purchases, resulting in higher customer prices and competition with dealers with access to such facilities.

Battery backup: The battery is a critical EV component, and the vehicle's range depends on the battery's capacity. If the battery backup is low, it may need frequent replacement, which can increase the vehicle's cost and lead to customer dissatisfaction. Furthermore, battery backup depends on the needs of consumers based on their use cases. A person traveling shorter distances may not want to

invest in a battery with high backup and would prefer an E2W with lower backup instead. In contrast, a person who regularly travels long distances or uses the 2-wheeler for commercial purposes like delivery would prefer high battery backup. Low battery backup can also make it difficult for EV dealers to compete with dealers of other types of vehicles, as buyers may be more likely to purchase vehicles with longer ranges. Aftersales service provision also becomes more difficult for dealers in this case.

High E2W price: High E2W prices can be a significant challenge for EV dealers. The high cost of E2Ws can make it difficult for dealers to sell the product and compete with dealers of other types of vehicles, as buyers will be more uncertain about purchasing an EV with a higher price tag and may opt for cheaper vehicles. Moreover, the high price of E2Ws can also make it difficult for EV dealers to attract price-sensitive buyers, who may prefer to purchase a conventional two-wheeler. Additionally, the high price of E2Ws can make it difficult for dealers to offer financing options and make E2Ws affordable for a wider range of customers.

Low speed: The previous generation of EVs was characterised by low speed, a significant concern for buyers who demanded high-speed vehicles. However, the situation has changed with the introduction of high-speed electric vehicles into the Indian market. Now, buyers have the option to choose from a wide range of high-speed EVs that can compete with ICE vehicles. Despite this, many buyers compare EVs' top speed with ICE vehicles. This comparison is often unfair, as EVs are not designed solely for high-speed performance. Instead, they are designed to be more efficient, eco-friendly, and cost-effective in the long run. Therefore, dealers have to convince buyers to consider EVs based on their specific use cases and requirements rather than comparing them to ICE vehicles.

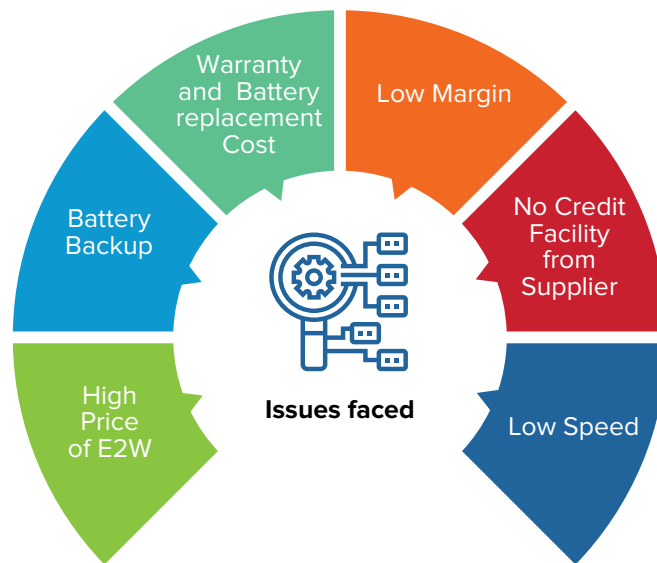


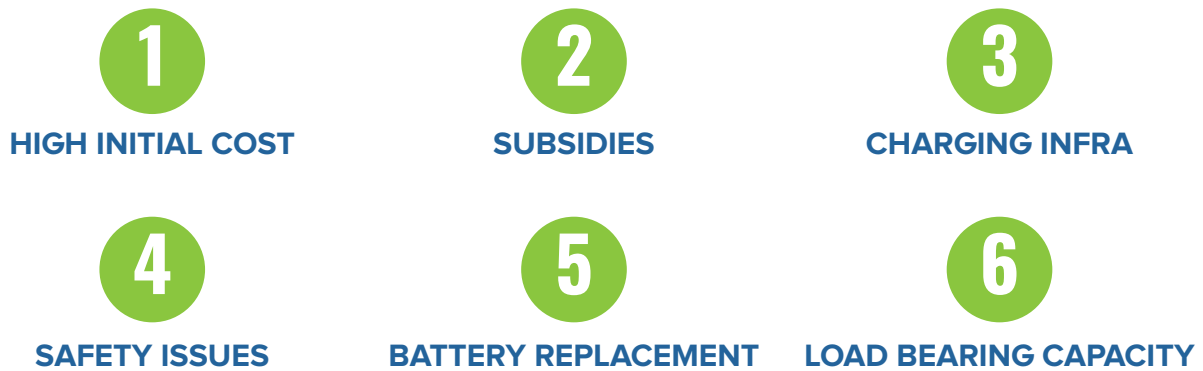
FIGURE 25: ISSUES RAISED BY DEALERS

In conclusion, EV dealers face several challenges, including warranty and battery replacement costs, low margins, absence of credit facilities from suppliers, battery backup, the high price of E2Ws, and low speed. These challenges can hinder their ability to sell EVs and compete with dealers of other types of vehicles. However, as the EV market grows and develops, manufacturers and dealers can work together to address these challenges and create a more sustainable and competitive EV industry. Standardisation of warranty coverage and claims procedures, increasing margins for dealers, offering credit facilities, improving battery technology, and reducing the cost of E2Ws could help overcome these challenges and make EVs more accessible and appealing to consumers. Furthermore, dealers should educate buyers about EVs' unique benefits, such as efficiency, eco-friendliness, and long-term cost savings, rather than solely focusing on high-speed performance.

CHAPTER 05

KEY TAKEAWAYS AND RECOMMENDATIONS





High initial cost - One of the main barriers to EV adoption is the high initial cost of the vehicle. Customers have reported that even the average cost for a good-speed E2W is above INR 80,000, which can be a significant barrier for many people looking to purchase an EV. This high cost is often attributed to Li-ion batteries, which can be expensive. Alternative battery technologies or chemistries, such as sodium-ion batteries, are currently being investigated. Research is ongoing in this field, and many scientists believe sodium-ion batteries could be a viable alternative for EVs in the future, as they can help reduce the high EV cost. Furthermore, the Indian government has launched the Production Linked Incentive (PLI) scheme for the advanced chemistry cell (ACC) battery storage industry, which includes incentives for E2W manufacturing in the country. Under the PLI scheme, incentives are provided to manufacturers of ACC batteries and related components, aiming to boost domestic manufacturing and reduce India's dependence on imports. The scheme also includes a specific incentive for manufacturing E2Ws with ACC batteries. The E2W incentive under the PLI scheme is a financial incentive of up to INR 15,000 per kWh of battery capacity, similar to the Faster Adoption and Manufacturing of Hybrid and Electric Vehicles (FAME) II subsidy for E2Ws. However, the PLI scheme also provides additional incentives for the localisation of components and value addition in the manufacturing process, which can further reduce the cost of E2W manufacturing in India. The PLI scheme is expected to accelerate EV adoption in India and boost the growth of the EV industry.

GOI has also introduced a Partial Credit Guarantee (PCG) scheme to provide a partial risk-sharing facility to financial institutions that provide loans for the purchase of EVs, including E2Ws. The scheme aims to de-risk the financiers and encourage them to lend more for the purchase of EVs. Under the scheme, the government provides a partial guarantee to the financial institutions for the loans they provide to customers for the purchase of EVs. The guarantee covers up to 50% of the default amount and is applicable for a maximum loan amount of INR 10 lakhs per borrower. The PCG scheme is expected to increase the flow of credit to the EV sector, particularly to small and medium-sized enterprises (SMEs) and individual buyers. It is also expected to reduce the risk perception of the lenders and encourage them to lend at competitive rates for EV purchases.

Subsidies - The availability of subsidies can play a significant role in making EVs more affordable for customers and increasing adoption rates. However, suspending subsidies for certain manufacturers can negatively impact sales. If subsidies were to be stopped altogether, EV adoption would likely slow down, as they would become less financially accessible to customers. The government must balance providing EV adoption incentives and ensuring manufacturers meet certain standards and requirements. This can include localisation requirements for components, minimum performance standards, and regulations on emissions. The government can also invest in building charging infrastructure and promoting R&D in new battery technologies to make EVs more accessible and affordable for consumers.

Individual states in India may continue to provide EV subsidies in addition to those provided under the FAME II scheme. Several states in India have already announced their own EV policies and incentives to promote EV adoption. For example, states such as Delhi, Telangana, and Uttar Pradesh provide additional incentives and subsidies for the purchase of EVs, including E2Ws. These incentives can include lower road tax and registration fees and additional financial incentives for EV buyers. Moreover, some state governments have announced plans to establish their own charging infrastructure to promote the use of EVs in their states. The continuation of state-level incentives for EVs, in addition to the FAME II subsidy, is likely to further boost the adoption of E2Ws and other EVs in India and support the growth of the EV industry in the country.

Charging infrastructure - The lack of accessibility and convenience of public charging stations also plays a role in the low usage of these stations. Many respondents stated that they prefer to charge their E2Ws at home, as it is more convenient and they have control over the charging process. Furthermore, even in urban areas where charging stations are available, they may not be conveniently located or easily accessible to E2W users. This lack of charging infrastructure can create “range anxiety” among E2W users, making them hesitant to switch to E2Ws. To overcome this challenge, governments, manufacturers, and private companies must invest in building and maintaining robust charging infrastructure that is easily accessible to E2W users. ICA India has launched an initiative to support the installation of EV charging infrastructure in the residential and commercial building sectors, focused on the safety and standard operating procedures of the charging infrastructure. The initiative aims to promote EV adoption by enabling convenient and accessible charging options for EV owners in these sectors. This highlights the importance of developing robust and accessible home charging infrastructure, in addition to public charging stations, to facilitate widespread E2W adoption in India.

The safety of EV charging infrastructure in India is a key concern for both EV owners and the general public. The safety of charging infrastructure is governed by various safety standards and regulations, which are enforced by regulatory bodies such as the Bureau of Indian Standards (BIS), the Ministry of Power, and the Central Electricity Authority (CEA). To ensure the safety of charging infrastructure, BIS has developed standards for EV charging infrastructure, including specifications for charging connectors, cables, and safety features. The charging infrastructure must also comply with the Indian Electricity Rules (1956) and the National Building Code of India (2016) to ensure the safety of the electrical installation and its integration with the building. Moreover, the government has mandated that all public EV charging stations must be installed and operated by licensed and authorised entities and must comply with safety standards and regulations. Furthermore, charging infrastructure operators and service providers must follow safety protocols and guidelines, such as conducting regular safety checks and inspections and providing safety instructions to EV users.

Safety issues - Manufacturers must address safety concerns and ensure their vehicles are designed and built with safety in mind. Proper testing and quality control measures should be implemented to minimise the risk of E2Ws catching fire. Fire risk in E2Ws is a significant concern, as it poses a danger to both the vehicle and the rider. The main cause of fire in E2Ws is the overheating of electric circuits, which can lead to electric sparks and, eventually, a fire. To address this issue, manufacturers should ensure that the electric circuits and components used in E2Ws are of high quality and meet safety standards. Furthermore, proper maintenance and regular check-ups should be conducted to prevent overheating and other issues that can lead to a fire. Riders should also be educated on E2W charging and maintenance to prevent fires. GOI has initiated several programmes and initiatives to ensure EV safety in the country:

- **Automotive Research Association of India (ARAI) Certification:** The ARAI provides safety certification for EVs in India, ensuring that the vehicles meet safety standards and regulations.
- **FAME Scheme:** The FAME scheme provides financial incentives to promote EV adoption in India. The scheme also focuses on improving the safety of EVs by supporting the development of safer EV technology.
- **Battery Safety Guidelines:** The Ministry of Heavy Industries and Public Enterprises has developed safety guidelines for EV batteries to ensure they are safe to use and handle.
- **Charging Infrastructure Safety Guidelines:** CEA has released guidelines on the safety of EV charging infrastructure in India. The guidelines cover various aspects of EV charging infrastructure, including safety protocols, installation procedures, and maintenance guidelines.
- **National Automotive Board:** The National Automotive Board (NAB) has been set up to provide a platform for industry stakeholders to collaborate on issues related to EV safety, including developing safety standards and regulations.

Overall, these initiatives demonstrate the government's commitment to promoting EV adoption in India while ensuring that safety remains a top priority.

Battery replacement – Battery replacement is a significant challenge for EV adoption. The high battery replacement cost can make the overall cost of owning an E2W much higher than that of an ICE two-wheeler. Manufacturers need to find ways to lower the battery replacement cost, e.g., through advancements in battery technology or by offering longer warranty periods. Furthermore, governments could consider providing incentives or subsidies for battery replacement, similar to those provided for purchasing new EVs, thus making the overall cost of owning an E2W more affordable for consumers.

Battery swapping enables EV owners to quickly and easily replace the depleted batteries in their vehicles with fully charged ones, eliminating the need for long charging times. In recent years, battery swapping has emerged as a potential solution to reduce the cost of EVs, as batteries account for a significant portion of the vehicle's cost. One way to reduce the cost of EV batteries is to adopt a subscription-based model, in which the EV manufacturer owns the battery, and the EV owner pays a monthly fee for the use of the battery. This model, known as Battery as a Service (BaaS), can help reduce the upfront cost of EVs and make them more accessible to a wider range of consumers. GOI has recognised the potential benefits of BaaS and is working towards encouraging its adoption in the country. In 2020, the Ministry of Heavy Industries and Public Enterprises launched the National Advanced Battery Storage Programme (NABSP) to develop and promote BaaS models in India. Moreover, the government has also announced various incentives and subsidies to encourage EV adoption and the development of EV charging infrastructure in the country, including support for the development of battery swapping stations.

Weight-carrying capacity - The weight-carrying/load-bearing capacity of the vehicle is an important factor to consider for E2Ws, as it affects both the performance and usability of the vehicle. Some manufacturers claim that their vehicles can carry a weight of 150-200 kilograms (kg), but there are reports of customers facing issues when trying to do so. This can be a barrier for some consumers to purchase an E2W. It is important for manufacturers to represent their vehicles' weight-carrying capabilities accurately and for the industry to continue innovating and improving E2Ws' load-bearing capacity.

In conclusion, India's widespread adoption of E2Ws faces multiple challenges, including high initial costs, limited charging infrastructure, safety concerns, and battery replacement and load-bearing capacity issues. However, the government, manufacturers, and private companies are actively working to address these challenges by investing in R&D, providing subsidies and incentives, and building charging infrastructure. Furthermore, alternative battery technologies like sodium-ion batteries are being developed, which could potentially make E2Ws more affordable and accessible to consumers. As these challenges are overcome, E2Ws have the potential to revolutionise transport in India by reducing emissions, improving air quality, and providing a more sustainable mode of transport to millions of people. The Indian government has set a target of achieving 80% adoption of electric two- and three-wheelers in the country by 2030, with a specific focus on promoting E2W adoption. Through this report, we aim to support the acceleration of the adoption of E2Ws and assist all stakeholders in the EV ecosystem, including GOI and OEMs, in achieving the national goal. By promoting E2W adoption, we can help India to achieve its national targets of reducing carbon emissions and enhancing sustainable transport.



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