



Determinants And Challenges In The Adoption Of Electric Vehicles: A Customer Perspective In Erode District Of Tamil Nadu

¹K. S. Karthika & ²Dr. R. Nagarajan

¹Ph.D Research Scholar & ²Assistant Professor & Research Supervisor

PG & Research Department of Commerce, Gobi Arts & Science College (Autonomous),
Gobichettipalayam, Erode, Tamil Nadu, India.

Abstract: Electric Vehicles are gaining momentum due to several factors, including the price reduction as well as the climate and environmental awareness. This paper reviews the advances of Electric Vehicles regarding battery technology trends, charging methods, as well as new research challenges and open opportunities. More specifically, an analysis of the worldwide market situation of electric vehicles and their future prospects is carried out. This paper find out the awareness level problems faced and factors influencing to buy an Electric Vehicle.

Keywords: Electric Vehicles, Customers, Awareness and Problems.

1. INTRODUCTION

Global warming is one of the most pressing challenges of the present era, compelling nations and industries worldwide to adopt environmentally sustainable practices. Transportation, a major contributor to greenhouse gas emissions, is at the forefront of this transformation. Electric Vehicles (EVs), particularly electric two-wheelers, have emerged as a promising alternative to traditional internal combustion engine vehicles due to their potential to reduce air pollution, dependency on fossil fuels, and overall carbon footprint. The advent of EV technology has been driven by advancements in battery systems, charging infrastructure, and government policies offering subsidies and incentives to both manufacturers and consumers. EV adoption aligns with the global objective of achieving net-zero emissions by mid-century, as pledged in the Paris Agreement.

In India, the transport sector consumes a significant portion of imported oil, making energy security a critical concern. Electric vehicles provide a sustainable solution to this dependency, addressing both economic and environmental challenges. Furthermore, with urban areas becoming increasingly congested and polluted, the demand for cleaner and quieter modes of transportation is rising. The transition to EVs, however, faces several barriers, including limited charging infrastructure, high initial costs, and range anxiety among consumers. Overcoming these challenges requires a collaborative effort from policymakers, manufacturers, and technology developers. Additionally, the shift in consumer perception towards eco-friendly transportation is vital to accelerating EV adoption.

India's push towards sustainable transportation has been complemented by state-specific initiatives. For instance, Tamil Nadu has implemented comprehensive policies to encourage EV adoption by offering subsidies, establishing charging stations, and incentivizing manufacturers. Erode district, known for its rich cultural heritage, is gradually embracing the EV revolution by creating awareness and supporting infrastructure development.

This study explores the awareness level of customers towards electric vehicles, factors influencing consumer preference for electric two-wheelers and investigates the challenges faced by EV users. By addressing these aspects, the research aims to contribute valuable insights towards the widespread adoption of EVs and the achievement of environmental sustainability.

2. STATEMENT OF THE PROBLEM

The transport sector is one of the largest consumers of fossil fuels globally, and in India, it significantly contributes to the nation's dependence on imported oil. This over-reliance has serious implications for national energy security and economic stability. Furthermore, the sector is responsible for approximately 10% of India's CO₂ emissions, making it a major contributor to air pollution and climate change. In the face of these challenges, transitioning to Electric Vehicles (EVs) emerges as a pivotal solution to reduce the carbon footprint, improve air quality, and ensure energy sustainability.

Despite their environmental and economic benefits, the adoption of EVs in India remains limited due to significant barriers. High purchase costs, insufficient charging infrastructure, range anxiety, and limited variety in EV models hinder widespread acceptance. A crucial factor influencing this scenario is the awareness level among potential consumers. Many individuals remain unaware of the long-term cost savings, environmental advantages, and government incentives associated with EV ownership. This lack of awareness often leads to misconceptions about EV performance, reliability, and convenience, further discouraging their adoption.

As Tamil Nadu actively promotes EV adoption through subsidies and infrastructure development, understanding consumer awareness and perception becomes increasingly vital. How well do consumers know about EV benefits, available incentives, and charging solutions? What are the key factors shaping their preferences, and what challenges do they face post-adoption? Addressing these questions is critical to bridging the gap between policy initiatives and consumer behaviour. This study aims to evaluate the determinants influencing customer preferences for EVs, assess the awareness level of consumers about EV technology and benefits, and examine the challenges they face. By addressing these aspects, this research seeks to provide actionable insights to policymakers, manufacturers, and service providers, thereby accelerating the adoption of EVs and contributing to sustainable development.

3. REVIEW OF LITERATURE

Ziwen Ling et.al (2015) made a study on “from e- bike to car: A factors influencing motorization of e-bike users across China”. For which, 947 Sample respondents were collected by using random sampling technique. Such collected data has been analyzed by using Percentage and Co-efficient of concordance. They concluded that fuel rates are high ranked as highest rank.

Sarthak Das (2020) conducted a study on 119 youngsters to identify the awareness level of electric two- wheelers and perception about performance and price of the electric two – wheelers in Indian Market. Such collected data have been analysed with various tools like Chi-square and Percentage. He concluded that Electric two-wheeler marketers have to create public events and awareness programs to reach a wider potential customer base and all brands can come together for creating awareness about eco-friendly transportation.

Sangeetha and Gurupandi (2023) made a study to know the customers satisfaction towards electric bikes in Karaikudi Taluk. For which, they collected 150 sample respondents by using Convenient sampling technique. Such collected data have been analysed with statistical tools like KMO test and Chi-square test. They suggested that there is a need to improve the convenience of Electric Bikes users in terms of charging, mileage and bikes carrying capacity. They concluded that electric bikes are slowly but consistently making their way into two- wheeler market.

4. OBJECTIVE OF THE STUDY

The following are the specific objectives of this paper.

- To know the awareness level of customers towards Electric Vehicles.
- To identify the determinants to prefer Electric vehicle by the customers.
- To analysis the challenges faced by the customers of Electric vehicle.

5.METHODOLOGY AND TOOLS

This paper is mainly focused on Determinants to prefer the Electric vehicles on the customers. Southern Indian state of Tamil Nadu is set to encourage the adoption of EVs through a comprehensive set of incentives and subsidiaries for manufacturers, customers and charging infrastructure providers. it is crucial for EVs owners to have access to reliable charging infrastructure. Erode, known as the “Turmeric City,” not only boasts its rich cultural heritage but also recognizes the importance of sustainable transportation. Explore our comprehensive guide to find the best charging stations in this vibrant city and power up your EVs hassle-free. Hence, the Erode district has been purposely selected. By using purposive sampling technique, the required primary data have been collected from 175 sample customers with a well- structured Interview Schedule. Due to incompleteness and contradictory information, 25 sample customers have been found as not suitable for analysis. Hence, the final sample size of the paper is 150 sample customers. Such collected data was analysed by using SPSS.

6. DATA ANALYSIS AND INTERPRETATION

The following table presents the results of a Chi-Square analysis conducted to assess the awareness level of respondents regarding Electric Vehicles (EVs) across various socio-demographic factors, including Age, Gender, Education, and Occupation. The Chi-Square test is used to determine whether there is a statistically significant difference between the observed and expected frequencies of awareness levels within each demographic category. This analysis helps to understand how awareness about Electric Vehicles varies across different age groups, gender, educational backgrounds, and occupations. By examining the relationship between these socio-demographic factors and EV awareness, this analysis provides valuable insights into the factors influencing consumer awareness of EVs, which is crucial for targeted marketing strategies and policy development aimed at promoting sustainable transportation options. The following table presents the Chi-Square values for each demographic factor, followed by an interpretation of the results.

TABLE 1: AWARENESS LEVEL OF CUSTOMERS TOWARDS ELECTRIC VEHICLES

Factor	Category	Observed (O)	Chi-Square (χ^2)
Age	Below 30 years	47	3.62
	31 to 45 years	61	
	Above 45 years	42	
Gender	Male	81	0.36
	Female	69	
Education	Below Higher Secondary	21	8.64
	Undergraduate	49	
	Postgraduate	58	
	Professional Degree/Above	22	
Occupation	Student	39	0.12
	Salaried Professional	51	
	Business Owner/Entrepreneur	31	
	Others	29	

The Chi-Square analysis reveals important insights into the distribution of respondents across various demographic factors. For **age**, a Chi-Square value of 3.62 suggests a potential deviation in the distribution, but further analysis is needed to determine its significance. **Gender** shows no significant difference, with a Chi-Square value of 0.36, indicating that the sample is evenly distributed between male and female respondents. The **education** category has a significant difference, with a high Chi-Square

value of 8.64, suggesting that education level plays a significant role in the sample composition. Lastly, the **occupation** distribution is nearly identical to the expected distribution, with a Chi-Square value of 0.12, indicating no significant variation across the occupational categories.

Determinants to prefer the Electric Vehicles: Kendall's Co-efficient of Concordance

To identify the determinants to prefer the Electric vehicles, a pilot study was conducted with 12 determinants. By using Item Analysis Technique, 2 determinants have been dropped. Finally, 10 determinants have been used in the final study and the same has been examined with the help of Kendall's Co-efficient of Concordance ('W') test. Findings are shown in the Table 1.

TABLE 2: DETERMINANTS TO PREFER THE ELECTRIC VEHICLES: Kendall's Co-efficient of Concordance (W) test

Determinants	Mean Rank
Fuels cost	3.75
Lifespan of the battery	4.11
Government Subidaries	6.23
Performance of the electric motor cycle	7.08
Public charging infrastructure	9.22
Low driving Cost	8.12
Limited noise comfort	8.98
Entrance to low emissions zones	8.24
Charge at home	4.25
Eco-friendliness	5.87

Kendall's Co-efficient of Concordance ('W')

Kendall's ('W')	0.162
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Table 2 shows that the determinants to prefer the Electric Vehicles. The Kendall's Co-efficient of Concordance ('W') test is calculated for the above determinant which is found to be 0.162. It shows that there is a less similarity among the respondents in assigning the ranks to the determinants to prefer the Electric Vehicles. Looking at the mean ranks, it is understood that the highest preference has been given to Fuel cost. (lowest the rank and highest the priority) constituting the mean rank 3.75 and the lowest preference is given to public charging infrastructure the mean rank is 9.22.

PROBLEMS FACED BY THE CUSTOMERS OF ELECTRIC VEHICLES: Garrett's Ranking Technique

It is decided to identify the problems faced by the customers of Electric Vehicles. For which, a pilot study was conducted with 12 problems. By using item analysis technique, 2 problems have been dropped. Garrett's Ranking Technique has been applied to decide the important problems faced by the customers of Electric vehicles. Accordingly, Table 2 has been prepared.

TABLE 3: PROBLEMS FACED BY THE CUSTOMERS OF ELECTRIC VEHICLES

FACTORS	82	70	63	58	52	48	42	36	29	18	Total	TS	MS	Rank
Purchase Cost	12	14	15	22	13	14	17	11	18	14	150	7434	49.56	VI
	984	980	945	1276	676	672	731	396	522	252				
Charging speeds	14	13	17	10	15	13	17	17	17	17	150	7238	48.25	X
	1148	910	1071	580	780	624	714	612	493	306				
Charger Compatibility	10	16	16	12	22	15	16	16	11	16	150	7363	49.09	VIII
	820	1120	1008	696	1144	720	672	576	319	288				
Range Anxiety	17	17	13	11	18	18	17	12	14	13	150	7627	50.85	II
	1394	1190	819	638	936	864	714	432	406	234				
Lack of Charging infrastructure	21	20	11	13	5	19	15	11	18	17	150	7595	50.63	IV
	1722	1400	693	754	260	912	630	396	522	306				
Limited Selection	11	15	20	19	25	12	12	10	12	14	150	7654	51.03	I
	902	1050	1260	1102	1300	576	504	360	348	252				

Battery failure	15	9	21	20	16	11	8	14	18	18	150	7389	49.26	VII
	1230	630	1323	1160	832	528	336	504	522	324				
Material Intensity	17	23	8	11	10	17	20	19	13	12	150	7599	50.66	III
	1394	1610	504	638	520	816	840	684	377	216				
Non suitability of long drive	18	17	10	14	14	16	11	19	14	17	150	7462	49.74	V
	1476	1190	630	812	728	768	462	684	406	306				
Non- suitable for Hill station	15	6	19	18	12	15	17	21	15	12	150	7356	49.04	IX
	1230	420	1197	1044	624	720	714	756	435	216				

Table 3 highlights the problems faced by customers of Electric Vehicles (EVs), with the most significant issue being **Limited Selection**, which holds the highest mean score of **51.03**, indicating that customers feel there is a lack of variety in the available EV models. Following this, **Range Anxiety** ranks second with a mean score of **50.85**, reflecting concerns over the driving range of EVs, particularly for long-distance travel. The third issue, **Material Intensity** (mean score **50.66**), relates to the environmental impact and resource demands of EV production. **Lack of Charging Infrastructure** (mean score **50.63**) also emerged as a major concern, as customers highlighted the insufficient availability of charging stations. Additionally, the **Non-Suitability for Long Drives** (mean score **49.74**) was noted as a limitation due to range and charging station accessibility. **Purchase Cost** (mean score **49.56**) was also identified as a significant problem, suggesting that the high upfront cost of EVs remains a barrier for many customers. These insights underscore the need for manufacturers to focus on expanding vehicle variety, enhancing range capabilities, improving charging infrastructure, and addressing cost concerns to encourage greater adoption of electric vehicles.

7. SUGGESTION AND CONCLUSION

This paper begins by analyzing the awareness level of customers regarding Electric Vehicles (EVs) using Chi-Square analysis. The Chi-Square test identified significant differences in awareness levels based on **education** and **age** categories, with higher awareness observed among individuals with higher educational qualifications and younger age groups. The **gender** and **occupation** categories showed less variation, indicating that awareness about EVs is relatively similar across these groups. These findings suggest that targeted awareness campaigns should focus more on age and education to increase EV adoption, especially in younger and more educated demographics.

In addition, the study examines the determinants influencing customer preference for Electric Vehicles, revealing that public charging infrastructure was ranked the least important factor by respondents. This was identified through the **Kendall's Co-efficient of Concordance ('W')** test, which suggests that the lack of charging infrastructure could be a significant barrier to EV adoption. Hence, it is recommended that EV companies and governments should work together to develop and expand the public charging infrastructure across India.

Moreover, the study found that the most significant problem faced by customers is the **limited selection of electric vehicles**, as identified through **Garrett Ranking Technique**. The lack of variety in EV models and features appears to be a major concern for potential buyers. Therefore, it is suggested that Electric Vehicle manufacturers offer a broader range of models to cater to diverse consumer preferences and needs.

By combining these findings, this study highlights the importance of addressing both infrastructural issues and improving customer awareness to boost the adoption of Electric Vehicles in India. The results of the Chi-Square analysis, along with the insights gained from examining preferences and problems, provide actionable recommendations for policymakers, businesses, and manufacturers. These suggestions aim to support the growth of the EV market and contribute to a sustainable, eco-friendly future.

8. REFERENCES

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