An Empirical Study on The Growth of Electric Vehicle and Consumer Preferences: A Case Study of Ranchi District, Jharkhand

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***Abstract*—The escalating level of the pollution results in the rising of the earth's temperature and this ultimately affect the environment, health of an individuals, climate and global warming. Major pollution of the earth is contributed by the vehicular emission all over the world which roughly estimated as 25% of the total global emission. To overcome this constraint, a clean, low emission, efficient and sustainable transportation system is required. It will help in the reduction of emission of greenhouse gases, over-reliance on fossil fuel and lower ecological degradation. This requires a necessary shift from the Conventional Internal Combustion Engine (ICE) to the next best alternative towards the Electric Vehicle. Therefore, our study highlights the preferences and adoption rate by both existing as well as potential consumer of all segments of electric vehicle which will result in the growth of demand of the electric vehicle. This study mainly focusses on the major factor that influences the adoption of electric vehicle and consumer preferences. Factors such as cost of vehicle, charging infrastructures, maintenance cost, and performance of the battery. As this study is empirical in nature, it consists of both Primary as well as Secondary data. Primary data is collected through well-structured questionnaire from the respondent (about 100-150 respondent) of the Ranchi District where as Secondary data is collected through different government reports, research journal and automobile industry reports. To analyze the data different statistical tools were used such as percentage analysis, tabular analysis, graphical representation and comparative analysis. The findings of the study shows that various consumers are aware of the cost and reliability of the vehicles. However, the main hindrance occurs when it comes to factors like charging stations and battery performance. The consumers face a challenge in adoption of electric vehicle due to these factors. Therefore, our study helps the policymakers, automobile manufacturers and governments of the Ranchi District to create the awareness of the need of promoting the adoption of electric vehicle to strengthen the transportation system of the district.**

***Index Terms*—EV adoption, electric vehicle, Sustainable transportation, Empirical data, Cost structure, Battery performance.**

I. INTRODUCTION

Transportation is one of the most fundamental components of modern society and plays a vital role in the economic, social, and technological development of a nation. It refers to the movement of people, goods, and services from one place to another through various modes such as roadways, railways, waterways, and airways. An efficient transportation system facilitates connectivity, promotes trade and commerce, and enhances the overall quality of life. The transportation sector has witnessed remarkable growth due to rapid urbanization, industrialization, technological advancements, and increasing population. However, this growth has also resulted in traffic congestion, environmental pollution, excessive fuel consumption, and increasing dependence on fossil fuels. Conventional vehicles running on petrol and diesel emit harmful pollutants, contributing to air pollution, greenhouse gas emissions, climate change, and adverse health impacts. The increasing dependence on fossil fuels has also raised concerns regarding energy security and environmental sustainability. These challenges have created the need for sustainable transportation systems. Sustainable transportation promotes cleaner alternatives that reduce pollution and conserve natural resources. In this context, electric vehicles have emerged as a promising alternative to conventional internal combustion engine vehicles. They offer cleaner transportation by reducing harmful emissions, improving energy efficiency, and decreasing dependence on fossil fuels. The transition toward electric mobility is expected to play a

significant role in achieving sustainable economic development, environmental protection, and long-term energy security.

II. BACKGROUND OF THE STUDY

Electric vehicles (EVs) are an integration of a vehicle body, electric power, energy storage battery, and energy management. They are not just a mode of transport but a new form of electric equipment. An electric vehicle is a road vehicle based on modern electric power that consists of an electric motor, power converter, and an energy source such as a battery or fuel cell. The development of electric vehicles dates back to the eighteenth century, and with the invention of rechargeable batteries and continuous technological advancements, EVs have evolved into a practical and environmentally friendly alternative to conventional internal combustion engine vehicles. Today, Battery Electric Vehicles (BEVs), Hybrid Electric Vehicles (HEVs), Plug-in Hybrid Electric Vehicles (PHEVs), and Fuel Cell Electric Vehicles (FCEVs) are the major types of EVs. They offer several advantages, including zero or low tailpipe emissions, improved energy efficiency, lower operating costs, reduced noise pollution, and decreased dependence on fossil fuels. However, challenges such as high battery costs, limited charging infrastructure, range anxiety, and battery lifespan continue to affect their widespread adoption. Despite these limitations, supportive government policies, technological innovations, and growing environmental awareness have accelerated the global growth of electric vehicles, making them a key component of sustainable transportation and the future of the automobile industry. In India, the adoption of electric vehicles is gradually increasing, including in emerging cities such as Ranchi. Therefore, understanding the growth of electric vehicles and consumer preferences in Ranchi district is essential for assessing the opportunities, challenges, and future potential of electric mobility in the region.

III. STATEMENT OF PROBLEM

Indian banking sector has 3 most challenging factor that any bank suffer are their poor financial performance, increment of Non-Performing Assets and the poor Assets Quality of the Banks. this issues adversely affect the profitability, financial performances, stability of the bank. Most of the study focus on national level with less focus on regional studies. It's important to understand, how much NPA actually impact in the bank's efficiency and how much difference in the impact of the NPA in the private and the public banks. Many others study held in past, in different different context and their findings also vary. So, it is important to analysis with updated data so that we can make a realistic comparative study.

IV. SIGNIFICANCE OF THE STUDY

The present study is significant as it provides an understanding of the growth of electric vehicles and consumer preferences in Ranchi district, Jharkhand. It identifies the key factors influencing consumers' purchase decisions, awareness, and acceptance of electric vehicles. The findings will be useful for policymakers in formulating effective strategies to promote electric mobility and strengthen charging infrastructure. The study will also help automobile manufacturers and dealers understand consumer expectations and market potential in the region. Furthermore, it contributes to the existing literature by providing district-level empirical evidence, where limited research is available. The study will serve as a valuable reference for researchers, academicians, and students interested in sustainable transportation and consumer behaviour, while supporting the promotion of environmentally friendly and energy-efficient transportation systems.

V. SCOPE OF THE STUDY

The present study focuses on the growth of electric vehicles and consumer preferences with special reference to Ranchi district, Jharkhand. It examines the level of awareness, perception, and factors influencing consumers' purchase decisions regarding electric vehicles. The study also analyzes the current status of EV adoption, government initiatives, and the challenges and opportunities associated with electric mobility in the region. Primary data collected from consumers forms the basis of the analysis. The findings are expected to provide valuable insights for policymakers, automobile manufacturers, dealers, and researchers to promote the adoption of electric vehicles and support sustainable transportation in Ranchi district.

VI. REVIEW OF LITERATURE

1. Tiwari (2023) examined factors influencing electric vehicle adoption and sustainable transportation. Using data collected from EV users through online surveys, the study found that social influence had little effect on purchase decisions, while understanding adoption barriers and enablers is essential for promoting electric vehicles.

2. Joshi (2026) studied passenger electric vehicle adoption in Eastern India. The findings revealed that high purchase cost, limited charging infrastructure, range anxiety, and low awareness hinder EV adoption, whereas government incentives, environmental concern, and technological advancements positively influence consumer acceptance.

3. Saxena (2024) investigated consumer preference for electric two-wheelers in Haryana. The study identified safety and purchase cost as the most important factors influencing buying decisions. It recommended improving battery safety, charging infrastructure, and service centres to encourage greater adoption of electric vehicles.

4. Prateek Bansal et al. (2021) found that consumers are willing to pay more for improved electric vehicle features such as longer driving range and shorter charging time. The study suggested that better vehicle design and supportive government policies can significantly increase EV adoption.

5. Nikos Arechiga et al. (2022) emphasized the importance of personalized interventions in promoting electric vehicle adoption. The study concluded that understanding individual preferences through advanced prediction models can help policymakers develop more effective strategies to increase EV adoption.

6. Milad Ghasri et al. (2019) examined consumers' perceived advantages of electric vehicles compared to conventional vehicles. The study found that attractive design, environmental benefits, and improved safety positively influence EV adoption. Consumers prefer EVs when they perceive greater overall benefits than conventional vehicles.

7. B. Xavier et al. (2025) investigated factors influencing the adoption of electric four-wheelers in India. The study identified affordability and government subsidies as the most significant factors affecting consumer decisions and recommended improving financial support to accelerate EV adoption.

8. Ona Egbue and Suzanna Long (2012) explored socio-technical barriers to electric vehicle adoption. The study found that consumers hesitate to adopt unfamiliar technologies unless they offer better performance and benefits. It recommended consumer-oriented policies and improved vehicle design to encourage EV acceptance.

9. Jonn Axsen and Kenneth S. Kurani (2013) examined consumer acceptance of plug-in electric vehicles combined with green electricity. The study found that promoting both together increased consumer interest by 23%, highlighting the importance of environmental benefits and financial savings in encouraging EV adoption.

10. Rezvani, Jansson, and Bodin (2015) reviewed factors influencing electric vehicle adoption. The study concluded that consumer perception plays a crucial role, with environmental benefits, lower operating costs, and technological innovation encouraging adoption, while high purchase cost, limited charging infrastructure, and range anxiety remain major barriers.

11. Hardman et al. (2017) reviewed the importance of charging infrastructure for the successful adoption of plug-in electric vehicles. The study found that consumers prefer home charging, followed by workplace and public charging. It emphasized that accessible charging infrastructure is essential for increasing EV adoption.

12. Kumar and Alok (2020) examined factors affecting electric vehicle adoption in India. The study revealed that lower purchase prices and higher long-term savings significantly increase consumers' willingness to buy EVs. Younger consumers and married individuals also showed a more positive attitude toward EV adoption.

13. Li et al. (2017) analyzed the economic, psychological, and policy-related factors influencing electric vehicle adoption. The study concluded that consumer decisions are affected not only by financial benefits but also by psychological and social factors, highlighting the need for comprehensive policies to encourage EV adoption.

14. Sierzchula et al. (2017) investigated the impact of government policies on electric vehicle adoption. The study found that financial incentives, charging infrastructure, and local EV production positively influence adoption. However, consumer awareness and supportive policies are equally important for long-term market growth.

15. Carley et al. (2013) examined consumer intentions to purchase or lease plug-in electric vehicles. The study found that highly educated consumers and environmentally conscious individuals were more likely to adopt EVs, while battery limitations, charging concerns, and technology-related uncertainties remained major barriers.

16. Degirmenci and Breitner (2017) investigated factors influencing consumers' purchase intention toward electric vehicles. The study found that environmental performance has a stronger impact on purchase decisions than price and driving range, suggesting that emphasizing environmental benefits can significantly encourage EV adoption.

17. Javid and Nejat (2017) examined consumer attitudes toward low-carbon vehicles. The study revealed that limited awareness and inadequate knowledge about cleaner vehicle technologies reduce adoption. It suggested that improving consumer education and targeted information campaigns can effectively increase the acceptance of electric vehicles.

18. Graham-Rowe et al. (2012) explored consumers' perceptions of plug-in electric vehicles through user experience. The findings showed that concerns regarding charging infrastructure, vehicle reliability, and future technological changes influence adoption more than environmental benefits, highlighting the importance of improving consumer confidence.

19. Skippon and Garwood (2011) studied consumer perceptions of electric vehicle performance. The research found that dynamic performance, driving comfort, and cruising ability significantly influence consumer preferences. It recommended that manufacturers focus on improving vehicle performance to overcome existing adoption barriers.

20. Chan (1993) reviewed the development and future prospects of electric vehicles. The study highlighted the importance of technological advancements in electric motors, batteries, and power electronics. It concluded that supportive legislation, standardized technology, and charging infrastructure are essential for the long-term growth of the electric vehicle industry.

VII. RESEARCH GAP

Electric vehicles (EVs) have gained significant attention due to their potential to reduce environmental pollution, improve energy efficiency, and promote sustainable transportation. Many studies have examined consumer attitudes, government incentives, charging infrastructure, technology, and purchase intention. However, most research has focused on metropolitan cities, while smaller cities like Ranchi remain underexplored despite their different socio-economic conditions and consumer behaviour. Existing studies also provide limited comparison between urban and rural consumers and generally examine either EV growth or consumer preference separately. Moreover, most research relies on secondary data collected at the national or state level, with very few survey-based studies conducted in Ranchi district. The rapidly evolving EV market also requires updated empirical evidence. Therefore, the present study aims to examine the growth of electric vehicles and consumer preferences in Ranchi district using primary data, providing region-specific insights and practical recommendations for policymakers, manufacturers, and other stakeholders.

RESEARCH QUESTIONS

1. What is the current level of EV growth and visibility in Ranchi District?
2. How does consumer evaluate EVs in terms of price, battery life, charging time and service access?

3. What are the major differences in the consumer preferences among urban and rural respondent?

RESEARCH OBJECTIVES

1. To study the existing growth pattern and progression of electric vehicle in Ranchi District.
2. To study the impact of charging infrastructure on consumer intention while adopting electric vehicle.
3. To analyse the differences in consumer preferences among urban and rural respondents.

HYPOTHESIS OF THE STUDY

H_0 (Null Hypothesis): Income level has no significant effect on the purchase decision of electric vehicle.

H_1 (Alternative Hypothesis): Income level has a significant effect on the purchase decision of electric vehicle.

VIII. RESEARCH METHODOLOGY

Research Methodology is a systematic process of collecting data and relevant information by conducting proper research.

1. Research Design

The study adopts both descriptive and analytical research designs. An empirical field survey will be conducted to collect primary data from respondents in Ranchi district. Limited interviews with dealers and charging station operators will provide additional insights.

2.Data Collection

The study is based on both primary and secondary data.

A. Primary Data

Primary data will be collected through a structured questionnaire administered through both online and offline surveys. The questionnaire will assess consumer preferences, influencing factors, and perceptions towards electric vehicles.

B. Secondary Data

Secondary data will be collected from reliable sources such as:

- NITI Aayog Reports
- Ministry of Heavy Industries Reports
- International Energy Agency (IEA)
- Economic Times, Business Standard, etc.
- Government of Jharkhand publications

3.Nature of the Study

- Quantitative research based on statistical analysis.
- Includes qualitative insights on consumer opinions and perceptions.

1. Area of the Study

The study is confined to Ranchi district, Jharkhand, covering both urban and rural respondents.

2. Sampling Design

A. Population

Consumers and potential vehicle users in Ranchi district.

B. Sample Size

100–150 respondents.

C. Sampling Technique

Stratified Random Sampling based on age, income, and occupation.

3. Data Collection Method

- Survey method using a structured questionnaire.
- Data collected through Google Forms and field surveys.

IX. DATA ANALYSIS AND HYPOTHESIS TESTING

In this topic we are going to analyze as well as interpret the data that have been collected through the questionnaire. This chapter also includes a hypothesis testing so as to examine the null hypothesis and the alternative hypothesis of income and purchase decision. This will enable us to interpret the meaning of the data in a simple manner.

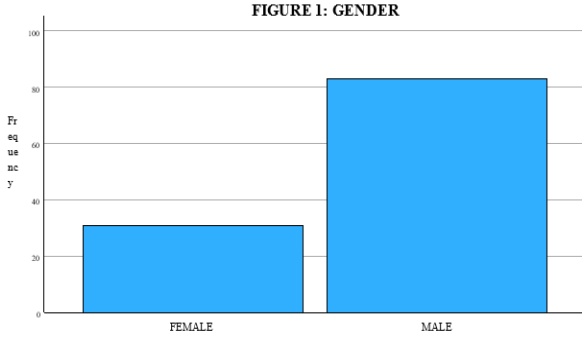
1. GENDER

GENDER	FREQUENCY	PERCENTAGE
MALE	60	60
FEMALE	40	40
TOTAL	100	100

The table shows the respondent's gender distribution. Among 114 respondent 83 respondent (72.8%) are male and 31 respondents (27.2%) are female. This

shows that the majority of the respondent are male and the finding are influenced largely by male respondents.

FIGURE 1: GENDER

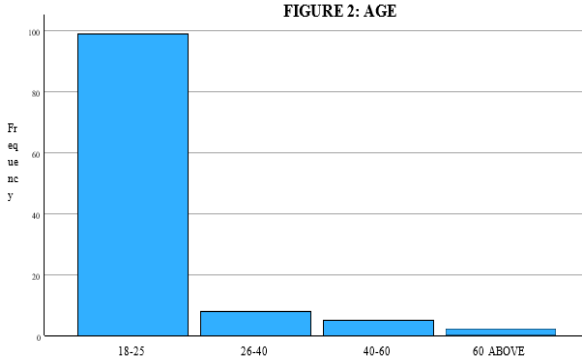


2. AGE BRACKET

AGE	FREQUENCY	PERCENTAGE
18-25	99	86.80
26-40	8	7.0
40-60	5	4.4
60 ABOVE	2	1.8
TOTAL	114	100

The table shows age distribution of the respondents. Major percentage of respondents that is 99 (86.8%) are from the age gap 18-25 years. 8 respondents (7%) of age group between 26-40 years. 5 respondent (4.4%) belongs to 40–60 years category. 2respondent (1.8%) are above the category of 60 years. This represent that most of the respondent are young individual

FIGURE 2: AGE

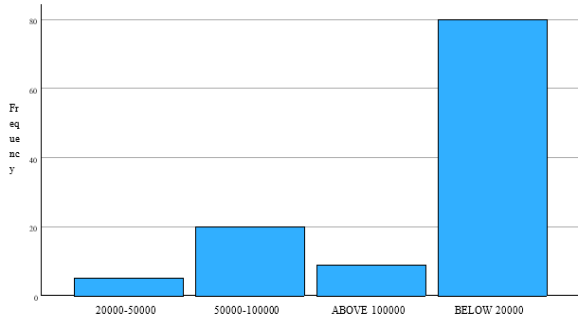


3. AVERAGE MONTHLY INCOME

INCOME	FREQUENCY	PERCENT
20000-50000	5	4.4
50000-100000	20	17.5
ABOVE 100000	9	7.9
BELOW 200000	80	70.2
TOTAL	114	100

This table provide the information about monthly income of the respondents. Out of 114 respondent 80 (70.2%) belongs to the category of monthly income below 20000 rupees. Income between 50000 to 100000 rupees consist of 20 respondent (17.5%). 9 respondent belongs to the category of above 100000 rupees (7.9%) while only 5 respondent (4.4%) fall within the category of 20000 to 50000 rupees. This shows that majority of respondent belongs to the category below 20000 rupees.

FIGURE 3: MONTHLY INCOME

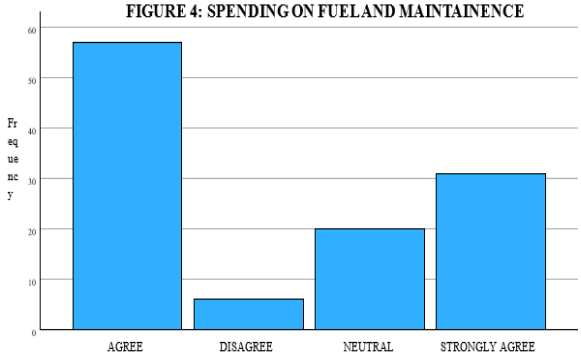


4. I BELIEVE EVS ARE ECONOMICAL BECAUSE THEY REQUIRE LESS SPENDING ON FUEL AND MAINTENANCE.

LIKERT SCALE	FREQUENCY	PERCENTAGE
AGREE	57	50
DISAGREE	6	5.3
NEUTRAL	20	17.5
STRONGLY AGREE	31	27.2
TOTAL	114	100

This table represents that electric vehicles are economical as the required less spending on fuel and maintenance. Out of the total 114 respondents 57 respondents (50%) agree and 31 respondents (27.2%) strongly agree that electric vehicle is economical. While only 6 respondents (5.3%) disagree and 20 respondents (17.5%) remains neutral. This represents that the respondents perceive positive impact toward the economical factor of electric vehicle.

FIGURE 4: SPENDING ON FUEL AND MAINTAINENCE

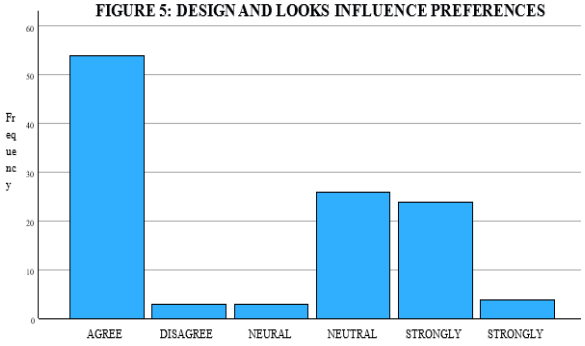


5. AN ELECTRIC VEHICLE'S DESIGN AND OVERALL LOOK INFLUENCE MY PREFERENCES

LIKERT SCALE	FREQUENCY	PERCENT
AGREE	54	47.4
DISAGREE	3	2.6
NEUTRAL	29	25.4
STRONGLY AGREE	24	21.1
STRONGLY DIAGREE	4	3.5
TOTAL	114	100

This table represents that electric vehicles design and overall look influence the preferences of consumers. Out of total 114 respondents 54 responded (47.4%) agree and 24 respondents (21.1%) strongly agree that design and overall look of the electric vehicle influence the preference. Only 7 respondents (6.1%) disagree while 26 respondents (22.8%) remain neutral. This represents that the design of electric vehicle and overall look in the preference of the consumer.

FIGURE 5: DESIGN AND LOOKS INFLUENCE PREFERENCES



X. FINDING OF THE RESULT

The Pearson Chi-Square test revealed a significant association between monthly income and the purchase decision of electric vehicles. The p-value (0.021) was less than 0.05, indicating a significant relationship. Higher-income respondents showed a stronger preference for electric cars, while lower-income respondents preferred e-bikes and e-scooters. The findings confirm that income level and purchasing power significantly influence consumers' choice of electric vehicles.

KEY RESULTS OF THE STUDY

The study revealed that the majority of respondents were male (72.8%), 18–25 years old (86.8%), students (71.1%), belonged to the lower-income group (70.2%), and were from urban areas (90.4%). Most respondents were consumers (95.6%). Electric cars emerged as the most preferred EV (59.6%), with Tata Motors (57%) and TVS (39.5%) being the most preferred car and bike brands, respectively. Most respondents believed that electric vehicles represent the future of transportation and expressed satisfaction with their travel efficiency and cost-effectiveness. Brand reputation, vehicle design, and affordable financing through bank loans or EMI were found to significantly influence purchase decisions. Respondents also considered EVs suitable for Ranchi's road conditions. Although nearly half of the users experienced minor technical issues, the overall perception of EVs remained positive. However, only a small proportion of respondents had received government subsidies, indicating the need for greater awareness and accessibility of government incentive schemes to encourage wider adoption of electric vehicles.

XI. SUGGESTIONS

Based on the findings of the study, several measures can promote the adoption of electric vehicles in Ranchi district. Charging infrastructure should be expanded in both urban and rural areas, with more fast-charging stations. Government agencies and manufacturers should conduct awareness campaigns to educate consumers about the environmental and economic benefits of EVs. Financial incentives, subsidies, tax benefits, and affordable loan or EMI facilities should be strengthened to make EVs more accessible. Manufacturers should focus on reducing vehicle costs, improving battery technology, enhancing product quality, and providing efficient after-sales service. Domestic manufacturing should be encouraged to reduce production costs and increase employment. Public-private partnerships should be strengthened to develop charging infrastructure and EV service centres. Finally, greater environmental awareness, improved consumer trust, wider model availability, and future research involving larger samples and broader geographical areas will further support the sustainable growth of electric vehicles.

XII. CONCLUSION

The study concludes that consumers have a positive attitude towards electric vehicles, although challenges

such as limited charging infrastructure, high cost, and low awareness still affect adoption. Improving government support, financing options, battery technology, and infrastructure can accelerate EV adoption and promote sustainable, environmentally friendly transportation in Ranchi and across India.

XIII. FUTURE SCOPE OF STUDY

The present study provides valuable insights into the growth of electric vehicles and consumer preferences in Ranchi district. However, future research can be extended by covering larger geographical areas, including other districts and states, with a larger and more diverse sample. Comparative studies between urban and rural consumers and different categories of electric vehicles can provide deeper insights into consumer behaviour. Future studies may also examine the impact of charging infrastructure, government policies, technological advancements, battery performance, financing options, environmental awareness, and post-purchase satisfaction on EV adoption. In addition, comparative studies between electric and conventional vehicles, international comparisons, and longitudinal research can provide a better understanding of changing consumer preferences and market trends. Such research will support policymakers, manufacturers, and other stakeholders in promoting sustainable electric mobility in India.

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