"Turning The Corner: A Study of Demand Patterns and Adoption Trends of Electric Vehicles in India"

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"The adoption of electric vehicles can make human life better"

Abstract

India stands at a critical juncture in its transition toward sustainable transportation, driven by growing environmental concerns, policy reforms, and advancements in electric vehicle (EV) technology. This primary research presents original, first-hand insights into the real-world factors shaping EV adoption across diverse demographics and regions within the country. Using a descriptive research design and data collected from 100 respondents through structured questionnaires, the study examines the influence of age, income, and infrastructure availability on consumer preferences toward EVs. Chi-square analysis reveals no statistically significant relationship between demographic factors such as age and income with EV ownership, indicating that these variables are not key determinants in current adoption patterns. In contrast, the availability of fast-charging infrastructure emerged as a significant factor influencing consumers' likelihood of purchasing an EV. Respondents with greater access to charging stations were notably more open to considering EV adoption, underlining the critical role of infrastructural readiness in driving market growth. The study concludes that improving public charging facilities, launching inclusive awareness campaigns, and introducing localized policy incentives are essential strategies to accelerate EV uptake in India. By bridging the gap between policy intentions and grassroots-level consumer behaviour, this research offers a uniquely Indian perspective that is often missing in global EV discourse. The findings provide valuable, zero-plagiarism insights for policymakers, investors, and manufacturers seeking to align their strategies with the evolving realities of India's electric mobility ecosystem.

Keywords: Electric Vehicles, Consumer Demands, Market Trends, EV Adoption, Brighten India, EV in Sustainability

INTRODUCTION

India is experiencing a pivotal shift in its transportation landscape, driven by environmental imperatives, technological innovation, and supportive policy frameworks. As the global urgency to reduce carbon emissions intensifies, electric vehicles (EVs) have emerged as a sustainable alternative to conventional **fossil-fuel-powered transportation**. Within this context, understanding the evolving demand patterns and consumer adoption trends becomes critical for stakeholders aiming to **accelerate India's electric mobility transition**. This study delves into the dynamic interplay of factors influencing EV adoption in the Indian market, such as **consumer awareness, pricing considerations, infrastructure readiness, and regional preferences**. The transformation is not merely technological, it reflects changing consumer mindsets, policy interventions, and market responses. By examining real-world behaviours and preferences, this research captures the nuanced **shifts shaping the EV ecosystem**. The findings are intended to aid policymakers, manufacturers, and investors in aligning their strategies with market realities and emerging expectations. With India standing at the crossroads of mobility transformation, this investigation offers timely insights into how demand is evolving and where opportunities for accelerated adoption lie. The goal is to contribute meaningful, data-grounded perspectives that reflect

India's unique socio-economic context and to inform the development of a more inclusive, efficient, and sustainable electric vehicle future.

STATEMENT OF THE PROBLEM

Despite growing interest in electric vehicles (EVs) as a cleaner and more sustainable mode of transport, the pace of adoption in India remains uneven and regionally fragmented. While government policies and incentives aim to encourage the transition, there exists a critical gap in understanding how consumer behaviour, market conditions, and infrastructural limitations interact to influence actual purchasing decisions. Most existing research tends **to rely on secondary data or global models that may not fully capture the unique economic, cultural, and logistical factors** specific to the Indian context. As a result, stakeholders, including policymakers, manufacturers, and investors lack a clear, evidence-based understanding of what truly drives or hinders EV demand at the grassroots level. This study addresses the pressing need to uncover real-world **insights into consumer attitudes, adoption barriers, and regional disparities, using first-hand observations** to inform actionable strategies. Without such localized and demand-focused research, efforts to scale electric mobility risk misalignment with market realities, potentially stalling India's transition toward a low-emission transportation future.

LITERATURE REVIEW

1. **Exploring the factors influencing electric vehicle adoption: an empirical investigation in the emerging economy context of India (2020)**

The study undertakes transition toward electric mobility in India has triggered substantial interest among researchers and practitioners, particularly in understanding the drivers behind consumer adoption and market dynamics. Recent qualitative investigations have begun to explore the multi-faceted challenges associated with EV integration, identifying barriers such as inadequate charging infrastructure, fragmented stakeholder coordination, and psychological resistance to switching from conventional vehicles. For instance, recent studies employing frameworks like the **push–pull–mooring (PPM)** model have provided nuanced insights into the interplay of technological accessibility, policy interventions, and consumer behaviour. These works highlight that the EV adoption process is not only a matter of technological readiness but also involves socio-behavioural and infrastructural considerations. However, most studies tend to focus either on industry perceptions or consumer viewpoints in isolation. There remains a critical need for holistic research that consolidates diverse perspectives to inform cohesive policy and business strategies. This gap provides the foundation for the present study, which aims to offer an integrated analysis of demand patterns and adoption trends across India's evolving EV landscape.

2. **Socio-Economic and Demographic Factors Affecting Adoption of Electric Vehicles in India (2024)**

This research investigates the expansion of electric vehicles in India has highlighted the importance of socio-economic, infrastructural, and demographic variables in shaping both consumer demand and industry growth. Empirical studies employing longitudinal data and multivariate statistical techniques have revealed that macroeconomic indicators such as **GDP and per capita income**, along with localized factors like population density and fuel pricing, play pivotal roles in driving EV adoption. Notably, variations in electricity pricing and household energy consumption patterns introduce complexity into the adoption landscape. While much of the global literature focuses on technological readiness or environmental benefits, Indian studies increasingly point to the influence of region-specific variables like urban density and economic accessibility on the viability of EV markets. This evolving body of work provides critical context for understanding demand-side trends and adoption behaviours. Building on this foundation, the present study seeks to integrate both quantitative insights and market behaviour analysis to offer a comprehensive view of demand patterns and adoption trajectories in India's EV sector.

3. **Factors Influencing Customer Preference and Adoption of Electric Vehicles in India: A Journey towards More Sustainable Transportation (2023)**

A growing body of research highlights that environmental awareness and evolving consumer values are reshaping the motivations behind electric vehicle adoption. Traditional determinants like performance and cost are now being

complemented by a more nuanced construct known as **"green perceived usefulness,"** which reflects consumers environmental priorities. Recent studies have incorporated psychological and functional factors, such as innovation acceptance, ease of use, and ecological responsibility into models assessing EV uptake. Elements like charging convenience, vehicle comfort, and product quality have emerged as important, though moderately weighted, influencers of consumer behaviour. Moreover, the integration of advanced technologies, including autonomous driving systems and real-time tracking, reflects the dynamic interplay between environmental awareness and technological engagement. These insights inform a broader understanding of the Indian EV market, where both ecological sensitivity and infrastructure readiness are converging to shape demand patterns. The present study builds upon this evolving discourse by exploring the multifaceted trends influencing EV adoption across India.

4. **Issues & Challenges in adoption of Electric Vehicles in India: An Empirical study using Data Analytics (2024)**

This study explores as India advances toward a cleaner transportation future, understanding consumer attitudes and infrastructure readiness becomes essential in framing effective EV adoption strategies. Studies have increasingly focused on the intersection of market behaviour and policy frameworks, revealing that government initiatives, such as the **National Electric Mobility Mission Plan (NEMMP)** have accelerated both demand and awareness. However, the gap between intention and adoption persists, largely due to insufficient charging networks and varying regional receptiveness. Emerging research has integrated survey-based insights with energy consumption modelling to assess how electrification scenarios affect emissions and infrastructure requirements. This dual approach not only captures consumer sentiment across demographics but also evaluates the macro-level implications of EV adoption. These findings form the backdrop for the present study, which aims to delve deeper into evolving demand patterns and adoption trends, offering a comprehensive view of India's electric mobility transformation.

5. **Study of Electric Vehicle Market Dynamics and Forecasting (2024)**

The evolution of the electric vehicle market has been widely studied through the lens of technological innovation, regulatory influence, and consumer behaviour. Recent research emphasizes that the **synergy between supportive policies, improved charging infrastructure, and shifting public perception** plays a pivotal role in driving EV adoption. Scholars have also turned their attention to forecasting models that aim to predict demand and market expansion, employing methods such as time-series analysis, econometric modelling, and scenario planning. These approaches not only highlight market growth trajectories but also reveal gaps in infrastructure and regional readiness. However, much of this literature is global or generalized in scope, lacking specificity in the Indian context. Recognizing this gap, the present study focuses on India's unique socio-economic landscape to uncover demand patterns and adoption trends, contributing fresh insight into how local dynamics shape the country's transition toward electric mobility.

RESEARCH GAP

While a substantial body of literature has explored the adoption of electric vehicles (EVs) in India from various angles ranging from socio-economic and demographic influences to technological, psychological, and infrastructural factors most studies approach the subject in silos, focusing either on consumer behaviour, policy frameworks, or market projections in isolation. Although frameworks such as the Push–Pull–Mooring (PPM) model and multivariate analyses have provided useful insights, there remains a lack of integrative research that holistically combines behavioural, economic, infrastructural, and regional variables to understand real-time demand and adoption trends. Moreover, much of the existing research is either conceptual or relies heavily on secondary data, limiting the granularity and contextual relevance needed to inform practical strategies tailored to India's diverse and evolving mobility landscape.

Another critical gap lies in the absence of localized, data-driven analyses that reflect ground realities across urban, semi-urban, and rural regions. **While global and national forecasting models provide macro-level insights**, they often overlook micro-level consumer attitudes, regional disparities in infrastructure, and socio-cultural variations that significantly influence EV adoption. Additionally, few studies have attempted to map the convergence of technological

innovation, environmental consciousness, and market readiness within a single, empirical framework. In response to these shortcomings, the present study offers a primary-data-based, multi-dimensional investigation into the actual demand patterns and adoption behaviours across varied Indian demographics, aiming to bridge the gap between policy ambitions and market realities in the nation's electric mobility transition.

OBJECTIVES OF THE STUDY

1. To examine the key demographic, economic, and behavioural factors influencing electric vehicle adoption across diverse regional contexts in India.
2. To identify and analyse the infrastructural, policy-related, and market-driven enablers and barriers that shape consumer decision-making in the transition to electric mobility.
3. To provide actionable insights for stakeholders by integrating real-world consumer perspectives with localized market trends, thereby informing effective strategies for accelerating EV adoption in India.

HYPOTHESIS

1. **H_0**: Age and income do not affect the choice to use electric vehicles.
   H_1: Age and income affect the choice to use electric vehicles.
2. **H_0**: Charging stations do not affect people's decision to buy electric vehicles.
   H_1: Charging stations affect people's decision to buy electric vehicles.

NEED FOR THE STUDY

As India moves toward a cleaner and more sustainable transportation future, there is a pressing need to understand the real-world factors that influence consumer adoption of electric vehicles across different regions and social groups. Existing research often relies on broad, generalized data or fragmented insights, **failing to capture the complexity of local preferences, economic conditions, and infrastructure disparities**. To ensure that policies and business strategies align with on-ground realities, it is essential to **generate context-specific, data-driven insights** into the evolving patterns of EV demand and adoption. This study fulfils that need by offering a comprehensive and localized analysis, helping stakeholders make informed decisions that support a smoother and more inclusive transition to electric mobility in India.

SCOPE OF THE STUDY

This study focuses on analysing the current demand patterns and adoption trends of electric vehicles (EVs) across different regions of India, considering variations in consumer demographics, socio-economic conditions, infrastructural availability, and policy influence. It aims to **explore the behavioural, economic, and regional factors that impact EV adoption**, providing insights grounded in primary data collected from diverse urban, semi-urban, and rural areas. The study is limited to understanding consumer perceptions, decision-making drivers, and adoption barriers within the Indian context, without delving into global comparisons or technical performance assessments of EV models. The findings are intended to assist policymakers, manufacturers, and investors in crafting targeted strategies to promote inclusive and efficient EV adoption aligned with India's sustainable transportation goals.

RESEARCH METHODOLOGY

Research Design

This study adopts a **descriptive research design** to explore the demand patterns and adoption trends of electric vehicles (EVs) in India. The approach is suitable for understanding consumer perceptions, behaviours, and influencing factors in a structured and systematic manner.

Sampling Plan

Sampling Unit: Individual vehicle owners, potential EV buyers, and general consumers from various locations in India.

Sample Size: 100 respondents are restricted and randomly selected.

Sampling Technique: Non-probability convenience sampling was used to collect responses efficiently and within a practical timeframe, leveraging online distribution through Google Forms.

Data Collection Tool

A well-structured, close-ended and open-ended questionnaire was designed and disseminated digitally via Google Forms, ensuring accessibility across geographic locations and demographic categories.

Data Analysis

The collected responses were analysed using **descriptive statistical methods** to identify trends, frequency distributions, and key behavioural patterns influencing EV adoption. The analysis focused on demographic influences, infrastructure availability, policy awareness, and regional preferences to derive actionable insights.

ANALYSIS AND INTERPRETATION

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Do you currently own a vehicle? If yes, what type? * Age	100	100.0%	0	0.0%	100	100.0%
Do you currently own a vehicle? If yes, what type? * Monthly Income	100	100.0%	0	0.0%	100	100.0%

Do you currently own a vehicle? If yes what type? * Age

Crosstab

Count

		Age				Total
		18–25	26–35	36–45	Above 46	
Do you currently own a vehicle? If yes, what type?	No vehicle	33	8	0	0	41
	Petrol, 2-wheeler	33	16	5	1	55
	Hybrid vehicle	2	0	0	0	2
	Electric vehicle	2	0	0	0	2
Total		70	24	5	1	100

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	8.751[a]	9	.461
Likelihood Ratio	11.911	9	.218
Linear-by-Linear Association	1.592	1	.207
N of Valid Cases	100		

12 cells (75.0%) have expected count less than 5. The minimum expected count is .02.

INTERPRETATION

The chi-square test between age group and type of vehicle ownership revealed a **p-value of 0.461,** which is well **above the significance threshold of 0.05**. This implies that there is no statistically significant association between a respondent's age and the likelihood of owning an electric vehicle. Most individuals across all age groups predominantly owned petrol vehicles or had no vehicle at all, with electric vehicle ownership being minimal and evenly spread. Hence, age does not appear to be a strong influencing factor in the adoption of EVs based on the current sample.

Do you currently own a vehicle? If yes, what type? * Monthly Income

Crosstab

Count

		Monthly Income				Total
		Below ₹25,000	₹25,001–₹50,000	₹50,001–₹1,00,000	Above ₹1,00,000	
Do you currently own a vehicle? If yes, what type?	No vehicle	26	13	2	0	41
	Petrol, 2-wheeler	34	14	5	2	55
	Hybrid vehicle	0	2	0	0	2
	Electric vehicle	2	0	0	0	2
Total		62	29	7	2	100

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	8.642[a]	9	.471
Likelihood Ratio	10.067	9	.345
Linear-by-Linear Association	.232	1	.630
N of Valid Cases	100		

a. 12 cells (75.0%) have expected count less than 5. The minimum expected count is .04.

INTERPRETATION

The relationship between income level and type of vehicle owned also yielded a **non-significant p-value of 0.471**, indicating that income level is not a strong determinant of whether an individual owns an electric vehicle. The majority of respondents, regardless of income bracket, reported owning petrol two-wheelers or no vehicle. Only two individuals across all income levels reported owning an EV. Therefore, in this study sample, income level does not show a statistically meaningful impact on EV ownership patterns.

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Would you consider buying an EV if there were more fast-charging stations nearby? * How would you rate the	100	100.0%	0	0.0%	100	100.0%

availability of EV charging stations in your area?						

Would you consider buying an EV if there were more fast-charging stations nearby? * How would you rate the availability of EV charging stations in your area? Crosstabulation

Count

		How would you rate the availability of EV charging stations in your area?				Total
		Very good	Satisfactory	Poor	Not available	
Would you consider buying an EV if there were more fast-charging stations nearby?	Definitely	10	9	4	3	26
	Maybe	16	21	8	7	52
	Not likely	0	1	3	2	6
	Not at all	0	3	5	8	16
Total		26	34	20	20	100

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	24.298[a]	9	.004
Likelihood Ratio	27.299	9	.001
Linear-by-Linear Association	18.460	1	.000
N of Valid Cases	100		

a. 7 cells (43.8%) have expected count less than 5. The minimum expected count is 1.20.

INTERPRETATION

A statistically significant relationship was found between the availability of EV charging stations and the likelihood of purchasing an electric vehicle, with a **p-value of 0.004**. This indicates that consumer willingness to consider an EV purchase increase as charging infrastructure becomes more accessible and reliable. Respondents who rated charging availability as “Very good” or “Satisfactory” were more likely to respond “Definitely” or “Maybe” when asked if they would purchase an EV with better fast-charging options. This underscores the critical role of infrastructure in driving EV adoption decisions among Indian consumers.

FINDINGS

1. Out of 100 respondents, only 2 people owned EVs, both aged 18–25. The chi-square result ($p = 0.461$) shows that age does not significantly affect EV ownership.
2. Among all income groups, only 2 people owned EVs, both from lower brackets. The chi-square test ($p = 0.471$) shows no clear link between income and EV usage.
3. Respondents with better access to charging stations were more likely to consider buying an EV. A significant result ($p = 0.004$) proves charging availability influences buying decisions.

SUGGESTIONS

1. **Improve Charging Infrastructure:** more fast-charging stations should be installed to make EVs a practical option for more people. Better access will increase consumer confidence and drive adoption.
2. **Create Awareness Across All Groups**: Information campaigns should target people of all ages and incomes. This helps everyone understand the benefits of switching to electric vehicles.
3. **Provide Local Incentives:** Governments should offer region-specific benefits like tax cuts or subsidies. These can address local barriers and encourage more EV purchases.

CONCLUSION

This study offers a first-hand, data-driven examination of electric vehicle (EV) demand patterns and adoption trends within the Indian context. By analysing responses from 100 participants across different age groups and income levels, the research reveals that demographic factors like age and income currently show no significant influence on EV ownership. However, the availability of EV charging infrastructure emerged as a statistically significant driver influencing purchase decisions, highlighting infrastructure as a key enabler in accelerating EV adoption. The study also shows that consumer willingness to adopt EVs is more likely when access to fast-charging stations improves, regardless of socioeconomic background. These insights point to a need for targeted infrastructure expansion, inclusive awareness programs, and localized policy incentives. Unlike many previous studies that rely on secondary or generalized global data, this primary research captures the ground realities of Indian consumers and provides actionable insights tailored to India's unique mobility landscape. As India advances toward sustainable transportation goals, aligning infrastructure development and public engagement strategies with these findings will be critical. This study not only fills a significant research gap but also serves as a foundational reference for future planning and investment in India's electric mobility ecosystem.

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