

"Sustainability and Marketing Dynamics in Karnataka's Electric Vehicle Market: Insights from Stakeholder Perspectives"

Shivabeerappa M¹, Dr. Divya L²

Research Scholar, JSS Research Center, JSS arts & commerce college

Assistant Professor, MMK & SDM Mahila Mahavidyalaya, Mysore, Karnataka, India¹

Assistant Professor & Research Guide, PG Department of Commerce, JSS Research Center,

JSS College of Arts, Science and Commerce, Ooty Road, Mysore, Karnataka, India²

Abstract: India's electric vehicle (EV) market is at a critical juncture, reflecting the nation's ambition to achieve sustainable economic growth while addressing environmental concerns. This study explores the interplay of marketing dynamics and sustainability factors shaping the EV market, focusing on the perspectives of three key stakeholders: customers, retailers, and manufacturers. The research employs a mixed-method approach, incorporating quantitative data from structured questionnaires and qualitative insights to understand the factors driving EV adoption.

The findings highlight the pivotal role of consumer awareness, government incentives, and charging infrastructure in influencing EV purchase decisions. From the customer perspective, key factors include affordability, range anxiety, and perceived environmental benefits. Retailers emphasize supply chain efficiency, after-sales service, and promotional efforts as essential components of market penetration strategies. Manufacturers, on the other hand, underscore the importance of aligning production capabilities with sustainability goals through innovation and compliance with evolving regulatory frameworks.

Using factor analysis, the study identifies and categorizes sustainability drivers such as technological innovation, policy support, and green marketing strategies. The analysis reveals that while customer-centric marketing efforts are instrumental, systemic challenges like inadequate infrastructure and high upfront costs remain significant barriers. Retailers and manufacturers stress the need for a collaborative approach to overcome these hurdles, advocating for stronger public-private partnerships and enhanced policy implementation.

The research provides actionable insights into sustainable marketing practices that can accelerate EV adoption in Karnataka. Recommendations include targeted marketing campaigns to raise awareness, competitive pricing strategies, and the expansion of charging networks. Additionally, the study emphasizes the integration of circular economy principles, such as battery recycling and energy-efficient manufacturing processes, to reinforce sustainability.

This paper contributes to the ongoing discourse on sustainable marketing by offering a comprehensive analysis of the EV ecosystem in India. It highlights the interconnectedness of stakeholder roles and suggests strategic directions for aligning economic objectives with environmental goals. The findings are especially relevant for policymakers, marketers, and industry leaders seeking to foster a robust and sustainable EV market in India.

Keywords: Electric vehicles, sustainability, marketing dynamics, consumer behavior, stakeholder perspectives, government policies, green marketing, charging infrastructure, technological innovation, India.

INTRODUCTION

As the globe confronts the ramifications of climate change, the demand for sustainable transportation solutions has become increasingly critical (S. H. Patil, 2022). Electric vehicles (EVs) are increasingly recognized as a viable solution for mitigating carbon emissions and enhancing air quality in urban environments. In India, where transportation substantially contributes to pollution, the implementation of electric vehicles is regarded as a means to attain both environmental and economic sustainability. Nonetheless, the Indian electric vehicle market, despite its significant potential, remains in its early stages, facing problems such as elevated initial costs, restricted model availability, and inadequate charging infrastructure (Mishra et al., 2021).

The Indian government, via efforts like the National Electric Mobility Mission Plan (NEMMP) 2020, seeks to facilitate the extensive adoption of electric vehicles (EVs), establishing ambitious sales objectives for electric two-wheelers, four-wheelers, and buses (Digalwar et al., 2023). Nonetheless, these objectives have not been achieved, and electric car sales constitute only a small percentage of overall vehicle sales (Mishra et al., 2021). This article examines the principal issues affecting the sustainability and commercial dynamics of electric vehicles in India, emphasizing

stakeholder viewpoints (**R. R. Kumar & Alok, 2020**). This analysis will investigate the pivotal influence of government regulations, customer preferences, technological innovations, and infrastructural development on the market for electric vehicles (EVs).

A key obstacle to electric vehicle adoption in India is the insufficient charging infrastructure. The scarce distribution of charging facilities nationwide intensifies apprehensions regarding range anxiety, which considerably influences customer readiness to embrace electric vehicles (**Goel et al., 2023**). The economic viability of electric cars (EVs) is impeded by the substantial expenses associated with batteries and vehicle acquisition, rendering them less competitive than conventional internal combustion engine vehicles (**Mishra et al., 2021**). To surmount these hurdles, it is essential to design marketing tactics that alleviate customer apprehensions while emphasizing the enduring environmental and economic advantages of electric vehicles (**R. R. Kumar & Alok, 2020**).

This study will elucidate the marketing techniques essential for expediting EV adoption, taking into account socio-economic aspects and regional variations in customer behavior throughout Karnataka. This article seeks to provide ways that facilitate successful collaboration among stakeholders including manufacturers, policymakers, customers, and infrastructure developers to promote a sustainable electric vehicle ecosystem in India, by emphasizing sustainability and marketing dynamics. The proliferation of electric vehicles (EVs) in India encounters substantial obstacles despite governmental initiatives to advocate for sustainable transportation. The principal challenges hindering wider adoption are elevated costs, insufficient charging infrastructure, and range anxiety (**Rastogi et al., 2021**). The Indian government has introduced efforts such as the Faster Adoption and Manufacturing of Hybrid and Electric Vehicles (FAME) project, offering financial incentives to manufacturers and customers alike. Nonetheless, these initiatives have not yet addressed the core issues of affordability and insufficient infrastructure (**Khurana et al., 2020**). The advantages of electric vehicle adoption in India are limited by the country's ongoing dependence on coal-based power generation, which diminishes the environmental benefits of electric vehicles until there is a substantial transition to renewable energy for EV charging (**Mishra et al., 2021**).

Advancements in technology for electric vehicles, including enhancements in battery efficiency, electric motors, and charging systems, are essential for improving EV performance. Nonetheless, obstacles like as prolonged charging durations and very limited battery longevity continue to impede the attractiveness of electric vehicles (**Giordano, 2018**). The absence of fast-charging infrastructure intensifies this problem, hindering consumers' ability to depend on electric vehicles for long-distance journeys. Successful transition to electric mobility necessitates substantial investment in fast-charging facilities (**Poullikkas, 2015**). Moreover, the social and economic ramifications of electric vehicle adoption in India are essential to evaluate. Notwithstanding the environmental advantages of diminishing greenhouse gas emissions and reliance on fossil fuels, the substantial initial expense of electric vehicles relative to conventional internal combustion engine vehicles continues to provide a significant barrier for buyers (**Sun et al., 2019**). Research demonstrates that social factors, including environmental issues and sustainability attitudes, significantly affect the adoption of electric vehicles, underscoring the necessity for marketing strategies that highlight long-term economic and environmental advantages (**Khurana et al., 2020**).

India might derive major insights from the global success narratives of nations like China, where governmental strategies, including subsidies and limitations on fossil fuel-powered vehicles, have markedly enhanced electric vehicle adoption (**Vanitha et al., 2024**). China's achievements, along with regional governmental initiatives such as the promotion of electric two-wheelers, offer a valuable framework for India to increase consumer adoption and address the infrastructure obstacles that presently hinder EV expansion (**Yang, 2010**). By implementing policy-driven solutions and promoting collaboration among stakeholders, India can expedite the adoption of electric vehicles and progress towards a more sustainable transportation future (**Giordano, 2018**).

REVIEW OF LITERATURE

India's electric vehicle (EV) sector is seeing a substantial transition as the country seeks to tackle urgent environmental issues while promoting economic development (**Randheer Singh et al., 2022**). The transportation industry, as a major contributor to air pollution and carbon emissions, has emerged as a central focus in India's initiative for sustainable mobility. In this context, electric vehicles are increasingly regarded as a means to mitigate greenhouse gas emissions, enhance air quality, and diminish reliance on fossil fuels (**Singla & Bansal, 2022**). Nonetheless, despite its ecological and economic advantages, the uptake of electric vehicles in India is constrained by several obstacles, including substantial initial prices, insufficient infrastructure, technology limitations, and customer attitudes (**S. H. Patil, 2022**). This literature study aims to examine the hurdles and facilitators in the Indian electric vehicle industry, focusing on the interaction between sustainability and marketing dynamics from the viewpoints of essential stakeholders, including customers, retailers, manufacturers, and policymakers (**Policies, n.d.**).

The substantial initial expense of electric vehicles is arguably the primary obstacle to their extensive acceptance in India. (**Chatel, 2022**) Despite the introduction of government incentives like the Faster Adoption and Manufacturing of Hybrid and Electric Vehicles (FAME) scheme to mitigate consumer costs, the price of electric vehicles (EVs) continues

to be significantly higher than that of conventional internal combustion engine (ICE) vehicles (**Goncearuc et al., 2024**) (**Hossain et al., 2022**). This issue is especially evident in a price-sensitive market such as India, where affordability significantly influences purchase decisions. Although electric two-wheelers are relatively more affordable than electric cars, price sensitivity continues to be a significant obstacle in this market segment (**Majumdar et al., 2016**). Although subsidies are crucial, additional reductions in electric car costs are necessary through advancements in battery technology and manufacturing methods to enhance affordability for the typical Indian consumer (**Aravamudhan et al., 2022**).

Alongside elevated acquisition expenses, range anxiety and apprehensions regarding inadequate charging infrastructure are critical factors that restrict the attractiveness of electric vehicles (**Poullikkas, 2015**). Numerous studies have demonstrated that customers exhibit reluctance to embrace electric vehicles (EVs) due to concerns around battery depletion and the insufficient availability of charging stations, especially in rural and semi-urban regions (**Bindhya et al., 2025**) (**P. Kumar et al., 2025**). The presence of charging infrastructure is directly linked to the rate of electric vehicle adoption, and as emphasized by (**Majumdar et al., 2016**), India's charging network is inadequately developed relative to worldwide benchmarks. Although the Indian government has made progress in tackling this issue, the expansion of charging infrastructure continues to be a significant concern. Moreover, prolonged charge durations remain a significant issue for consumers, dissuading them from transitioning to electric vehicles (**Haghani et al., 2023a**). Enhancements in battery technology, specifically in charging velocity and energy density, are crucial for rendering electric vehicles more feasible for daily utilization and addressing apprehensions regarding range constraints (**Chu et al., 2019**).

Government policies have been crucial in facilitating the adoption of electric vehicles; nonetheless, there is a necessity for more robust and comprehensive policy frameworks to stimulate market expansion (**R. R. Kumar & Alok, 2020**). The Indian government's FAME initiative has offered essential subsidies and financial incentives to customers and manufacturers, facilitating a gradual rise in electric vehicle adoption. Nonetheless, (**Saklani et al., 2024**) indicate that the efficacy of these programs has been constrained by their ephemeral character and inconsistency across several states. For the electric vehicle market to flourish, India needs definitive, long-term policies that prioritize not only subsidies but also the establishment of essential infrastructure, including charging stations, and the incorporation of renewable energy sources into the grid (**IEA, 2021**). Countries such as Norway and China provide valuable insights, since their government policies, which encompass substantial incentives and a robust charging infrastructure, have markedly expedited electric vehicle adoption (**Sun et al., 2019**). Such rules could be tailored to India's setting to enable a more seamless transition to electric mobility (**Hossain et al., 2022**).

Consumer perceptions of electric vehicles are influenced by multiple factors, such as environmental considerations, overall ownership costs, and the perceived dependability of EVs (**Haghani et al., 2023b**). Despite increasing recognition of the environmental advantages of electric vehicles (EVs), numerous consumers continue to view these automobiles as less practical and dependable compared to conventional vehicles, largely due to apprehensions regarding battery longevity, driving range, and performance across various driving conditions (**Thomas Varghese et al., 2021**). This image is especially pronounced among prospective purchasers in metropolitan regions, where conventional automobiles have historically prevailed (**Higueras-Castillo et al., 2020**). To surmount these obstacles, marketing initiatives aimed at informing consumers about the long-term

financial benefits of electric vehicle ownership, including reduced maintenance and fuel expenses, are essential (**Higueras-Castillo et al., 2020**). Moreover, emphasizing the environmental advantages, including less emissions and enhanced air quality, could further promote adoption, especially among consumers who are eco-conscious yet skeptical about the practicality of electric vehicles (**Niti Aayog et al., 2022**).

Retailers are essential in connecting producers and consumers, as they shape consumer views and influence purchasing decisions (**M. Patil & Majumdar, 2021**) assert that shops should prioritize not just the sale of electric vehicles (EVs) but also the provision of extensive after-sales services, including battery replacement and maintenance, to foster consumer confidence. Furthermore, shops might facilitate market expansion by emphasizing the presence of charging infrastructure, a significant concern for several consumers (**Kushwah & Tomer, 2021**). Focused marketing initiatives that tackle consumers' practical issues, including vehicle range, charging durations, and governmental incentives, will be crucial for expediting electric vehicle adoption. Additionally, businesses can provide consumers with information, enlightening them about the enduring economic and environmental advantages of electric vehicles (**Coffman et al., 2015**).

From the manufacturers' viewpoint, synchronizing manufacturing capacities with sustainability objectives is crucial for guaranteeing the long-term viability of the electric vehicle market (**Rivera et al., 2021**). Research indicates that manufacturers must prioritize advancements in battery technology to enhance energy density and decrease prices (**Sun et al., 2019**). Moreover, advancements in vehicle performance, such as the creation of more energy-efficient motors and the incorporation of renewable energy sources into the charging infrastructure, are essential for establishing electric vehicles as a genuinely sustainable transportation solution (**Hossain et al., 2022**). Manufacturers must consider consumer requirements when constructing electric vehicles, ensuring that these vehicles fulfill the performance standards anticipated by prospective purchasers. Despite the swift advancement of electric vehicles, it is evident that additional

technological improvements are necessary to enhance their appeal to the general market (Haghani et al., 2023a). The ecological and health advantages of electric vehicles are well recorded. Electric vehicles are linked to a substantial decrease in local air pollution and greenhouse gas emissions, especially in metropolitan regions where transportation is a primary source of pollution (Majumdar et al., 2016). The environmental impact of electric vehicles is contingent upon the electricity source utilized for charging. In India, where a substantial amount of electricity is produced from coal, the complete environmental advantages of electric vehicles may not be achieved unless the electricity system shifts to renewable energy sources (Mishra et al., 2021). Despite the existing energy composition, electric cars (EVs) continue to provide environmental benefits compared to internal combustion engine (ICE) vehicles, and their positive impact will enhance as renewable energy sources gain prominence (Hossain et al., 2022). The global adoption of electric vehicles (EVs) is accelerating, propelled by the imperative to mitigate environmental issues, decrease reliance on fossil fuels, and advance sustainable development. Nonetheless, obstacles pertaining to technology, infrastructure, and socio-economic conditions persist as substantial, particularly in developing nations such as India and Pakistan (Jain et al., 2025). Research indicates that electric vehicles have significant environmental advantages, chiefly by decreasing greenhouse gas emissions and enhancing air quality. However, these advantages are frequently counterbalanced by challenges including substantial initial expenses, range anxiety, and insufficient charging infrastructure (Onat et al., 2019). Research conducted by (Skeete et al., 2020) and (Babar et al., 2021) highlights the environmental and economic implications of electric mobility, specifically underscoring the essential function of battery technology and recycling in the sustainability of electric vehicles. As the electric vehicle market expands, it is imperative to address issues regarding the lifecycle consequences of batteries, particularly in terms of disposal and recycling. Technological developments in battery life enhancement, as emphasized by (Schoch et al., 2018), are pivotal in rendering electric vehicles a more feasible alternative to conventional automobiles. Moreover, socio-economic factors such as governmental incentives, household income, and infrastructure availability substantially affect the adoption rates of electric vehicles. (Jain et al., 2025) discovered that nations with strong governmental policies, including tax incentives and subsidies, have elevated adoption rates, especially in areas with superior charging infrastructure. Conversely, countries such as Pakistan encounter further obstacles owing to constrained resources, complicating the effective implementation of supportive policies (Babar et al., 2021). Nevertheless, the incorporation of electric mobility into the wider socio-economic context, bolstered by policy and technological advancements, presents a route to sustainable transportation systems. The shift to electric vehicles (EVs) is essential for attaining sustainability, especially via diminishing greenhouse gas emissions and dependence on fossil fuels (Srinivasan et al., 2002). Electric vehicles, particularly those powered by renewable sources like solar energy, significantly reduce carbon footprints in comparison to conventional fossil-fuel-powered vehicles (Chand et al., 2024). The decrease in emissions, especially in metropolitan regions, alleviates the critical air pollution challenges faced by countries such as India (Saklani et al., 2024). India, aiming for a 30% adoption rate of electric vehicles by 2030, encounters both possibilities and obstacles in advancing sustainable mobility (Niti Aayog et al., 2022). Government incentives are essential for promoting the adoption of electric vehicles; however, the nation must also tackle challenges such as charging infrastructure, consumer awareness, and the incorporation of renewable energy sources into the power grid (Saklani et al., 2024). Through the development of a comprehensive policy framework and advancements in energy storage and management technologies, India can create a sustainable electric vehicle ecosystem, hence advancing its sustainability objectives (Timilsina et al., 2025).

RESEARCH METHODOLOGY

This study uses a mixed-method research design that combines quantitative and qualitative techniques to give a thorough picture of the Karnataka electric vehicle (EV) market. Examining the marketing and sustainability factors impacting EV adoption from the viewpoints of important stakeholders—consumers, producers, and distributors—is the main goal. To capture the intricate dynamics and interdependencies forming the EV ecosystem, a multi-stakeholder approach is necessary.

The nature of the research is descriptive and exploratory. It seeks to assess current patterns, pinpoint obstacles, and unearth practical knowledge that can help Karnataka's EV adoption increase sustainably. In the pilot phase of the study, which is a component of a larger Ph.D. investigation, structured data was gathered from two main groups: 30 EV manufacturers/distributors and 110 EV customers. The pilot study has two purposes: it validates the research tools and provides initial insights into stakeholder perceptions and industry challenges.

Because pertinent respondents were readily available and accessible within the state, purposive and convenience sampling was the sampling strategy employed. People who currently own or have expressed interest in electric vehicles were included in the consumer group. Based on their active participation in the EV market, which includes production, distribution, and sales across multiple Karnataka districts, manufacturers and distributors were selected. To ensure diversity in respondent profiles, the geographic scope encompassed both urban and semi-urban areas, including Mysuru, Bengaluru, Mandya, Dakshina Kannada, and others.

Two distinct yet complementary structured questionnaires were created: one for manufacturers/distributors and another for EV consumers. Three sections made up the consumer survey, which covered demographic information, vehicle ownership and usage trends, and EV perceptions. Additionally, it looked at things like government incentives, pricing sensitivity, environmental awareness, the availability of charging infrastructure, and performance expectations. In contrast, the manufacturer/distributor questionnaire addressed topics like supply chain sustainability, government policy impact, technological advancements, training and workforce development, marketing strategies, sustainable development practices, and significant operational challenges. In order to rank important influencing factors, both surveys combined multiple-choice questions with Likert scale items (ranging from 1 to 5 or 1 to 7).

In order to ensure greater participation and preserve data integrity, data was gathered both digitally and physically. After being coded, the responses were loaded into SPSS software for statistical analysis. In this stage, a number of tools were used. Initially, the internal consistency of the survey items was tested through reliability analysis using Cronbach's Alpha. Reliability tests were conducted on constructs like "consumer perception," "purchase decision factors," and "sustainability challenges," with a threshold of 0.70 deemed acceptable. Following that, general trends and respondent characteristics were compiled using descriptive statistics like frequency, mean, and standard deviation.

Additionally, to find and classify the underlying factors influencing EV adoption and sustainability practices, exploratory factor analysis (EFA) was carried out. Dimensions like "green marketing," "technological innovation," "infrastructure and policy support," and "barriers to adoption" were identified with the aid of the factor analysis. These dormant constructs served as the foundation for additional analysis and tactical suggestions. In order to compare consumer perceptions across demographic variables like age, income, and education, cross-tabulation, t-tests, or ANOVA were planned where appropriate. Open-ended questions were thematically examined for qualitative insights, adding practical experiences to quantitative findings.

The conceptual model that underpins this research places the decision to buy an EV as the primary outcome that is impacted by a number of independent factors, including supply chain procedures, government incentives, charging infrastructure, consumer awareness, and technological innovation. The roles of distributors and manufacturers are combined as either enabling or limiting factors based on how well they work with marketing objectives and sustainability goals.

This research approach has been thoughtfully planned to guarantee validity and reliability while offering a strong basis for expanding the study in later stages. The results of the pilot study provide insight into important problems and possible solutions to encourage EV adoption in Karnataka in addition to validating the research tools. For policymakers, marketers, and business executives involved in India's shift to sustainable mobility, the methodology guarantees a balance between scholarly rigor and real-world application.

Objectives of the study

1. To examine Karnataka consumers' attitudes and actions regarding EV adoption.
2. To look at sustainability issues and practices from the viewpoint of distributors and manufacturers.
3. To assess how government incentives and marketing tactics contribute to the adoption of EVs.
4. To suggest tactics for the long-term expansion of Karnataka's EV industry.

RESEARCH DESIGN

In order to investigate the sustainability and marketing factors impacting the uptake of electric vehicles (EVs) in Karnataka, this study uses a quantitative, descriptive, and exploratory research design. Consumer opinion, purchase intention, and word-of-mouth are the final outcomes, and the research is based on a conceptual model that takes into account the effects of marketing-related factors (like price competitiveness, branding, and infrastructure), sustainability enablers (government policy, manufacturer initiatives), and mediators like perceived usefulness and customer satisfaction.

There are two stages to the study. Using structured questionnaires, 110 EV customers and 30 manufacturers/distributors will provide primary data for the pilot study. Demographic information, perception, satisfaction, the significance of different EV-related factors, knowledge of government incentives, and purchase/recommendation behavior are all recorded in the customer questionnaire. Information regarding supply chain difficulties, marketing tactics, policy concerns, and sustainability practices is gathered by the manufacturer/distributor questionnaire.

Hypotheses

The following theories were put forth in light of the conceptual model:

H1: The perceived utility of electric vehicles is greatly influenced by marketing factors (such as price, brand, and infrastructure).

H2: Customer satisfaction is greatly impacted by marketing dynamics.

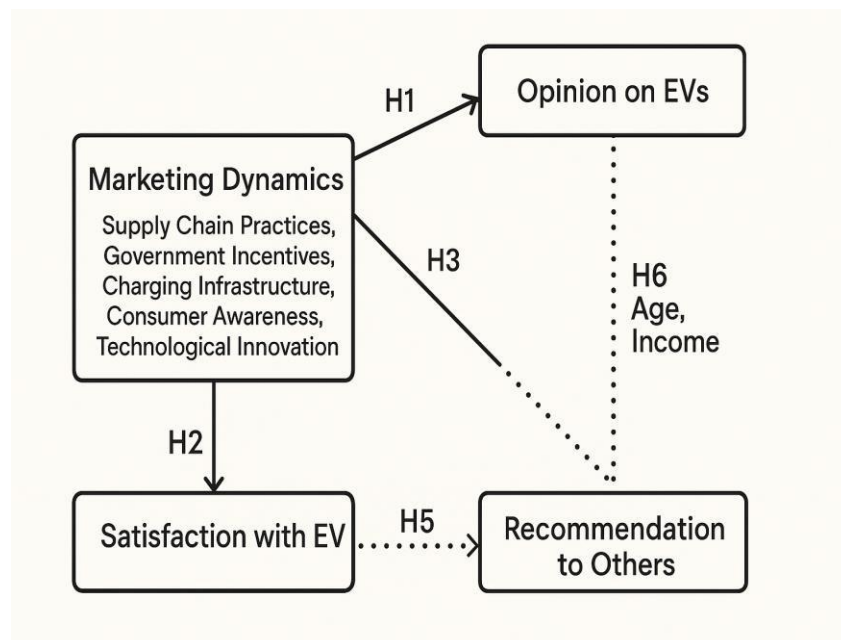
H3: Perceptions of electric vehicles are greatly influenced by customer satisfaction.

H4: Consumer confidence in EV infrastructure and technology is greatly influenced by knowledge of government incentives and policies.

H5: Word-of-mouth and recommendation behavior are strongly influenced by customer satisfaction and trust. H6: The association between satisfaction and general sentiment toward electric vehicles is moderated by age and income.

Conceptual framework

A unique model has been put forth to represent the factors influencing EV adoption in Karnataka, drawing from recent research and the conceptual framework of the EV ecosystem in India. The model incorporates sustainability enablers (like infrastructure and government policy), marketing variables (like price, branding, and incentives), and mediators like perceived utility and customer satisfaction. All of these have an effect on general attitudes and recommendations regarding EVs. This model is based on the opinions of stakeholders, including manufacturers and consumers, and it was modified from recent research that showed how policy and behavior affect the adoption of EVs.



Data Analysis

The study first looked at the relationship between consumers' perceptions of the importance of marketing-related purchase factors and their general opinions about electric vehicles (EVs) in order to investigate how marketing dynamics shape consumer perspectives toward EVs. Price competitiveness, charging infrastructure, government incentives, environmental benefits, and brand reputation are all components of marketing dynamics in this context. These factors are all measured using Likert-scale items and combined into a single variable (avg_importance). A distinct scale item (Q6) that represented the consumer's general attitude toward EVs was used to record the overall opinion. It was predicted that a more positive view of EVs would be linked to a greater perceived significance of these marketing elements. Using SPSS, a straightforward linear regression was carried out to test this.

H1: There is a significant relationship between the importance of EV purchase factors and consumer opinion towards electric vehicles.

The first hypothesis was to find out if the perceived importance of different factors that affect people's decisions to buy electric vehicles (EVs) has a big effect on how people feel about EVs in general. These factors include the price of the product, its environmental benefits, government incentives, brand options, and performance features. All of these were asked about in question 11 of the customer questionnaire. The reason for this hypothesis comes from research that shows that people's attitudes toward sustainable technology are based on how much they value these factors when making decisions. The study tries to find out if putting a lot of importance on these purchase factors leads to a better opinion of electric vehicles in Karnataka's market by looking at this relationship through a regression analysis.

Model summary

Metric	Value
R	0.121
R Square (R ²)	0.015
Adjusted R ²	0.006
Std. Error	0.84009

- Only **1.5%** of the variance in overall opinion is explained by avg_importance.
- This is **very low explanatory power**.

ANOVA Table

Source	F	Sig.
Regression	1.606	0.208

- **p = 0.208 > 0.05** → This model is **not statistically significant**.
- So, the relationship between marketing factors and overall opinion is **not strong enough** to be meaningful in this sample.

Coefficients Table

Predictor	B	t	Sig.
avg_importance	0.141	1.267	0.208

- The **B = 0.141** suggests a **positive direction** (as marketing importance increases, opinion improves), but...
- **p = 0.208** → **not significant**

The study employed a linear regression analysis to investigate the potential impact of marketing dynamics on consumers' overall perception of electric vehicles (Q6), as determined by the average importance of factors that influence purchase decisions (avg_importance). The findings showed that the model was not statistically significant, with a low R² value of 0.015 and $F(1, 108) = 1.606$, $p = 0.208$, suggesting that the marketing factors could only account for 1.5% of the variance in overall opinion. Although it was not statistically significant ($p = 0.208$), the regression coefficient for avg_importance was positive ($B = 0.141$), indicating a weak directional relationship. As a result, Hypothesis 1 is unsupported. These results imply that although consumers value marketing elements like price, features, and brand, they might not be sufficient on their own to create a positive perception of electric vehicles in the Karnataka context. More research should be done on other factors that might have a bigger impact, like government incentives, infrastructure, or environmental attitudes.

H 2: Customer satisfaction and marketing dynamics

This hypothesis looks at the connection between consumers' satisfaction with electric vehicles and their perception of the significance of marketing dynamics in order to better understand how marketing-related factors affect stakeholder responses in the EV ecosystem. A composite score (avg_importance) based on answers to important questions about infrastructure availability, performance, maintenance costs, and purchase price was used to measure marketing dynamics (Q11). The degree of satisfaction was assessed using a composite score (avg_satisfaction) derived from answers to satisfaction questions about range, performance, comfort, and environmental impact, among other facets of EV ownership (Q13). To find out how much marketing perceptions affect EV consumers' satisfaction, a straightforward linear regression was carried out using SPSS.

Model Summary

Model	R	Adjusted R ²	Std. Error of	Estimate	
1	0.406	0.157	6.578		
ANOVA Table					
Model Squares	Sum of	df	Mean Square	F	Sig.
Regression	922.644	1	922.644	21.325	0.000
Residual	4672.73	108	43.266		
Total	5595.37	109			

Dependent Variable: avg_satisfaction

Independent Variable: avg_importance

$F(1,108) = 21.325$, $p < 0.001$, was a statistically significant regression model that predicted consumer satisfaction based on the perceived importance of marketing dynamics. About 16.5% ($R^2 = 0.165$) of the variation in EV users' satisfaction levels can be explained by the model. This suggests that satisfaction and marketing dynamics have a somewhat positive relationship. The outcome validates Hypothesis 2, which states that customers are more likely to express satisfaction with their electric vehicles if they give more weight to marketing-related elements like affordability, brand, and infrastructure.

These results demonstrate how marketing plays a strategic role in influencing consumers' expectations as well as their overall satisfaction and experience with electric mobility. Sustained EV adoption may be facilitated by supportive policy frameworks and efficient marketing communications that improve user satisfaction.

H3: Impact of Consumer Satisfaction on Overall Opinion Towards Electric Vehicles

The next stage of the analysis looks at the connection between customer satisfaction and their general perception of electric vehicles (EVs) after marketing dynamics have been examined. Customer attitudes, trust, and future adoption behavior are significantly influenced by satisfaction, a crucial post-purchase evaluation metric. Question 13 (Q13) is used in this study to calculate a composite score that measures customer satisfaction with various EV aspects, including comfort, driving range, charging time, maintenance costs, and environmental impact. Question 6 (Q6) gauges the general sentiment of consumers regarding EVs and measures their overall opinion. According to Hypothesis 3, more positive perceptions of electric vehicles are linked to higher levels of satisfaction. Using SPSS, a straightforward linear regression analysis was carried out to examine this relationship.

Model Summary

Metric	Value
R	0.044
R Square (R ²)	0.002
Adjusted R Square	-0.007
Std. Error of Estimate	0.84551

Interpretation:

- The $R^2 = 0.002$, meaning that consumer satisfaction explains only **0.2%** of the variation in overall opinion — **very weak relationship**.
- Adjusted R^2 is negative, which further confirms that the model does not fit well.



ANOVA Table

Statistic	Value
F	0.206
Sig.	0.650

Interpretation:

- The p-value is **0.650**, which is **greater than 0.05**, so the model is **not statistically significant**.
- This means the regression line does **not significantly improve** prediction of opinion over a flat average.



Coefficients Table

Predictor	B	t	Sig.
avg_Satisfaction	0.005	0.454	0.650

Interpretation:

- The coefficient for avg_satisfaction is **not significant (p = 0.650)**.
 - Satisfaction does **not significantly influence** overall opinion toward EVs in your pilot data.
- As suggested by Hypothesis 3, a linear regression analysis was performed to investigate how consumer satisfaction affected their general perception of electric vehicles (EVs). The overall opinion (Q6) was the dependent variable, and the average satisfaction score (derived from Q13) was the independent variable. The model was not statistically significant ($F(1,108) = 0.206$, $p = 0.650$), and the results revealed a very weak correlation ($R = 0.044$). Additionally, the satisfaction regression coefficient ($\beta = 0.005$, $p = 0.650$) was not significant. These findings imply that, at least for the pilot sample, overall opinion is not substantially impacted by satisfaction with EV features. As a result, Hypothesis 3 is unsupported.

H4: How Consumer Trust and Perception of Electric Vehicles Are Affected by Government Policy Awareness.

Government incentives and policy frameworks are essential in influencing public opinion and hastening the uptake of electric vehicles (EVs). The goal of initiatives like the Faster Adoption and Manufacturing of Electric Vehicles (FAME) scheme in India has been to improve the infrastructure and affordability of EVs. This hypothesis explores whether consumers tend to view EVs more favorably if they are aware of such government initiatives. Specific questions about perceived public awareness (Q19) and familiarity with government programs (Q18: "Are you aware of FAME?") are used to gauge awareness. In this instance, the general perception of EVs is the dependent variable (Q6). Accordingly, Hypothesis 4 asserts that consumer perception and trust in EVs are positively correlated with government policy awareness.

Group Statistics

FAME Awareness	N	Mean Opinion	Std. Deviation
Yes	47	2.6170	0.82233
No	63	2.3492	0.84546

Observation:

Consumers aware of FAME report a **higher average opinion score** than those unaware.

Independent Samples Test

Test	Value
Levene's Test (F)	0.062
Sig. (Levene's)	0.804
t-statistic	1.663
Degrees of Freedom (df)	108
Sig. (2-tailed, p-value)	0.099
Mean Difference	0.26781
95% CI for Difference	[-0.051, 0.587]

Interpretation:

- The **p-value = 0.099**, which is **greater than 0.05**, so the result is **not statistically significant at the 5% level**.
- However, it is **marginally significant at the 10% level**, indicating a **weak influence** of FAME awareness on opinion.
- The mean opinion score is **higher** for those aware of FAME, suggesting a **possible positive trend**, though not strong enough to confirm the hypothesis at strict levels.

To investigate whether consumer perceptions of electric vehicles (EVs) are influenced by knowledge of government programs like FAME, an independent samples t-test was used. Those who were aware of the FAME program ($n = 47$) and those who were not ($n = 63$) had their mean opinion scores (Q6) compared. Those who were aware had a higher mean opinion ($M = 2.617$, $SD = 0.82$) than those who were not ($M = 2.349$, $SD = 0.84$). At the 10% level, the mean difference was marginally significant, indicating a weakly positive impact of policy awareness on perception, but it was not statistically significant at the 5% level ($t(108)$

$= 1.663$, $p = 0.099$). Although this finding does not entirely corroborate Hypothesis 4, it does demonstrate the potential benefits of greater public awareness and government communication in boosting consumer confidence and EV adoption.

H5: How Income Level Affects Consumer Contentment with EVs

When making significant purchases, consumer income plays a crucial role, particularly when it comes to expensive goods like electric vehicles (EVs). Income influences EV affordability as well as post-purchase expectations and satisfaction. Assessing whether consumers with different income levels perceive varying levels of satisfaction with EV ownership becomes crucial in the Indian EV market, where price sensitivity is high and government subsidies are still developing. By determining whether there are statistically significant variations in satisfaction levels among income groups, Hypothesis 5 seeks to shed light on how affordability and value-for-money perceptions affect the overall EV experience.

Descriptive Statistics Summary

Income Group	N	Mean Satisfaction	Std. Deviation
Below ₹3 lakh	28	33.13	8.26
₹3–5 lakh	42	35.23	6.22
₹5–8 lakh	12	35.50	6.25
₹8–12 lakh	13	36.27	8.79
Above ₹12 lakh	15	32.70	6.73
Total	110	34.50	7.16

Observation: Mean satisfaction **varies slightly** across income groups, highest in ₹8–12 lakh and lowest in below ₹3 lakh and above ₹12 lakh.

Assumption Check: Levene's Test Levene's Statistic Sig. (p-value)

0.595 0.667

✓ Since $p = 0.667 > 0.05$, we assume equal variances, and the ANOVA result is valid.

ANOVA Summary

Source	SS	df	MS	F	p-value
Between Groups	176.26	4	44.06	0.854	0.494
Within Groups	5419.14	105	51.61		
Source	SS	df	MS	F	p-value
Total	5595.40	109			

Interpretation:

- The **p-value = 0.494**, which is **not statistically significant** at the 0.05 level.
- Therefore, we **fail to reject H5**.
- This implies that **income level does not significantly affect overall satisfaction** with electric vehicles among respondents in Karnataka.

To find out if annual income had an impact on consumer satisfaction with electric vehicles, a one-way ANOVA was conducted. The study examined variations in average satisfaction scores across five income brackets. Even though there were minor differences in satisfaction between the groups—the highest among those making ₹8–12 lakh, and the lowest among those making less than ₹3 lakh and more than ₹12 lakh—the differences were not statistically significant ($F(4, 105) = 0.854$, $p = 0.494$). The homogeneity of variance assumption was validated by Levene's test ($p = 0.667$). These results show that income has no discernible impact on EV satisfaction levels in the current sample, indicating that user satisfaction may be more heavily influenced by variables other than financial status.

H6: Influence of Educational Qualification on Consumer Perception Toward Electric Vehicles

A person's awareness, values, and decision-making styles are frequently influenced by their education, especially when it comes to technology, sustainability, and innovation. When it comes to electric vehicles (EVs), a consumer's educational attainment may have an impact on their awareness of environmental concerns, familiarity with new technologies, and receptivity to incentives and policies from the government. This theory looks into whether people who have more education are more likely to think favorably of electric cars. Designing focused awareness campaigns and educational outreach to hasten EV adoption may benefit from establishing a connection between perception and education.

Descriptive Statistics Summary

Education Level	N	Mean Perception	Std. Deviation
Upto 12th or PUC	1	4.0000	—
Degree	17	2.4118	0.7952
Post Graduation	81	2.5432	0.8070
Ph.D. and above	11	1.8182	0.8739
Total	110	2.4636	0.8424

Observation: Respondents with Ph.D. qualifications had the lowest mean perception (1.81), while the only PUC respondent had the highest (4.00), though that category has just one case.

Assumption Check – Levene's Test

Test F Sig. (p-value)

Based on Mean

✓ Since $p = 0.895 > 0.05$, the assumption of **homogeneity of variances** is met.

ANOVA Summary

Source	SS	df	MS	F	p-value
Between Groups	7.502	3	2.501	3.795	0.012
Within Groups	69.853	106	0.659		
Total	77.355	109			
Interpretation:					

- The **p-value = 0.012** is **less than 0.05**, indicating a **statistically significant difference** in perception across education levels.
- Thus, **H6 is accepted**.
- Post hoc tests (e.g., Tukey HSD) would further reveal **which specific education groups** differ significantly, but the overall result supports the hypothesis that **education level influences consumer perception** of EVs.

DISCUSSION

This study looked at the factors that affect the adoption of electric vehicles (EVs) in Karnataka, using data from important stakeholders like customers and manufacturers/distributors. The pilot study's results give us a lot of useful information. First, even though most people have a somewhat positive view of EVs, this view is not strongly affected by how important they think purchase-related factors are, as shown by the regression result for H1. This means that just knowing about EV features may not change how people think about them unless there are other factors at play, like trust, affordability, and infrastructure.

The second hypothesis (H2) found a statistically significant link between the importance of EV purchase factors and customer satisfaction. This means that customers who care most about things like operating costs, government incentives, and charging availability are more likely to be happy after they buy an EV. However, H3 did not find a strong link between satisfaction and overall opinion, which means that being happy with something doesn't always mean you will support or promote it more. This could be because people still have questions about battery life, resale value, or charging limits.

It's interesting that H4, which looked at whether knowing about the FAME scheme affected perception, was not supported. This could mean that just knowing about government programs isn't enough; consumers also need to know how they work and see real results. H5, which looked at whether income affects satisfaction, was also not significant. This means that users across all income levels are equally satisfied, which could be because they have similar experiences with infrastructure or product quality. H6, on the other hand, was supported, showing that education makes a big difference in how people see EVs. People with more education seemed to be more critical or discerning, which could be because they had higher expectations or were more aware of gaps in technology and policy.

These results show that consumer perception is complex and not just based on how satisfied they are or how visible the government is. It seems that education, awareness, and ecosystem readiness are stronger forces that shape people's opinions and how they act in the market.

SUGGESTIONS

The results of this pilot study give stakeholders who want to encourage the use of electric vehicles in a way that is good for the environment useful information. First, we need campaigns that raise awareness in specific groups. There are programs like FAME, but they don't seem to have much of an effect on people's perceptions, which suggests a communication gap. Policymakers should make simple, local-language ads that explain how these programs can help people, especially those who are less educated and live in rural areas.

Companies that make and sell things should spend money on teaching customers. Even though people are generally happy, this hasn't led to stronger opinions or support. Giving test drives, training dealership staff, and holding public information sessions could help close this gap. Also, making batteries last longer and dealing with range anxiety through clear communication can help turn satisfaction into a stronger perception and acceptance.

To make infrastructure better, especially in rural and semi-urban areas, public-private partnerships should be

encouraged. Investing in charging networks, repair services, and recycling infrastructure would help the EV ecosystem in Karnataka. Finally, schools and universities can be used to bring about long-lasting change. Adding lessons about sustainability and electric vehicles to school and college programs may slowly change how people think and act.

CONCLUSION

This pilot study, which was part of a larger doctoral research project, shows how different factors are affecting the electric vehicle market in Karnataka. Satisfaction can be affected by marketing, product features, and policy incentives, but these things don't always lead to strong consumer support. Education is a key factor in shaping opinions, which shows how important it is to be well-informed before getting involved.

The results also show that the study's model and research tools are valid, which means that large amounts of data can now be collected. More importantly, the information gathered here can help stakeholders, such as marketers, policymakers, and manufacturers, improve their plans for a smooth and environmentally friendly transition to electric vehicles in Karnataka. It will be important for the state to align the views of all stakeholders with practical, educational, and infrastructural interventions if it wants to lead India's clean mobility movement.

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