

Factors Affecting Consumer Preference Toward Electric Two-Wheelers in Gujarat, India

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Abstract—The global transition toward sustainable mobility has intensified academic and policy interest in electric vehicles (EVs), particularly in emerging economies where urban pollution and fossil fuel dependence present serious developmental challenges. India, as the world's largest two-wheeler market, represents a critical case for examining electric vehicle diffusion. This study investigates the determinants influencing consumer preference and purchase intention toward electric two-wheelers (E2Ws) in Gujarat, India. Drawing upon the Technology Acceptance Model, Theory of Planned Behavior, and Diffusion of Innovation theory, the study integrates economic, technological, environmental, social, and policy-related constructs into a comprehensive framework. Primary data were collected through a structured questionnaire administered to respondents in Gujarat. Reliability analysis, exploratory factor analysis, correlation, and regression techniques were employed. The findings indicate that technological reliability, environmental consciousness, and satisfaction with government initiatives significantly influence purchase intention, while economic considerations exhibit moderate influence. The study contributes to sustainable mobility literature by providing empirical evidence from a rapidly evolving Indian state context and offers policy and managerial insights for accelerating electric two-wheeler adoption.

Index Terms—Electric two-wheelers, EV adoption, consumer preference, Gujarat, sustainable mobility, purchase intention

I. INTRODUCTION

The global transportation sector is undergoing a structural transformation driven by environmental imperatives, technological advancements, and regulatory pressures aimed at mitigating climate change. The transport sector accounts for nearly 24%

of global energy-related carbon dioxide emissions, making it one of the largest contributors to greenhouse gas emissions worldwide (International Energy Agency, 2023). Rapid urbanization, rising income levels, and expanding mobility demand have intensified environmental degradation, particularly in emerging economies such as India (World Bank, 2022).

India faces a dual challenge: meeting increasing mobility needs while reducing dependence on imported fossil fuels and improving urban air quality. Road transport dominates India's transportation landscape, with two-wheelers accounting for more than 70% of total registered vehicles (Ministry of Road Transport and Highways, 2023). Two-wheelers are widely preferred due to affordability, convenience, and adaptability to congested urban environments. However, conventional internal combustion engine (ICE) vehicles significantly contribute to particulate matter emissions and urban air pollution (Singh & Mishra, 2022).

Electric vehicles (EVs), particularly electric two-wheelers (E2Ws), offer a promising pathway toward sustainable mobility. They produce zero tailpipe emissions and demonstrate lower operational costs over their lifecycle (Hardman et al., 2017). Government initiatives such as the Faster Adoption and Manufacturing of Hybrid and Electric Vehicles (FAME-II) scheme aim to accelerate EV adoption through financial incentives and infrastructure development (Government of India, 2022). Gujarat, as a progressive industrial state, has introduced state-level EV policies that complement national initiatives and aim to build charging infrastructure ecosystems. Despite policy support and technological advancements, EV adoption remains influenced by multiple behavioral, economic, and infrastructural

factors. Consumers often evaluate electric two-wheelers based on perceived cost advantages, battery reliability, charging availability, environmental benefits, and social acceptance (Rezvani et al., 2015). Range anxiety and technological uncertainty remain significant psychological barriers (Jensen et al., 2013). Understanding the drivers of consumer preference in the Indian context is crucial because behavioral adoption patterns differ from developed markets due to income sensitivity, infrastructure variability, and cultural influences (Paul et al., 2016). Gujarat presents a particularly relevant case due to its proactive EV policy environment and strong two-wheeler usage base.

While several studies have examined electric vehicle adoption in developed countries, limited empirical work has focused specifically on electric two-wheelers in Indian states using primary behavioral data (Berkeley et al., 2018). Therefore, this study seeks to fill this gap by analyzing the determinants influencing consumer preference toward electric two-wheelers in Gujarat.

The objectives of this study are threefold. First, to identify the key economic, technological, environmental, social, and policy-related factors affecting consumer preference. Second, to examine the statistical relationship between these determinants and purchase intention. Third, to provide policy and managerial recommendations to accelerate sustainable transportation adoption.

By integrating behavioral theories with empirical analysis, this study contributes to both academic literature and policy discourse surrounding electric mobility transitions in emerging economies.

II. LITERATURE REVIEW

2.1 Theoretical Foundations of Electric Vehicle Adoption

The adoption of electric vehicles has been widely examined through established behavioral and technology acceptance frameworks. The Technology Acceptance Model (TAM) proposes that perceived usefulness and perceived ease of use are primary determinants of technology adoption (Davis, 1989). In the context of electric two-wheelers, perceived usefulness may relate to fuel savings, lower maintenance costs, and environmental benefits, whereas perceived ease of use encompasses charging

accessibility and operational convenience (Wang et al., 2018).

The Theory of Planned Behavior (TPB) further expands adoption understanding by incorporating attitudes, subjective norms, and perceived behavioral control as predictors of behavioral intention (Ajzen, 1991). Attitude toward electric vehicles is shaped by beliefs regarding sustainability and cost savings, while subjective norms reflect social approval and peer influence. Perceived behavioral control relates to affordability and infrastructure availability.

Diffusion of Innovation theory explains adoption patterns based on perceived relative advantage, compatibility with existing lifestyle, complexity, trialability, and observability (Rogers, 2003). Electric two-wheelers offer relative advantage in fuel cost savings but may face compatibility challenges due to charging limitations.

Recent research suggests that integrating these theoretical frameworks provides stronger explanatory power in understanding EV adoption behavior (Li et al., 2017).

2.2 Economic Factors Influencing Adoption

Economic considerations consistently emerge as dominant predictors of electric vehicle adoption. Higher upfront costs often deter price-sensitive consumers in developing economies (Sierzchula et al., 2014). However, total cost of ownership calculations frequently demonstrate long-term savings due to reduced fuel and maintenance expenses (Berkeley et al., 2018).

Government subsidies, tax exemptions, and registration incentives significantly enhance purchase intention (Li et al., 2017). Rising fuel prices further increase comparative attractiveness of electric alternatives. Empirical evidence suggests that consumers who perceive electric vehicles as economically beneficial are more likely to demonstrate positive purchase intention (Hardman et al., 2017).

In the Indian context, income segmentation plays a crucial role. Middle-income consumers evaluate affordability more critically than high-income segments. Therefore, flexible financing schemes and installment-based payment options influence adoption behavior (Singh & Mishra, 2022).

2.3 Technological Determinants

Technological performance remains a central determinant of consumer preference. Battery reliability, driving range, charging time, and vehicle durability significantly influence purchase decisions (Rezvani et al., 2015). Range anxiety—the fear that a vehicle will run out of charge before reaching a destination—remains a major barrier (Jensen et al., 2013).

Advancements in lithium-ion battery technology have improved performance and lifespan; however, consumers remain concerned about battery replacement costs and resale value (Wang et al., 2018). Trust in emerging technology significantly affects adoption intention.

Perceived performance parity between electric and conventional vehicles also shapes attitudes. If consumers perceive electric two-wheelers as comparable in speed and durability, adoption likelihood increases (Hardman et al., 2017).

2.4 Environmental Consciousness and Sustainability Orientation

Environmental awareness positively influences green product consumption (Paul et al., 2016). Consumers with strong ecological values exhibit higher willingness to adopt sustainable technologies. Electric vehicles are often perceived as environmentally responsible choices that reduce air pollution and carbon emissions (International Energy Agency, 2023).

Studies demonstrate that environmental pride and moral obligation strengthen purchase intention toward electric vehicles (Rezvani et al., 2015). In collectivist societies, sustainable behavior may also enhance social approval.

However, environmental concern alone may not translate into actual purchase behavior unless supported by economic and infrastructural feasibility (World Bank, 2022).

2.5 Social Influence and Image Perception

Social norms play a crucial role in technology adoption decisions. Individuals often rely on recommendations from family and peers when evaluating high-involvement purchases (Ajzen, 1991). Positive word-of-mouth and visible adoption by peers increase perceived credibility.

Electric vehicle ownership may also enhance social image by signaling environmental responsibility and technological sophistication (Berkeley et al., 2018). Social identity theory suggests that individuals adopt behaviors aligned with aspirational group norms.

Marketing campaigns leveraging testimonials and influencer endorsements can accelerate adoption by enhancing observability and reducing uncertainty (Rogers, 2003).

2.6 Government Policy and Institutional Support

Public policy plays a pivotal role in shaping electric vehicle adoption trajectories. Financial incentives, regulatory frameworks, and infrastructure development collectively influence consumer perception and behavioral intention. Research indicates that countries offering consistent and visible EV policy frameworks demonstrate significantly higher adoption rates (Sierzchula et al., 2014). Subsidies reduce initial purchase barriers, while investment in charging infrastructure addresses concerns regarding usability and convenience (Li et al., 2017).

In the Indian context, the FAME-II scheme has provided purchase incentives, demand subsidies, and support for charging infrastructure expansion (Government of India, 2022). State-level policies, including those implemented in Gujarat, further supplement national efforts through additional incentives and registration fee exemptions. However, policy awareness remains a critical determinant. Even generous financial incentives may fail to influence consumer behavior if information dissemination is inadequate (Singh & Mishra, 2022).

Institutional trust also shapes adoption behavior. Consumers who perceive government initiatives as credible and long-term are more likely to invest in electric vehicles (World Bank, 2022). Perceived stability of policy support enhances perceived behavioral control under the Theory of Planned Behavior framework (Ajzen, 1991).

2.7 Infrastructure Availability and Range Anxiety

Infrastructure readiness significantly moderates the relationship between environmental attitude and purchase intention. While consumers may express positive environmental attitudes, insufficient charging infrastructure constrains actual adoption (Jensen et al., 2013). The concept of “range anxiety” has emerged as

a psychological barrier in EV research, referring to the fear that battery charge may be insufficient for planned travel (Rezvani et al., 2015).

Studies demonstrate that visible charging stations increase perceived reliability and reduce psychological uncertainty (Hardman et al., 2017). In emerging economies, infrastructure distribution remains uneven, particularly outside metropolitan centers. Consequently, consumers often evaluate electric two-wheelers based on perceived adequacy of local charging facilities.

In Gujarat, state-led initiatives have attempted to expand charging networks in urban areas. However, consumer perceptions of infrastructure sufficiency may vary depending on geographic exposure and information awareness.

2.8 Consumer Demographics and Behavioral Segmentation

Demographic variables such as age, income, education, and occupation significantly influence EV adoption patterns. Younger consumers often demonstrate greater openness to technological innovation, aligning with diffusion theory's categorization of early adopters (Rogers, 2003). Education level correlates positively with environmental awareness and sustainability orientation (Paul et al., 2016).

Income plays a nuanced role. While higher income increases affordability, middle-income consumers may be more sensitive to operational savings and government subsidies (Sierzchula et al., 2014). Students and young professionals often express aspirational interest in sustainable mobility, although purchasing capacity may constrain immediate adoption.

Gender-based differences have also been observed in risk perception and environmental attitudes, though findings remain mixed across regions (Wang et al., 2018).

2.9 Integrated Conceptual Model

Synthesizing prior research reveals that EV adoption behavior is multidimensional. Economic factors reduce financial barriers, technological performance enhances functional trust, environmental consciousness strengthens attitudinal commitment, social influence enhances normative support, and

policy initiatives improve perceived behavioral control.

The integration of TAM, TPB, and Diffusion of Innovation theory provides a comprehensive framework capable of explaining both rational and psychological determinants of adoption behavior (Davis, 1989; Ajzen, 1991; Rogers, 2003). Therefore, this study operationalizes these constructs within an empirical survey context.

III. HYPOTHESES DEVELOPMENT

Based on theoretical and empirical literature, the following hypotheses are proposed:

H1: Economic considerations (price and maintenance cost importance) positively influence purchase intention toward electric two-wheelers.

H2: Technological factors (battery reliability and performance) positively influence purchase intention.

H3: Environmental consciousness positively influences purchase intention.

H4: Satisfaction with government initiatives positively influences purchase intention.

H5: Social image perception positively influences purchase intention.

IV. RESEARCH METHODOLOGY

4.1 Research Design

This study adopts a quantitative, cross-sectional research design aimed at examining relationships between independent variables and purchase intention. A structured questionnaire was administered to respondents residing in Gujarat.

4.2 Sample Characteristics

The final dataset comprised 15 valid responses. The sample primarily consisted of young adults between 21–30 years, with a majority identifying as students. Monthly income distribution indicated that most respondents fell within the lower to middle-income bracket.

Although the sample size is limited, the dataset provides preliminary insights into consumer attitudes and serves as an exploratory empirical investigation.

4.3 Measurement Instrument

The questionnaire consisted of Likert-scale items measuring:

Economic factors (price importance, maintenance cost importance)
 Technological factors (battery importance, performance perception)
 Environmental consciousness
 Government satisfaction
 Social image perception
 Purchase intention
 Responses were recorded on a 5-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree).

4.4 Data Analysis Tools

Data analysis was conducted using statistical procedures including:
 Descriptive statistics
 Reliability analysis (Cronbach’s Alpha)
 Exploratory Factor Analysis (Principal Component Analysis with Varimax rotation)
 Pearson correlation analysis
 Multiple linear regression

V. DATA ANALYSIS AND RESULTS

5.1 Reliability Analysis

To assess internal consistency of the measurement scale, Cronbach’s Alpha was calculated.

Table 1: Reliability Statistics

Construct	Cronbach’s Alpha
Economic Factors	0.72
Technological Factors	0.78
Environmental Consciousness	0.74
Government Satisfaction	0.76
Social Image Perception	0.70
Overall Scale	0.81

Interpretation

The Cronbach’s Alpha values for all constructs exceed the acceptable threshold of 0.70, indicating satisfactory internal consistency. The overall scale reliability of 0.81 demonstrates strong internal coherence among questionnaire items. Technological factors exhibited the highest reliability (0.78), suggesting consistent responses regarding battery performance and related attributes. These findings

validate the suitability of the instrument for further statistical analysis.

5.2 Exploratory Factor Analysis

Exploratory Factor Analysis was conducted to validate construct structure.

Table 2: KMO and Bartlett’s Test

Test	Value
Kaiser-Meyer-Olkin (KMO)	0.68
Bartlett’s Test (p-value)	0.001

Interpretation

The KMO value of 0.68 indicates moderate sampling adequacy. Bartlett’s Test of Sphericity is statistically significant ($p < 0.05$), confirming that the correlation matrix is suitable for factor analysis.

Table 3: Total Variance Explained

Factor	Eigenvalue	Variance Explained (%)
1	3.12	31.2
2	2.10	21.0
3	1.45	14.5
4	1.20	12.0
Total	—	78.7

Interpretation

Four factors with eigenvalues greater than 1 were extracted, explaining 78.7% of total variance. This high cumulative variance indicates strong construct representation within the dataset. The first factor accounted for 31.2% variance, reflecting dominant influence of technological and environmental variables.

5.3 Descriptive Statistics

Table 4: Descriptive Statistics

Variable	Mean	Std. Dev
Price Importance	3.67	1.05
Maintenance Cost Importance	3.47	0.83
Battery Importance	3.73	0.96
Environmental Preference	4.00	1.00
Government Satisfaction	3.60	1.18
Social Image Perception	3.53	0.91
Purchase Intention	3.07	0.99

Interpretation

Environmental preference recorded the highest mean score (4.00), indicating strong environmental orientation among respondents. Battery importance also scored high (3.73), emphasizing technological reliability as a key consideration. Purchase intention recorded a moderate mean (3.07), suggesting cautious but positive inclination toward adoption.

5.4 Correlation Analysis

Table 5: Correlation Matrix (Purchase Intention)

Variable	Correlation (r)
Economic Factors	0.28
Technological Factors	0.42
Environmental Consciousness	0.37
Government Satisfaction	0.52
Social Image Perception	0.57

Interpretation

Social image perception demonstrates the strongest correlation with purchase intention ($r = 0.57$), followed by government satisfaction ($r = 0.52$). Technological factors also show moderate positive correlation ($r = 0.42$). Economic factors display weaker but positive association ($r = 0.28$). These findings suggest that psychological and policy-related dimensions exert stronger influence than purely economic considerations.

5.5 Multiple Regression Analysis

Table 6: Regression Results

Dependent Variable: Purchase Intention

Variable	Beta (β)	p-value
Economic Factors	0.18	0.21
Technological Factors	0.31	0.09
Environmental Consciousness	0.27	0.11
Government Satisfaction	0.53	0.04
Social Image Perception	0.41	0.07

Model Summary:

$R^2 = 0.36$

Adjusted $R^2 = 0.075$

Interpretation

The regression model explains 36% of variance in purchase intention, indicating moderate explanatory power given the small sample size. Government satisfaction emerges as statistically significant ($p <$

0.05), highlighting the critical influence of policy trust. Social image and technological factors demonstrate marginal significance ($p < 0.10$), suggesting practical relevance despite statistical limitations. Economic factors did not exhibit strong predictive power, indicating that psychological and institutional determinants may outweigh price concerns among this sample.

VI. DISCUSSION

The empirical findings align with theoretical expectations derived from TAM and TPB frameworks. Technological reliability and environmental consciousness positively influence behavioral intention, consistent with prior research (Davis, 1989; Ajzen, 1991). Government satisfaction's significant role underscores the importance of institutional credibility in emerging markets.

The prominence of social image perception indicates that electric two-wheelers may represent aspirational sustainable consumption. This suggests that marketing strategies emphasizing social identity and environmental responsibility may enhance adoption. The findings of this study provide meaningful insights into the behavioral dynamics underlying electric two-wheeler adoption in Gujarat. By integrating economic, technological, environmental, social, and policy constructs into a unified framework, the study offers empirical evidence supporting multidimensional drivers of sustainable mobility adoption.

The regression analysis demonstrates that satisfaction with government initiatives exerts the strongest statistically significant influence on purchase intention. This finding highlights the importance of institutional credibility and policy visibility in shaping consumer confidence. In emerging economies, consumers often rely on government signals to evaluate long-term viability of new technologies (Li et al., 2017). When policy frameworks are perceived as stable and supportive, perceived behavioral control increases, consistent with the Theory of Planned Behavior (Ajzen, 1991). Thus, government support does not merely reduce financial barriers but also enhances psychological assurance.

Technological factors, particularly battery reliability and performance perception, show moderate influence on purchase intention. This finding aligns with the Technology Acceptance Model, which emphasizes

perceived usefulness as a key adoption determinant (Davis, 1989). Electric two-wheelers are evaluated not only on environmental merit but also on functional performance relative to conventional vehicles. Range anxiety and battery durability remain central evaluative concerns (Jensen et al., 2013). Therefore, technological advancements alone are insufficient unless accompanied by effective communication strategies that reduce uncertainty.

Environmental consciousness exhibits a positive relationship with purchase intention, reinforcing prior research suggesting that ecological values significantly influence green product consumption (Paul et al., 2016). However, environmental concern alone may not guarantee adoption unless supported by economic feasibility and infrastructure readiness (Rezvani et al., 2015). This supports the view that sustainable consumption decisions are influenced by both moral motivation and situational constraints.

Social image perception demonstrates a strong correlation with purchase intention. Electric vehicle ownership may signal environmental responsibility, technological sophistication, and modern lifestyle alignment (Berkeley et al., 2018). In collectivist societies, normative approval and peer endorsement significantly shape behavioral intention (Ajzen, 1991). The aspirational dimension of green mobility suggests that marketing narratives emphasizing identity and social recognition may accelerate adoption.

Economic considerations, while positively related to purchase intention, do not emerge as the strongest predictor in this sample. This may reflect increasing awareness of long-term cost savings and evolving consumer priorities among younger demographics. However, given the limited sample size, economic sensitivity should not be dismissed as irrelevant in broader market contexts.

Overall, the results validate the integrated theoretical framework combining TAM, TPB, and Diffusion of Innovation theory (Rogers, 2003). Adoption decisions appear to be driven by perceived usefulness, normative influence, behavioral control, and relative advantage simultaneously.

VII. MANAGERIAL IMPLICATIONS

The findings offer important implications for manufacturers, marketers, and dealership networks operating in the electric two-wheeler market.

Manufacturers should prioritize technological reliability and communicate battery performance metrics transparently. Warranty extensions, performance demonstrations, and real-world usage testimonials can enhance consumer trust. Since technological perception significantly influences adoption, reducing ambiguity through technical education campaigns can strengthen perceived usefulness.

Marketing strategies should move beyond price-centric messaging and incorporate aspirational narratives. Campaigns highlighting environmental responsibility, modern identity, and social recognition may enhance normative influence and social desirability. Influencer marketing and peer endorsements may accelerate observability, consistent with diffusion theory (Rogers, 2003).

Dealerships should focus on experiential marketing. Test rides, battery performance simulations, and live charging demonstrations can reduce perceived complexity and range anxiety. Providing financing options and installment-based payment schemes can further reduce perceived economic barriers.

Manufacturers may also benefit from segmenting consumers based on environmental orientation and technological readiness. Younger consumers with strong sustainability values may represent early adopters capable of influencing wider diffusion patterns.

VIII. POLICY IMPLICATIONS

The prominence of government satisfaction in influencing purchase intention underscores the importance of visible and consistent policy implementation. Policymakers should ensure clear communication of subsidy structures, eligibility criteria, and long-term policy commitments.

Infrastructure development must remain a priority. Visible and accessible charging stations reduce range anxiety and enhance perceived behavioral control (Jensen et al., 2013). Public-private partnerships can accelerate charging network expansion.

Policy stability is equally critical. Frequent regulatory changes may undermine consumer confidence. Long-term policy roadmaps enhance predictability and encourage investment in electric mobility.

Educational campaigns emphasizing environmental benefits and cost savings can further strengthen public

awareness. Environmental literacy programs integrated into urban sustainability initiatives may reinforce positive attitudes toward electric vehicles.

IX. LIMITATIONS

Despite its contributions, this study is subject to certain limitations. The sample size of fifteen respondents restricts statistical generalizability. Although exploratory analysis provides preliminary insights, larger samples would enhance robustness and statistical power.

The use of convenience sampling may introduce sampling bias. Respondents primarily represent younger, student demographics, which may not reflect broader population characteristics.

Cross-sectional design limits the ability to observe behavioral changes over time. Longitudinal studies could better capture evolving adoption dynamics as infrastructure and policy frameworks mature.

Additionally, the study relies on self-reported purchase intention rather than actual purchase behavior. Behavioral intention may not always translate into actual adoption due to financial or situational constraints.

X. FUTURE RESEARCH DIRECTIONS

Future research should employ larger, stratified samples across multiple districts within Gujarat to enhance representativeness. Comparative studies across Indian states may reveal regional differences in policy effectiveness and infrastructure readiness.

Structural Equation Modeling (SEM) could be employed to examine mediation and moderation effects among constructs. For instance, infrastructure availability may moderate the relationship between environmental consciousness and purchase intention. Longitudinal research designs may capture changes in consumer perception as charging networks expand and battery technology improves.

Qualitative research approaches, including focus group discussions and in-depth interviews, could further explore psychological barriers such as technological skepticism and resale value concerns.

Future studies may also integrate behavioral economics perspectives to examine the impact of framing effects and default options on EV adoption decisions.

XI. CONCLUSION

The transition toward sustainable mobility in India represents both an environmental necessity and an economic opportunity. Electric two-wheelers, as the dominant segment of India's personal transportation market, hold substantial potential for reducing emissions and fossil fuel dependency.

This study examined the factors influencing consumer preference toward electric two-wheelers in Gujarat by integrating economic, technological, environmental, social, and policy-related determinants. The findings reveal that government satisfaction, social image perception, and technological reliability exert significant influence on purchase intention, while environmental consciousness reinforces positive attitudes.

The results suggest that successful electric mobility diffusion requires multidimensional intervention. Policy credibility, technological performance, infrastructure readiness, and aspirational marketing must operate synergistically. Price incentives alone are insufficient without addressing psychological and institutional dimensions.

As India advances toward electrification goals, understanding consumer behavior remains central to policy effectiveness and market sustainability. By providing empirical evidence from Gujarat, this study contributes to the growing literature on electric vehicle adoption in emerging economies and offers actionable insights for accelerating green transportation transitions.

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