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## Behavioral Determinants of Electric Vehicle Adoption in India: A Systematic Review for Sustainable Mobility Transitions

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### Keywords:

Electric Vehicles, Consumer Behavior, Behavioral Drivers, India, Technology Acceptance, Sustainable Mobility, Systematic Review. Abstract: This study provides a critical analysis of the factors that determine behavior related to the adoption of electric passenger cars (EVs) in India. This study covers the period during which the nation is transitioning to sustainable transportation. This research synthesizes 30 high-impact empirical studies published from 2010 to 2024. These studies were from Scopus Q1 journals and ABDC A-rank journals. This review bases its analysis on established theories of behavior. These include the Technology Acceptance Model, Unified Theory of Acceptance and Use of Technology (UTAUT), and Theory of Planned Behavior. The analysis included drivers and behavioral factors, including attitudinal orientation, subjective norms, perceived behavioral control, and infrastructure readiness, as well as trust, risk perception, economic incentives, and demographic moderators. A critical aspect of this review is that it explains the imperativeness of a complete consumer education policy framework. It also underlines pedagogical approaches that will have to consider the sociocultural and economic realities of India. All these policy actions have the focus of bridging the difference that exists between actions of regulations and practical behaviors. Overall, these measures will help make up a complete decarbonization strategy in the transport sector in India.

### Introduction

The direct CO<sub>2</sub> emissions from fuel combustion account for approximately 24 percent of the global carbon footprint, similar to those from transport, and therefore, it is a central part of the carbon footprint, according to the International Energy Agency (IEA, 2023). Driven by the intensifying global climate crisis, economic systems across all sectors must decarbonize rapidly, making this one of the most urgent existential challenges of the 21st century. This includes the transportation sector, which plays a significant role in anthropogenic greenhouse gas (GHG) emissions. The direct CO<sub>2</sub> emissions from fuel combustion account for approximately 24 percent of the global carbon footprint, similar to those from transportation, and therefore, it is a central part of the carbon footprint, according to the International Energy Agency (IEA, 2023). The existing conditions create motivation to analyze why consumers behave as they do in India's

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electric vehicle market. The rates of urbanization and motorization have increased rapidly in emerging economies, including India, along with a corresponding acceleration in energy consumption patterns. The nation faces double trouble from its heavy reliance on imported crude oil and skyrocketing private vehicle ownership, which creates escalating risks for environmental damage and undermines energy security and national economic welfare (Mohanty, Raj, & Kamboj, 2022). In this regard, government officials were at the forefront. The dynamic environment experienced in the world today highlights the importance of the policy in developing a sustainable future by ensuring the promotion of sustainable mobility reform, such as the implementation of emission-reducing technology in terms of supporting low-emission vehicles, setting up of the public-transit system, and the integration of renewable energy into the mobility system. The relevance of electric vehicles (EVs) has been elucidated by the fact that they are associated with reduced greenhouse gas emissions and are less economically taxing.

To ensure that fuel mobility is successfully and effectively replaced by electric mobility, strategic management is essential because the adoption of electric mobility by consumers is hindered by barriers linked to behaviors, infrastructure, economics, and institutions in Indian society, which is guite diverse.

The context in which climate imperatives demand technological innovation and behavioral dynamics that shape consumer decisions must be considered simultaneously, given the level of urgency of climate imperatives and the fundamental entanglement of the fossil sector in India. The adoption of electric vehicles (EVs) as a technically viable and ecologically positive option has been modest, indicating that the readiness of infrastructure is insufficient. Given the importance of these factors in consumers' inclination and adoption of EVs, it is necessary to study the psychological, normative, and socioeconomic determinants of consumers' intent and actual adoption of EVs in the Indian environment. Consequently, India's fast-evolving EV market needs a critical review and a call to systematically explore behavior in formulating effective policy and market strategies.

Against this backdrop, electric vehicles (EVs) have come to play a crucial role in providing GHG mitigation with the added benefit of reduced fossil fuel consumption. However, strategic management of the transition from fuel to electric mobility is necessary, given the behavioral, infrastructural, economic, and institutional barriers to consumer adoption in the context of societal diversity, as seen in India.

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### **Electric Vehicles as a Strategic Decarbonization Pathway**

Electric vehicles (EVs) are among the leading solutions for reducing transport-related emissions. The list includes Battery Electric Vehicles (BEVs), Plug-in Hybrid Electric Vehicles (PHEVs), and Hybrid Electric Vehicles (HEVs). However, EVs have some advantages over those of Bourak et al. (2020), Kumar and Anbalagan (2021), and Raj et al. (2023). To support the adoption of EVs, the government of India has taken forward steps in recent years by implementing mission plans, such as the National Electric Mobility Mission Plan (NEMMP 2020) and the Faster Adoption and Manufacturing of Hybrid and Electric Vehicles (FAME I and II) schemes. These policies aim to encourage the use of EVs and develop a supporting infrastructure. This policy is emphasized to highlight the importance of our study, as our focus is on identifying the behavioral factors that encourage EV adoption among India's electric passenger vehicle consumers. Although these strategic initiatives are underway, the penetration of electric passenger vehicles in the Indian market remains very low, at less than 2% of the total vehicle sales. Understanding the behavioral dimension of EV adoption is paramount to understanding the difference between policy intent and consumer response. This review aims to bridge this knowledge gap and provide policymakers, manufacturers, and practitioners working in the area of sustainable mobility transition with valuable insights.

### **Behavioral Drivers of Electric Vehicle Adoption**

According to the literature, although technological and economic viability are considered the main drivers of EV adoption, psychological, social, and attitudinal factors also play a role. A variety of theoretical

models, such as the Theory of Planned Behavior (TPB), the Technology Acceptance Model (TAM), and the Unified Theory of Acceptance and Use of Technology (UTAUT), have been applied to explain how perceptions of behavioral control, subjective norms, environmental concerns, perceived usefulness, and risk perception influence adoption intentions (Jaiswal, Kaushik, & Kumar, 2021; Lee, Basremains, 2022; Li, Wang, & Chen, 2023).

Research on the adoption of electric vehicles (EVs) continues to grow, but most evidence remains fragmented and heterogeneous, with many studies and countries focusing on developed countries. This is crucial due to the lack of India-specific research, and thus, the analysis can be applied only to the Indian market with some difficulty. Moreover, the demography, economy, and infrastructural situation in India is peculiar; hence, it is of tremendous significance (Kumar et al., 2023). Moreover, the mediating and moderating factors, including consumers' attitude toward EVs and their moderators, including income, education, and family size, have not yet been known to affect the choice of people wishing to adopt EV in India (Raj et al., 2023; Cui et al., 2021).

#### Purpose and Scope of the Systematic Review

This review systematically reviews high-quality, empirically based literature, particularly that in Scopus Q1 and ABDC A journals\*, to understand the behavioral factors that lead to the adoption of electric vehicles. Review is based on PRISMA, and several barriers and enabler items are determined to make the consumer choices. This will provide a brief review of current work, the most substantial findings and practical recommendations to decision makers, manufacturers and practitioners themselves, as they maneuver the road forward to the realization of sustainable mobility in India.

#### Methodology

### **Review Design PICOS Element**

This systematic literature review employs the PICOS (Population, Intervention, Context, Outcomes, and Study Design) framework to guide the selection and synthesis of empirical studies examining the behavioural drivers of electric vehicle (EV) adoption in India.

### **PICOS Elements and Descriptions**

Element	Description		
Population	Consumers and prospective adopters of electric passenger vehicles.		
Interest	Behavioral, psychological, and socio-demographic determinants influencing EV purchase intentions and actual adoption.		
Context	Primarily India, with comparative insights from other emerging economies where contextually relevant.		
Outcomes	Empirical evidence identifying key behavioral factors shaping consumer decision-making in the EV adoption process.		
Study Design	Peer-reviewed quantitative, qualitative, and mixed-method studies, published in high-quality journals.		

#### **Inclusion Criteria**

- Studies published between 2010 and 2024.
- Research published in Scopus Q1-indexed or ABDC A-rated\* journals.
- Focus on behavioral, psychological, or socio-demographic variables that influence EV adoption.
- Explicit application of established theoretical frameworks, such as:
  - Theory of Planned Behaviour (TPB)
  - Technology Acceptance Model (TAM)
  - Unified Theory of Acceptance and Use of Technology (UTAUT)
- Articles must be published in English.
- Studies must involve Indian consumers or draw comparable insights from other emerging markets

#### **Exclusion Criteria**

- Studies often focus solely on the technical, engineering, or infrastructure aspects of EVs, without considering behavioral analysis.
- Non-peer-reviewed literature, including:
  - Editorials
  - Commentaries
  - Conference proceedings
  - Book chapters
- Studies that do not address consumer behaviour or fall outside the context of electric passenger vehicle adoption.

Inclusion Criteria	Exclusion Criteria
Studies published between 2010 and 2024 in Scopus Q1	Studies are limited to technical,
are indexed in journals or A*-rated journals (Australian	engineering, or infrastructure aspects
Business Deans Council).	without a behavioural focus.
Focus on behavioural, psychological, or	Non-peer-reviewed literature (e.g.,
socio-demographic determinants of EV adoption.	editorials, commentaries,
	conference proceedings, book chapters).
Application of theoretical frameworks such as the Theory	Studies unrelated to consumer behavior
of Planned Behavior (TPB), Technology Acceptance	or outside the context of electric
Model (TAM), Unified Theory of Acceptance and Use of	passenger vehicle
Technology (UTAUT).	adoption.
Articles published in English.	

### **Information Sources and Search Strategy**

### Information Sources and Search Strategy (Improved Version)

A comprehensive and systematic search was conducted across the following five leading academic databases:

- Scopus
- Web of Science
- ScienceDirect
- Emerald Insight
- SpringerLink

To retrieve high-quality literature, Boolean operators and controlled vocabulary were employed. These keywords were included in the search strings:

"electric vehicles", "EV adoption", "consumer behavior", "purchase intention", "behavioral determinants", "India", "emerging markets", "Technology Acceptance Model (TAM)", "Theory of Planned Behavior (TPB)", and "Unified Theory of Acceptance and Use of Technology (UTAUT)".

Search queries were refined using advanced filters to ensure:

- Peer-reviewed journal articles only
- Indexed in Scopus Q1 or ABDC A\* rated journals
- Published between 2010 and 2024
- Written in English

This structured strategy ensured the inclusion of only high-impact empirical studies relevant to the behavioural determinants of EV adoption.

### **Study Selection Process**

- A two-stage screening protocol was followed in the study selection.
- Title and Abstract Screening involves the elimination of duplicates and irrelevance.
- Identification of complete texts was done separately by two reviewers.
- Dialogue was used to resolve disputed matters and reach a mutually agreed-upon agreement.

#### **Data Extraction and Coding**

A strict data extraction template has been used, where information is all at the same level, which will facilitate the retrieval of information accurately and reliably. In both studies, the following was observed:

- The name and the year of the author
- Publication and indexation status
- Study context and sample characteristics
- Theoretical framework applied
- Key behavioural constructs examined
- Methodological approach and analytical techniques
- Principal findings and implications

### **Quality Appraisal**

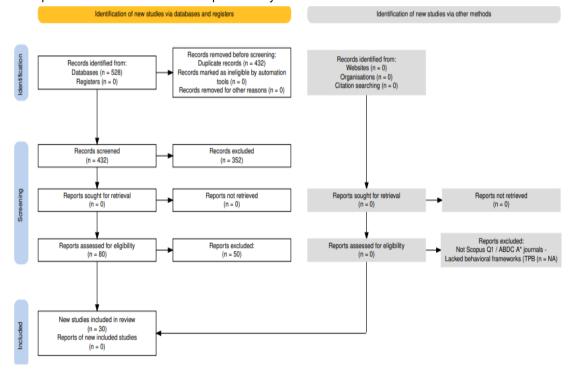
The study designs have been appraised against the study methodology and results of the JBI critical appraisal tools, which are appropriate for the study designs. The assessment criteria included:

- Clarity of research objectives
- Sampling adequacy and representativeness
- Validity and reliability of measurement instruments
- Analytical robustness
- Relevance to the review objectives

The final synthesis was thus based on only studies of sufficient quality.

### The PRISMA Flow Diagram

An illustration of how the studies were chosen using a diagram (figure) is explained in the example of a PRISMA 2020 flow that indicates how they were chosen and the flow of the various studies in the different steps. It shows how many studies were met, excluded, rejected, and traced forward at every stage of the procedure. This facilitates the reproducibility of the literature review.



#### Results

### **Overview of Included Studies**

Finally, from 30 peer-reviewed empirical articles published between 2010 and 2024 in Scopus Q1 and A-ranked journals, the final selection is made for the 2020 guidelines of PRISMA. The studies are based on different methodological traditions, with most quantitative research methods and predominant analytical tools used being Structural Equation Modeling (SEM) and Partial Least Squares Structural Equation Modeling (PLS-SEM). Hence, it provides strong empirical proof to investigate the behavioral dynamics governing the adoption of Electric Vehicle (EV), a niche market attributable to its political imperatives and infrastructural constraints, as well as the behavioral diversity of the wealthy Indian market.

One can find either in integrated form (Jaiswal, et al. (2021) or Kumar et al. (2023), Lee et al. (2022)), recycled application of behavioural theories like the Theory of Planned Behaviour (TPB), Technology Acceptance Model (TAM) and Unified Theory of Acceptance and Use of technology (UTAUT). This other word indicates the fact that in whatever space we are moving on the field of EV behavioural study, in order lines, we went from descriptive and suggestive research to theory-driven research.

### **Distribution of Theoretical Frameworks**

An in-depth analysis reveals the following distribution:

- TPB was employed in 12 studies (40%), leveraging constructs such as attitude, subjective norms, and perceived behavioral control. The predictive power of TPB was reaffirmed in contexts where social conformity and perceived facilitation significantly influence decision-making (Jaiswal et al., 2021; Li et al., 2023).
- TAM and its variants were applied in 9 studies (30%), highlighting perceived usefulness and ease of use as core predictors of behavioral intention (Kumar & Anbalagan, 2021; Raj et al., 2023).
- UTAUT and its extensions had been applied by 6 works (20%) that reveal the significance of the factors such as social influence, effort expectancy, supportive infrastructure defining the intent to adopt the piece of interest (Lee et al., 2022; Li et al., 2023).
- The third category of research included an even smaller number of investigations, which applied the combination of TPB, TAM, and Value-Belief-Norm (VBN) theory to build not only more explanatory potential but also more situational precision (Cui et al., 2021).

### **Emergent Themes and Behavioral Determinants**

### Attitudinal and Environmental Orientation

The most persistently predictive variable across theoretical streams is attitude. Studies focused on the fact that personal innovativeness, as well as favorable environmental attitudes, and

Pro-ecological values have a significant influence on purchase intention (Kumar et al., 2023; Jaiswal et al., 2021). Additionally, in the Indian context, eco-conscious consumers generally have a stronger alignment with sustainable technologies than those in the global South (Cui et al., 2021).

### Subjective Norms and Socio-cultural Pressures

In collectivist cultures, such as India, subjective norms or perceived social pressure to do something have left their mark. EV adoption decisions are influenced by a strong emphasis on familial opinions, peer recommendations, and community acceptance (Lee et al., 2022). Surprisingly, however, normative influence has a larger marginal effect on first-time technology adopters, providing opportunities for social marketing strategies, including the use of influencers and community networks.

### Perceived Behavioral Control and Infrastructure Constraints

Studies of the TPB have used charging infrastructure accessibility, battery range, and perceived self-efficacy to operationalize it, which is often referred to as perceived behavioral control (PBC) (Kumar et al., 2023; Sahoo et al., 2023). The perceived lack of public infrastructure significantly lowered behavioral intention, although attitudes remained positive in this case, thus making public car parks emerge as a contextual barrier.

### • Technology-Related Trust and Risk Perception

One study found that technological risk, financial risk, and performance uncertainty are negative determinants of adoption (Li et al., 2023; Mohanty et al., 2022). However, trust vis-à-vis EV-related systems (battery durability, charging compatibility, and after-sales service) mediated all that. On the other hand, studies have shown that trustworthiness is positively influenced by product warranties, government-backed safety certifications, and brand reputation.

### Economic Incentives and Regulatory Drivers

Financial subsidies under FAME I and II policies improved perceived affordability to some extent, but their long-term effect was ambiguous. According to several scholars, behavior nudges, public awareness programs, infrastructural investments, and economic incentives must be combined (Sahoo et al., 2023; Raj et al., 2023). Indeed, some have asked about the sustainability of

subsidy dependency and have even recommended moving away from subsidies and toward value-based customer engagement models.

#### Demographic Moderators

There are both a large number of studies that have employed moderator variables to study the effects of other factors like level of income, education level, age of the individual and gender. The results revealed that environmental concern positively moderated the intention to drive EVs (Kumar et al., 2023). Nevertheless, there were no consistent gender-based differences in adoption intent, with some studies showing higher adoption intent among males and others reporting no effects. Market segmentation approaches are therefore required to address the heterogeneity in demographic effects in policymaking.

#### **Integrated Findings: A Behavioral Systems View**

The cross-reviews of frameworks show that Indian EV adopters following Behavior is governed under a multifaceted behavioral ecosystem whose variables are modality of cognitive (especially attitude, risk, and trust), normative (through social push), contextual (infrastructure and financial incentives), and demographic (socioeconomic status). It is notable that these dimensions are interdependent and that to design an EV policy vigilance, an integrative behavioral model and systems thinking must be used.

### **Discussion and Implications**

#### Theoretical Contributions

This systematic review of the behavioral determinants of electric vehicle (EV) adoption in India is based on theories with a well-established reputation: TPB, TAM, and UTAUT. The findings underscore the multidimensionality of EV adoption, indicating that the process of intention is not merely a matter of maximizing utility, but is also influenced by psychological, normative, and situational factors.

This review provides a basis for incorporating context-specific forms of classical behavioral constructs into theory and practice.

- Subjective norms in the Indian market have a greater bearing on the TPB structure than in Western contexts (Lee et al., 2022).
- In the constructs of TAM, such as perceived ease of use, TAM is expanded in a contextual extension relative to conventional technology adoption models (Kumar et al., 2023), which makes such realities possible by considering bases such as the availability of charging.
- Conceptual development of the tripartite behavioral models begins with the concept of tripartite behavior, which is then expanded to the tripartite behavioral models that lead to the hybrid tripartite behavioral model, which includes the value-based and risk perception sides (Li et al. 2023).

### Policy Implications

This review identifies critical **levers for policy innovation and refinement** in India's sustainable mobility transition.

• While FAME I and II subsidies bring down financial entry barriers, their long-term effectiveness is limited until parallel investments in infrastructure, consumer education, and after-sales service ecosystems (Sahoo et al., 2023) are made.

- Findings show that charging infrastructure availability is more than a technical question, and it is a core aspect of perceived behavioral control that controls thoughts and actions in understanding adoption intent (Kumar et al. 2023).
- Subjective norm effects and social influence mechanisms can provide insights into behavioral policy nudges that, based on their persuasive psychological salience, could increase the psychological salience of EV adoption (Lee et al., 2022).
- The moderators are demographic and would require segmentation of the policy scheme, where the group of low-income earners and first-time adopters may require appropriate support programs. The incentives and striving towards sustainability motivate higher-income groups, whereas higher incomes can stimulate innovation.

### Managerial and Industry Implications

Actionable strategies are synthesized from insights, which in turn yield further insights.

- Enhancing Consumer Awareness Through Education Programs: Priority should be given to Customer Education Programs by manufacturers and dealerships to educate consumers on the myths about EV performance, maintenance, and long-term cost-benefit equation (Mohanty et al., 2022).
- Risk Reduction Strategies: Directly reducing risk perceptions and product trust is offered
  by providing extended warranties, battery replacement guarantees, and buyback options (Li
  et al., 2023).
- Experience Design and Trial Programs: Offering test-drive opportunities, as well as shows of the software, could help reduce the psychological distance between the act of intent and the object of one's attention, which is salient on the attitudinal level.
- Coexistence of Product Communication with Eco Value, Social Identity Cue, and Technological Trust: Through the strategy of linking product communication with the emergence of eco-values, new social identifications, and technological trust, it is possible to intensify the market resonance of the segment that has recently begun to consider environmental issues.

### Directions for Future Research

Despite the breadth of the current literature, several **knowledge gaps and future avenues** emerge:

- Longitudinal Behavioral Design: Most of these studies are cross-sectional; however, longitudinal studies may allow the study of the evolution of behavioral constructs over time.
- **Underexplored Constructs:** Emotions, hedonic motivations, and moral norms are underexplored Constructs in the Indian EV literature. On the other hand, using Affective Events Theory or Moral Norm Activation Models may generate more nuanced insights.
- Behavioral Spillovers: Future research can explore cross-product behavioral effects, for example, whether adopting solar panels or smart appliances influences EV purchase intent.
- Digital Interventions: The development of digital ecosystems dictates future consumer behavior; thus, future research should determine the impact of mobile apps, telematics, and behavioral dashboards on adoption.

Future researchers should investigate how mobile applications, telematics, and behavioral dashboards affect adoption and usage behavior. Future studies can assess the effects of mobile applications, telematics, and behavioral dashboard applications on adoption and usage patterns, especially as digital ecosystems play a significant role in changing consumer behavior.

### Conclusion

The systematic literature review, in its current form, presents a concise and evidence-based overview of empirical research studies conducted to investigate the determinants of EV adoption behavior in India. According to the review of 30 peer-reviewed papers published in 2010-2024 in Scopus Q1 and the Australian Business Depository Index (ABDC A \*) journals, EV adoption is a provider of the complex interrelation of factors, which are confined to individual attitudes, perceived behavioural control, social norms, demographic moderators, and contextual enablers. The results indicate the validity of classical

theories of behavior, such as the Technology Acceptance Model (TAM), the Unified Theory of Acceptance and Use of Technology (UTAUT), and the Theory of Planned Behavior (TPB), in explaining how the topic of EVs will penetrate.

Nevertheless, the review also notes that these models are not ideal for understanding all aspects of India-specific components of behavior, such as the positions of risk perception, trust, and level of infrastructure preparedness, as mediating variables in consumer decision-making.

From a practical standpoint, evidence points to the necessity of **integrated strategies** that combine

- Economic incentives to improve affordability,
- Robust infrastructure to enhance perceived behavioral control,
- and targeted social marketing to strengthen normative influence and consumer confidence.

Critically, this review emphasizes the need for a behaviorally informed policy design that can be effectively applied to the highly segmented and diverse Indian consumer base.

Furthermore, as the mobility scenario in India shifts towards sustainable mobility, there is a need to conduct longitudinal, interdisciplinary, and context-appropriate behavioral studies. This type of scholarship is crucial to reducing the pervasive disjuncture between technological preparedness and client adoption purposes, and hastening the decarbonization of transportation and the achievement of national climate and energy objectives.

### **Recommendations Table**

Stakeholder	Strategic Recommendation	Expected Outcome
Policymakers	Conducts behaviorally informed incentives (green nudges, peer-based promotions)	Enhanced psychological salience of EV adoption
	Urban and semi-urban corridors require expansion, and charging infrastructure should be readily available.	Improved perceived behavioral control and adoption intent
	Develop the segmented policies targeting specific demographic groups.	Equitable market diffusion across income and education strata
Industry Actors	Design comprehensive consumer education and awareness programs	Reduced knowledge gaps and perceived technological complexity
	Introduce warranty extensions, battery replacement schemes, and trust-enhancing policies.	Mitigation of perceived risk and financial anxiety
	Position EVs within a broader ecological identity narrative	Alignment with pro-environmental consumer values
Researchers	Carry out longitudinal and cross-sector behavioural studies	Deeper understanding of evolving adoption drivers
	Discover how we can mitigate the human reaction to digital transportation ecosystem interventions (apps, gamification, telematics) using the Delivery Agency.	Identification of new behavioural leverage points
	Include emotional, moral, and affective variables in behavioural modelling.	Richer and more human-centred adoption frameworks

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