Journal of Marketing & Social Research

ISSN (Online): 3008-0711

Volume: 02 | Issue 06 | 2025

Journal homepage: https://jmsr-online.com/

Research Article

Why Aren't Electric Vehicles on Indian Roads? Re-examining Acceptance of Battery Electric Vehicles (BEVs) in India

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Received: 11/07/2025; Revision: 05/08/2025; Accepted: 14/08/2025; Published: 29/08/2025

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Abstract: The study reassesses Indian consumers' acceptance of battery electric vehicles (BEVs) using an extended Technology Acceptance Model (TAM). A survey of 162 qualified respondents who had test-driven an EV was analyzed using structural equation modeling (SEM). Five out of six hypotheses were supported: Perceived Usefulness (PU), Social Status (SS), Perceived Enjoyment (PE), and Perceived Risk (PR, negative) significantly influenced Behavioral Intention (BI), while Perceived Ease of Use (PEOU) was insignificant. BI strongly predicted stated purchase. Reinterpreting these results in the 2025 context, India has seen EV sales accelerate—electric cars crossed ~4% of the market in May 2025—with more than 25,000 public chargers, and new incentives under PM E-DRIVE following FAME-II. Findings emphasize that PU and SS remain the most critical adoption drivers, while risk perceptions around cost, charging, and safety remain barriers. Policy and managerial implications highlight the importance of enhancing charging visibility, reducing range anxiety, positioning BEVs as green and aspirational products, and strengthening after-sales support. This study contributes by extending TAM with hedonic, risk, and social image constructs in an emerging market, while providing a benchmark against which India's evolving EV ecosystem can be compared.

Keywords: battery electric vehicles; behavioral intention, consumer buying behavior; electric vehicles; technology acceptance model.

INTRODUCTION

India's automotive industry is experiencing a rapid transition as electric vehicles (EVs) move from niche to mainstream. Supported by government policy, rising consumer awareness, and localized manufacturing, EVs are now central to the nation's climate and energy security strategies. The launch of the FAME-II schemes in 2019 provided demand incentives and charging infrastructure support, while the recently notified PM E-DRIVE program (2024) extends subsidies and infrastructure development beyond 2030 (Home - PM E-DRIVE,). As of December 2024, India had over 25,200 public charging stations, with Karnataka leading in state-level deployments (Welcome to ICCT 2025 & ICCT2025 Survey). EV adoption has also accelerated in May 2025, electric cars accounted for about 4% of new vehicle sales, led by Tata Motors and growing competition from global and domestic OEMs (Electric Vehicle Sales Growth Eases to 21% in July, Research Firm Says | Reuters).

Despite this momentum, adoption remains uneven. While Tier I cities show rising penetration, Tier II and rural areas lag due to limited infrastructure, high upfront costs, and concerns about range and battery reliability. These contextual barriers make consumer acceptance particularly important to study in India. In emerging markets, technological diffusion is not only influenced by utility but also by symbolic factors such as social status and environmental consciousness (Chanda et al., 2024a; Sharma et al., 2024).

This study uses the Technology Acceptance Model (TAM), extended with constructs of social status, perceived risk, and perceived enjoyment, to analyze consumer intentions toward BEVs. Using data collected in 2019, we provide insights into early perceptions and reinterpret findings against today's transformed policy and market environment. Such a longitudinal framing contributes by highlighting how consumer drivers may remain stable (e.g., usefulness, social identity) while barriers evolve with infrastructural growth.

Sustainability-linked factors such as ESG ratings also influence consumer and investor confidence, highlighting that perceptions of risk and responsibility extend beyond individual buyers into financial markets (Bathia et al., 2025).

LITERATURE REVIEW:

BEV customer perceptions and acceptance behavior:

Researchers have compared the BEV and Combustion Vehicle (CV) owners based on demographics. The results reflect that BEV are mostly males with high educational qualification and income, with more than one car at home (Bjerkan et al., 2016). Researchers have also pointed out that the usual household size of BEV owners is larger than non-users (Nayum et al., 2016).

Thus, researchers have concluded these two groups to be different as different needs and motivations influence them. As the BEVs is an emerging Product and relatively

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a smaller number of users have experienced it, it is challenging to compare BEV and CV product experience. Based on the commercial reviews and WOM information, it is tough to assess the customer experience and satisfaction levels. Thus, some researchers have used onsite vehicle trial information to measure the before and after attitudes towards BEVs (Jensen et al., 2014). The studies have also confirmed that the post-trial attitude changed to positive but worries about battery charging and other operational feasibilities have made consumer concerned.

(Franke & Krems, 2013) discovered that as experience increased, the BEV's minimally acceptable driving range reduced. Customer participation in a one-day BEV field test resulted in a more favorable assessment of affective BEV features, while assessing factors and purchase intention stayed the same in an experimental study by (Schmalfuß et al., 2017).

Research has also looked into how BEVs are consumed, and it has been noted that short trips are the main use for BEVs (Jensen & Mabit, 2017; Langbroek et al., 2017). Additionally, (Jensen & Mabit, 2017) discovered that BEVs are utilized for scheduled travels where flexibility is not necessary.

Theoretical Model and Hypothesis Building:

The willingness of Indians to accept BEV is evaluated in the current study. The Technology Acceptance Model (TAM) is employed to guarantee that the most pertinent constructs of technology acceptance are included.

Technology Acceptance Model (TAM)

The study uses Technology Acceptance Model by (Davis, 1989) derived from the Theory of Planned Behavior, which is an extended model of the Theory of Reasoned Action by (Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975). TPA and TAM have been widely used in understanding the acceptance and decision-making criteria of consumers (Haustein & Hunecke, 2007; Haustein & Jensen, 2018).

In the case of vehicle adoption behavior single or multiple constructs of these models have been used by the researchers (S. Wang et al., 2016). Three major constructs being used in vehicle adoption studies are, "Attitude towards Act of Behavior", "Subjective Norm" and "Perceived Behavioral Control".

The current study uses the TAM and amends it basis the situation requirement of BEV acceptance. The "Theory of Planned Behavior's" core premise is that a person's purpose and action are in line with their innate nature, as well as with social or external influence and control (Ajzen, 2005). The out of TPB, which is TAM, helps predict the behavioral intention of customers towards a new technology or technological innovations. It is a widely accepted model to explain as well as to predict an individual's "attitude" towards technological innovations. The two self-efficacy perspective factors, "perceived ease of use" (PEOU) and "perceived usefulness" (PU), are seen to be the most significant antecedents that influence users' "attitudes" and "behavioral intention" (BI) (Davis, 1989; Pavlou, 2003). So, TAM has been used in the current study to predict customers purchase intention towards BEVs in India.

The conceptual framework drawn using this model is given in Figure 1. TAM is explored in multi-dimensional areas like Telecom, education, organizations, technological products etc. and is altered by many researchers (Lee et al., 2003). However, according to (Sanchez-Franco, 2010), specific factors like cultural differences, infrastructure and change in the environment may affect the relationships in the TAM.

Understanding the same, each construct of TAM is understood and relevantly molded basis the scope of the current study. Bibliometric studies in adjacent domains, such as perishable supply chains, reveal similar thematic transitions where risk perception and technological readiness shape adoption trajectories (Kasar et al., 2025).

Perceived Ease of Use and Perceived Usefulness:

The factor "perceived usefulness (PU)" is an indicator to what extent an individual believes the use of a particular system would help them in improving their job performance. On the contrary, the factor "perceived ease of use (PEOU)" signifies to what extent the individual believes the use of a particular system would reduce the physical or mental efforts.

TAM asserts that both PEOU and PU are the influencing factors which govern the formation of favorable attitude associated with the use of technology. In the context of user acceptance of EVs benefits like long battery life, low emission, and low maintenance can be positioned as useful characteristics. Also, if the handling and usage is secure, customers are more likely to adopt it (Y. Wang et al., 2003). Thus, we can hypothesize that:

H1: Perceived Ease of Use of BEV will have a direct influence on BI of people towards EV.

H2: Perceived Usefulness will have a direct influence on BI of people towards EV.

Social Status:

Because it affects a person's social objectives and conduct, social status is crucial to social cognition (Samson et al., 2012). According to (Rubin et al., 2006), social standing inside the peer group is known as social status. Essentially, "social influence" refers to how much weight one gives to other people's opinions (rather than one's own) when it comes to using the system. A person's self-estimated likelihood of using the system should take into account the characteristics of a necessary external referent. (Venkatesh et al., 2006; Warshaw & Davis, 1985).

The two indicators of social status are popularity and social preference (Cillessen & Marks, 2011; Venkatesh et al., 2006) in a study concluded that "social norms" shape

the "Behavioral Intention" (BI). Social status can be linked to a person's mental representation. This drives the persons' urge to present themselves as the best. Thus, we can hypothesize that:

H3: Social Status will have a direct influence on BI of customers towards EV.

Perceived Risk (PR):

Perceived risk was described by (Bauer, 1969) as the unpredictability and adverse outcomes linked to consumers' expectations. It guides the consumer's assessment of the degree of uncertainty surrounding the result. Perceived Risk affects people's confidence in their decisions. Risky situations can be those where the probabilities of results are not known and the outcome is known or unknown. Uncertainties about the acceptance of new products relate to the process of looking for and selecting product and service information prior to making a purchase decision (Cox, 1967) .

The customers perceive higher risks if the difference between their expected experience and the perceived experience is high. Also, the perceived risk would be dependent on the degree of subjective uncertainty of outcomes (Kesharwani & Bisht, 2012). The risk associated with any new technology is always high. Especially, looking at the infrastructural challenges associated with EV's. However, customers are likely to choose try EVs if their risk perceptions are alleviated. As, TPB predicts, consumers would show their willingness to use a new product if their perceived risk is low. Thus, we hypothesize that:

H4. Perceived risk has a negative influence on BI of customers towards EV's.

Perceived Enjoyment (PE):

Product consumption can be utilitarian or hedonistic (Chaudhuri & Holbrook, 2002; Venkatesh et al., 2012). Hedonistic items cause pleasure and happiness and appeal to the senses, while utilitarian products are usually concrete, objective, and functional. Automobiles are classified as high in both hedonic as well as a utilitarian dimension (Voss et al., 2003). One way to define enjoyment is as a sense of fun. Customers are both feelers and thinkers, according to (Holbrook & Hirschman, 1982), who also emphasized the significance of both positive and negative emotional reactions. Good feelings are important indicators of new technologies, particularly those pertaining to consumers (Ding & Chai, 2015; Hew et al., 2015).

H5: Perceived enjoyment positively influences the BI of the customer towards EV's.

Behavioral Intention (BI):

As stated by (Venkatesh et al., 2008), "A target behavior is executed after a temporal sequencing of events." The way a person perceives a product is known as behavioral intention (BI), which stands for "internal determination to perform a behavior." This is the result of all the internal factors that influence conduct. Following that, people's perceptions take into account a variety of outside elements that may make it more difficult for behavior to be successfully executed, or for BE to form. Until and unless the persons establish the internal determination to attain a behavior, i.e. BI, external constraints to doing the action are improbable. A person's intention to buy is influenced by BI. Thus, we can hypothesize that:

H6: BI will have a positive effect on the final purchase of EV's.

Recent research (2019–2025) has expanded the understanding of EV adoption in emerging markets, confirming that perceived usefulness and facilitating conditions remain dominant predictors of behavioral intention (Kautish et al., 2024). Indian studies emphasize that perceived risk—particularly cost of ownership, charging infrastructure, and battery safety—negatively impacts adoption (Chanda et al., 2024b). Further, hedonic and identity dimensions have become increasingly relevant. (Merdin et al., 2025) highlight that green self-identity and brand engagement strengthen long-term adoption in India, complementing earlier findings that social status acts as an adoption driver.

At a policy level, synchronized growth in EV sales and charging infrastructure has been documented ICCT, 2025), though uneven distribution across states continues to create consumer uncertainty. Compared with studies in developed economies, Indian consumers appear more sensitive to infrastructure availability and financial risk, while still valuing status signaling and environmental consciousness. These insights reinforce the relevance of extending TAM with risk, enjoyment, and social image constructs in this study.

RESEARCH METHODOLOGY:

Sample and Procedure

The target participants were Indian customers above the age group of 18 years who have at least had a test drive of any BEV (Four wheelers or Two-wheeler). We chose this necessary condition, as this would help validate the intention to purchase. Given the specific population that we were targeting, a google form was created and circulated. Finding respondents was not an easy task but we started with the postgraduate students (Current as well as some alumni) of a Private B School. The students were briefed about the scope of the research in the email and their expression of interest was being asked. Further, students were also asked to share the email with their parents and other peer groups. Using this referral approach, we received a positive response from 427, against which only 162 responses were complete and met the necessary and sufficient condition. Table 1 shows the demographics of valid respondents. Table 1 explains the sample distribution.

Table 1: Socio-Demographic profiles of 162 BEV users

Measure	Items	Frequency
Gender	Male	94
	Female	68
Age	18-22	56
	23-26	18
	27-35	16
	36-45	49
	>45	23
Income (Per month INR)	<10,000	9
	10,000-25000	46
	26000-50000	34
	50000- 100000	38
	101000-150,000	13
	>150,000	22
When did you last drove an EV?	Yesterday	3
	1 week	15
	1 month	47
	3 months	19
	>3 months	56
Residence is situated in	Smart City	79
	Tier II city	61
	Tier III City	16
	Rural	6
Cars in household	One	
	Two	
	More than two	
No. of Members in the family	1	
	2-3	
	4-5	
	More than 5	

Measurements:

The questionnaire's items are taken from the literature and have been regarded as valid and reliable for measuring constructs of the phenomena they are meant to reflect. To increase content validity, the items were modified from the literature. To gauge Indian consumers' purchase intentions for EVs, a total of 22 goods were used. PEOU, PU, and the other three constructions were taken from (Davis, 1989). Five items were used to measure social status (Ajzen & Fishbein, 1980). The perceived risk metric was taken from Wu and Wang (2005). In order to determine behavioral intention to buy EVs, three items were modified from the scale by (Venkatesh et al., 2012) .

The Perceived Emotions construct was derived from (Sun & Zhang, 2006). Also, demographics like age, gender, occupation, income and type of city was measured as control variables. The majority of the questionnaire's items employ a 7-point Likert scale, in which participants rate how much they agree or disagree with a statement on a scale of 1 to 7. Additionally, a nominal scale was used to measure the demographics.

Data Analysis:

To determine the statistical fitness, 22 items were subjected to exploratory factor analysis. The sample adequacy recommendation of 0.60 was exceeded by the KMO score of 0.892. Bartlett's test of sphericity was also performed on the items, and the results were significant (P=0.000). Each item's Eigen value and factor loadings were examined, and those with Eigen Value >1 and factor loading >0.60 were kept for additional examination. Since all 22 entries fit the criteria well, none were eliminated. Seven factors were found to account for 72.01 percent of the variance after the varimax rotation. Additionally, the scale reliability coefficients fell between 0.60 and the acceptable range (Hair et al., 2010). Appendix 1 displays the Cronbach alpha for each build. For additional data analysis, a two-stage SEM method recommended by (Gerbing & Anderson, 1984) was employed. Separate tests were conducted for measurement models and structural models.

Measurement Model:

AMOS 16.0 was used to do a CFA of the measurement model. Validity was assessed using CFA while construct reliability was verified at the EFA stage. Good reliability of the scales utilized is indicated by the Composite reliability values in Table 2, which are above 0.80. Each construct's AVE (Average Variance Estimated) score is greater than 0.50, suggesting strong convergent validity (Fornell & Larcker, 1981) . Furthermore, the AVEs' square roots are greater than any of the matching correlation coefficients, indicating that the scales have strong discriminant validity (Fornell & Larcker, 1981).

Table 2: Reliability and Validity results

	Perceived Usefulness (PU) Cronbach's α=0.866	**Loading**	**AVE**	**CR**
1	Using a BEV would increase the quality of my life.	0.806		
2	Using a BEV would be useful for me.	0.839		
3	Using a BEV would be beneficial for me	0.802	0.667	0.879
4	Using a BEV would be convenient for me.	0.765		
5	I would consider an BEVa useful means of transport	0.769		
	Perceived Ease of Use (PEOU) Cronbach's α=0.812			
1	I believe a BEV would be easy for me to use.	0.672		
2	I believe learning to operate a BEV would be easy for me.	0.77		
3	I believe the operation of a BEV would be clear and understandable for me	0.7452	0.625	0.891
4	I believe it would be easy for me to become skillful at using a BEV.	0.653		
5	I believe it would be easy for me to schedule battery re-charging with my time planning.	0.728		
6	I believe a BEV would be well-suited to carry out my daily tasks	0.691		
	Social Status (SS)			
1	My peer group think BEV's are better than combustion vehicles.	0.808	0.683	0.904
2	Driving a BEV adds to my socially responsible behavior.	0.892		
3	My family thinks BEV's are better than combustion vehicles.	0.804		
4	BEV are costlier so add status to my profile	0.782		
5	I would do what my family thinks I should do	0.821		
	Perceived Risk (PR)			
1	Using BEVs has a high potential Risk	0.81	0.652	0.897
2	Using BEV has significant monetary risk associated	0.849		
3	Maintenance of BEV is a risky thing	0.768		
4	Performance of BEV has risk associated.	0.781		
	Perceived Emotions (PE)			
	I think using BEVs			
1	Is pleasant	0.934		
2	Is exciting	0.885		
3	Is enjoyable	0.832	0.761	0.962
4	Is frustrating	0.791		
5	is disturbing	0.828		
	Behavioral Purchase Intention (BPI)			
	If I have the resources to purchase the BEV			
1	I intend to use it.	0.732	0.673	0.851
2	In the coming years I will think of using it.	0.704		
3	I think purchasing it would be a good decision.	0.721		
	Purchase (PUR)			
1	I would want to purchase BEV soon	0.857	0.689	0.862
2	I will recommend others to buy BEVs	0.74		

Structural Model: Hypothesis testing:

After analyzing the reliability and validity of all the constructs, a structural model was estimated to test the research hypothesis suggested in the study. The structural model fitted well in the data with satisfactory standard estimates. The goodness of fit measures was satisfactory with *CMIN/df= 2.124, RMR= 0.095, GFI= 0.952, CFI=0.971, RMSEA= 0.057.* The path diagram for the SEM presents the direction and magnitude of the direct impact (positive or negative) of the relationships. Figure 2 shows the derived model with pat coefficients of the constructs that are statistically significant. The results supported H2, H3, H4, H5 and H6. If results are seen more specifically, H1 is rejected as it did not support the relationship of PEOU and BI, with insignificant p= 0.92. The results clearly indicate a direct relationship between perceived usefulness and BI (Path Coefficient= 0.543), significant at p <0.05 level, thus supporting H2. Social Status and perceived Enjoyment are positively related to BI with p values to be statistically significant. However, perceived risk showed a negatively significant relationship with BI with coefficient to be – 0.281, significant at p=0.000. Thus, supporting H3, H4 and H5. Lastly, Behavioral intention showed a positive relationship with purchase with coefficient = 0.604, significant at 0.001. This is the strongest relationship of the model reflecting if purchase intention is strong, purchase is bound to happen. The details of hypothesis testing can be referred in Table 3.

Table 3: Path Coefficients and hypothesis testing.

Hypothesis	**Relationship**	**Path Coefficient**	**P Value**	**Result**

H1	PEOU → BI	0.027*	0.921	Not Supported
H2	PU → BI	0.543*	0.000	Supported
H3	SS → BI	0.482*	0.001	Supported
H4	PE→BI	0.378*	0.001	Supported
H5	PR → BI	-0.281*	0.000	Supported
H6	BI→PP	0.604*	0.001	Supported
Note: *P<0.001				

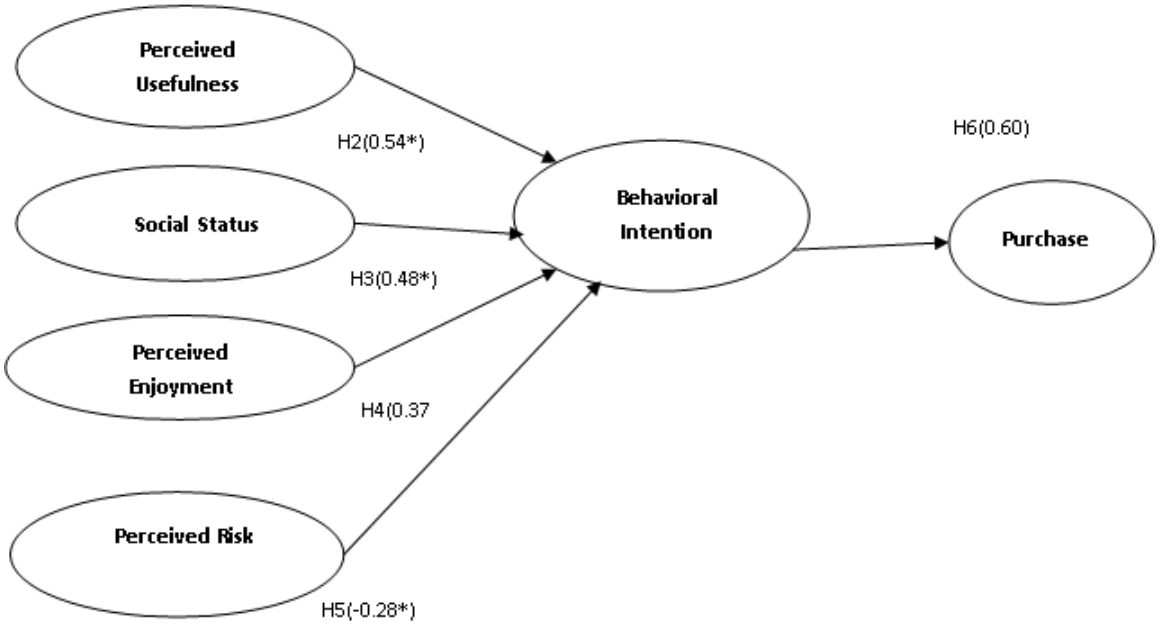

Figure 2: Derived Model: Results of Model Testing

DISCUSSION:

Our findings reveal that Perceived Usefulness (PU) remains the strongest driver of behavioral intention toward BEVs, consistent with global and Indian evidence (Chanda et al., 2024b; Merdin et al., 2025). This underscores the importance of communicating functional benefits—cost savings, range improvements, and low emissions. Social Status (SS) and Perceived Enjoyment (PE) also significantly shaped intention, aligning with recent work linking green identity and aspirational signaling to EV uptake (Dong et al., 2025).

Interestingly, Perceived Ease of Use (PEOU) was not significant in 2019. At that time, sparse infrastructure and limited familiarity may have made "ease" less salient compared to cost and social image. Today, despite over 25,000 chargers nationwide, perceived effort in route planning and recharging remains a psychological barrier, particularly outside Tier I cities. Thus, marketing and policy should focus on making new infrastructure more visible (apps, integrated navigation) to convert objective availability into subjective ease.

Perceived Risk (PR) showed a strong negative effect on intention, especially regarding costs and reliability. This continues to hold in 2025, with consumers still voicing concerns about battery safety and replacement costs. Firms must therefore emphasize warranties, battery recycling initiatives, and transparent residual value guarantees to reduce risk perceptions. This aligns with prior findings that sustainable marketing narratives play a critical role in shaping consumer adoption of green technologies (Koul & Kasar, 2024).

Managerial & Policy Implications:

For firms (OEMs):

– Highlight total cost of ownership advantages using online calculators and transparent service cost breakdowns.

– Leverage status signalling in campaigns, positioning EVs as both aspirational and environmentally responsible.

– Design experiential marketing (extended test drives, EV fairs, gamified apps) to enhance enjoyment and reduce uncertainty.

– Bundle home charging units and showcase public charging density to mitigate perceived risk.

For policymakers:

– Under PM E-DRIVE, ensure state-level parity in charging infrastructure to reduce geographic inequality in adoption.

– Mandate interoperability standards and publish quarterly EV-to-charger ratios to build consumer trust.

– Continue targeted subsidies in Tier II/III cities where financial support may shift hesitant consumers.

Limitations & Future Research:

The study is limited by its 2019 cross-sectional dataset, which predates the significant EV adoption surge in India.

While the findings remain relevant as a pre-policy benchmark, replication with a 2025 dataset is recommended to validate shifts in predictor strength. Future research should employ multi-group SEM to compare metro vs. non-metro consumers and examine gender and income differences in EV adoption drivers. Integrating objective telematics data (post-purchase usage patterns) could also enrich future behavioural models by capturing habit formation and actual range usage.

CONCLUSION:

This study contributes to understanding Indian consumers' acceptance of BEVs by extending TAM with social status, perceived risk, and enjoyment. Findings confirm the salience of usefulness, image, and hedonic appeal, while highlighting persistent risk perceptions as key barriers. With India's EV market now supported by expanded infrastructure and policy incentives, companies and policymakers must convert infrastructure availability into perceived ease, address safety and cost concerns, and emphasize the symbolic and emotional value of EVs. By doing so, India can accelerate EV adoption across both metro and non-metro markets and move closer to its sustainable mobility goals.

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