What's Holding Them Back? Investigating Resistance to Electric Vehicle Adoption

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The adoption of electric vehicles (EVs) is essential for reducing environmental impacts and fostering sustainable transportation. However, despite their economic and ecological benefits, EV adoption rates remain low, particularly in developing countries like India. This study investigates the barriers to EV adoption using Innovation Resistance Theory (IRT), focusing on functional and psychological factors that impede consumer acceptance. A survey of potential EV users across five major Indian metropolitan cities was conducted, and data was analysed using Partial Least Squares Structural Equation Modelling (PLS-SEM). The findings reveal that usage, tradition, value, and risk barriers significantly influence consumer intentions to adopt EVs, while image barriers do not show any notable impact. This research contributes to the literature by applying IRT to a developing context, addressing a gap in studies that predominantly focus on developed countries. Practical implications include strategies for policymakers to improve charging infrastructure and industry stakeholders to address consumer concerns around EV performance and usability.

Keywords: Electric Vehicles, Innovation Resistance Theory, Consumer Behavior, Adoption Barriers

1. Introduction

Electric vehicles (EVs) are increasingly recognised as a vital solution to combat climate change and reduce dependence on fossil fuels(A. Chakraborty et al., 2021). With their potential to lower greenhouse gas emissions and operating costs, EVs offer a sustainable alternative to traditional vehicles powered by internal combustion engines(Dlugosch et al., 2022). Governments worldwide, including India, have introduced policies, incentives, and ambitious targets to promote the adoption of EVs(Pachpore et al., 2024). Despite these efforts, the adoption of EVs remains limited, especially in developing countries where challenges such as infrastructure gaps, affordability concerns, and cultural factors play a significant role(Karacan & Kayacan, 2024). While the environmental benefits of EVs are well-documented, understanding why consumers resist this shift is crucial to addressing the barriers that hinder their widespread acceptance.

Despite the growing body of research on electric vehicle adoption, much of the focus has been on enabling factors, such as government incentives, environmental awareness, and advancements in charging infrastructure(Choi et al., 2024; Higueras-Castillo et al., 2019; Ozcelik et al., 2024; Shen & Lin, 2012; Wang & Shi, 2024). These studies emphasize the drivers of adoption, highlighting how economic, technological, and policy interventions encourage consumers to transition to EVs. However, there is a limited exploration of the inhibiting factors—the barriers that prevent potential consumers from adopting EVs. These barriers can significantly slow the rate of adoption, even in regions with well-established enabling conditions.

This research explores why consumers resist adopting electric vehicles in India, using a framework that considers both practical and psychological barriers. Innovation Resistance Theory provides a useful lens to examine these barriers(Kumar et al., 2022).The theory identifies two broad categories of resistance: functional barriers and psychological barriers. Functional barriers include usage barriers, which relate to the practical difficulties of using an innovation; value barriers, which concern the perceived cost-benefit imbalance; and risk barriers, which stem from uncertainties about performance and reliability. Psychological barriers, on the other hand, encompass tradition barriers, reflecting resistance due to attachment to established practices, and image barriers, which involve negative perceptions of how the innovation is viewed socially or culturally. Together, these barriers provide a comprehensive framework for understanding the resistance to adopting innovations like electric vehicles. By focusing on these barriers, this study provides a holistic understanding of the resistance to EV adoption in the Indian context. While practical concerns like limited charging stations and battery performance are critical, psychological factors such as the perceived complexity of EVs or their association with specific social groups may also play a significant role.

This study also contributes to the academic literature by applying the Innovation Resistance Theory to the context of EV adoption in a developing country. Most studies using this theory have been conducted in developed economies, where consumer behaviour and market conditions differ significantly from those in countries like India. By examining functional and psychological barriers, this research expands the application of the theory and provides a framework that can be used in similar contexts. Furthermore, the study's focus on resistance provides a fresh perspective on EV adoption, complementing existing research that primarily emphasizes drivers of adoption.

2. Theoretical Framework

Innovation Resistance Theory

Innovation Resistance Theory (IRT) provides a comprehensive framework for understanding the factors that hinder the adoption of new technologies and innovations(Siddiqui et al., 2023). Unlike traditional adoption theories that focus on the drivers of acceptance, IRT shifts attention to the barriers that create resistance among consumers(D. Chakraborty, 2022). This resistance stems from the natural tendency of individuals to maintain the status quo, as adopting innovations often involves changes in behavior, routines, or perceptions that can evoke uncertainty or discomfort(Kaur et al., 2021).

IRT identifies two broad categories of barriers: functional barriers and psychological barriers. Functional barriers are practical concerns that arise from the characteristics of the innovation itself(Chen et al., 2022). These include usage barriers, which relate to perceived difficulties in using the innovation, value barriers, which concern the perceived lack of benefits relative to costs, and risk barriers, which reflect uncertainties about performance, reliability, and long-term sustainability(Chen et al., 2022). These barriers highlight how functional shortcomings can deter consumers from embracing an innovation, even when its benefits are well-documented.

Psychological barriers, on the other hand, stem from individual attitudes, beliefs, and societal influences(George & Nair, 2022). These include tradition barriers, which reflect resistance due to attachment to established habits and practices, and image barriers, which pertain to negative perceptions of how the innovation aligns with social or cultural expectations(Verma et al., 2023). Psychological barriers are particularly significant in contexts where innovations challenge deeply ingrained social norms or require a shift in consumer identity.

Table 1 *Description of Barriers*

Barrier	Description	Example
Usage Barrier	Relates to the perceived difficulty or inconvenience of using the innovation	Limited charging infrastructure, long charging times, and lack of familiarity with EV-specific technology.
Value Barrier	Reflects the perception that the innovation does not offer sufficient benefits compared to its cost or effort.	High upfront costs of EVs, limited perceived savings, and doubts about long-term financial or environmental advantages.
Risk Barrier	Concerns related to uncertainties about the innovation's performance, reliability, and long-term viability.	Fear of battery degradation, range anxiety, maintenance uncertainties, and concerns over resale value.
Tradition Barrier	Resistance arising from attachment to existing habits, routines, and traditional practices.	Preference for conventional vehicles due to familiarity, trust in existing infrastructure, or resistance to behavioral change.
Image Barrier	Negative perceptions or societal judgments about the innovation's image, suitability, or social alignment.	Negative perceptions or societal judgments about the innovation's image, suitability, or social alignment.

3. Hypothesis Development

1. Image Barrier

The image barrier reflects societal and cultural perceptions of an innovation. Negative associations with innovation can heighten resistance, as consumers often rely on social cues to evaluate new products(Kumar et al., 2022). In the context of EVs, some consumers may perceive them as lacking prestige, being suitable only for environmentally conscious individuals, or appearing complex and unfamiliar(Gulzari et al., 2022; Yang et al., 2022). Such perceptions may discourage potential adopters who prioritize status or prefer established norms. Social identity theory suggests that individuals gravitate toward products that enhance their self-image and align with their perceived social status. When EVs fail to meet these expectations, resistance to their use increases. Thus, We hypothesise that:

H1: Image barrier is positively related to resistance to use.

2. Value Barrier

The value barrier arises when consumers perceive an imbalance between the cost of adopting an innovation and the benefits it provides(Chen et al., 2022). Despite the potential for long-term savings, EVs are often associated with high upfront costs, creating a perception of low economic value. Additionally, intangible benefits such as environmental impact are often undervalued by consumers who prioritize immediate utility. Prospect theory explains that consumers tend to focus on losses (high upfront cost) more than gains (future savings), leading to a higher resistance to adoption(Liu et al., 2021). In markets with high price sensitivity, as in many developing countries, consumers are particularly reluctant to invest in products with uncertain or delayed returns. If the perceived value of EVs fails to outweigh the associated costs, resistance to use is likely to increase significantly. Thus, we hypothesize that:

H2: Value Barrier is negatively related to resistance to use.

3. Risk Barrier

Risk barriers reflect an innovation's uncertainty and perceived dangers, particularly regarding performance, reliability, and maintenance(Leong et al., 2020b). EVs, as a relatively new technology, evoke concerns about battery life, charging infrastructure availability, range limitations, and long-term costs(Wang & Shi, 2024). The theory of perceived risk highlights that individuals are naturally averse to uncertainties that could result in potential loss, such as financial setbacks or inconvenience(Yaoyuneyong et al., 2018). In the case of EVs, the lack of established service ecosystems and varying battery performance in extreme climates amplify these concerns. Such risks disproportionately affect early adopters, who often act as

opinion leaders in driving broader acceptance. If potential consumers perceive EVs as a high-risk investment, their resistance to use will likely increase, stalling broader market penetration. Thus, we hypothesize that:
H4: Risk Barrier Positively Influences Resistance to Use.

4. Tradition Barrier

Tradition barriers arise from consumers' attachment to existing practices and their reluctance to abandon familiar routines. For many consumers, conventional vehicles represent a trusted, well-understood choice backed by established infrastructure and servicing options(Leong et al., 2020a). EVs, on the other hand, often require behavioural shifts such as planning charging schedules, using new technologies, or adapting to limited infrastructure(Nylund & Brem, 2024). Status quo bias theory suggests that people prefer the comfort of existing practices over the uncertainty of change, even when the new option offers superior benefits(Balakrishnan et al., 2021). This inertia is particularly strong in regions where cultural norms emphasize continuity and risk aversion. For instance, individuals accustomed to refuelling vehicles quickly at gas stations may resist the slower and less familiar EV charging process. As the attachment to traditional vehicle usage deepens, resistance to EV adoption intensifies. Thus, we hypothesize:
H5: Image Barrier positively influences Resistance to Use.

5. Usage Barrier

Usage barriers relate to practical difficulties and inconveniences associated with using an innovation(James et al., 2022). For EVs, common usage barriers include limited charging infrastructure, long charging times, and unfamiliarity with EV-specific features(Gulzari et al., 2022). Complexity theory explains that innovations perceived as difficult to use or integrate into daily routines face greater resistance(Bhattacharyya et al., 2023). In developing countries, where charging networks are sparse and travel distances are often unpredictable, these challenges are magnified. Consumers may view the logistical hurdles of owning and operating an EV as outweighing its benefits(Athanasopoulou et al., 2023). Additionally, fear of being stranded due to limited range or inaccessible charging stations reinforces these barriers. When consumers perceive EVs as too inconvenient or incompatible with their lifestyles and due to this their resistance to use increases significantly.
H6: Usage Barrier positively influences Resistance to Use.

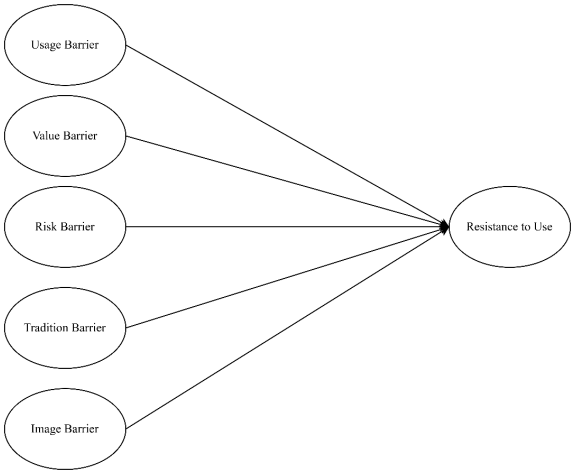

Figure 1 *Conceptual Model*

4. Methodology

Cross-sectional survey was conducted to collect data from potential EV users in urban settings, as these areas represent the highest potential for early EV adoption due to infrastructure and market availability. The study employs a structured questionnaire as the primary data collection tool, enabling the measurement of perceptions, attitudes, and behavioural intentions related to EV adoption. The target population consists of potential EV users in India, particularly individuals residing in metropolitan cities where EV infrastructure is gradually developing(Vimal et al., 2024). The sample was selected using a non-probability purposive sampling method to ensure that participants had basic awareness of EVs and could provide relevant insights. A total of 400 questionnaires were distributed across five major cities—Delhi, Mumbai, Bengaluru, Hyderabad, and Chennai—chosen for their varying levels of infrastructure and consumer demographics. Out of the distributed questionnaires, 305 valid responses were obtained, achieving a response rate of 76.25%. The survey instrument was designed to measure the constructs identified in the conceptual model. Each construct was operationalized using validated scales adapted from existing literature, ensuring reliability and consistency. A 5-point Likert scale (ranging from 1 = Strongly Disagree to 5 = Strongly Agree) was used to capture participants' perceptions of barriers and their resistance to EV use.

Data were collected through an online survey platform, ensuring accessibility and convenience for participants. A preliminary pilot test was conducted with 50 respondents to assess the clarity and reliability of the questionnaire. Feedback from the pilot study was incorporated to refine item phrasing and improve the flow of the questionnaire. Participants were informed about the

study's purpose, assured of anonymity, and given the option to withdraw at any stage. Inclusion criteria required participants to have some prior knowledge of EVs, such as familiarity with brands or basic awareness of EV benefits and challenge. The collected data were analyzed using Partial Least Squares Structural Equation Modelling (PLS-SEM), a robust technique suited for testing complex relationships in conceptual models with multiple constructs(Sarstedt et al., 2022). PLS-SEM was chosen for its ability to handle non-normal data distributions and relatively small sample sizes while providing comprehensive insights into relationships between latent variables (Hair et al., 2019).

5. Results

The measurement model was utilized to assess the reliability and validity of the survey instrument. It examined the psychometric properties of the constructs, including content validity, internal consistency, convergent validity, and discriminant validity.

Common Method Bias Test

Given the reliance on self-reported data, the potential for common method bias (CMB) was addressed. Harman's single-factor test revealed that no single factor explained more than 50% of the variance, indicating the absence of significant CMB(Podsakoff et al., 2003).

Measurement Model

The measurement model was rigorously tested for its reliability and validity to ensure the robustness of the survey instrument. Content validity was established by adapting survey items from validated scales in the literature, while face validity was confirmed through a pilot test involving 50 respondents, ensuring clarity and relevance of the items. Convergent validity was confirmed as all factor loadings exceeded 0.50, while average variance extracted (AVE) values for all constructs were greater than 0.50, and composite reliability (CR) values were above 0.70, indicating high internal consistency and shared variance within constructs(Sarstedt et al., 2017). Discriminant validity was assessed using the Heterotrait-Monotrait Ratio (HTMT), a robust criterion that evaluates the distinction between constructs. All HTMT ratios were below the recommended threshold of 0.85 (Henseler et al., 2015), confirming that the constructs are conceptually distinct and do not exhibit significant overlap. Together, these results establish the measurement model's reliability, validity, and suitability for hypothesis testing.

Table 2 *Reliability and Validity*

	Cronbach's Alpha	Composite Reliability	AVE
Image Barrier	0.902	0.912	0.836
Risk Barrier	0.881	0.882	0.808
Resistance to Use	0.819	0.819	0.734
Tradition Barrier	0.786	0.885	0.682
Usage Barrier	0.809	0.812	0.724
Value Barrier	0.844	0.85	0.681

Table 3 *Discriminant Validity*

	Image Barrier	Risk Barrier	Resistance to Use	Tradition Barrier	Usage Barrier	Value Barrier
Image Barrier						
Risk Barrier	0.228					
Resistance to Use	0.231	0.387				
Tradition Barrier	0.112	0.083	0.219			
Usage Barrier	0.238	0.453	0.523	0.077		
Value Barrier	0.251	0.346	0.408	0.194	0.335	

Structural Model

The structural model results reveal that four of the five hypothesized barriers significantly contribute to consumer resistance to using electric vehicles (EVs). Usage barriers had the strongest positive influence on resistance to use ($\beta = 0.303$, $T = 4.908$, $p < 0.001$), highlighting the substantial impact of practical challenges such as limited charging infrastructure and long charging times. Tradition barriers also showed a significant positive relationship with resistance ($\beta = 0.158$, $T = 2.863$, $p = 0.004$), indicating that attachment to conventional practices and routines plays a key role in shaping resistance. Similarly, the value barrier demonstrated a significant positive effect on resistance ($\beta = 0.174$, $T = 2.285$, $p = 0.022$), suggesting that perceptions of high costs and inadequate benefits deter adoption. Risk barriers were also significant ($\beta = 0.149$, $T = 2.072$, $p = 0.038$), reflecting consumer concerns about uncertainties related to battery performance, range, and maintenance. In contrast, the image barrier had a positive but statistically insignificant relationship with resistance ($\beta = 0.059$, $T = 0.975$, $p = 0.329$), indicating that societal perceptions and the symbolic image of EVs do not significantly influence resistance in this context. These findings underscore the importance of addressing functional and tradition-related barriers to reduce consumer resistance to EVs.

Table 4 *Path Coefficient*

Hypothesis	β	T statistics	P values
Image Barrier ->Resistance to Use	0.059	0.975	0.329
Risk Barrier ->Resistance to Use	0.149	2.072	0.038
Tradition Barrier ->Resistance to Use	0.158	2.863	0.004
Usage Barrier ->Resistance to Use	0.303	4.908	0
Value Barrier ->Resistance to Use	0.174	2.285	0.022

6. Discussion

The findings of this study provide critical insights into the factors influencing consumer resistance to electric vehicle adoption, guided by the Innovation Resistance Theory(Laukkanen, 2016). The results highlight that usage barriers have the strongest positive influence on resistance to EV use. This finding aligns with previous research emphasising the role of practical challenges, such as limited charging infrastructure and long charging times, as major obstacles to adoption(Cortes-Murcia et al., 2019). In developing economies like India, where EV infrastructure is still in its nascent stages, these barriers are particularly pronounced. Addressing usage barriers requires concerted efforts to expand charging networks, reduce charging times, and ensure that EVs can seamlessly integrate into consumers' daily routines.

Tradition barriers also significantly contribute to resistance, indicating that attachment to conventional vehicles and established practices pose a substantial challenge. Consumers often prefer the familiarity and reliability of internal combustion engine vehicles, which have been the dominant mode of transportation for decades. This finding is consistent with the literature on status quo bias, highlighting resistance to change as a significant impediment to innovation adoption(Tsai et al., 2019). To mitigate tradition barriers, stakeholders should focus on educational campaigns that emphasize the ease of transitioning to EVs and highlight their long-term benefits. Demonstrating the similarities between EVs and conventional vehicles in terms of usability could also help alleviate resistance stemming from entrenched habits.

The study also finds that value barriers play a significant role in driving resistance. High upfront costs and perceptions of inadequate long-term benefits deter consumers from considering EVs as a viable option. These results echo prior findings that emphasize the importance of perceived cost-benefit balance in adoption decisions(Soetevent, 2024; Verma et al., 2023). Policymakers can address value barriers by providing subsidies, tax benefits, and low-interest financing options to reduce the initial financial burden of purchasing EVs. Additionally, manufacturers should focus on communicating the long-term savings associated with lower maintenance and operating costs to enhance the perceived value of EVs.

Risk barriers are another significant factor contributing to resistance, reflecting concerns about EV performance, reliability, and maintenance uncertainties. These findings are consistent with the theory of perceived risk, which underscores the negative impact of uncertainties on consumer decision-making(Wang & Shi, 2024). To alleviate these concerns, manufacturers can offer extended warranties, transparent battery performance metrics, and robust after-sales support. Ensuring the availability of reliable service networks will also help build consumer confidence in the technology.

Interestingly, image barriers were not found to influence resistance in this study significantly. This result contrasts with research conducted in developed countries, where societal perceptions and the symbolic image of EVs often play a critical role in shaping adoption decisions. In the Indian context, consumers appear to prioritise functional and financial considerations over societal perceptions. This suggests that while improving the image of EVs through targeted marketing campaigns may be beneficial, addressing practical and economic concerns should take precedence to drive adoption in developing economies.

Theoretical Implications

This study makes several significant theoretical contributions by advancing the understanding of consumer resistance to innovation, particularly in the context of electric vehicles. It extends the application of Innovation Resistance Theory (IRT), originally developed to understand consumer resistance to new products, by applying it to a complex and context-specific innovation—EV adoption in a developing economy. First, the study underscores the relevance of IRT in explaining resistance to sustainable innovations like EVs. While prior research has predominantly focused on the drivers of adoption, this study highlights the importance of examining resistance as a critical opposing force that impedes consumer behaviour. By identifying and empirically testing the relationships between functional barriers (usage, value, risk) and psychological barriers (tradition, image), the study validates the multidimensional framework of IRT, demonstrating its robustness in capturing resistance dynamics in a real-world context.

Second, the study provides new insights into the relative importance of different barriers in shaping resistance. The findings reveal that usage barriers are the most influential factor, highlighting the critical role of practical challenges such as limited infrastructure and usability concerns in deterring EV adoption. This emphasis on usage barriers extends the theoretical understanding of functional resistance and suggests that practical considerations may outweigh psychological barriers in certain contexts, such as developing economies. Third, the study challenges existing literature by showing that image barriers—a key psychological construct in IRT—do not significantly influence resistance in the context of EV adoption in India. This finding contrasts with studies conducted in developed markets, where societal perceptions and symbolic meanings of innovations often play a significant role. By identifying the limited role of image barriers, the study adds a contextual dimension to IRT, suggesting that the relative importance of barriers may vary across cultural and economic settings. This highlights the need for future research to consider the role of contextual factors in shaping resistance.

Fourth, the study integrates tradition barriers into the IRT framework, providing evidence for their significant impact on resistance to sustainable innovations. The findings emphasize that attachment to conventional practices and reluctance to abandon established routines are important psychological drivers of resistance. This contributes to the theoretical discourse by highlighting the interplay between tradition and innovation, particularly in markets where consumers are deeply rooted in existing behaviours and infrastructures. Lastly, the study contributes to the literature on sustainable innovation by applying IRT in the context of developing economies, which are often underrepresented in innovation research. By focusing on India, the study broadens the scope of IRT, demonstrating its applicability in diverse economic and cultural contexts. It provides a theoretical foundation for understanding resistance to EVs in other developing countries, where similar functional and psychological barriers may be at play.

Practical Implications

The findings of this study offer valuable practical implications for policymakers, manufacturers, and marketers aiming to reduce consumer resistance to EV adoption. By addressing the specific barriers identified, stakeholders can create targeted strategies to accelerate the transition to sustainable mobility. Although the study found that image barriers were not a significant driver of resistance, it is still important to ensure that EVs are positioned as modern, innovative, and convenient products. Marketing efforts should prioritize addressing functional concerns over societal perceptions. Campaigns can focus on practical benefits, such as cost savings and ease of use, rather than heavily investing in repositioning the symbolic image of EVs, which appears less critical in this context.

Risk barriers, however, were found to significantly influence resistance. Uncertainties regarding battery performance, range, and maintenance contribute to consumer hesitation. To alleviate these concerns, manufacturers should provide extended warranties, clear and transparent communication about battery durability, and reliable after-sales support. Additionally, the development of accessible and robust service networks can enhance consumer confidence in the technology, making EVs a more reliable and trustworthy option. Tradition barriers also emerged as a significant factor, highlighting the role of consumer attachment to conventional practices. Many consumers prefer familiar routines and technologies, making the transition to EVs challenging. To counter this resistance, stakeholders should focus on consumer education, emphasizing the ease of switching to EVs and their long-term benefits. Offering hands-on experiences, such as test-drive programs, can help consumers overcome psychological resistance by familiarizing them with EV technology and its usability.

Usage barriers had the strongest impact on resistance, emphasizing the importance of addressing practical challenges. Limited charging infrastructure, long charging times, and compatibility with daily routines are critical issues. Policymakers and private entities should prioritize expanding charging networks, particularly fast-charging stations in urban and rural areas, to reduce inconvenience. Investments in technology that reduces charging times can also significantly improve the usability of EVs, making them a more practical choice for consumers. Lastly, value barriers significantly influenced resistance, reflecting concerns about the perceived cost-benefit imbalance of EVs. High upfront costs, coupled with scepticism about long-term savings, deter consumers from adoption. To address this, governments can offer financial incentives such as subsidies, tax rebates, and low-interest financing options to make EVs more affordable. Manufacturers and marketers should effectively communicate the long-term savings associated with EV ownership, such as reduced maintenance and fuel costs, to enhance the perceived value proposition of EVs. By implementing these targeted strategies, stakeholders can address the specific barriers to EV adoption identified in this study, ultimately reducing resistance and fostering a smoother transition toward sustainable transportation.

7. Conclusion

This study explored consumer resistance to EV adoption using IRT focusing on functional and psychological barriers. The findings reveal that usage barriers are the most significant contributor to resistance, followed by tradition, value, and risk barriers, while image barriers were not significant in this context. These results highlight the dominant role of practical challenges such as limited charging infrastructure and high upfront costs, alongside the influence of established habits and perceptions of uncertainty.

The study makes theoretical contributions by extending IRT to the EV context in a developing economy, demonstrating the contextual variability of barriers and emphasizing the importance of functional over psychological resistance in such settings. Practical implications include the need for infrastructure development, financial incentives, and consumer education to address these barriers effectively. By targeting these areas, stakeholders can reduce resistance and accelerate EV adoption, contributing to sustainable transportation and environmental goals.

8. Limitations and Future Research Directions

This study provides valuable insights into consumer resistance to EV adoption but is not without its limitations. First, the research focuses exclusively on urban areas in India, where EV infrastructure and awareness are relatively advanced. This approach may not fully capture resistance dynamics in rural or semi-urban areas, where infrastructure is limited, and affordability concerns are more pronounced. Second, the cross-sectional design of the study limits its ability to explore how resistance evolves over time. Resistance to EVs may change as technology, infrastructure, and policy interventions progress, and this dynamic nature cannot be captured in a single snapshot. Third, while the study examines significant psychological barriers such as tradition and image, it does not account for other influential factors like consumer trust, social influence, or

environmental consciousness, which could enrich the understanding of resistance. Lastly, the reliance on self-reported data introduces the possibility of bias, as respondents may misrepresent their resistance due to social desirability or limited knowledge about EVs.

Addressing these limitations opens several avenues for future research. Longitudinal studies could investigate how resistance to EVs changes over time, particularly as advancements in technology and infrastructure are introduced. Expanding the research to rural and semi-urban areas could provide a more comprehensive understanding of resistance in less developed regions. Additionally, incorporating other psychological constructs, such as trust, perceived behavioural control, and social influence, could offer a more holistic perspective on resistance to EVs. Comparative studies across developed and developing economies would shed light on how cultural and economic contexts influence barriers, offering global insights into EV adoption dynamics. By addressing these research gaps, future studies can build on the current findings, offering deeper insights and practical strategies to accelerate the adoption of sustainable innovations like EVs.

9. Appendix

Constructs	Measurement Items	Source
Usage Barrier	1. EVs are inconvenient because the charging infrastructure is not widely available. 2. EVs are convenient because I can charge them at home. (R) 3. EVs are inconvenient because charging takes a long time	(Laukkanen, 2016)
Value Barrier	1. EVs offer more advantages compared to conventional vehicles (e.g., lower operating costs, reduced emissions). (R) 2. Using an EV increases my ability to save money in the long term. (R) 3. The benefits of using an EV do not outweigh the cost of switching to one.	(Laukkanen, 2016)
Risk Barrier	1. I fear that I might not find a charging station when I need one. 2. I fear that EVs may not provide sufficient range for my trips. 3. I fear that EV batteries may degrade quickly, reducing vehicle performance.	(Laukkanen, 2016)
Tradition Barrier	1. I find it difficult to get accustomed to the new features of EVs compared to conventional cars. 2. I find it challenging to locate service centres for EVs. 3. I find it difficult to resolve technical issues with EVs without professional help.	(Laukkanen, 2016)
Image Barrier	1. I feel that EVs are not considered stylish or prestigious. 2. I feel that EVs are viewed as a complicated technology by others. 3. I have an impression that EVs are only suitable for environmentally conscious people, not for everyone.	(Laukkanen, 2016)
Resistance to Use	1. I expect to use an EV for commuting in the future. 2. I intend to use an EV in the near future. 3. I plan to switch to an EV as soon as possible	(Laukkanen, 2016)

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