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The Role of Consumer Perceptions in Electric Vehicles Adoption: Financial incentives, Retrofitting, and Environmental Concerns in India.

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Abstract:
The study investigates the key determinants influencing consumer adoption of electric vehicles (EVs) in India, focusing on financial incentives, relative advantages, desire for unique products, percieved ease of use and usefulness of technology and the potential of retrofitting existing vehicles. In the context of India's dominance by internal combustion engines (ICE), understanding consumer decision-making is critical for facilitating the transition to a sustainable transportation system. The study combines the Theory of Planned Behaviour and the Technology Acceptance Model to examine the above factors. The data collection included pilot study in form of interviews of end users and a survey of 333 participants, including both potential and actual consumers. The study employed Partial Least Squares Structural Equation Modeling (PLS-SEM) revealing key drivers if EV adoption. Study also revealed that reluctance towards retrofitting comes from indeaquate infrastructure, concerns about mining pollution, a preference towards a new vehicle, limited awareness and lack of interest. The study holds impliactions for EV manufacturers and marketers and offers actionable recommendations for advancing green transportation initiatives in India.

Keywords: Electric Vehicles, Structural Equation Model (SEM), Technology Acceptance Model (TAM), E-retrofitment, Consumer Adoption.

1. Introduction

Road transportation causes 20-30% of the air pollution in urban India (IEA, n.d.). The growing environmental concerns across various levels of society have prompted a significant rise in the production of eco-friendly or green products. EVs represent a notable example of such products, having been in development since the early 20th century. However, they faced challenges and were overshadowed by gasoline-powered vehicles due to issues such as high costs, battery problems, and subpar performance (Bradley and Frank, 2009). The decarbonization of transportation means on roads is essential for mitigating climate change by reducing the carbon footprint (Tran et al., 2012). EVs are anticipated to combat adverse environmental impacts and contribute to the conservation of scarce non-renewable fuel resources throughout their lifecycle (Liu et al., 2019). Recognized as an efficient alternative for urban transportation, EVs play a crucial role in diminishing reliance on oil and abating air pollution, resulting in substantial health and environmental benefits (Wu et al., 2019). Over the years, there has been a sustained effort to enhance battery technology, making EVs more cost-effective and appealing to environmentally conscious drivers (Scown et al., 2013). The strategic promotion of EVs has been a central point of interest, marked by the formulation of targets and the implementation of policies. This concerted effort aims to position EVs as crucial components in the landscape of future vehicles (Buekers et al., 2014). This has led to a resurgence of interest in EVs, with many major vehicle manufacturers actively developing electric or hybrid electric vehicles. In recent times, there has been a global push by auto manufacturers, government agencies, and organizations to advance vehicle technologies that aim to reduce dependence on petroleum and mitigate environmental impact (Ng, Law and Zhang, 2018). There has been a massive rise in studies on EV adoption and adoption intention. Many studies have been conducted on electric four-wheelers and public transportation, but there is a shortage of research investigating electric scooters (Ho, Wu, and Hsieh, 2023). Hence, a research gap exists in the study of EV adoption behaviour in India, especially in the segment of electric two-wheelers.

The Indian government has committed to an ambitious objective of achieving a 30% sales penetration of electric passenger cars by 2030, as part of its larger mission to attain Net Zero emissions by 2070. Against this backdrop, the emerging e-retrofitment industry in the country becomes a significant consideration. E-retrofitting involves the conversion of vehicles by replacing their ICE with an electric powertrain, thereby transforming them into EVs (Anon, 2020). Thus, there is a need to understand consumers' views on e-retrofitment adoption.

This study endeavours to formulate and assess an adoption model designed to explore the key factors influencing consumers' intentions to adopt EVs within the Indian context. The primary objectives of this study were as follows.

i. Scrutinize and analyse the importance and interrelationships of factors affecting the adoption of electric vehicles using the theoretical frameworks of the theory of planned behaviour (TPB) and Technology Acceptance Model (TAM).

ii. Exploring the connections among variables influencing intentions and actual behaviours within the context of electric vehicle adoption.

iii. Obtain perspectives from automobile users on the policy framework for retrofitting electric vehicles, aiming to comprehend and assess their viewpoints and contribute valuable insights to this research.

The paper further encompasses literature review in Section 2, a conceptual framework in Section 3, and data presentation with methodology in Section 4. Analysis and results are in Section 5, practical implications in Section 6, and findings, conclusions, and future research directions in Section 7.

2. Literature Review

The adoption of EVs has garnered significant attention in recent years due to the increasing awareness of environmental issues and the push toward sustainable transportation. The surge in environmental consciousness has propelled EVs into the spotlight, prompting a comprehensive examination of the factors influencing their uptake. This literature review delves into key determinants of EV adoption.

2.1 Environmental Concerns and Regulatory Support:

A pivotal driver for EV adoption stems from heightened concerns about environmental sustainability. The imperative to curtail carbon emissions and minimize overall environmental impact has been a significant motivator for individuals to transition to electric vehicles (Smith et al., 2019). Government regulations and incentives further amplify this push (IEA, 2020).

2.2 Technological Advancements and Infrastructure:

Continuous advancements in EV technology, particularly in battery efficiency and range, significantly contribute to increased adoption (EIA, 2018). The development of widespread and efficient charging infrastructure is concurrently vital in mitigating range anxiety and further encouraging adoption (Sierzchula et al., 2014).

2.3 Economic Factors and Cost of Ownership:

The initial high cost of electric vehicles has historically impeded widespread adoption. Yet, studies suggest that technological progress and scaled-up production are poised to reduce costs, enhancing the economic viability of electric vehicles for a broader consumer base (Chhikara, Ritu, et al., 2021; Axsen & Kurani, 2013). Further ease of financing has been considered as a factor that drives the automobile industry (Sharma & Aggarwal, 2019). Thus economic factors have been recognised as a major cause for adoption of Electronic vehicles.

2.4 Social Influences and Consumer Awareness:

Social factors, including peer influence and societal norms, play a role in the decision to adopt electric vehicles (Yang et al., 2015). The dissemination of knowledge regarding the environmental and cost-saving benefits of electric vehicles is pivotal in shaping consumer attitudes and preferences. Moreover familiarity of product through awareness and advertisements stimulate the liking or preference for the product (Iyer & Aggarwal, 2019).

2.5 Range Anxiety and Charging Infrastructure:

Despite strides in battery technology, the shadow of range anxiety persists. Addressing this concern necessitates the development of a robust charging infrastructure (Sierzchula et al., 2014).

Understanding the nuanced factors influencing electric vehicle adoption is imperative for policymakers, manufacturers, and researchers alike and the understanding of the relative significance of these factors, offering valuable insights for fostering broader electric vehicle adoption in the future.

3. Theoretical Framework

3.1. Financial Incentive Policy

Financial Incentive Policy (FIP) is considered a significant factor influencing consumers' perceptions and intentions towards EV adoption. Drawing on the Technology Acceptance Model (TAM) (Davis, 1989), which emphasizes perceived ease of use (PEU) and perceived usefulness of technology (PUT), we posit the following hypotheses:

H1: Financial Incentive Policy (FIP) has positive relationship with consumer's Perceived Ease of Use (PEU) regarding adoption intention of electric vehicles.

H2: Financial Incentive Policy (FIP) has positive impact on consumer's Perceived Usefulness of Technology (PUT) towards electric vehicle adoption.

3.2. Desire for Unique Consumer Products

The Desire for Unique Consumer Products (DUCP) is proposed to influence consumers' perceptions and intentions (Aggarwal & Agrawal, 2024) and same is the case with regard to EV adoption, specifically concerning perceived ease of use (PEU). Building on the theory of reasoned action (Fishbein & Ajzen, 1975), we suggest the following hypotheses:

H3: Desire for Unique Consumer Products (DUCP) has impact on Perceived Ease of Use (PEU) on behavioural intention towards EVs.

H4: Desire for Unique Consumer Products (DUCP) is positively related to consumer's Perceived Ease of Use (PEU) to intention of EV adoption.

3.3. Perceived Relative Advantage

Perceived Relative Advantage (PRA) is theorized to significantly influence consumers' perceptions and intentions towards EV adoption. Drawing on Rogers' Diffusion of Innovations Theory (1962), we propose the following hypotheses:

H5: Consumer's Perceived Relative Advantage (PRA) has positive impact on consumer's Perceived Ease of Use (PEU) to EV adoption intention.

H6: Consumer's Perceived Relative Advantage (PRA) has positive relationship with consumer's Perceived Usefulness of Technology (PUT) to intention of adoption of EV.

3.4. Perceived Ease of Use

Perceived Ease of Use (PEU) is considered a crucial mediator influencing consumers' adoption intentions of EVs. Building on the TAM (Davis, 1989), we hypothesize:

H7: Consumer's Perceived Ease of Use (PEU) is positively correlated to adoption intention (INT) of EVs as a mediator.

3.5. Perceived Usefulness of Technology

Perceived Usefulness of Technology (PUT) is proposed to mediate the relationship between financial incentives and consumers' intentions to adopt EVs. We posit the following hypothesis:

H8: Consumer's Perceived Usefulness of Technology (PUT) has positive correlation towards intention of EV purchase as a mediator.

3.6. Intention

Intention is known to predict behaviour with regard to consumption of goods (Aggarwal, Kirtana & Balasubramanian, 2023). Intention serves as the ultimate outcome in the theoretical framework, representing consumers' predisposition to adopt EVs. The hypotheses related to intention are derived from the proposed relationships outlined in the previous sections.

The Proposed Research Model

The model has PEU and PUT as mediators for FIP, DUCP and PRA leading to purchase intention of EV.

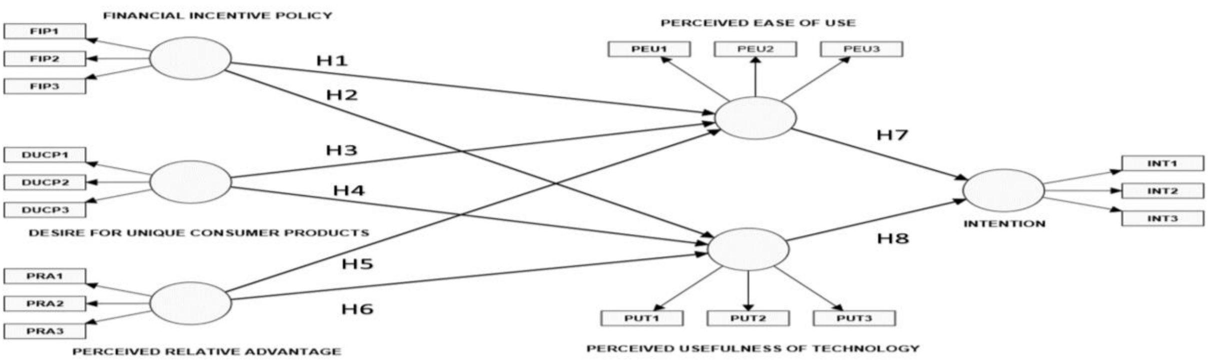

Figure 1: Proposed Research Model

4. 4.Methodology

4.1 Data Collection

The purpose of this study is to identify the predecessor that influences EV adoption intention in India. As the initial step, three interviews were conducted to gather insights from early adopters of Electric Vehicles (EVs). For data collection, a self-administered questionnaire was developed based on a previous study. The survey was conducted in two steps. The first section consisted of general demographic information, such as gender, age, occupation, and income (Table 1). The second section consisted of 18 questions regarding the regarding endogenous and exogenous variables adapted from previous studies on consumer perceptions of EVs. Three items (indicators) for each of the 6 variables i.e. Financial Incentive Policy, Desire for Unique Consumer Products, Perceived Relative Advantage, Perceived Ease of Use, Perceived Usefulness of Technology, Intention were adapted from (Dong et al., 2020, Jaiswal et al., 2021, Smith et al., 2017, Xu et al., 2020). Each item was measured on the five-point likert scale ranging from 1=Strongly disagree to 5=Strongly agree.

The data was collected from various states of the country including Andhra Pradesh, Punjab, Tamil Nadu, Telangana, Karnataka, Assam, Kerela, Maharashtra, Odisha and Delhi (NCT-National Capital Territory). Of the mentioned states, Maharashtra and Karnataka recorded a massive jump in EV sales between fiscal year 2014-2022 (pv magazine International, 2023). The study employed a purposive sampling technique for data collection due to the unknown nature of the population. The decision to use non-probability sampling was driven by the challenge of accurately identifying and accessing the entire population. The determination of the sample size in this study was guided by the recommendations of (Andrew Laurence Comrey, 1973). According to their guidelines, a sample size of 50 was considered poor, 300 was deemed good, 500 was categorized as very good, and 1000 was considered excellent. Around 335 responses were collected and 333 were usable for data analysis.

Table 1: Respondents demographic profile

Variables	**Characteristics**	**Frequency**	**Percentage**
Gender	Female	200	60.06%
	Male	129	38.74%
	Prefer not to say	4	1.20%
Age	Under 18	10	3.00%
	18-24	163	43.95%
	25-34	85	25.53%
	35-44	28	8.41%
	45-54	24	7.21%
	55-60	12	3.60%
	Above 60	11	3.30%
Occupation	Full-time employment	158	47.45%
	Part-time employment	10	3.00%
	Unemployed	11	3.30%
	Self-employed	15	4.50%
	Home-maker	10	3.00%
	Student	118	35.44%
	Retired	11	3.30%

Annual Income	Below 2,50,000	41	12.31%
	₹2,50,000 - ₹5,00,000	35	10.51%
	₹5,00,000 - ₹7,50,000	38	1.41%
	₹7,50,000- ₹10,00,000	33	9.91%
	₹10,00,000- ₹12,50,000	12	3.60%
	₹12,50,000- ₹15,00,000	13	3.90%
	Above ₹15,00,000	42	12.61%
	Not Applicable	119	35.74%

5. Data Analysis and Results

Structural Equation Modeling (SEM) stands out as a powerful analytical tool, surpassing first-generation multivariate analysis tools in terms of accuracy, efficiency, and convenience, as highlighted by (Aslam et al., 2019). SEM comprises two main types: covariance-based SEM (CB-SEM) and variance-based SEM (VB-SEM or PLS-SEM) (Henseler, Ringle and Sarstedt, 2015). Recent studies emphasize the preference for PLS-SEM in an exploratory approach and for achieving superior predictive accuracy (Ramli, Latan and Solovida, 2019).

The significance of SEM, particularly PLS-SEM, in business studies cannot be overstated. PLS-SEM is often referred to as a "silver bullet" or "Holy Grail" due to its unparalleled ability to concurrently navigate complex relationships, a trait crucial for understanding intricate business dynamics (Hair, Ringle and Sarstedt, 2011).

For the current study, PLS-SEM was the methodology of choice, implemented using Smart-PLS software 4.0, aligning with the characteristics of PLS-SEM and the study's objectives.

The PLS-SEM methodology follows a two-step approach, consisting of the measurement model assessment and structural model assessment, as outlined by (J. F Hair et al., 2016). The PLS-SEM analysis procedure involves evaluating both the validity of measurements and assessing hypotheses. The measurement model assessment encompasses reliability and validity tests, ensuring the robustness of the inner model. Meanwhile, the structural model assessment involves evaluating the significance of hypotheses to derive conclusive outcomes for the study.

5.1. The Measurement Model

5.1.1. Assessment of Reliability and Validity

Before delving into hypothesis examination, we conducted thorough reliability and validity assessments for the constructs. As illustrated in Table 2 and Figure 2, factor loadings of all items exceeded 0.7, underscoring their robustness. Furthermore, the composite reliability values fell within the range of 0.842–0.935, while Cronbach's alpha demonstrated a range of 0.721–0.896, all surpassing the 0.70 threshold. These results affirmed the constructs' reliability, meeting the recommended loading criterion of at least 0.70 (J. F Hair et al., 2016).

To examine construct validity, we employed the average variance extracted (AVE) method. The AVE scores for all constructs ranged from 0.641 to 0.828, surpassing the suggested threshold of 0.50 set by (J. F Hair et al., 2016), indicating satisfactory convergent validity for the constructs (Asadi, Hussin and Dahlan, 2017). Consequently, we concluded that the measurement model exhibited a commendable fit with the collected data.

Applying Fornell-Larcker's criterion, we assessed discriminant validity by examining the correlation of the square root AVE for the dependent variable. As depicted in Table 3, the square root values in AVE on the diagonal matrix were higher than those off-diagonal, meeting the established standards for discriminant validity. This outcome underscores the robustness of the measurement model and supports the validity of the constructs in the study.

Table 2: Measurement Model-Reliability and Validity results for the construct

Constructs	Items	Factor Loading	Cronbach α	Composite Reliability	AVE
Financial Incentive Policy (FIP)	FIP1 FIP2 FIP3	0.889 0.866 0.868	0.848	0.908	0.766
Desire for Unique Consumer Products (DUCP)	DUCP1 DUCP2 DUCP3	0.900 0.904 0.902	0.884	0.928	0.812
Perceived Relative Advantage (PRA)	PRA1 PRA2 PRA3	0.749 0.797 0.845	0.721	0.842	0.641
Perceived Ease of Use (PEU)	PEU1 PEU2 PEU3	0.887 0.929 0.914	0.896	0.935	0.828
Perceived Usefulness of Technology (PUT)	PUT1 PUT2 PUT3	0.879 0.829 0.878	0.829	0.897	0.745
Intention (INT)	INT1 INT2 INT3	0.920 0.931 0.874	0.896	0.935	0.828

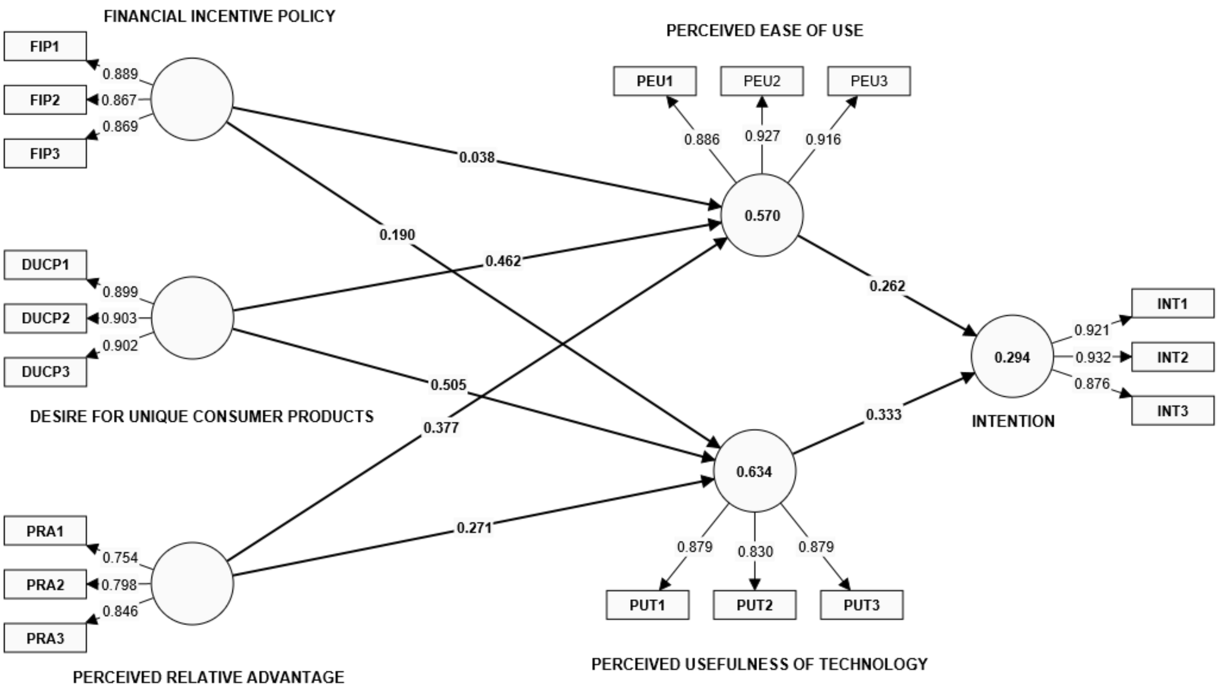

Figure 2: Measurement Model with Loadings

Table 3: The result of Fornell and Larcker's Criterion

	FIP	DUCP	PRA	PEU	PUT	INT
FIP	**0.875**					
DUCP	0.360	**0.901**				
PRA	0.533	0.534	**0.800**			
PEU	0.405	0.676	0.644	**0.910**		
PUT	0.516	0.718	0.642	0.657	**0.863**	
INT	0.413	0.390	0.624	0.480	0.505	**0.910**

5.2. Structural Model

5.2.1. Hypothesis Testing

The assessment of the structural model in this study relied on the multiple correlation coefficients squared (R^2) (Table 5), which quantifies the extent to which the model explains construct variance. Following the guidance of Hair Jr et al. (2016), a value equal to or greater than 0.25 is considered appropriate. In our study, R^2 values of 0.570, 0.634, and 0.293 were achieved for perceived ease of use, perceived usefulness of technology, and adoption intention, respectively. These values surpass the recommended minimum, indicating that a substantial proportion of the model variance is accounted for by the underlying factors. For hypothesis acceptance, path coefficients (β), t-values (t), and p-values (p) were determined using the bootstrapping technique with 5000 resamples, predictive relevance (Q^2) (Table 6), and effect size (f^2) (Table 7). As depicted in Table 4 and Figure 2, all hypotheses, except for H1, were supported. Table 4 provides insights into the significance of eight paths, confirming the statistical relevance of these relationships.

Hypothesis 1 was deemed untenable, as the financial incentive policy exhibited a β-value of 0.038 with a p-value exceeding the threshold of 0.05 (0.211). Consequently, there was no observed positive impact on Electric Vehicle (EV) adoption intention when mediated by perceived ease of use. Conversely, Hypothesis 2 found support, as the financial incentive policy displayed a β-value of 0.190, coupled with a p-value below 0.05. This suggests a positive influence on EV purchase intention, mediated by perceived usefulness of technology. Hypotheses 3 and 4 were likewise substantiated, revealing that the desire for unique consumer products is positively correlated with the adoption intention of EVs. This relationship is mediated by both perceived ease of use (β-value=0.462, p-value<0.05) and perceived usefulness of technology (β=0.505, p-value<0.05). The findings underscore the significant role of perceived relative advantage in influencing EV adoption intention. Both hypotheses 5 and 6 garnered support, indicating that perceived relative advantage, with β-values of 0.377 and 0.271 respectively, has a meaningful impact, with p-values below 0.05. Ultimately, Hypotheses 7 and 8 were affirmed, highlighting the crucial associations between perceived ease of use (β-value=0.262, p-value<0.05) and perceived usefulness of technology (β-value=0.333, p-value<0.05) with adoption intention. These associations were identified within the context of financial incentive policy, desire for unique consumer products, and perceived relative advantage as antecedents.

Table 4: Structural Model Results

Results of SEM and Hypothesis Testing						
Hypo thesis	**Relationship**	**Hypothesis Testing**				
		Path Coefficients	**Standard deviation (STDEV)**	**t- statistics**	**p- values**	**Result**
H1	FIP →PEU	0.038	0.047	0.803	0.211	Not Supported
H2	FIP → PUT	0.190	0.049	3.869	0.000(***)	Supported

H3	DUCP → PEU	0.462	0.054	8.615	0.000(***)	Supported
H4	DUCP → PUT	0.505	0.053	9.549	0.000(***)	Supported
H5	PRA → PEU	0.377	0.058	6.512	0.000(***)	Supported
H6	PRA → PUT	0.271	0.051	5.304	0.000(***)	Supported
H7	PEU → INT	0.262	0.068	3.823	0.000(***)	Supported
H8	PUT → INT	0.333	0.074	4.504	0.000(***)	Supported

Note: ** <0.05, *** <0.01

Table 5: Multiple correlation coefficients squared (R^2) Results

	R-square	**R-square adjusted**
PEU	0.570	0.566
PUT	0.634	0.630
INT	0.293	0.289

Table 6: Predictive relevance(Q^2) Results

	Q^2predict
PEU	0.559
PUT	0.620
INT	0.305

Table 7: Effect Size (F^2) Results

	F^2
FIP →PEU	0.002
FIP → PUT	0.070
DUCP → PEU	0.350
DUCP → PUT	0.492
PRA → PEU	0.192
PRA → PUT	0.116
PEU → INT	0.055
PUT → INT	0.089

5.3. Consumers' perspectives on E-retrofitment

E-retrofitment involves the conversion of conventional Internal Combustion Engine (ICE) vehicles into Electric Vehicles (EVs) by replacing the engine with an electric powertrain. This process includes the substitution of the fuel tank, engine, fuel pipes, and exhaust system with a battery, inverter, and motor (www.downtoearth.org.in, n.d.). The majority of the surveyed participants express a positive inclination toward retrofitting, driven primarily by motivations such as environmental protection, pollution reduction, and cost savings. On the contrary, reluctance to embrace retrofitting is attributed to factors such as inadequate infrastructure, concerns about mining pollution, a preference for upgrading to a new vehicle, limited awareness, and a lack of interest.

Table 7: Willingness to Retrofit Vehicles: Consumers' Considerations

Retrofit Readiness	**Frequency**	**Percentage**
Willing to Retrofit	217	65.17%
Unwilling to Retrofit	116	34.83%

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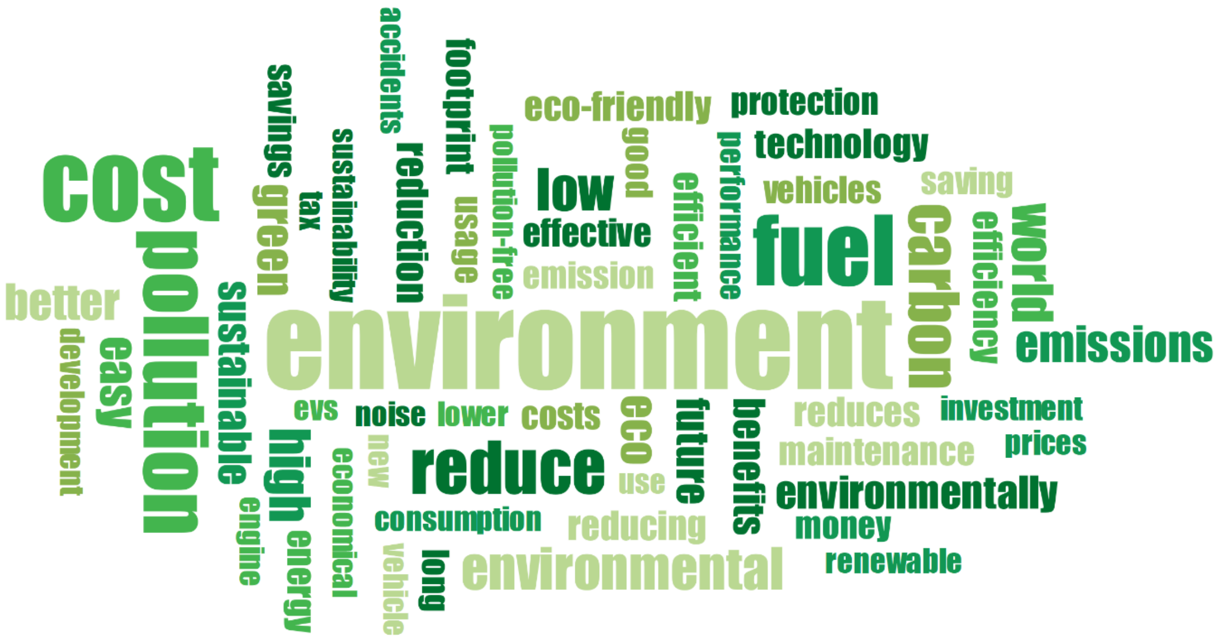

Figure 3: Reasons for consumers' willingness to retrofit

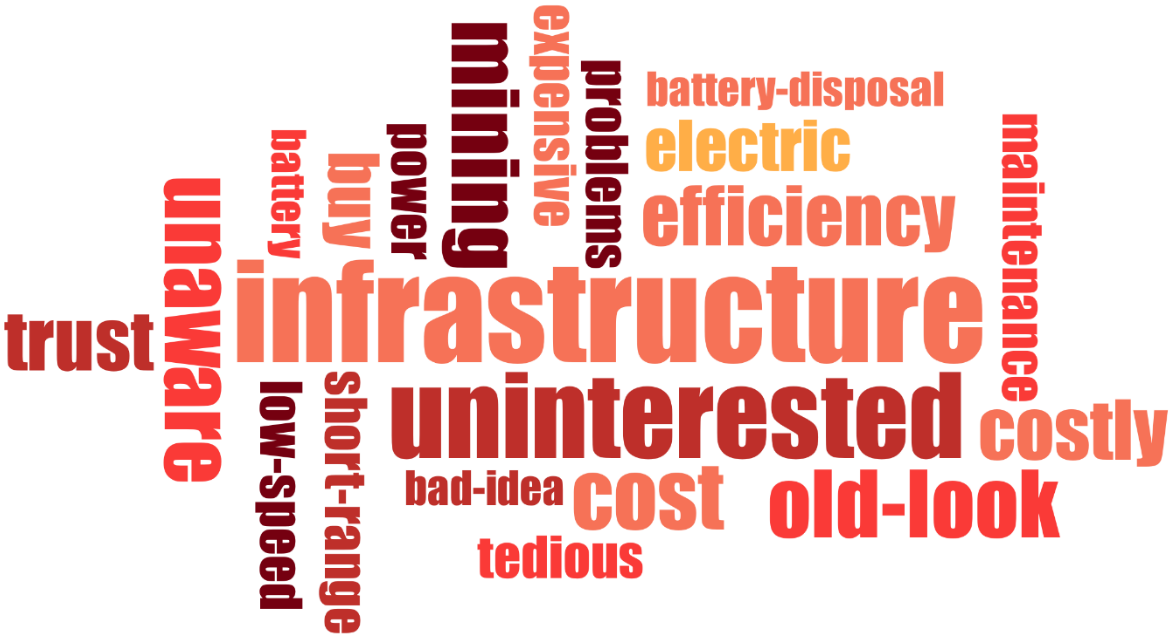

Figure 4: Reasons for consumers' unwillingness to retrofit

6. Discussion and Implications

Initially, the integration of the Theory of Planned Behaviour (TPB) and the Technology Acceptance Model (TAM) stands out as a comprehensive framework for understanding consumer inclinations towards Electric Vehicles (EVs). This amalgamation, enriched with additional factors from prior research, provides a holistic perspective on the various influences shaping consumer attitudes and intentions in the context of EV adoption. Secondly, the validation of seven out of eight hypotheses underscores the robustness of the developed model. The results emphasize the significance of factors such as financial incentives, desire for unique consumer products, perceived relative advantage, perceived ease of use, and perceived usefulness of technology in influencing consumers' behavioural intentions regarding EV adoption.

Moving to practical implications, thirdly, the identification of financial incentives as a key influencer suggests that marketing strategies should prioritize communicating cost-related benefits to potential EV adopters. Emphasizing potential savings on fuel and maintenance costs can be a persuasive approach in marketing campaigns. Fourthly, the recognition of the desire for unique consumer products as a significant factor opens avenues for innovative product positioning and branding. Marketers can capitalize on this by highlighting the distinctive features of EVs, thereby appealing to consumers' preferences for uniqueness and individuality.

Shifting to policy implications, fifthly, policymakers can use the validated factors to design targeted interventions. For instance, the emphasis on perceived ease of use implies that policies promoting user-friendly EV technologies, such as simplified charging infrastructure, may facilitate wider adoption. Sixthly, recognizing the importance of financial incentives, policymakers may consider implementing supportive measures such as tax credits or subsidies to make EVs more economically attractive to a broader consumer base. This aligns with the broader goal of encouraging environmentally friendly transportation options.

Finally, the multifaceted practical and policy implications derived from the research outcomes offer valuable guidance for stakeholders. By addressing these implications systematically, both marketers and policymakers can contribute to the accelerated and sustainable adoption of Electric Vehicles, fostering a positive impact on the environment and meeting consumer needs.

7. 7.Conclusion, Limitations and Future Studies

The current investigation sought to create a research model and examine the factors influencing consumers' inclination to embrace EVs. The model development involved the amalgamation of the Theory of Planned Behaviour (TPB) and the Technology Acceptance Model (TAM), with additional factors drawn from prior research. The efficacy of the model and its ability to forecast consumers' intention to adopt EVs were enhanced through the integration of TAM with TPB. To achieve the research objectives, a questionnaire was formulated for data collection. The study's results revealed that out of the eight hypotheses posited, seven were substantiated and identified as potential influencers on consumers' intention to adopt EVs. Consequently, the direct effects of factors such as FIP with PUT as a mediator, DUCP, PRA, PEU, and PUT on behavioural intention were supported. Ultimately, identified the major reasons influencing both willingness and unwillingness among consumers regarding vehicle retrofitment.

Limitations are integral part of a research and acknowledging them is essential to maintain the integrity and ensure transparency. The following are the limitations of this study:

- The study majorly covered the southern regions of India (specifically, the states-Andhra Pradesh, Telangana, Karnataka, Tamil Nadu and Kerala) and a few north and eastern regions like Punjab, Assam and West Bengal for data collection.
- It is important to note that the results of this study may not be universally applicable to the entire geographical area of India due to variations in demographics, culture, and environmental factors.
- Purchase intention is more common in studies on the adoption of electric vehicles (EVs) than it is in studies including actual adopters, even if it may not fully reflect consumer behaviour.
- The problem is that EV adoption is still rather low, which makes it more challenging to find people who have actually driven one.

India's consumer stance to EV adoption with brand influence and post-service support as the variables and their inclination towards EV-Retro fitment can be studied considering larger sample with regional variations of the country in demographics, culture and environmental factors for data collection to analyse and shed light on the unfolding panorama of EV adoption. Future research with more diverse and larger samples with actual electric vehicle users (ev adopters) is recommended to address these constraints.

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Appendix

Appendix A. Survey Instrument-Questionnaire

Financial Incentive Policy (FIP): Five-point Likert Scale (Strongly Disagree to Strongly Agree) **Source:** (Jaiswal et al., 2021)
FIP 1-I think subsidy policy will encourage for adopting electric vehicles.
FIP2-Subsidy and tax policies are important to me for purchasing electric vehicles.
FIP3-The government should provide other incentives for using electric vehicles.

Desire for Unique Consumer Products (DUCP): Five-point Likert Scale (Strongly Disagree to Strongly Agree)
Source: (Smith et al., 2017)
DUCP1-Keeping my knowledge up to date about technology is necessary.
DUCP2-I enjoy the challenge of figuring out high-tech gadgets.
DUCP3-I prefer to use the most advanced technology available.

Perceived Relative Advantage (PRA): Five-point Likert Scale (Strongly Disagree to Strongly Agree)
Source: (Xu et al., 2020)
PRA1-EVs are more fuel-efficient and cost-effective than traditional fuel vehicles.
PRA2-EVs excel in terms of acceleration, power, and noise.
PRA3-EVs are much more environmentally friendly than traditional fuel vehicles.

Perceived Ease of Use (PEU): Five-point Likert Scale (Strongly Disagree to Strongly Agree)
Source: (Jaiswal et al., 2021)
PEU1-I think it would be simple to use electric vehicles.
PEU2-I think it would be easy for me to drive electric vehicles.
PEU3-My interaction with electric vehicles would be clear and understandable.

Perceived Usefulness of Technology (PUT): Five-point Likert Scale (Strongly Disagree to Strongly Agree)
Source: (Smith et al., 2017)
PUT1-Using new technologies makes life easier.
PUT2-I use online maps to plan my travel when I need to visit a new place.
PUT3-Exploring new technologies enables me to take benefit from latest developments.

Intention (INT): Five-point Likert Scale (Strongly Disagree to Strongly Agree)
Source: (Dong et al., 2020)
INT1-When I buy a (next) vehicles, I will consider buying a pure electric vehicle.
INT2-I will encourage my friends to buy a pure electric vehicle.

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INT3-I will encourage my friends to buy an energy-saving vehicle.

Appendix B. Loadings and cross loadings of measures

	FIP	DUCP	PRA	PEU	PUT	INT
FIP1	**0.889**	0.338	0.413	0.393	0.469	0.328
FIP2	**0.867**	0.278	0.465	0.317	0.387	0.369
FIP3	**0.869**	0.323	0.523	0.346	0.489	0.390
DUCP1	0.316	**0.899**	0.424	0.631	0.626	0.314
DUCP2	0.259	**0.903**	0.512	0.588	0.604	0.355
DUCP3	0.391	**0.902**	0.507	0.608	0.706	0.385
PRA1	0.524	0.344	**0.754**	0.442	0.422	0.476
PRA2	0.349	0.470	**0.798**	0.537	0.524	0.464
PRA3	0.430	0.456	**0.846**	0.557	0.579	0.556
PEU1	0.383	0.587	0.633	**0.886**	0.614	0.461
PEU2	0.391	0.618	0.567	**0.927**	0.598	0.416
PEU3	0.330	0.641	0.554	**0.916**	0.581	0.432
PUT1	0.476	0.578	0.592	0.548	**0.879**	0.482
PUT2	0.384	0.573	0.487	0.519	**0.830**	0.354
PUT3	0.469	0.699	0.573	0.627	**0.879**	0.459
INT1	0.355	0.365	0.607	0.461	0.465	**0.921**
INT2	0.367	0.346	0.599	0.438	0.418	**0.932**
INT3	0.405	0.352	0.497	0.411	0.491	**0.876**

Notes: FIP=financial incentive policy, DUCP= desire for unique consumer products, PRA= perceived relative advantage, PEU= perceived ease of use, PUT= perceived usefulness of technology, INT= intention.

Appendix C. Indicator Multicollinearity

INDICATORS	VIF
FIP1	2.145
FIP2	2.164
FIP3	1.903
DUCP1	2.471
DUCP2	2.643
DUCP3	2.421
PRA1	1.388
PRA2	1.375
PRA3	1.527
PEU1	2.221
PEU2	3.481
PEU3	3.179
PUT1	2.017
PUT2	1.773
PUT3	1.941
INT1	3.464
INT2	3.885
INT3	2.125

Appendix D. Specific Indirect Coefficients

	Path Coefficients	Standard deviation (STDEV)	T statistics (|O/STDEV|)	P values
FIP → PEU → INT	0.010	0.013	0.747	0.227
FIP → PUT → INT	0.063	0.022	2.904	0.002
DUCP → PEU → INT	0.121	0.034	3.565	0.000
DUCP → PUT → INT	0.168	0.035	4.746	0.000
PRA → PEU → INT	0.099	0.033	2.955	0.002
PRA → PUT → INT	0.090	0.032	2.796	0.003

Appendix E. Total Indirect Effects

	Path Coefficients	Sample mean (M)	Standard deviation (STDEV)	T statistics (|O/STDEV|)	P values
FIP	0.073	0.074	0.025	2.880	0.002
DUCP	0.289	0.288	0.033	8.721	0.000
PRA	0.189	0.192	0.027	6.892	0.000

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