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A Study On EV Consumer Behavior Decision-Making Process

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Abstract

The study found that consumers' attitudes towards electric cars have a significant positive impact on their intention to adopt them. Environmental concerns, moral norms, price concerns, buying intention, social norms, extra price willingness, and perceived behavioural control all have a positive impact on the intention to adopt electric cars. However, the study also found no significant difference in buying intent among different education and income groups. Middle-aged respondents had more buying intent than other groups, and the research suggests that manufacturers should convert these attitudes into behaviour and adoption. The study suggests that marketers should consider these factors when promoting electric cars.

Keywords: Environmental concerns, moral norms, price concerns

Introduction

The Theory of Planned Behavior (TPB) was indeed developed by Icek Ajzen in 1991. It's an extension of the earlier Theory of Reasoned Action (TRA) which Ajzen co-developed with Martin Fishbein. TPB aims to predict and understand motivational influences on behavior that are not entirely under volitional control. It posits that three main factors influence an individual's intention to perform a behavior: attitude towards the behavior, subjective norms, and perceived behavioral control. These factors shape behavioral intentions and predict actual behavior, making TPB widely used in fields like psychology, health, and marketing. The study investigates consumer behavior towards Electric Vehicles (EVs) using the Theory of Planned Behavior (TPB). Key research questions include evaluating Attitude, Subjective Norm, and Perceived Behavioral Control in BEV adoption, examining the impact of Moral Norm on BEV adoption, examining the impact of Environmental Concern on EV adoption, and examining the role of demographic and experiential factors. Price Sensitivity is also examined, examining its influence on BEV adoption. The study also explores the structural relationships among variables and their interrelationships within the TPB framework.

Theory of Reasoned Action (TRA) (1980): Developed by Fishbein and Ajzen, TRA focuses on the relationship between attitudes, intentions, and behaviors. It posits that behavior is directly influenced by behavioral intention, which is shaped by the individual's attitude toward the behavior and subjective norms (i.e., perceived social pressures). **Theory of Planned Behavior (TPB) (1991):** Ajzen extended TRA to account for behaviors over which individuals might not have full control. TPB incorporates **Perceived Behavioral Control (PBC)**, reflecting an individual's perception of their ability to perform a behavior, thus offering a more nuanced prediction of behavioral intention and actual behavior. The TPB is one of the widely accepted theories of adoption that evaluate consumers' adoption behaviour in various situations (Abrahamse et al., 2009; Cronin et al., 2000; Simsekoglu and Nayum, 2019). Asadi et al. (2022) addresses a crucial aspect of electric vehicle (EV) adoption by examining the impact of altruism and pro-environmental behavior on consumers' intentions. Jain and Singh (2024) Using the Theory of Planned Behavior (TPB) to investigate the adoption of electric vehicles (EVs) among Indian consumers is a robust approach. By incorporating variables like attitudes, green nudges, perceived behavioral control, and environmental concern, you can gain comprehensive insights into the factors driving EV adoption

Core Components of TPB

1. Behavioural Attitude (ATT): This refers to the individual's positive or negative evaluation of performing the behavior. A positive attitude towards a behaviour increases the likelihood of an individual intending to perform that behavior. *Consumers' attitude toward electric car has a significant positive impact on the intention to adopt it* Ajzen (1991) research has highlighted the significant impact of perception and attitude on individual buying behavior. Kaplan, Gruber, Reinthaler, and Klauenberg (2016) Consumers' adoption of electric vehicles (EVs) was positively impacted by their perceived individual benefits and ease of use, thereby enhancing their attitude towards EVs. When consumers felt that EVs were more advantageous for them personally or that using them was simpler and more convenient, it had a favourable effect on their attitude towards EVs and led to a rise in the adoption of electric cars. Psychological considerations must be taken into account in order to fully comprehend the elements impacting intents and decisions about the adoption of electric vehicles. These psychological elements are included into a number of constructs that may have an immediate effect on adoption intentions.

H1) Consumers' attitude toward electric car has a significant positive impact on the intention to adopt electrical cars

1.a) Environmental Concern (EC): This variable accounts for the broader concern for environmental issues and can influence behavioral intention both directly and indirectly. Environmental concern can shape an individual's beliefs about specific behaviors or products, such as green electricity or BEVs. For example, someone with high environmental concern may be more likely to develop strong beliefs about the benefits of BEVs and the importance of reducing carbon emissions. Once these beliefs are formed, they influence how individuals evaluate the importance and feasibility of obtaining information about environmentally friendly products. For instance, individuals who are concerned about the environment may evaluate the benefits of BEVs more favorably and actively seek out information about them (Bamberg, 2003). TPB has been effectively used to study intentions related to environmentally friendly behaviors, including sustainable transport choices like Battery Electric Vehicles (BEVs). The theory's components help to explain why individuals might choose to adopt pro-environmental behaviors based on their attitudes, social pressures, and perceived control over the behavior. Asadi et al. (2022) environment behavior have significant impact on behavioral intention EV adoption process.

H2) Environmental Concern has a significant positive impact on the attitudes towards to adopt electrical cars

1.b) Moral Norms (MN): Adding moral norms as an additional variable can help capture the ethical dimensions influencing behavior, providing a more comprehensive understanding of motivations for pro-environmental actions.

H3) Moral norms has a significant positive impact on the attitudes towards the electrical cars

2. Buying intentions

Asadi et al. (2022) studied EV car consumer buying intentions in emerging economies and suggest BI is main driver of EV car purchases. Abrahamse, Steg, Gifford, and Vlek (2009) greater behavioural intentions were only linked to greater personal standards when perceived behavioural control was low, according to the study, which also indicated that perceived behavioural control modulated the relationship between behavioural intents and personal norms. A few questions raised by these findings are addressed. The review of past literature shows that consumers' behaviour towards adopting EVs in India has yet to be thoroughly investigated. There have been few studies on EV adoption in India. However, unfortunately, most of the studies have focused their attention either on buying intention (Khurana et al., 2019; Kumar et al., 2015; Mishra and Malhotra, 2019) or on actual behaviour (Chhikara et al., 2021; Digalwar and Rastogi, 2022). Jain and Singh (2024). Positive attitudes towards EVs are likely to increase the intention to adopt them. For instance, if consumers perceive EVs as environmentally friendly and cost-effective in the long run, they are more likely to intend to purchase one.

Price willingness: Investigating how price sensitivity affects the relationships between TPB components and the intention to adopt BEVs can offer insights into the economic factors influencing consumer behaviour. Price sensitivity is a critical factor in car purchasing decisions, particularly for high-cost items like Battery Electric Vehicles (BEVs). Understanding how price sensitivity impacts the decision-making process can provide valuable insights into consumer behavior and help in designing effective marketing and pricing strategies. Here's a comprehensive look at how price sensitivity influences car purchases. Liu el., (2020). Experienced BEV drivers have a better understanding of the benefits and functionalities of BEVs, such as lower operating costs, environmental advantages, and advanced technology features. This familiarity makes them more confident in their purchase decisions. Peters and Dütschke (2014) adoption willingness is more favorable among experienced consumers compared to inexperienced ones aligns with existing research on consumer behavior and technology adoption

H4) Price concern has a significant positive impact on the intention to adopt electrical cars

H5) Buying intention has a significant positive impact on electrical cars consumer behavior

3. **Subjective Norms (SN):** These are the perceived social pressures or expectations from others regarding the behavior. If individuals believe that significant others approve of a behavior, they are more likely to intend to perform it. Bamberg, Bamberg and Blöbaum (2018) highlights a nuanced understanding of how personal norms influence the intention to use a particular technology or behavior, such as electric vehicles (EVs), even when accounting for other factors like attitude and perceived behavioral control. This insight is crucial for developing targeted interventions and understanding consumer behavior. Personal norms are a significant predictor of behavioral intention, even after considering the effects of attitudes and perceived behavioral control. Jain and Singh (2024). Adnan, Md Nordin, Bin Bahruddin and Ali (2018) social norms have significant influence on behvaiourl intention.

H6) Social norms has a significant positive impact on the intention to adopt electrical cars

4. Perceived Behavioral Control (PBC): This involves the perceived ease or difficulty of performing the behavior, considering both internal factors (e.g., skills, confidence) and external factors (e.g., resources, opportunities). High PBC is associated with a greater likelihood of intending to and actually performing the behavior. Perceived ease or difficulty of adopting EVs, influenced by factors like availability of charging infrastructure, financial costs, and personal capability. Jain and Singh (2024) suggest PBC have significant impact on EC consumer intentions

H7) price concerns has a significant positive impact on electrical cars consumer behaviour

H8) Perceived Behavioral Control has a significant positive impact on the intention to adopt electrical cars.

H9) Perceived Behavioral Control has a significant positive impact on electrical cars consumer behavior

Research methodology

The respondents in this research study were people who were interested in purchasing EC in southern part of Tamilnadu. Population and Sample Size: 156 person and selected on person basis approaching electric vehicle shops. Data acquisition: A self-administered convenience sample approach was used to obtain primary data, and the full data collecting process took place over the course of one month. Survey Instrument: A structured questionnaire was developed with a five point Likert scale, with 1 for strongly disagreeing and 5 for strongly agreeing. Statistical Tools: Statistical methods including the mean, standard deviation, one way ANOVA and Measured structural equation model (SPSS and AMOS software version 25)

Explotary Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA)

To conform items loading in the particular variable, exploratory factor analysis has executed in SPSS version 21.vermax rotation was used in that process. Items which are contributing negatively, gross loading items, contributing below 0.350 had removed. Out of 40 only 32 and 33 items was finalized in this process for unit one and two. (Suppress small coefficient is .30 was used) Confirmatory Factor Analysis (CFA) In a analysis is intent to test convergent and discriminant validities in order to examine the extent to which measures of a latent variable shared their variance and how they are different from other variables. CFA has test through the MSEM in AMOS graphics. Item/loading was for included in the latent variable was test for their significant contribution. In that process made easy by plugin developed Gaskin & Lim (2016) Known as parametric model builder and with lot thanks to their work, the present study uses three plugins from their web site, including parametric model builder.

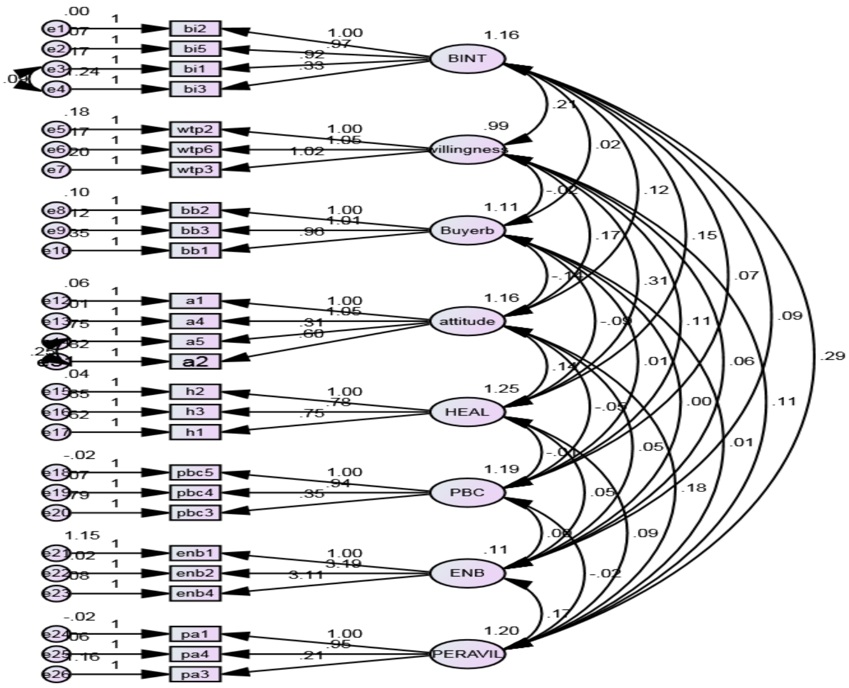
The study utilizes the Measured Structural Model (MSM) to meet CFA requirements, testing composite reliability, average variance, and correlation between contracts. The research employs three tools: Parametric Model Builder, Master Validity Table, and Model Fit summary tool.

Exploratory factor analysis

Table -1 Rotated Component Matrix[a]									
	Component								
	1	2	3	4	5	6	8	8	9
a1	.860								
a4	.843								
a5	.825								
a2	.820								
a3	.651								
bb2		.962							
bb3		.960							
bb1		.925							
m2			.885						
m1			.828						
m3			.824						
bi4				.851					
bi2				.829					
bi1				.642					
bi3				.586					
pa5					.831				
pa3					.692				
pa1					.684				
pa2					.661				
eb2						.850			
eb4						.828			
eb5						.805			
eb3						.623			
wtp3							.869		
wtp4							.692		
wtp5							.686		
ex2								.886	
ex4								.883	
ex3								.554	
pbc5									.861
pbc3									.831
pbc1									.803
Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.									
a. Rotation converged in 6 iterations.									

Standardized Estimated

Before running the measured structured equation model, confirmative factor analysis is executed and the items which have less contribution to the construct removed. Measurement model shows that there is no composite reliability issue and average variable extracted issues in this data set (master validity table in unit 3).



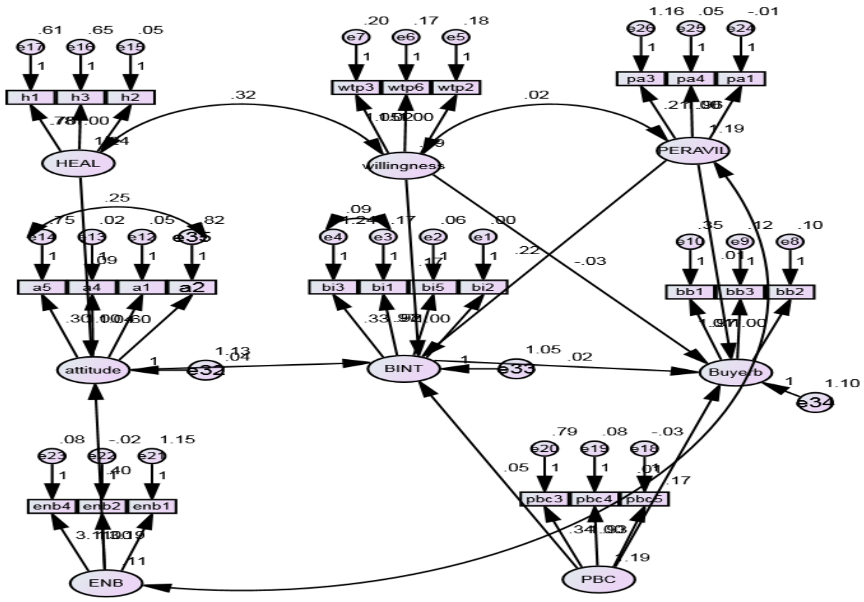
Model Fit Summary: The model fit summary was prepared with, AMOS Plugin developed by Gaskin and Lim (2016) and the model is an excellent fit for the analysis. Hu and Bentler (1999) suggested five important measures and threshold for this model .The results of the table shows that the model excellent fit for the analysis.

Table – 2 : Results of the Model Fitness

Criterion	Estimate	Threshold	Interpretation
CMIN	890.968	--	--
DF	314	--	--
CMIN/DF	2.637	Between 1 and 3	Acceptable
CFI	0.919	>0.95	Acceptable
SRMR	0.053	<0.08	Excellent
RMSEA	0.054	<0.06	Excellent
P Close	0.060	>0.05	Excellent

Measured Sectorial Equation Model

The hypotheses test in MSEM on basis of three endogenous (attitude, buying intent, and buyer behavior variables) and five exogenous (moral, environmental behavior, price conscious , PBC, and perceived availability)



Figures - 3.

S.No	Dependent variable	Independent Variable	Variance Explained
1	Attitude	Moral, environmental behavior	29%
2	Buying intent	Attitude, price concerns, perceived behavior control, social norms	60%
3	Buyer behavior	Buying Intent, Price concerns, perceived behavior control,	46%

Table – 4 Hypotheses Results: Measured Structural Equation Model

				Estimate	S.E.	C.R.	P
H3	Attitude	<---	Moral norms	.093	.039	2.384	.017
H2	Attitude	<---	Environmental behaviour	.403	.137	2.945	.003
H1	Buying intent	<---	Attitude	.221	.037	5.914	***
H8	Buying intent	<---	PBC	.047	.036	1.289	.197
H4	Buying intent	<---	Price concerns	.173	.042	4.105	***
H6	Buying intent	<---	Social norms	.044	.038	1.166	.244
H9	Buyer behaviour	<---	PBC	.011	.038	.279	.780
H7	Buyer behaviour	<---	Price Willingness	.005	.040	.128	.898
H5	Buyer behaviour	<---	Buying intent	.020	.042	.481	.631

Source: primary data (Output generated by AMOS graphic 21version)

Results and Interpretation (Measured Structural Equation Model)

H1 is accepted and consumers' attitude toward electric car has a significant positive impact on the intention to adopt electric cars. It suggests manufacture should converted the intension into behaviour and adoption behaviour. H2 is also accepted and it suggest that environmental concern has a significant positive impact on the attitudes towards to adopt electrical cars. H3 is also affected and moral norms has a significant positive impact on the attitudes towards the electrical cars.

H4 is accepted, and it suggests that Price concern has a significant positive impact on the intention to adopt electric cars, and EV buyers do not consider price variations. H5 is rejected and it suggests that buying intention is not significant impact on electrical cars consumer behaviour and it should be considered by the marketers.

H6 is rejected, and it suggests that social norms have less impact on the intention to adopt electric cars and we can assume that EC user intention is not affected by surrounding persons and users of other cars. H7 is not accepted @5% level of significance, and it suggests that extra price willingness has less impact on electric cars consumer behavior.

H8 and H9 both were rejected, and present research suggests that Perceived Behavioural Control has an insignificant impact on the intention to adopt and behaviour of electric cars

Results and Statistical Analysis

Results of one-way ANOVA with Scheffe's Post hoc

The descriptive statistics show that consumers' attitude towards electric cars is positive, with the second-highest mean score (3.58) for this study. In this study, consumer Age (H10), education (H11), and income (H12) effects on attitude towards electric cars were tested. The result is illustrated in the table below (**ANOVA with** Post Hoc test). Statistical analysis and results (Attitude and demographic variables). One-way ANOVA tells us whether there is any significant difference in the mean scores of the dependent variable across the groups. Post-hoc tests were done to find out where these differences lie‖ (Pallant, 2020). The present study consists of unequal groups in size, so the researcher goes with Scheffe's Post hoc tests, which are most suitable for unequal groups.

Table -5: Tests of Between-Subjects Effects

Dependent Variable: Attitude

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared	Observed Power[b]
H10 Age	1.287	4	.322	.480	.751	.003	.165
H11 Education	12.75	3	4.252	6.52	.000	.030	.971
H12 Income	3.345	4	.836	1.25	.287	.008	.394

Source: Primary Data

Frist the researcher takes the Age, education, and income as independent variable and attitude towards the electrical cars as the dependent variable in this group analysis. In below the table illustrated H 10, H 11 and H12 results. H 10 and H 12 were accepted @5% significant that means that age and income of the different group respondent do not significantly differ on the attitude towards electrical cars. Sign value age and income are .751 and.281 respectively which is comfortable above required p > 05 levels. In the case of education, the sign value (.000) below the required P >.05, so H11 was rejected. Scheffe's Post –hoc tests multi-group comparison explains that postgraduate consumer group significantly differ from the school and graduate level education consumer groups.

In this analysis, the researcher takes the age, education, and income as the independent variable and buying intent of the electrical cars as the dependent variable in this analysis. In below the table illustrated the results H13, H14, and H15. H14 and H15 were accepted @5% significant that means that there is no significant difference among various educations and income group of the respondent on buy intent of electrical cars. Sign value education and income are .454 and.241 respectively which are comfortable above required p <.05 level. In the case of age, the sign value (.000) below the required P >.05, so H 13 was rejected. Scheffe's Post – hoc tests multi-group comparison explains that middle aged respondent has more buying intent than another group of the respondent.

Table -6: Tests of Between-Subjects Effects

Dependent Variable: Buying Intent

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared	Observed Power[b]
H13Age	36.71	4	9.179	8.39	.000	.051	.999
H14 Education	3.008	3	1.003	.875	.454	.004	.242
H15 Income	6.287	4	1.572	1.37	.241	.009	.431

Source: Primary Data

Conclusion

The study reveals a positive attitude towards electrical cars among consumers, with a second-high mean score of 3.58. Age, education, and income were tested to determine their impact on attitude. Post-hoc tests were used to identify significant differences, as the study was conducted in an unequal group. The researcher analyzed age, education, and income as independent variables and attitude towards electrical cars as a dependent variable. Results showed no significant difference in attitudes towards electrical cars between different age and income groups. Postgraduate consumer groups significantly differ from school and graduate education consumer groups. However, there was no significant difference in buy intent of electrical cars among different education and income groups. Middle-aged respondents had more buying intent than other groups.

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