Consumer's Intention to Embrace Electric Vehicles: A Study of Indian EV Market

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Abstract

The study focuses on understanding the influence on consumers' intention to embrace electric vehicles in India. This study uses Regression analysis to analyze the effect of Six Factors viz. perceived utility, perceived usability, environmental concern, compatibility, moral norms, and individual inventiveness on the consumers' intention to embrace electric vehicles. The study is analytically examined based on the data obtained from 152 relevant respondents in India. The analysis revealed that ecological crisis (EC) is essential in influencing the consumer adoption intention of electric vehicles. The data showed that environmental concern is positively associated with it. The study also showed that moral standards are positively associated with consumers' intentions to purchase electric vehicles, indicating that ethical standards positively and significantly impact consumer adoption. Though perceived usefulness is a positive indicator of consumer adoption, it does not significantly influence their intention. Additionally, it was discovered that consumers' perceived usability, compatibility, and individual innovativeness are not positively connected with their intent to purchase electric vehicles and are not statistically significant. Planners and Legislators may find the study's findings helpful in increasing the rate at which electric vehicles are adopted in the real world.

***Keywords**: Electric Vehicles, Consumer's Intention, Perceived Usefulness*

Introduction

The electric vehicle industry is a rapidly growing industry. According to the International Energy Agency, electric vehicle sales have expanded exponentially in recent years, along with their range, model availability, and performance.

Vehicle pollution is a significant source of air pollution in India, notably in major cities like Delhi. There are more than 3.4 million vehicles, according to the Department of Transport, Government of National Capital Territory of Delhi, with a 7% annual growth rate. By 2030, India's transport industry will be responsible for 50% of all greenhouse gas emissions. Scientists, researchers, and many government bodies have proposed EVs as a reliable alternative to petrol and diesel-run vehicles to protect the environment and reduce reckless fossil fuel consumption. India, the third-largest energy consumer in the world, is currently rated eighth on the Climate Change Performance Index (CCPI) 2023 after moving up two spots. India needs sustainable solutions like electric vehicles to maintain this streak of progress.

Compared to conventional engines with equivalent performance, hybrid vehicles use less petrol and produce less pollution every mile. (2008) Gallagher, Muehlegger, and E. J. Three significant categories can be used to classify EVs: BEVs are battery-powered, HEVs are plug-in EVs with a large battery and a small engine, and PHEVs are plug-in EVs with a small battery and an engine. Sharma and Shalender (2020). BEVs are the only emission-free form of electric mobility among these three. However, HEVs are regarded as the most useful due to their easy transition between a petrol engine and an electric motor. Kurani, K. S., and Turrentine (2007).

Due to the COVID-19 pandemic, overall automotive sales in 2020 decreased dramatically for passenger and commercial vehicles. However, sales of electric vehicles stayed the same in India. The post-lockdown sales of pure and hybrid electric vehicles are a crucial factor driving the electric car market in India.

It is also projected that the government's regulations on greenhouse gas (GHG) emissions, such as the Bharat Stage (BS) VI emission standards imposed by India's Ministry of Road Transport and Highways (MoRTH), will considerably aid the market's rise. EVs can help reduce air pollution and improve energy efficiency, significantly contributing to environmental sustainability and development Dhar, Pathak & Shukla (2018). This is one of the reasons for consumer's growing interest in electric vehicles, as they not only meet a person's transport requirements but also decrease the carbon footprint and noise pollution Park, Hong & Le (2021). The Indian government has announced several initiatives to encourage people to buy electric vehicles, like FAME (Faster adoption and manufacturing of hybrid and electric vehicles), which is aimed at improving electric mobility in India; under this, the National Capital Territory of Delhi (NCT of Delhi) provides tax incentives to give an edge to hybrid and electric vehicles over the conventional petrol and diesel vehicles, PMP (Phase manufacturing program) is another important initiative to promote the development of electric vehicles by considering the manufacturing industry's condition in the country.

Marketers should research the consumer market based on its current and potential for future adoption. Many researchers in the past have examined consumers' buying intentions. Some studies investigated whether factors such as attitude, perceived utility, perceived ease of use, and perceived danger, with the moderation of financial incentives policies, impacted the intention to adopt EVs. Some focused on how lifestyle influenced the adoption of electric vehicles Jaiswal et al. (2021).

Past studies have researched EV customers' purchase profiles. Customers from the first three customer groups- innovators, early adopters, and the early majority from the technology adoption cycle-were highlighted in various studies. It was found that personal innovativeness and environmental concern impacted the purchase intention of electric vehicles X.He, W. Zhan, and Y. Hu (2018). Studies also described how charging infrastructure influenced consumer intentions; charging infrastructures in both public and domestic domains are insufficient, so governments should focus more on

this to remedy Wang S. et al. (2018). The most extensive study was done by Shanyong et al.. To explore the consumer adoption intention of electric vehicles, researchers employed an expanded version of the theory of planned behavior that takes into account attitude, subjective standards, perceived behavioral control, and moral norms. The researchers also argue that it is vital to correctly identify early adopters to determine to what extent their decision-making process differs from late adoption intention groups Gärling and Thogersen, (2001).

Literature Review:

Environmental Concern

The 21st century's technological developments cause the environment's daily improvement. People today are working to protect the environment because they know its adverse effects. Understanding and being aware of environmental issues is called environmental concern. According to a study by Schuitema et al. (2013), customers' concern for the environment influences their adoption of environmentally friendly products. This is a crucial factor in determining whether an individual will change their behavior from what they are currently doing to something more environmentally friendly, according to Daziano and Bolduc (2013). Environmental concern, however, only indirectly affects a particular behavior that is environmentally favorable, according to Ajzen and Fishbein (1980). The relationship between social-cognitive perceptions, attitude, and intention and how these relate to the mediation of attitude towards BEV and the moderating of socio-demographic variables (Jaiswal et al. (2022).

EV adoption intention and environmental concerns are positively correlated; research by Shalender and Naman (2020), their study indicated that manufacturers, sellers, or retailers should embrace an environment-centric approach for the promotion of electric vehicles as this can encourage the customer's environmental concerns, and reinforce their intention to adopt electric vehicles. This is one of the reasons for consumer's growing interest in electric vehicles, as they not only meet a person's transport requirements but also decrease the carbon footprint and noise pollution Park, Hong & Le (2021).

Sajjad et al. (2020) have shown that environmental quality urges individuals to buy EVs and replace their petrol and diesel vehicles; people must be made aware of the consequences of driving petrol and diesel vehicles and how they affect the environment.

Perceived usefulness

Prior research has examined the impact of perceived usefulness on customers' adoption intentions, and they found that its impacts could and should be altered by external variables and structures. Perceived usefulness significantly and positively impacts behavior intention, and sometimes, it affects behavior through attitude (Chen et al. (2015). Under TAM (technology acceptance model), perceived usefulness positively affects Behavioral intention significantly, and external variables will work through perceived usefulness Cheng et al. (2013). In the context of green or environmentally friendly products, consumption can have substantial environmental benefits compared to conventional alternatives (Maniatis, 2016).

Adoption intention has been demonstrated to be positively influenced by performance expectancy and conducive situations (Jain et al.(2022).

Electric vehicles are a sustainable form of transportation and have the potential not just to transform but also reform the traditional transport system. The article by Chen (2016) described the idea of "green perceived usefulness," which refers to consumers' perceptions of how much using new products will improve their life's environmental performance. It also mentioned that TAM consists of two factors that influence the intentions of technical innovations: perceived usefulness and perceived ease of use, but it does not account for the social influence on the adoption of new technologies. Chen (2016). EVs help reduce harmful CO2 emissions and control gasoline fuel consumption.

Perceived ease of use

The degree to which things may be learned or utilized is expressed as their perceived ease of use. The term "degree to which a person believes that using a particular system would be free of effort" describes perceived ease of use. This aligns with the meaning of "ease," which is "freedom from difficulty or great effort." This means people prefer to use relatively easier products Davis (1989). Unlike perceived usefulness, which affects behavior intention very strongly, sometimes perceived ease of use has a relatively insignificant impact on behavior intention Chen (2016). Some focused on how lifestyle influenced the adoption of electric vehicles Jaiswal et al. (2021).

According to other research, perceived ease of use strongly and significantly affects attitude and behavior intention (Kaplan et al. (2017). Additionally, according to researchers, perceived usability might influence how useful something is seen favorably. As a result, new technology offers can only be viewed as helpful if they are simple to use and appropriate for client consumption. 2019 Cheng et al. Perceived utility and perceived ease of use are the two components of TAM that influence the intentions of technological breakthroughs. However, it does not take into account how new technologies will be influenced by social factors (Chen, 2016).

Compatibility

Under innovation diffusion theory, Roger (2003) "The degree to which a new idea is viewed as being consistent with the needs, past experiences, and values of potential adopters shows its compatibility. An innovation's adoption rate is positively correlated with how well-suited it is, as judged by other social system members". People are more inclined to accept technologies that are compatible with them, such as mobile banking, according to prior research by Makanyeza (2017). With regards to the task-technology fit theory Goodhue and Thompson (1995), the existence of a fit between tasks and technologies can help to make people feel comfortable and thus encourage them to use the technology that they were not used to before, on the other hand, we, people tend to reject any new technological development if they feel that it doesn't fit with the tasks that they have to perform it leads to misfit-induced stress. In this regard, it is prudent to think that consumers who believe electric vehicles can help them meet their daily transport needs and match their lifestyles will have a greater

tendency to adopt electric vehicles. If not, they are more likely to choose the traditional petrol and diesel vehicle. According to the study (Bhat et al.(2022) customers' intentions to embrace electric vehicles are positively impacted by environmental passion, technological enthusiasm, social image, social influence, perceived benefits, performance expectations, and facilitating factors. So, compatibility can play an important role in ascertaining the consumer adoption intention of electric vehicles. In this paper, I am assessing whether the lifestyle of the consumers is compatible with electric vehicle adoption and whether the consumers are inclined to adjust their lifestyles to make them more compatible with driving electric vehicles.

Adopter categories as a means for understanding innovativeness

The desire to discover something new and different is referred to as "innovativeness" by Hirschman (1980). Individuals' innovativeness or novelty-seeking tendencies are expressed by their willingness to attempt or experience new things. Adopter categories are groups into which adopters are allocated based on their time of adoption Brown et al. (1976). This paper uses the five adopter categories: innovators, early adopters, early majority, late majority, and laggards.

Moral Norms

The moral norms are a part of TPB theory (theory of planned behavior); they are one of the four determinants of this theory. Moral norms are defined as a responsibility that an individual feels for performing a certain kind of action Ajzen and Fishbein(1980). The study(Sahoo et al. (2022) provides directions that there is a need for subsidies and incentives. One of the key ideas in the psychology of consumer behaviour is the moral norm. The foundation from which the idea of a moral standard has emerged is the standard Activation Model proposed by Schwartz in 1977. The NAM states that two conditions must be fulfilled for an individual's norm to be activated. First, the person must realize that the behavior has a positive or a negative consequence related to society. This realization is the awareness of consequences that a person has, in essence, the consequences and outcomes that their behavior will result in. Secondly, the person must feel that they have a responsibility, i.e., Ascription of responsibility to contribute positively concerning the issue in consideration. Additionally, some experts have asserted that prospective buyers who value their social responsibility and are inwardly driven are more likely to adopt EVs than those who do not feel any responsibility; other researchers have observed that congruence between the value system of individuals and EVs is expected to result in adoption behavior Shalender and Naman (2020). Research by Lane and Potter (2007) highlighted the role of personal values in consumer buying behavior and found that people with strong moral and value systems are likely to embrace electric vehicles.

Objectives

1. To examine the relationship between environmental concern and consumer adoption intention of electric vehicles: This objective aims to investigate how consumers' level of environmental concern influences their intention to adopt electric vehicles.

2. To assess the role of perceived usefulness, perceived ease of use, compatibility, and personal innovativeness in shaping consumer adoption intention of electric vehicles.
3. To assess the role of moral norms in shaping consumer adoption intention of electric vehicles.

Hypothesis

Hypothesis: 1

H0: There is no significant positive association between environmental concern and the adoption intention of EVs

Hypothesis: 2

H0: There is no significant positive association between moral norms and the adoption intention of EVs

Hypothesis: 3

H0: There is no significant positive association between perceived usefulness and adoption intention of EVs

Hypothesis: 4

H0: There is no significant positive association between perceived ease of use and adoption intention of EVs

Hypothesis: 5

H0: There is no significant positive association between compatibility and adoption intention of EVs

Hypothesis: 6

H0: There is no significant positive association between personal innovativeness and the adoption intention of Evs.

Research Methodology:

The type of research is qualitative and descriptive. The study used an internet-based survey questionnaire to test the hypothesis. A total number of 152 relevant responses were received. Respondents were of different age groups who had experience with EV driving.

Sampling: Convenience sampling is done. The multiple regression model is used to describe and analyse the responses. The model comprised items reflecting each of the proposed constructs, namely, perceived usefulness, perceived ease of use, compatibility, personal innovativeness, environmental concern, and moral norms, which comprised an Ascription of responsibility and awareness of consequences and questions related to whether the respondent will adopt EV or not.

The questions in the last subsection were in the form of a Likert scale questionnaire ranging from 1 to 5.

The online data collection tool, i.e., Google Forms, was used, and the questionnaire was distributed using social networking. To examine the theoretical model, a regression analysis was done. Cronbach's alpha test - before proceeding with the regression analysis, Cronbach's alpha test was done. The internal consistency or reliability of a group of survey items is assessed using Cronbach's alpha statistic. It is to determine whether the group of items reliably assesses the same traits.

Data Analysis

Table: 1 Cronbach's alpha

Variables	Cronbach's Alpha Value
PU	0.833488372
PEU	0.496779542
C	0.67678729
PI	0.530856477
EC	0.84608201
AC	0.723413663
AR	0.796807218

Table 1 gives the Cronbach values of perceived usefulness (PU), perceived ease of use (PEU), Compatibility, Personal innovativeness (PI), Environmental concern (EC), Awareness of consequences (AR), Ascription of responsibility (AR), and personal norms (PN). The values have to lie between 0 and 1. Values near 1 mean greater internal consistency in the set of survey items.

Table: 2 Test of Normality for the data

Test of Normality						
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	Df	Sig	Statistic	df	Sig
PU	0.147	52	0.007	0.901	52	0
PEU	0.106	52	.200*	0.951	52	0.031
CM	0.164	52	0.001	0.944	52	0.016
PI	0.119	52	0.063	0.962	52	0.099
EC	0.177	52	0	0.898	52	0
AC	0.192	52	0	0.871	52	0
AR	0.196	52	0	0.904	52	0
PM	0.216	52	0	0.883	52	0
ADOP	0.222	52	0	0.826	52	0
*. This is a lower bound of the true significance.						

Test of normality – This test was conducted with the support of SPSS. The Shapiro-Wilk test effectively measures how well the sample data fits a normal distribution, or "goodness-of-fit." The statistic will accept a value in the range of 0 and 1, where 1 represents the ideal match. If the Shapiro-Wilk test's sig. Value is larger than 0.05, and the confidence level for the test is set at 95%; the data is considered to be normally distributed; if it is less than 0.05, however, it is said to have considerably deviated from a normal distribution.

Regression analysis

Since our data is not normally distributed, we have to use ordinal regression.

Table:3 Regression Model

Model	-2Log Likelihood	Chi-Square	df	Sig.
Intercept Only	120.041			
Final	91.531	28.511	8	0
Link function: Logit.				

Model Fitting Information

Model fitting tells us how well a model fits the data. The final value is less than 0.05 so the model fits the data very well.

Table: 4 Goodness for Fit test

Goodness-of-Fit			
	Chi-Square	Df	Sig.
Pearson	139.22	145	0.62
Deviance	91.531	145	1
Link Function: Logit.			

The discrepancy between the present model and the complete model is evaluated using the Pearson goodness-of-fit test. It determines whether the predicted probabilities deviate from the observed probabilities. The final value is greater than 0.05 i.e., .0.620 so the model fits the data very well.

Table 5: Parameter Estimates

Parameter Estimates							
	Estimates	Standard Error	Wald	df	Sig.	95% Confidence Lower Bound	95% Confidence Upper Bound
Threshold [ADOP=1.00]	1.003	2.397	0.175	1	0.676	-3.696	5.702
[ADOP= 3.00]	4.973	2.427	4.198	1	0.04	0.216	9.731
[ADOP =4.00]	7.58	2.57	8.701	1	0.003	2.543	12.616
Location PU	0.052	0.326	0.025	1	0.873	-0.587	0.691
PEU	-0.08	0.495	0.026	1	0.871	-1.051	0.891
CM	-0.049	0.443	0.012	1	0.911	-0.918	0.891
PI	-0.342	0.514	0.444	1	0.505	-1.349	0.664
EC	1.692	0.581	1.416	1	0.023	0.831	0.948
AC	0.729	0.653	1.246	1	0.026	-0.551	2.01
AR	-0.286	0.591	0.234	1	0.629	-1.444	0.872
PM	2.194	0.546	16.16	1	0	1.124	3.264
Link Function: Logit.							

For this data, when adjusting for the remaining independent variables, ordinal regression coefficients are understood as the estimated or expected change in the probabilities of being in a higher category (as opposed to a lower category) on the dependent variable (35). For a positive estimate or coefficient, there is a predicted rise in the likelihood that the independent variable will fall at a higher level on the dependent variable for every unit increase on the independent variable. For a negative estimate or coefficient, there is a predicted drop in the probability of being at a higher level on the dependent variable for every unit increase on the independent variable.

· The perceived usefulness (PU), environmental concern (EC), and Moral norms (PM) are positive indicators of the adoption intention of electric vehicles (ADOP); this means for every one unit increase in the adoption intention of EVs (ADOP), there is a predicted increase of 0.052 (in PU), 1.692 (in EC) and 2.194 (in PM) in the odds of being at a higher level on adoption intention of EV (ADOP). Only environmental concern (EC) and moral norms (PM) show significance from these independent variables. Null Hypotheses 1 and 2 are rejected.

· The perceived ease of usefulness (PEU), compatibility (CM), and personal innovativeness (PI) are negative indicators of the adoption intention of electric vehicles (ADOP). This means the negative coefficient -0.08(in PEU), -0.049(in CM), -0.342(in PI) indicate that for every one unit increase in PEU, CM, and PI, there is a predicted decrease of 0.08 (in PEU), 0.049 (in CM) and 0.342 (in PI) in the odds of being on a higher level of adoption intention of the electric vehicle. Hypothesis 4, Hypothesis 5, and Hypothesis 6 are accepted.

The data analysis revealed that Environmental concern (EC), Perceived usefulness (PU), and moral norms (MN) are positive indicators of the adoption intention of electric vehicles (ADOP).

The results of only environmental concern and moral norms are statistically significant.

Discussions and Conclusions:

The study shows that the null hypothesis for environmental concern hypothesis 1 is rejected, and it can be said that for this data, environmental concerns were a significant factor in determining consumer intentions to use electric automobiles. This suggests that because consumers are concerned about the environment, manufacturers and dealers must promote electric vehicles in an environmentally friendly manner. Companies and government agencies can encourage consumers to purchase electric vehicles by launching an environmental-focused advertising campaign. Similarly, the null hypothesis for moral norms Hypothesis 2 is rejected, and it can be said that for this data, moral norms have a positive relationship with consumer adoption of electric vehicles. Moral norms include ascribing responsibility and awareness of the consequences of using petrol and diesel vehicles. In this data, most of the respondents were aware that they have a moral obligation to use EVs and thereby aid in the efforts of protecting the environment, so even though for this data, moral norms are positively significant, governments must continue to sensitize people about the harmful effects of using petrol and diesel

vehicles as using these can lead to air pollution. Hypothesis 3 for perceived usefulness is accepted as the significant value is more than 0.05. However, its estimated values in parameter estimates are positive, indicating that it is a positive indicator but not strong or significant enough to influence consumer adoption of electric vehicles. Perceived usefulness is defined here as "the extent to which a person thinks that utilizing a certain system would improve his or her ability to perform at work." This data shows that though it is a positive indicator, the respondents don't consider it significant enough to influence their adoption intention of electric vehicles. It was also revealed that perceived ease of use (PEU), compatibility (CM), and personal innovativeness (PI) are negative indicators of the adoption intention of electric vehicles. This shows that hypothesis 4 for perceived ease of use is accepted and that for this data, PEU is not playing a very significant role in shaping the adoption intention of electric vehicles. Perceived ease of use is "the extent to which a person thinks using a certain system would be easy." Data from the respondents revealed that this variable does not influence their adoption intention. There is no positive association between compatibility and adoption intention of electric vehicles. Similarly, there is no significant positive association between personal innovativeness and the adoption intention of electric vehicles.

Planners and Legislators may find the study's findings helpful in increasing the rate at which electric vehicles are adopted in the real world.

The sample size taken is small and collected from Indian respondents. Also, only six relevant factors are taken to analyze the adoption intention of EVs. Future studies can be based on large samples and related to other countries. Finally, many other relevant factors can be taken to analyze consumer's intention to embrace electric vehicles.

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