



A STUDY ON CUSTOMER PERCEPTION TOWARDS PURCHASE INTENTION OF ELECTRIC CARS IN INDIA

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ABSTRACT

Electric Vehicles still accounts for only a tiny fraction of the total Vehicles sold in India. The Indian government has taken several steps and efforts to ensure the effective introduction and deployment of electric cars in the country. In 2019 budget, Finance Minister Nirmala Sitharaman outlined several initiatives targeted at making India a worldwide EV manufacturing powerhouse. The purpose of this study is to find the factors influencing the purchase decision of electric cars. The sample size of the study is 102. The statistical technique used in this study is Non probability convenience sampling. For this research "Primary data" was collected by using structured questionnaire. The statistical methods used were independent sample t test, multiple regression and two-way Anova. The study concluded that among the five independent variables, perceived monetary benefits has the highest impact on Electric car purchase intension followed by personal innovativeness.

Keywords: Electric Vehicle, Electric Cars, Purchase Intension, Perceived Monetary Benefit, Personnel Innovativeness

1. INTRODUCTION

It's not a mystery anymore that the automobile sector will soon be facing a revolutionary change from combustion vehicles to electric vehicles. In comparison to the conventional fuel vehicles that we currently use, the world requires a large-scale use of electric motor-driven vehicles. The depletion of fossil fuels is unavoidable; nevertheless, what the global community can do is reduce the strain on the conventional source and gradually shift its demands to electric motor (EV) vehicles.

(Murugan Ramu, 2021)

The Indian government has taken several steps and efforts to ensure the effective introduction and deployment of electric cars in the country. For instance, it has been said that the use of E-Rickshaws will become compulsory from 2023, sale of electric 2 wheelers will become mandatory from 2025 and sale of electric cars evidently will become a compulsion from 2030. In 2019 budget, Finance Minister Nirmala Sitharaman outlined several initiatives targeted at making India a worldwide EV manufacturing powerhouse. Customers can get up to 1.5 lakh in income tax rebates on interest paid on loans to purchase electric vehicles, with a total exemption benefit of 2.5 lakh over the life of the loan, according to Sitharaman. She also stated that lithium-ion cells will be free from customs taxes, which would assist down the cost of lithium-ion batteries. However, the current battery technology is insufficient, and charging infrastructure is lacking. In 2021 Budget, Nirmala Sitharaman announced the new scrappage policy with requirement 20 years for personal vehicles and 15 years for commercial vehicles. INR 18000 crores was provided for acquisition of 20000 buses and few other incentives were announced but unfortunately no direct announcements were made for EV. Industry experts were expecting GST reduction and an update on FAME II policies. **(Deep Mehta, February 2021)**

Some incentives are being offered to make carmakers develop new EV models and manufacturing components such as lithium-ion batteries and electric motors. In addition to the federal government's subsidies, some state governments have made investments in EV adoption by offering incentives to electric car buyers. Delhi is at the top of the list, because it matches the national government's subsidies. According to the Delhi government website, there are 72 charging stations in the city. But these incentives are not enough for consumers to shift from conventional cars. **In order to further understand the factors impacting the purchase intention of consumer, the paper will study few factors with more attention on buyer's perception of the benefits derived and risks associated with the purchase of an electric cars.**

2. LITERATURE REVIEW

A study was conducted to measure the impact of home-location based spatial characteristics and individual characteristics of BEV in regions without strong policies. The study revealed that BEV adoption is impacted by one's affinity to technology, income and green party preferences. **Gracia Brückmann, Fabian Willibald, Victor Blancoac (Dec 23 2020)**. Another research was undertaken to further understand and investigate the aspects that influence customers' attitudes about electric car adoption. A model was created using two theoretical models: The Norm Activation Model and the Theory of Planned Behaviour. According to the findings, consumers' choices were influenced by perceived value, attitude, attribution of responsibility, subjective norms, personal norms, perceived consumer effectiveness, and awareness of consequences. **Shahla Asadi, Mehrbakhsh Nilashi, Sarminah Samad, Rusli Abdullah, Marwan Mahmoud, Monagi H. Alkinani, Elaheh Yadegaridehkordi ,28 September (2020)**. Another research looked into the problems that India has in adopting electric vehicles (EVs) by 2030. Given the high cost of EVs, lack of infrastructure, and weak purchasing power of Indian customers, the study's findings state that the sharing economy and public utilities play a vital role in promoting EV adoption. **Kumar, R., Jha, A., Damodaran, A., Bangwal, D., & Dwivedi, A. (2020)**. Another research was carried out to better understand the socio-technical nexus of EV barriers to adoption in the Nordic countries. Despite recent technology developments, typical hurdles such as range, pricing, and charging infrastructure persist, according to the qualitative findings and cluster analysis. At the same time, the findings reveal that obstacles are linked closely to customer knowledge and experience. **Noel, L., Zarazua de Rubens, G., Kester, J., & Sovacool, B. K. (2020)**. Another study was conducted to scrutinise the various factors that influence a consumer's adoption of an EV. The results show that the study found that the perceived economic benefit (PEB) is not related to the behavioural intention while environmental concerns and social influence are partial predictors of the BI. **Khurana, A., Kumar, V. V. R., & Sidhpuria, M. (2019)**. Another research looked at econometric research revealed that energy costs and financial incentives had a favourable impact on PEV adoption. Financial incentives have a positive influence on PEV sales and can help spread them. **Münzel, C., Plötz, P., Sprei, F., & Gnann, T. (2019)**. Another study looked at three factors that impact customer mobility concerns: charging station preferences, the availability of a second conventional automobile, and the presence of sophisticated range management technologies. Almost all the survey participants were enthusiastic about workplace charging stations and expressed a desire to use them. It also implies that range information should be made available in a variety of ways. **Pedrosa, G., & Nobre, H. (2019)**. Another study looked into the adoption of electric cars (EVs) as a replacement for internal combustion engine cars (ICVs) and the advent of the EV as a mobile intelligent terminal for social commerce. The findings revealed that EV adoption has been delayed due to customers' imprecise perceptions and the dispersion of pilot

EV projects; however, the introduction of social commerce to EVs can help solve this issue and encourage EV adoption. **Feng, B., Ye, Q., & Collins, B. J. (2018)**. Based on the theory of planned behaviour, another study used consumer cognitive status, product perception, and incentive policy measures to develop a purchase intention influence mechanism model for EVs (TPB). The findings suggest that policy indicators such as attitude, perceived behaviour control, cognitive status, product perception, and monetary incentive policies have a substantial favourable impact on customers' intents to buy electric vehicles in Beijing. **Huang, X., & Geb, J. (2019)**. Another paper studied the perception and awareness levels of EV customers. The results show that people's levels of awareness of EVs are substantially influenced by their education. **Masurali, A., & Surya P., (2018)**. The goal of this study is to determine customer preferences for business models in the context of EV adoption. According to the findings, business model preferences differ depending on the vehicle type: for battery electric vehicles (BEVs), vehicle leasing is the most preferred option, while for conventional cars (CVs) and plug-in hybrids (PHEVs), the traditional business model of full purchase is still preferred. **Liao, F., Molin, E., Timmermans, H., & van Wee, B. (2018)**. Environmental concerns, cost, comfort, trust, technology, societal acceptance, and infrastructural availability all influence vehicle choice. These arguments have been put to the test in both conventional and electric vehicles. According to the findings, the general public is fully aware of the environmental benefits. According to the paper the government and manufacturers share responsibilities for investing in the EV sector. **Pretty Bhalla, Inass Salamah Ali, Afroze Nazneen, July, 2018**. Another research was conducted to study the consumer preferences for electric vehicles. Financial and technical characteristics of electric vehicles, including as their purchase and running costs, driving range, charging time, vehicle performance, and brand variety on the market, are all proven to have a substantial influence on their utility. The number of charging stations available has a favourable impact on the utility and promotion of electric vehicles. The influence of incentive measures, such as tax cuts, was fairly significant. **Liao, F., Molin, E., & van Wee, B. (2016)**. Another study illustrated a conceptual framework to exemplify electric vehicle adoption & preferences. The paper studied consumer need for EVs. Results indicated that innovativeness and attitudes regarding the functional performance of EVs significantly affects preferences for EVs. **Morton, C, Anable, J orcid.org/0000-0002-4259-1641 and Nelson, JD (2016)**. Another study investigated the impact of financial incentives and other socioeconomic factors on the adoption of electric vehicles. According to the findings, financial incentives, charging infrastructure, and local presence of production facilities was the most significantly influencing factor with relation to the deployment of electric vehicles. **Sierzchula, W., Bakker, S., Maat, K., & van Wee, B. (2014)**.

3. STATEMENT OF THE PROBLEM

Government and Automobile OEMs and related companies are taking various initiatives to increase the sales of electric cars. Consumers select whether they want to purchase an electric car based on the perception they have for electric cars. This perception is formed from the information he/she receives from the environment and he/she organizes and interprets it. Thus, an important question to be raised is what is the consumer perception about electric cars in India? If India can study consumer perception on electric vehicles, its perceived advantages and disadvantages and how it will influence the purchase decision, they will be able to develop necessary policies to encourage electric cars adoption.

4. RESEARCH GAP

Several studies have been conducted throughout the world to better understand customer acceptance of electric cars. Technology, customer, and context are the three primary areas that are thought to influence whether or not to purchase electric cars. As per the literature review, numerous research studies have been conducted on all three aspects technology, customer, and context but widespread adoption of electric cars in India depends heavily on consumer perception of the benefits and risks surrounding it. The literature reviewed recommends further study on customer perception of various factors impacting buying decisions of electric cars. **(William Sierzchula, Sjoerd Bakker, Kees Maat Bert van Wee, 2014).**

Consumer perceptions includes potential benefits through electric car purchase and making a sacrifice in form of payment. Most paper do not study the two factors together. In this paper we have tried to bridge the gap by studying the perceived consumer benefits and the perceived consumer risks together. Some paper talk about personality and suggest further study on personal innovativeness as an important personality trait. Thus, in this paper we have studied “personal innovativeness” as a factor affecting purchase decision of electric cars. We aim to study perceived monetary benefits and perceived environmental benefits as utilities derived from purchase of electric cars, while perceived risk and perceived cost as risks impacting purchase intention. Several demographic variables such as gender, age, income, region, education and occupation were also studied.

4.1 Variables

Sr. No.		Variable	Perceived Benefit/Risk	Dependent / Independent	Source
1	PMB	Perceived Monetary Benefits	Perceived Benefit	Independent	William Sierzchula· Sjoerd Bakker · Kees Maat, Bert van Wee, 2014
2	PF	Perceived Costs	Perceived Risk	Independent	Craig Morton, Jillian Anable and John D. Nelson, 2016
3	PEB	Perceived Environmental Benefits	Perceived Benefit	Independent	Xiuhong He, Wenjie Zhan, Yingying Hu, 2018
4	PI	Perceived Innovativeness	Personality Trait	Independent	Morton, C, Anable, and Nelson, JD, 2016.
5	PR	Perceived Risks	Perceived Risk	Independent	Mauricio Feathermana, Shizhen (Jasper) Jia, Christopher B. Califf, Nick Hajli, 2021
6	ECPI	Electric Cars Purchase Intention	-	Dependent	Huang, X., & Geb, J., 2019

Table 1: Variables and its Sources

5. RESEARCH OBJECTIVES**5.1 PRIMARY OBJECTIVE**

To identify the factors influencing the purchasing intention of electric cars.

5.2 SPECIFIC OBJECTIVES

- To study the impact of personal innovativeness on purchasing decision of Electric cars.
- To study the impact of perceived environmental benefits on purchasing decision of Electric cars.
- To study the impact of perceived monetary benefits on purchasing decision of Electric cars.
- To study the impact of perceived risk on purchasing decision of Electric cars.
- To study the impact of perceived costs on purchasing decision of Electric cars.

6. RESEARCH QUESTIONS

Will personnel innovativeness, perceived environmental benefits, perceived monetary benefits, perceived risk, perceived costs have a significant positive or negative impact on the purchase decision of electric cars?

7. HYPOTHESES FORMULATION

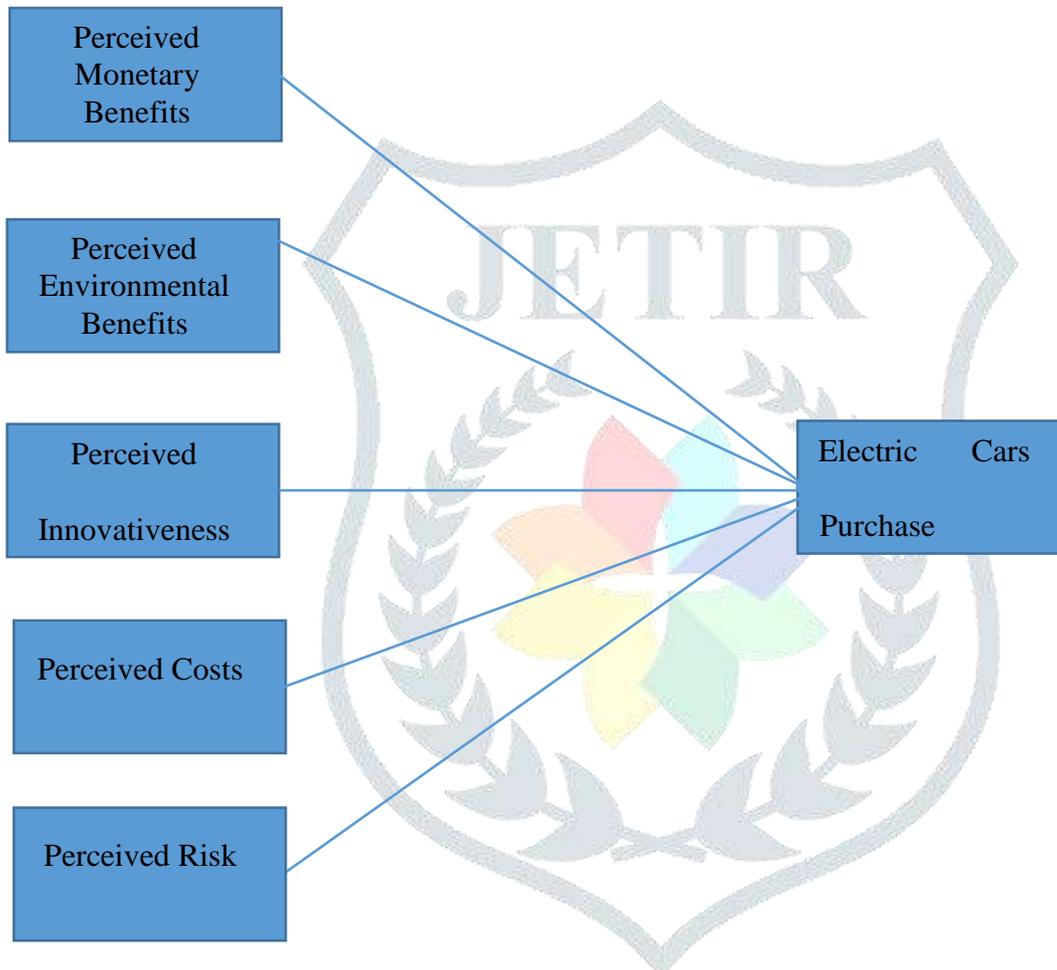


Table 2: Hypothesis Formulation

HYPOTHESES

H0: There is no significant impact of Perceived monetary benefit on purchase intention of Electric Cars.

H1: There is a significant impact of Perceived monetary benefit on purchase intention of Electric Cars.

H0: There is no significant impact of Perceived environmental benefit on purchase intention of Electric Cars.

H2: There is a significant impact of Perceived environmental benefit on purchase intention of Electric Cars.

H0: There is no significant impact of Personal innovativeness on purchase intention of Electric Cars.

H3: There is a significant impact of Personal innovativeness on purchase intention of Electric Cars.

H0: There is no significant impact of Perceived risk on purchase intention of Electric Cars.

H4: There is a significant negative impact of Perceived risk on purchase intention of Electric Cars.

H0: There is no significant impact of Perceived cost on purchase intention of Electric Cars.

H5: There is a significant impact of Perceived cost on purchase intention of Electric Cars.

8. METHODOLOGY

8.1 Data Collection and Questionnaire

For the study “Primary data” was collected by using structured questionnaire. (150) questionnaires were distributed to potential customers and (102) valid questionnaires were collected. The questionnaire has (25) items divided into six parts which is respectively related to each variable that have been used in this study which started with demographic variables then purchase intention followed by perceived monetary benefits, perceived cost, perceived risk and perceived environmental benefit.

8.2 Reliability

To examine the reliability of the survey, the study used Cronbach’s Alpha coefficient and the scores for the variables were indicative of the survey having a high level of reliability, i.e., higher than 0.70 in line with the abundant literature on scale measurement (Cronbach & Shavelson, 2004), it is possible to conclude that the reliability of the research instruments in terms of their internal consistency is with satisfactory level.

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.722	.760	20

Table 3: Reliability Test

9. DATA ANALYSIS AND INTERPRETATION

9.1 Descriptive analysis

Sr. No	Measure	Item	Frequency	%
1	Gender	Male	50	49.02%
		Female	52	50.98%
2	Age (in years)	less than 20	2	1.96%
		20-30	92	90.20%
		30-40	0	0.00%
		40-50	5	4.90%
		Above 50	3	2.94%
3	Education	High School or Below	1	0.98%
		Associate Degree	2	1.96%
		Bachelor's Degree	54	52.94%
		Master's degree or above	45	44.12%
4	Region	North	7	6.86%
		South	9	8.82%
		East	23	22.55%
		West	63	61.76%
5	Occupation	Students	74	72.55%
		Working	19	18.63%
		Unemployed	5	4.90%
		Others	4	3.92%
6	Monthly Income	less than 10,000	64	62.75%
		10,000-30,000	13	12.75%

	30,000-50,000	13	12.75%
	Above 50,000	12	11.76%

Table 3: Descriptive Analysis

9.1.1 Gender

Among the 102 respondents, there were 50 male respondents, which constitutes 49.02% of total of respondents and 52 female respondents which constitutes 50.98% of total which is slightly higher. The difference between the number of female and male respondents is negligible. Therefore, almost an equal proportion of males and females were a part of the data collection process.

9.1.2 Age

Among the 102 respondents, the majority lies in the age group of 20-30 which constitutes 90.20 % and the next was the age group of 40-50 which constituted 4.90 % of the total. The percentage of respondents for other age groups are very negligible and age category 30-40 was the lowest with zero respondent.

9.1.3 Education

The greatest number of respondents in this category was from bachelor's degree with a percentage of 52.94. Then comes people with master's degree or more with a percentage of 44.12. High school and associate degree respondents were negligible in numbers.

9.1.4 Region

Under this parameter, 4 different regions included were north, south, east, west. 61.76% respondents were from west. Then comes the people from the east with a percentage of 22.55. The respondents from south constituted 8.82% of total and respondents of north are only 6.86% of total percentage.

9.1.5 Occupation

72.55% of our total respondents are the people who are currently studying and are not employed. 18.63% respondents are employed. People who don't have any employment also responded to our study and constitute 4.90% of total respondents. We also included "other" category which contributed 3.92%.

9.1.6 Monthly Income

Under this parameter, 4 different income levels were included. Majority of the employees obtain an income that comes under the 'less than 10,000' level. 64 employees that constitute 62.75% of the total number of respondents come under this income level. The least number of employees are

under the income level 'Above 50,000'. This is only 12 employees, who constitutes 11.76% of the total number of employees.

9.2 Multiple Regression

Multiple Linear Regression is a statistical tool that permits us to encapsulate and study whether two or more independent variables influence one continuous dependent variable or not.

Coefficients								
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	2.917	1.909		1.528	.130	-.871	6.705
	Perceived Monetary Benefits	.350	.158	.265	2.212	.029	.036	.665
	Perceived Costs	-.078	.123	-.056	-.636	.526	-.323	.166
	Perceived Environmental Benefits	.085	.080	.110	1.069	.288	-.073	.244
	Perceived Innovativeness	.318	.076	.371	4.171	.000	.167	.470
	Perceived Risks	-.062	.069	-.076	-.904	.368	-.198	.074

a. Dependent Variable: Electric Car Purchase Intention

Model Summary									
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.673 ^a	.453	.425	1.623	.453	15.924	5	96	.000

a. Predictors: (Constant), PR, PF, PEB, PI, PMB

Table 4: Regression Analysis

In this model, R² of 0.453 implies that the five factors explain about 45% of the variation in purchase intentions. This is a sound result in this research domain.

Among the five factors, perceived monetary benefits has the highest impact with a significance value of 0.029 which is less than 0.05. This result is consistent with the findings of previous studies

that financial benefit drives consumers to purchase electric cars. **William Sierzchula, Sjoerd Bakker, Kees Maat, Bert van Wee, 2014.**

The other independent variable that has a significant impact on Electric car purchase intension is Personal innovativeness with a significance value of 0.000, which is also less than 0.05. This also is consistent with earlier findings that innovativeness and attitudes regarding the functional performance of EVs significantly affects preferences for EVs. **(Morton, C, Anable, and Nelson, JD, 2016).**

The independent variables not having an impact on Electric car purchase intension are Perceived risk, Perceived environmental benefit and Perceived cost with a significance value greater than 0.05. Therefore, the null hypothesis for all three are accepted. This result might be because of the magnitude of the **environmental problem** i.e. consumers might believe their individual efforts could not make a difference in solving the problem or because individual buyers do not want to concern themselves with worldly worries of climate change. Thus, although consumers perceive the environmental benefits of electric cars, it does not impact their purchase intension.

Also, perceived cost does not impact the purchase intention among the buyers. However, it is inconsistent with the previous finding **(Elena Higuera-Castillo, Sebastian Molinillo, J. Andres Coca-Stefaniak, and Francisco Liébana-Cabanillas, 2019)**. A key barrier to Electric car adoption, particularly in India's price-sensitive automobile market, has been the higher purchase price.

9.3 Independent Sample T Test

Independent sample t-test is an inferential statistical tool that identifies if any statistically remarkable difference exists amongst the means of two un-associated groups. Two sample T- Test has been used to find if there is a notable difference amongst gender and Electric car purchase intension.

Group Statistics					
	Gender	N	Mean	Std. Deviation	Std. Error Mean
ECP I	MALE	50	11.24	2.181	.308
	FEMALE	52	11.42	2.118	.294

Independent Samples Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
EC PI	Equal variances assumed	.438	.510	-.430	100	.668	-.183	.426	-1.028	.661
	Equal variances not assumed			-.430	99.524	.668	-.183	.426	-1.028	.662

Table 5: Independent Sample Test

The mean ECPI value of Male is 11.24 and the mean score of Female is 11.42. The independent samples t-test results show that the significant 2 tailed value 0.668 which is more than 0.05 and hence there is no significant difference in mean Electric Cars Purchase Intention score between Male and Female.

9.4 Two Way Anova

The two-way Anova compares the mean differences between groups that have been split on two independent variables (called factors). The primary purpose of a two-way anova is to understand if there is an interaction between the two independent variables on the dependent variable. In this study two-way anova was employed to examine the interactive impact of gender and education on customer purchase intention of Electric cars.

Tests of Between-Subjects Effects						
Dependent Variable: ECPI						
Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	24.684 ^a	6	4.114	.892	.504	.053
Intercept	1824.381	1	1824.381	395.715	.000	.806
Gender	7.127	1	7.127	1.546	.217	.016
Education	16.402	3	5.467	1.186	.319	.036
Gender * Education	10.511	2	5.256	1.140	.324	.023
Error	437.982	95	4.610			

Total	13564.000	102			
Corrected Total	462.667	101			
a. R Squared = .053 (Adjusted R Squared = -.006)					

Table 6: Two-Way Anova

The significance value of Gender and Education are 0.217 and 0.319 respectively which is greater than 0.05. The aggregate significance value of Gender and Income is 0.324 which is also greater than 0.05. Therefore, gender and education have no significant impact on purchase intention both individually and collectively, as these two variables chosen does not have interactive impact.

10. FINDINGS OF THE STUDY

Only two of all hypotheses, H1 and H3 were supported by the study. With regard to perception, one dimension of perceived benefits – perceived monetary benefit was found to have a positive influence ($b = .350$, $p < 0.05$) on buying decision of electric cars while results showed that perceived environmental benefits ($b = .085$, $p > 0.05$) does not impact electric cars purchase intention significantly. Both dimensions of perceived risk – perceived costs ($b = -.078$, $p > 0.05$) and perceived risk ($b = -.062$, $p > 0.05$) do not have significant impact on electric cars purchase intention. Personal innovativeness was considered as a personality dimension and results show that it has an influence ($b = .318$, $p < 0.05$) on the purchase decision of electric cars. Thus, potential customers with higher ratings on perceived monetary benefits and higher personal innovativeness are more likely to purchase Electric cars.

The demographic factors were not significant which is consistent with **(William Sierzchula, Sjoerd Bakker , Kees Maat, Bert van Wee, 2014)** where variables such as income, education level, environmentalism etc., were not good predictors of adoption levels. This could be because when compared to overall automobile sales, Electric car market are small.

11. RECOMMENDATIONS

Electric car adoption in India is now in its infancy; people are unfamiliar with electric cars and may be sceptical of a shift to them. Electric vehicle preference will evolve as technology evolves, familiarity grows, and penetration improves.

1. Because perceived monetary benefits influence purchase intent for electric cars, the government should take steps to improve consumers' perceptions of monetary benefits. The

government may provide financial incentives in the form of subsidies and tax breaks, and the industry could offer refunds and discounts for electric car buyers.

2. Because personal innovativeness influences electric car purchasing decisions, OEMs can convey new technologies employed in electric cars to grab the attention of innovative consumers.

3. Senior leaders and members of parliament may choose for electric cars, setting a good example for the rest of the population. All stakeholders are encouraged to establish a campaign like 'Swatch Bharat.'

4. Another factor that may promote the adoption of electric vehicles is celebrity endorsement. Advertising may elicit an emotional response that portrays the electric car driver in a positive manner.

12. CONCLUSION

When it comes to the purchase of electric cars, certain aspects like government incentives, infrastructure requirements, charging facilities etc. play an important role and the existing studies have examined its impact on the purchase decision. Consumers select whether they want to purchase an electric car based on the perception they have for electric cars. The study concluded perceived monetary benefits and personal innovativeness significantly impact the Electric car purchase intention. while the factors like perceived cost, perceived risk and perceived environmental benefit do not significantly influence electric car purchase intention. We also investigated the influence of demographic factor gender on electric car purchase intention and found out that there is no significant impact on gender. Consumers with higher personal innovativeness and higher perceived monetary benefits are more likely to purchase Electric cars.

13. LIMITATIONS AND FUTURE STUDY

Several limitations should be noted when interpreting the results of this study, first we have only considered Electric cars for our study and not included all the Electric vehicles in the market. So, the future study could be the study of all Electric vehicles. The dependent variable in our research model is EV purchase intention, but not actual behaviour, although behavioural intention is closely related to actual behaviour (Hun get al., 2003; Tan and Teo, 2000). And this study was conducted in India, given the differences among countries, the results may change when applying the research model to other countries. Thus, similar research may be conducted in other countries.

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