Consumer Preferences on Electric Vehicles and its Prospective in Indian Scenario

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Abstract

Consumer preferences are defined as the subjective or individual tastes, as measured by utility. This study will help to realize the key elements that generate preference in the consumers to opt for electric vehicles and generate comparison based on numerous features and applicability. The main purpose of the paper is to reveal theoretically consumer preference on electric vehicle and to test them empirically. The quantitative research (survey) has been chosen in order to meet the purpose of the research and to test that relationship empirically. The data is collected from structured questionnaire. Sample size is 110 and also descriptive research study is used as a research design and followed convenience sampling method. The respondents are the consumers of electric vehicles from Thanjavur, Thiruvarur, Tiruchirappalli and Kumbakonam in Tamilnadu. The study identifies factors which are responsible for building consumer preference for electric vehicles and various usability features. Moreover, study will indicate suggestive inferences to help the companies during selecting, targeting and positioning process of marketing their electric vehicles.

Keywords: Consumer preferences, Electric vehicles, and influential factors.

INTRODUCTION

An electric vehicle (EV) is one that works on an electric engine, rather than an interior ignition motor that creates power by consuming a blend of fuel and gases. In this way, for example, vehicle is viewed as a potential trade for current-age car, so as to address the issue of rising contamination, an Earth-wide temperature boost, draining regular assets, and so forth Despite the fact that the idea of electric vehicles has been around for quite a while, it has attracted a lot of intrigue the previous decade in the midst of a rising carbon impression and other natural effects of fuel-based vehicles.

In India, the principal solid choice to boost electric vehicles was taken in 2010. Most nations over the globe have taken up the promise to decrease the contaminations levels and commitment to the carbon impression because of the utilization of interior burning motor vehicles. These activities are essential for the environmental change promise and the objective is to have 30% electric vehicles by 2030. In India, the Faster Adoption and Manufacturing of Hybrid and Electric vehicles conspire has been dispatched so as to support the automobile producers to assemble a reasonable biological system and change versatility arrangements in India with an accentuation to accelerate the pace of building charging framework. China remains the world's biggest electric vehicles market, trailed by Europe also, the United States. While vehicle development in India is quick; responsibility for vehicles has expanded ongoing days.

Like that in recent years, consumer preference has gained significance in business research due to its ability to predict buyers' intentions during transaction and the importance of managing customer relationships. Literature review documents, there is a paucity of customer preference studies on mobility sector, such as electric vehicles. It is essential for business to shed light on the consumption behavior of its consumers in order to better serve this market. Therefore, the aim of this research is to discover consumer's preference components as they associate with electric vehicles. Many governments have

initiated and implemented policies to stimulate and encourage electric vehicle production and adoption (Sierzchula, Bakker, Maat, & Van Wee, 2014). The expectation is that better knowledge of consumer preferences for electric vehicles can make these policies more effective and efficient. Many empirical studies on consumer preferences for electric vehicles have been published over the last decades, and a comprehensive literature review would be helpful to synthesize the findings and facilitate a more well-rounded understanding of this study.

IMPORTANCE OF THE STUDY

Consumer preference for electric vehicle is one of the vital reasons for a company to achieve the organizations goal. Therefore, it is substantial to seek out the underlying factors that influence customer preference, which thus contributes to the organization indirectly the nation economy. Besides that, it is essential to examine the influence of independent variables as the chosen factors are less towards the field of electric vehicles the preference based on the customer, it is rare perspective compare to researches conducted based on electric vehicles factors namely driving range, environmental friendliness, performance, policy attributes, social influences and warranty

SCOPE OF THE STUDY

Conducting an effective customer preference analysis can lead a company to creating an accurate value proposition. A value proposition is a promise of value to be delivered and a belief from the customer that value will be experienced. A value proposition can apply to an entire organization, or parts, or customer accounts, or products or services. Developing a value proposition is based on a review and analysis of the benefits, costs and value that an organization can deliver to its customers, prospective customers.

REVIEW OF LITERATURE

Driving range is considered to be one of the biggest barriers to the widespread adoption of electric vehicles. The most common operationalisation is driving range with a full battery. An exception is Bockarjova et al. (2014), which included both range under normal and unfavourable circumstances.

Range is found to have a positive and statistically significant effect on electric vehicles adoption decisions in the vast majority of studies. However, Hess et al. (2012) found this effect to be insignificant, which may be explained by the limited range used in their experiment (30–60 miles). Jensen et al. (2013) found that the marginal utility for driving range is much higher for an electric vehicle than for a CV, which is probably due to the large difference in range between these two car types. Following a meta-analysis, Dimitropoulos, Rietveld, and Van Ommeren (2013) proposed that preference for range may be sensitive to charging station density and charging time. In the case of PHEV, a longer all-electric range (the distance solely battery-powered) also increases the likelihood of purchase (Helveston et al., 2015).

Environmental friendliness, other psychological constructs are also expected to have impacts on electric vehicles adoption. Dittmar (1992) and Steg (2005) identified that instrumental, hedonic and symbolic motives influence car purchase and use. Emotions are also found to be significant in some explorative research (GrahamRowe et al., 2012). These variables are rarely included in choice studies on electric vehicles preference. The only example is Helveston et al. (2015) who investigated the symbolic value in the united states people who attach high symbolic value to their vehicle are more prone to purchasing an electric vehicles implying that electric vehicles symbolizes high social status. In China it is the opposite case. So far, most studies incorporate psychological factors separately instead of a complete set of constructs in psychological theories such as the theory of planned behavior (Ajzen,1991) or other integrative models proposed specifically for pro environmental or sustainable technology acceptance behaviour (Bamberg & Möser, 2007; Huijts et al., 2012). Should future research wish to add more psychological factors, two points are worth noting: first, it is important to avoid the overlap with factors which are already covered by choice experiments; second, the researcher should control for correlation(s) between different psychological constructs.

Performance is usually represented by engine power, acceleration time or maximum speed. Consumers are generally found to prefer better performance. However, acceleration time is found to be insignificant in Mabit and Fosgerau (2011) since heterogeneous preferences among the population may cancel each other out: males have a significant preference for faster acceleration while females prefer slower acceleration (Mabit & Fosgerau, 2011 ; Potoglou & Kanaroglou, 2007; Valeri & Danielis, 2015). Potoglou and Kanaroglou (2007) also found that single people value shorter acceleration time more. Although emissions of BEV while driving are absent, many studies still set different levels of CO2 emission for electric vehicles in the choice experiment, representing the emissions of electricity generation. Choice experiments either directly use absolute CO2 emission per kilometre or the percentage relative to a gasoline vehicle. Hackbarth and Madlener (2013) found that for environmentally friendly people the same amount of emission brings higher disutility.

Policy attributes include different policy instruments for promoting electric vehicles adoption. If the preference parameter for a certain policy attribute in the final choice model is significant, then the policy can be regarded as potentially effective. Regarding one-time price reducing policies, reducing purchase tax is significant in all cases while reducing purchase price is only significant 2 out of 4 times. The difference can be most clearly seen in contrast to Hess et al. (2012): a $1000 tax reduction is significantly positive while a $1000 price reduction is not significant. This can possibly be due to the higher symbolic value attached to a higher priced car. Gallagher and Muehlegger (2011) also found that the type of tax incentive offered is as important as the generosity of the incentive. As for usage cost reduction policies, annual tax reduction seems to be the only significant policy, while free parking and toll reduction are not significant in any of the studies that explored their effects. The effectiveness of different types of tax reduction

reflects the difference in perceptions people have towards taxes versus other expenses.

Social influence An individual's decisions are expected to be influenced by the behaviour of people in their social network (Kahn, 2007; Lane & Potter, 2007) and social norms which can be regarded as the behaviour of the collective society (Araghi, Kroesen, Molin, & van Wee, 2014). Several qualitative studies found that social influence plays an important positive role in electric vehicles promotion (Axsen & Kurani, 2011 ; Axsen, Orlebar, & Skippon, 2013). Among choice studies, the influence of an individual's social network on HEV adoption has been demonstrated (He, Wang, Chen, & Conzelmann, 2014; Hsu, Li, & Lu, 2013). Social norm has also been found to be significant: a higher electric vehicles market share increases electric vehicles preference (Mau et al., 2008). (Rasouli and Timmermans 2013 and Kim et al. 2014) investigated social influence in electric vehicles preference studies. As proxy variables for social influence, they used electric vehicles market share among different groups (friends and acquaintances, larger family, colleagues) and the nature (positive or negative) of general public reviews about electric vehicles. Both have a significant although minor impact on electric vehicles preference.

Warranty is found to affect electric vehicles adoption positively (Mau et al., 2008). Jensen et al. (2013) found the influence of battery life to increase after respondents participated in a three month trial period of electric vehicles but both effects are non-significant. This issue is expected to be relevant because there are a lot of uncertainties regarding battery life and consumers may prefer more certainty for these aspects. Based on the existing results the significance of a warranty's effect remains unclear.

OBJECTIVES OF THE STUDY

The research objectives have taken an overall overview and attempt to indicate the comprehensive notion pertain to consumer preference for electric vehicles. Largely study has focused with the objectives of:

- To identify the factors affecting consumer preference for electric vehicles.
- To analyze factors and its relationship with electric vehicles.
- To assess the influence of factors of EVs on electric vehicles.

HYPOTHESES OF THE STUDY

H: Driving range, environmental friendliness, performance, policy attributes, social influences and warranty are having significant relationship with electric vehicles.

H: Electric vehicles factors namely driving range, environmental friendliness, performance, policy attributes, social influences and warranty have significantly influencing the electric vehicles.

RESEARCH METHODOLOGY

Research Methodology

The research design for this study is descriptive in nature and quantitative research methodologies are used. A structured questionnaire was used for quantitative research. A structured questionnaire was designed and was pre-tested before using as a final instrument for collecting the data, and analyzes these to make a critical evaluation of the performance.

Primary data:

The primary data were collected from the consumers of electric vehicles at Thanjavur, Thiruvarur, Tiruchirappalli and Kumbakonam in Tamilnadu, questionnaire prepared exclusively for find preference of consumers about

electric vehicles; this questionnaire contains direct questions in the Likert scale.

Secondary data:

Websites, magazines, articles were used widely as support to primary data as a secondary data source.

Sampling Design and Size:

Researchers targeted all the consumers of electric vehicles at Thanjavur, Thiruvarur, Tiruchirappalli and Kumbakonam in Tamilnadu, a detailed study comprising of all consumers is an arduous task for an individual researcher. Therefore, to keep the study within the reliable and manageable limits, **CONVENIENCE SAMPLING** was adopted. 150 questionnaires were distributed in the sample areas, in that 117 respondents was return back, and among that 110 questionnaires were found suitable for the study.

Pre Testing Procedures (Pilot Study)

Before the survey questionnaire was administered to the respondents, a pre-test of the questionnaire was conducted to test the validity of the questionnaire used for data collection 50 Questionnaires were distributed personally to the respondents, Some minor wording modifications to the questionnaire and certain changes were made which enabled the researches to plan the survey effectively and to accomplish the objectives of the study and made as a result of this process.

Reliability:

The internal consistency reliability method was used in this study to determine the reliability of the scale questions by determining the co-efficient alpha. Cronbach‘s co-efficient alpha is a measure of the internal consistency of measurement.

Overall reliability of the study is .812

ANALYSIS AND INTERPRETATION

Consumer preference on electric vehicles is most powerful promotion strategic in current Indian scenario, its

Table-1.: Consumer preference on electric vehicles

Factors	mean	Rank
Driving range	3.47	2
Environmental friendliness	3.76	1
Performance	3.20	3
Policy attributes	2.93	5
Social influences	3.05	4
Warranty	2.75	6

From the above table consumer ranked environmental friendliness (3.76), followed by driving range (3.47), performance (3.20), social influences (3.05), policy attributes (2.93) and warranty (2.75). It has been clearly stated that there are various factors that determine consumer preference, the study depicted that the respondents considered environmental friendliness as major factors building preference followed closely by driving range. However, policy attributes and warranty were comparatively considered less preferred.

Table – 2. : EVs factors and electric vehicles

Factors	Electric Vehicles	
	r-value	p-value
Driving range	0.829	0.001*
Environmental friendliness	0.826	0.001*

Performance	0.877	0.001*
Policy attributes	0.911	0.001*
Social influences	0.912	0.001*
Warranty	0.881	0.001*

H : Driving range, environmental friendliness, performance, policy attributes, social influences and warranty are having significant relationship with electric vehicles.

Table-2 portrays the relationship between driving range, environmental friendliness, performance, policy attributes, social influences and warranty and electric vehicles. In order to check the existence of any significant relationship between factors and electric vehicles. Pearson correlation test was executed. The calculated p-values are significant at one percent level for the EVs factors with the electric vehicles. Hence, it is inferred that the driving range, environmental friendliness, performance, policy attributes, social influences and warranty are having significant relationship with electric vehicles.

From the correlation values, it is noted that social influences (r = 0.912) is highly correlated with electric vehicles, followed by policy attributes and electric vehicles (r = 0.911), warranty and electric vehicles (r=0.881), performance and electric vehicles (r=0.877), driving range and electric vehicles (r=0.829) and environmental friendliness and electric vehicles (r = 0.826). It is noted that driving range, environmental friendliness, performance, and policy attributes, social influences and warranty having the significant and positive relationship with electric vehicles. However, environmental friendliness is having the least level of relationship with electric vehicles.

Table-3. Multiple regression analysis for factors and electric vehicles

Model Summary

R-value	R^2-value	Adjusted R^2 Value	F-value	P-value
0.935[a]	0.875	0.873	504.927	0.001[a]

Predictors	Unstandardized Coefficients		Standardized Coefficients	't'	p-value
	B	Std. Error	Beta		
(Constant)	11.462	1.513	-	7.575	0.001
Driving range	-0.138	0.359	-0.021	-.386	0.700
Environmental friendliness	-0.127	0.529	-0.013	-.239	0.811
Performance	4.836	0.784	0.481	6.164	0.001
Policy attributes	-1.946	0.952	-0.200	-2.043	0.042
Social influences	3.315	0.557	0.550	5.954	0.001
Warranty	1.005	0.319	0.183	3.151	0.002

H: Electric vehicles factors namely driving range, environmental friendliness, performance, policy attributes, social influences and warranty have significantly influencing the electric vehicles.

Multiple regression analysis is carried out to observe the influential effect of dependent variables on electric vehicles. Table-3 presents the regression analysis result. The adjusted R^2 value is found to be 0.873 which means that 87 percentage of the variation of electric vehicles is influenced by

independent variables. The R^2 value is also statistically significant ($F=504.927$; $p < 0.001$). Hence driving range, environmental friendliness, performance, policy attributes, social influences and warranty are the most influencing on electric vehicles.

The coefficients of each of the variables indicate the amount of change one could except in transformational leadership. It is given that for a one-unit change in the value of that variable that all other variables in the model are held constant. To compare the strength of coefficients of predictor variables the column of Beta coefficients have to be referred which is also known as standardized regression coefficients. The beta coefficients are used to compare the relative strength of the various predictors within the model. Because the beta coefficients are all measured in standard deviations, instead of the units of the variables, it can be compared to one another. In other words, the beta coefficients are the coefficients if the outcome and predictor variables were all transformed to standard scores, also called z-scores, before running the regression. In this regression, social influences have the largest beta coefficients (0.550) and policy attributes have the smallest beta (-0.200). One standard deviation increase leads to a 0.550 standard deviation increase in electric vehicles. In turn, policy attributes leads to a -0.200 standard deviation decrease in electric vehicles when other variables are constant. From the analysis, it is inferred that performance, social influences and warranty have positively influenced the electric vehicles. However, policy attributes is negatively influencing electric vehicles. But driving range and environmental friendliness are not significant with the electric vehicles.

SUGGESTIONS

Based on the study, the following suggestions are proposed.

1. Creation of Visible charging infrastructure in the urban setup. 2. Use the existing petrol bunk infrastructure effectively for battery availability. 3. Erect charging stations at malls, educational institutions through PPP/Franchise model. 4. Parking spaces to be effectively utilized as charging stations with a fee. 5. Subsidies in buying for commercial purpose to bring down payback period. 6. Target rental taxi conglomerate to use electric vehicles only from a stipulated period. 7. All vehicles in the proposed new smart cities to be electric. 8. All firms, schools and colleges providing transport services to employees to phase in electric vehicles. 9. Increase the confidence among citizens by using electric buses throughout the city. 10. Emphasize on RMA requirements (Reliability, Maintainability and Availability) 11. Cash back on return of empty battery sockets. 12. Utilize existing bounce model for battery replenishment. 13. Vehicle to grid to be realized to bring about balance during peak demand. 14. Solar energy harvesting by domestic houses to reduce the load on the grid to provide. 15. Substitute batteries to be sold for domestic purpose by anyone without taxation.

It is hoped that this study furthers the interest in researching on the consumer related issues to accelerate the switch from the conventional ICE vehicles to electric vehicles in the Indian context.

CONCLUSION

The result of the study may suggest that, during the early presentation of EVs into the standard car market, these vehicles are not being considered as alluring developments. In any case, this translation is probably going to be a distortion of an unpredictable issue, with Heffner et al. (2007) having just discovered that specific adopters of Hybrid Electric Vehicles in California did express an overall longing to grasp new innovation while others communicated

discord with being named a technophile. Thus, the exploration in this paper reverberates with other later research on EV take-up which recommends that there is more than one early adopter portion (Heffner et al., 2007; Anable et al., 2016). Every one of this adopter bunches is interesting, and obvious contrasts exist between gatherings. The exploration in this paper would recommend that imaginativeness may not be an individual trademark that has a ground-breaking enough impact on the acknowledgment choices of EVs to order potential client bunches into unmistakable and significant gatherings all alone. Notwithstanding, it does propose that the build of inborn imaginativeness, and conceivably actualized inventiveness, would be acceptable possibility to put close by other mental builds to plan onto explicit adopter classifications to permit the ID of gatherings of adopters who have particular inclined inclinations towards EV appropriation. This is significant for producers and strategy creators to center advertising and usage endeavors on those adopters who are bound to grasp the new innovation and encourage its further dispersion by filling in as courses for information, change specialist and opinion leaders.

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