

A Study on Customer Perception towards Electric Vehicle w.r.t Pune

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Abstract

Day by day air pollution level is increasing drastically and is creating various threats and difficulties to human lives. Air pollution has become one of the greatest challenges to nature and mankind in today's world. One of the main reasons for air pollution is the toxic smoke coming out of vehicles and with the increasing development in the country, metropolitan cities are the most affected ones. So, people living in these cities must be aware of the situations around them and the alternatives available to them. To overcome such a situation various initiatives have been taken up. One of them is the introduction of Electric Vehicles (EV). Across the globe, various governments are giving thrusts on the promotion of EVs. To utilize the benefits offered by an electric vehicle, it must be considered by all segments of the Society. The study is undertaken to investigate customer perception towards EVs. The research study is conducted through a descriptive research design and a questionnaire is used for data collection used for the study. Primary data is collected through a structured questionnaire. The study is conducted with a sample size of 215 respondents in the Pune region. The technique used to identify the respondent is convenient sampling.

Keywords: Consumer perception, Electric Vehicle (EV), awareness, environment, pollution.

1. Introduction

Demand for crude oil and crude oil derived fuels – petrol, diesel, kerosene, heavy oil, etc. is on the rise in India due to the pace of its development. This has increased the demand for crude oil within the country and the bill is on the rise due to the deficit between domestic production capacity and the demand for oil within the country. An additional factor is the rise in the vehicular sales which is causing for an increase in the need for crude oil in the country. These all drives enhanced demand for petroleum products. The entire automobile sector is highly oil-dependent. More than half of the nitrogen oxides in the air are emitted from transportation and are one of the major sources of global warming. Experts believe that it is now high time that we move on to some other source of energy for automobiles. Electric Vehicles are believed to be the best alternative for this issue. Governments are highly focused on this transformation in the automobile sector where efforts are being put to educate the public to shift towards Electric Vehicles. Still, we can see that sales of Electric Vehicles have not gone up as it should have been. This study is con-

ducted to find out the perception of consumers towards Electric Vehicle in a developing city like Pune where the number of automobiles on the road is also high as well as potential customers for an automobile is also on the higher side.

EVs are considered to be the best possible replacement for current automobiles which would in turn help in solving problems like increasing pollution levels, global warming, and continuous depletion of natural resources. The research endeavours to achieve the following objectives in investigating consumer attitudes towards Electric Vehicles (EVs) and their purchase intentions:

- a) To assess the connection between consumers' awareness levels regarding Electric Vehicles and their corresponding purchase intentions.
- b) To examine the array of factors influencing customers' buying behaviours when it comes to Electric Vehicles.
- c) To explore the extent to which consumers are willing to invest in purchasing an Electric Vehicle by determining their maximum affordable price range.

2. Review of Literature

Masurali. A & Surya (2018) in their study on understanding the awareness level of potential customers of Electric Vehicles (EVs) have stated that the companies which produce and sell the EVs need to understand the perceptions regarding their products held within their customers and potential customers in the markets so that they will be able to reap success while launching their new products in the markets. A product launch is always accompanied by various campaigns for the promotion of the product. Hence it is important to understand the knowledge level, the awareness about the product, and the perception towards the product to create a successful and effective campaign for the promotion of the product. Survey was conducted with the help of a questionnaire which was divided into 4 parts. Demographic factors, awareness about the benefits of electric cars, and awareness about environmentally friendly cars were studied. The study revealed that the respondents were well aware of the fact that electric vehicles emit less toxic smoke as compared to other normal vehicles, yet they had very less awareness about the high efficiency and less maintenance cost incurred by electric vehicles. There was less awareness regarding the incentive offered by the government towards the adoption of electric vehicles. Respondents were active on social media, and it was suggested that more awareness campaigns should be run on social media to catch attention towards development in the automobile industry concerning electric cars and also towards Government incentives and schemes such as FAME introduced by the government to promote Electric Vehicles. Education of the people also played an important role when it comes to creating awareness of new technologies like electric vehicles and their benefits. Findings on perception were that – people perceived that for an electric car, price, maintenance cost, and charging time are on the higher side which might not be affordable. Inference given – The fact that people pay a premium for purchasing an electric car but the maintenance cost as well as running costs are low hence making them economical should be spread through proper medium to reach the potential customers.

(Bhalla. P, Ali. I. S & Nazneen. A. (2018) have stated in their study on the commercial success and purchase intention of EVs by Indians have stated in their statement regarding purchase intention that there is no need to study the factors influencing the customer acceptance levels of EVs. They also stated that there are several other factors such as environmental issues, trust factor, cost factor, technological advancement level, infrastructure level and societal acceptance, etc. which can influence a customer's purchase decision. Further, the researchers state that the adoption of any innovation by the consumers is based on their awareness levels and perceptions regarding the innovation. The literature review of the study shows that perception towards electric vehi-

cles in different parts of the world is studied by concentrating more on the features like carbon emission technology, cost, infrastructure, and social acceptance. This paper has conducted an exploratory study placing its focus on Indian consumers accepting Electric Vehicles through analysis of factors such as – Use cases, Features, Acceptance level and Reliability level of EVs over the other internal combustion engine powered vehicles.

The analyses done after the data collection showed that -

- As concern for the environment increases in the mind of consumers the adoption rate of electric vehicles also will increase.
- Cost plays a direct role and hence manufacturers should try to reduce their variable costs and the government should offer additional support in terms of schemes or subsidies to the consumers. Relaxation on interest rates for bank loans is also an option to attract consumers.
- Comfort was found to have a direct correlation when it comes to customers' intention to buy an electric vehicle. Comfort here indicates, the product reaches a certain level of market penetration and is easily available. Here the government has no role to play. But study shows that if electric cars are comfortable enough then the customer may consider buying an electric vehicle.
- When it comes to technology, it was found that people are ready to adopt new technology but continuous innovation and updating technology is leaving the customer confused. And was concluded that changing technology was good but adoption of the same was very slow.
- With reference to infrastructure less availability of facilities plays a very negative role in customer acceptance. Infrastructure should be provided to boost customer acceptance.

It was found in the study that the electric vehicle manufacturers and the Government had to invest more efforts and resources for building trust amidst the consumers in the Indian markets in order to improve the trust levels regarding electric vehicles as the customers were found to have strong awareness about the benefits regarding electric vehicles. The study shows more focus should be given to building more infrastructure facilities, which should be technologically efficient creating an additional amount of trust in electric vehicles.

Gujarathi, P. K., Shah, V. A. and Lokhande, M. M. (2018) have conducted a detailed study and idea on Indian electric vehicle status, covering factors such as the Indian market for electric vehicles, the leading market players, the policies put forward by the government, and issues related to these policies, etc. in their efforts to understand

the Indian consumer perspectives towards electric vehicles in the country and has covered the significant efforts done by the Government of India is doing its fair share for popularizing electric vehicles in India through initiatives and programs such as the 'National Electric Mobility Mission Plan 2020' (NEMMP 2020), the 'Faster Adoption and Manufacturing of Electric Vehicles India' (FAME) to increase the number of electric vehicles on the streets in the country, by boosting growth in this industry. FAME has been connected with the Make In India initiative to act as a 'catalyst' for the adoption and growth for electric vehicles in India. The study concludes that electric vehicles will operate alongside internal combustion engine vehicles as the rise of electric mobility may not cause much dents in the demand for the conventionally fuelled vehicles in the country. Also, the researchers also stated that there is a need for the development for 'Hybrid Electric Vehicles (HEVs) and Plug-In HEVs (PHEVs) as they combine the power of electricity with the convenience of internal combustion engines giving mobility to the customers in a convenient way and increased investments, research and developed into this class of vehicles can reduce the on road prices to a level, affordable for the Indian consumers. The researchers state that electric vehicles and hybrid electric vehicles have a bright future in India, provided that they are made and sold at attractive rates and the necessary infrastructure and facilities for EVs, HEVs and PHEVs as it can convince the Indian consumers to go for this option for their mobility solutions. Incentives, attractive prices and other options by the Government and Private players can work in this direction.

Motwani, B. and Patil, A. (2019) conducted a study to identify the awareness level of people regarding electric vehicles. With the government putting in lots of effort to turn the country fully electric by 2030 with the introduction of Schemes like FAME, the study focuses on trying to understand whether consumers will accept electric vehicles wholeheartedly. The researchers also tried to identify how the consumers would respond to the pitfalls of electric vehicles and presented their findings after analysing the primary data with the R Software. 9 Independent factors related to the characteristics of electric vehicles formed the focus of this study. The researchers claimed that the model developed had 88% accuracy and hence can be used to study consumer behaviour. Also, this study could be of prime importance to those businesses that are planning to launch electric vehicles in India. The study found that mobility and recharging characteristics like charging infrastructure and battery capacity played a significant role when it comes to influencing customers buying behaviour. Similarly, RTO Norms were found to be the least significant when it comes to influencing customers buying behaviour.

Ansar, M & Monika, B. (2019) have conducted a research for capturing the views, awareness levels and

sentiments of Indian customers regarding the usage of electric vehicles as a way for maintaining a sustainable balance with the environment. The researchers collected the data from the vehicle users in the city of Bangalore and through their research sought to present the benefits of electric vehicles over conventionally fuelled vehicles. The researchers stated that electric vehicles spewed out lesser volumes of carbon monoxide compared to internal combustion vehicles which was healthier to the citizens and the environment, along with other positive factors regarding operation and usage of electric vehicles, compared to internal combustion vehicles. Demographic analyses were made based on gender, age, educational qualification, and designation of the respondents. Data was collected on the type of vehicle owned by the respondent specifying if the respondent owned a 2-wheeler or a 3-wheeler, and it was identified that Rs. 3000-5000 was spent monthly for fuel according to the type of vehicle owned by the respondent. This data helped in comparing the running cost of an electric vehicle with a fuel vehicle.

Kumar, A. R. and Padmanabhan, S. (2019) in their Study have shown that India has huge challenges when it comes to shifting from IC engines to electric vehicles. It shows the change requires a lot of planning and regular support from the government. Also, schemes like FAME should be updated regularly with the present market conditions Electric vehicles should be manufactured keeping in mind the Indian conditions. A battery ecosystem to be developed which would help organizations as well as small businesses or start-ups who are into developing efficient batteries as well as cell manufacturing for electric vehicles.

Harikumar, A., Jain, A. and Thakur, P. (2019) have reported a comprehensive analysis of the significance of electric vehicles as a solution and have described the steps and efforts taken by the Government in the popularisation of EVs and the challenges faced for the adoption of the EVs along with the solutions for the lacunae to increase the levels of adoption of such vehicles. The research reveals that the market penetration of two wheeler electric vehicles (scooters, motorcycles, etc.) is expected to be between 2 to 5 percent by the year 2025 and is expected to increase to 10 to 30 percent by 2030.

Research gap: This study focuses on the level of awareness towards electric vehicles on the purchase intention of customers. Earlier research ignored the relationship between awareness level and purchase intention. The emphasis on the prior researches into this topic area laid emphasis of the significance of electric vehicles and the shifting of the consumer's mindset regarding internal combustion engines to electric motors. This study has pointed out the relationship between a consumer's willingness to pay extra money and his purchase intention regarding electric vehicles.

3. Research problem

It has been identified that customers are getting more and more attracted to the features of a product. Also, the development of technology has helped customers to avail all the information associated with their product with just a single click on the internet. The introduction of electric vehicles has ample amount of benefits to the environment as well as the customers. Still, the rate at which individuals switch to electric vehicles is extremely low. The study of consumer buying behaviour and consumer perception has become an important one within the present day of selling because it is supported by customer satisfaction. When a customer sees or gets information about a particular product the entire process of customer perception starts and continues till an opinion about the product is built in the consumer's mind. The key to the success of an organization or a product is associated with the organization's ability to understand the expectations of a customer, their actual satisfaction, and their awareness of the product. These factors necessitated the conduction of this research as the study on the consumer perception regarding electric vehicles can catalyse new developments, innovations and changes into the automobile industry and could lead to policy making level decisions regarding the automobile sector in India with a specific emphasis on the adoption of electric vehicles in the country.

3. Research methodology

This study employs a Descriptive Research Design to comprehensively examine the attitudes and intentions of prospective customers towards Electric Vehicles (EVs) in Pune City. The target population of this research comprises individuals who are potential customers for EVs within Pune City. A sample size of 215 respondents has been selected through Convenient Sampling, considering practicality and accessibility for data collection. Both primary data and secondary data were gathered by the researchers in the course of this research. Primary data was gathered from the respondents through the form of a structured questionnaire, which was administered to the selected respondents amidst the samples by the researchers. The questionnaire administered to the respondents included questions covering various dimensions regarding consumer's awareness levels regarding electric vehicles, their purchase intentions regarding electric vehicles and the various factors which influence their buying behaviour regarding electric vehicles. The secondary data is obtained from reputable journals and magazines, which aids in validating and enriching the findings. The collected data is subjected to a range of statistical analyses to derive meaningful insights. The One-way ANOVA is employed to assess potential variations in Purchase Intention based on different levels of consumer aware-

ness. Cross-tabulation and Chi-Square tests are utilized to determine associations between categorical variables. Graphs and charts are generated to visually represent the patterns, trends, and relationships within the data, facilitating better understanding and interpretation.

Table 1: Research Methodology Description

Research Design	Descriptive Research Design
Population	Prospective Customers at Pune City
Sample Size	215 Respondents
Sampling Method	Convenient Sampling
Data Collection	Primary - Questionnaire Secondary- Journals and Magazines
Statistical Tools	One-way ANOVA, Cross-tabulation, Chi-Square Test, Graphs & Charts

5. Hypothesis statements

The research hypotheses guiding this study are as follows:

Hypothesis 1:

- **H0:** There is no significant difference in the groups of Purchase Intention based on the Awareness Factors of the customers
- **H1:** There is indeed a significant difference in the groups of Purchase Intention based on the Awareness Factors of the customers

Hypothesis 2:

- **H0:** There is no significant relationship between the levels of awareness of the various Government incentive schemes and the purchase intention of the consumers
- **H1:** A significant relationship does exist between the levels of awareness of the various Government incentive schemes and the purchase intention of the consumers

Hypothesis 3:

- **H0:** There is no significant relationship between the respondents' willingness for paying extra money for electric vehicles and their purchase intentions
- **H1:** A significant relationship does exist between the respondents' willingness for paying extra money for electric vehicles and their purchase intentions
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6. Data analysis

The data analysis section provides an interpretation of the results, contributing to a comprehensive understand-

ing of consumers' attitudes and intentions towards Electric Vehicles in Pune City.

6.1. Test of Reliability

Table 2: Reliability

Cronbach's Alpha	0.611
Number of Items	5

Interpretations:

Since Cronbach's Alpha (0.611) is greater than 0.5 it can be interpreted that the data is reliable.

6.1. Hypothesis testing

6.2.1 Hypothesis 1

- **H0:** There is no significant difference in the groups of Purchase intention based on the awareness factors of the customers
- **H1:** There is indeed a significant difference in the groups of Purchase intention based on the awareness Factors of the customers

Variables:

1. Independent Variable—Awareness factors
2. Dependent Variable—Purchase intention

Table 3: Test of Homogeneity of Variances

What are the chances your next vehicle will be an Electric Vehicle?					
Levene Statistic	df1	df2	Sig.		
0.929	11	203	0.513		

Interpretations:

Since Significance (0.513) is greater than 0.05, No violation of Levene Statistics conditions is made.

Table 4: ANOVA Table for the 1st Hypothesis

What are the chances your next vehicle will be an Electric Vehicle?					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	17.445	17	1.026	0.797	0.695
Within Groups	253.551	197	1.287		
Total	270.995	214			

Interpretations:

As observed in the ANOVA Table, the Significance value factor is greater than 0.05 (Significance value factor – 0.695). This implies that there is no statistical rela-

tion between the responses, therefore we reject the Alternate Hypothesis and accept the Null Hypothesis which states that there is no significant difference in the groups of Purchase Intention based on the Awareness Factors of the customers.

6.2.2. Hypothesis 2

- **H0:** There is no significant relationship between the levels of awareness of the various Government incentive schemes and the purchase intention of the consumers
- **H1:** A significant relationship does exist between the levels of awareness of the various Government incentive schemes and the purchase intention of the consumers

Variables:

1. Independent Variable – Awareness of Incentives/Schemes offered by the Government.
2. Dependent Variable – Purchase Intention

Analysis:

Table 5: Cross-tabulation for 2nd Hypothesis

			What are the chances your next vehicle will be an Electric Vehicle?					Total		
			1	2	3	4	5			
Are you aware of various incentives/schemes like FAME (Faster and Adopt Manufacturing of Electric Vehicle) introduced by the Government to promote Electric Vehicles?	No	Count	8	29	19	49	7	112		
		Expected Count	10.4	33.3	19.3	43.2	5.7	112.0		
	Yes	Count	12	35	18	34	4	103		
		Expected Count	9.6	30.7	17.7	39.8	5.3	103.0		
Total			Count	20	64	37	83	11	215	
			Expected Count	20.0	64.0	37.0	83.0	11.0	215.0	

Table 6: Chi-Square Tests for 2nd Hypothesis

	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	4.550 ^a	4	0.337
Likelihood Ratio	4.573	4	0.334
N of Valid Cases	215		

Interpretations:

As can be seen from the chi-square table, the Significance value (0.337) is greater than 0.05, a statistical relationship between the variables does exist, thus we reject the alternate hypothesis. We conclude that there is no significant relationship between the levels of awareness of the various schemes for incentivising purchases of electric vehicles and the purchase intention of the consumers

Table 8: Chi-Square Tests for 3rd Hypothesis

	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	23.460 ^a	12	0.024
Likelihood Ratio	25.769	12	0.012
N of Valid Cases	215		

a. 7 cells (35.0%) have an expected count of less than 5.
The minimum expected count is 0.67

6.2.3 Hypothesis 3

- **H0:** There is no significant relationship between the respondents' willingness for paying extra money for electric vehicles and their future purchase intentions
- **H1:** A significant relationship does exist between the respondents' willingness for paying extra money for electric vehicles and their future purchase intentions

Variables:

1. Independent Variable – Willingness for paying extra money for electric vehicles
2. Dependent Variable – Future purchase intentions

Analysis:

Table 7: Cross-tabulation for 3rd Hypothesis

			What are the chances your next vehicle will be an Electric Vehicle?					Total
			1	2	3	4	5	
If there is an Electric Vehicle with more or less the same functionality as a gasoline-powered vehicle, how much more are you willing to pay for it?	Not more than 10%	Count	7	36	22	37	5	107
	Expected Count		10.0	31.9	18.4	41.3	5.5	107.0
	Not more than 20%	Count	4	14	9	9	1	37
	Expected Count		3.4	11.0	6.4	14.3	1.9	37.0
	Not more than 30%	Count	2	4	3	4	0	13
	Expected Count		1.2	3.9	2.2	5.0	.7	13.0
	Won't pay a higher price	Count	7	10	3	33	5	58
	Expected Count		5.4	17.3	10.0	22.4	3.0	58.0
Total		Count	20	64	37	83	11	215
		Expected Count	20.0	64.0	37.0	83.0	11.0	215.0

Interpretations:

As observed in the Chi-Square table, the level of significance (0.024) is lesser than 0.05. This implies that there is indeed a statistical relationship between the responses and thus, we accept the alternate hypothesis and reject the null hypothesis. We conclude by stating that a significant relationship does exist between the respondents' willingness for paying extra money for electric vehicles and their future purchase intentions.

7. Findings

The findings of the study disclose insightful information about the current vehicular transportation profile and the perceptions of the prospective customers in the City of Pune regarding electric vehicles. A significant portion of respondents own 2-wheelers (59.1%), followed by 4-wheelers (28.8%) and 3-wheelers (1.4%), while 10.7% rely on public transportation due to the absence of personal vehicles. A majority of participants (67.9%) travel less than 20 km daily, with 24.7% covering distances between 20 to 40 km, and 7.4% exceeding 40 km on a daily basis. The study underscores the strong association between environmental consciousness and EVs, as nearly 96.3% of respondents believe that electric vehicles contribute to pollution control. In alignment with the first research objective, a noteworthy 88% of participants acknowledge the role of EVs in reducing global warming, and 72% recognize their cost-effectiveness in comparison to conventional vehicles. However, concerns regarding infrastructure readiness are highlighted, with 40% expressing disagreement about suitable EV infrastructure in their city, while 23.7% remain uncertain about its availability.

The findings corresponding to the second hypothesis point out that 52.1% of respondents are aware of government incentives and schemes, such as FAME, intended to promote electric vehicles. In response to the second research objective, the key drivers for consumers considering an EV purchase include its lower operational costs, environmental advantages, and performance features. Conversely, factors impeding adoption involve extended recharge times, initial purchase costs, and limited mileage range. For the third objective, the study reveals a will-

ingness among consumers to pay specific price ranges for electric vehicles. Concerning electric bikes, 71.6% are willing to invest between 0.80 Lakh to 1.0 Lakh, while 24.7% consider a range of 1.0 Lakh to 1.5 Lakh suitable. Similarly, for electric cars, 51.2% expect prices between 5 Lakh to 7 Lakh, while 37.2% consider ranges between 7 Lakh to 9 Lakh acceptable, and 11.6% are prepared to invest above 9 Lakh. The findings in this research study offer valuable insights and can assist the policymakers in formation of policy level decisions regarding the further growth and development of electric vehicles in the City of Pune which can lead to the first steps for a greener and cleaner tomorrow.

8. Conclusion

Electric vehicles are highly beneficial as it provides environmental as well as economic benefits to society and customers. The major conclusion that could be drawn from this study is that the customers are aware of various benefits provided by an EV yet the study does not find any significant relation between their awareness of various benefits and their purchase intentions. Also, the study shows that only half of the population is aware of various schemes and incentives given by the government

to promote the sales of electric vehicles.

9. Limitation and Future research scope

The present study is not without its limitations. The research was undertaken in the aftermath of the Covid-19 pandemic during the years 2021-22, which presented challenges in effectively reaching out to potential respondents due to the disruptions caused by the pandemic. This circumstance may have influenced the availability and willingness of participants to engage in the study.

In terms of future research avenues, there is a promising scope for further investigation. Future studies could delve into the exploration of customers' awareness levels concerning the diverse benefits associated with electric vehicles and how this awareness impacts their purchase intentions. Additionally, a broader research domain could scrutinize the factors contributing to the perceived inadequacy in government efforts to generate comprehensive awareness about the incentives and schemes designed to stimulate the adoption of electric vehicles. Such an investigation could shed light on the efficacy of government initiatives and strategies in promoting electric vehicle sales, offering valuable insights for policy enhancement and more effective communication strategies.

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