

## **A Study on Impact of Perceived Benefits on Customer Preference for Electric Vehicles**

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### **Abstract**

Indian roads are currently dominated by petrol and diesel cars and bikes with only one percent of the vehicles in India being an electric vehicle. Out of this, more than 90 percent of electric vehicles are low-speed electric scooters.

India majorly relies on carbon fueled combustion engines because of which there is a huge demand for petroleum and petroleum products but India is not self-sufficient when it comes to crude oil as it imports crude oil from other countries which is a huge burden on the balance of payments of the country. According to the reports it is said that almost 20% of the total imports in India are of crude oil. Keeping in mind that India is a growing economy it is making some efforts to adapt to the EV trend, and various automobile manufacturers are trying to take the advantage of the situation and are producing and marketing EV vehicles. However for the Indian market for EV seems to be having a small bump in the road due to reasons such as shortage of semiconductor chips and also lithium mineral. But the Indian government and manufacturers are ambitious. The world's leading electric car manufacturer Tesla has also launched electric cars in India. Other serious players like Tata, Hyundai, Ola, Atherenergy and a dozen Indian startups have launched their electric cars or bikes in the country. But since these EVs have low maintenance costs, they are slightly expensive. Also, besides higher prices, there are a lot of other challenges as well in the Indian EV industry, one main challenge being the complete EV infrastructure. Currently India does not have the charging infrastructure in place today. Charging points are not available in parking lots or malls parking lots or building parking lots or anywhere else. This is where the EV industry as a whole is facing a challenge. Charging points for electric vehicles need to be provided in the same way that petrol pumps and gas stations are spread across the country in every nook and corner. Charging stations are required on highways and in the city. India needs to develop a widespread charging infrastructure in both urban and rural areas. The infrastructure required to aid the EV transportation industry is not ready for the future, but the infrastructure behind the EV industry will act as a catalyst for the growth of various other industries because it comprises an EV charging station (renewable energy generation), high load grid management system, battery maintenance, and handling battery waste management ecosystem and technological aspects of an electric vehicle, roads, and manufacturing facilities. This study analyzes the various aspects which influence or hinder consumers from switching to the electric fueled vehicle from carbon fueled vehicles.

**Keywords:** *EV Infrastructure, Renewable Energy, Customer Perception, Perceived Benefits*

### **Introduction**

A new mobility error is emerging in India propelled by net zero commitment sustainability being imperative and growing concerns of climate change. Our nation is charging ahead with electric vehicles adoption to decrease carbon footprint and build asustainable transportation system. At present the road transport segment contributes about 123 million tons of carbon emissions leveraging its India's expertise through renewable energy is contributing to the creation of India's robust mobility ecosystem with its pioneering grid to plug EV charging system and a grid eMotion fleet which offers a robust charging infrastructure for large-scale EV fleets. The major market leader's innovative flash charging technology grid eMotion flash is further powering e-buses and reducing carbon emissions to enhance environmental values through social innovation. India is committed towards improving people's quality of life and furthering the government of India's initiative in ushering in a green mobility future. In the present world, thegrowing demand for fossil fuels, industrialization, civilization, global warming, and depleting fossil fuels is driving the whole world to adopt different means to power themselves. It may be in the field of transportation, steel industry basic consumable electricity, etc. Increase in carbon fuel prices as well as increased carbon footprint in thisworld have caused major problems for consumers as well as the environment in variousforms so switching to an electric fuel vehicle seems to be a better sustainable option tosave the environment and money but only with the condition that such electricity is produced through clean energy formats. India along with various other countries has taken a pledge to reduce carbon footprint, andcarbon emission to safeguard this planet earth from increasing temperatures due to these reasons. India has said that it would reduce its carbon footprint by half of its current carbon emission by the year 2030. In this research, an attempt has been made to identify the factorsaffecting the decision to purchase the electric vehicle, and study the factors that affect the customers' preference when buying an electric vehicle.

## **Review of Literature**

Debashish Raut et.al in their study titled "A case study on the perception of consumers of Bhubaneswar towardselectric vehicle" International Journal of Research Culture Society December 2020, found that in Bhubaneswar, the awareness regarding HEV needs to be improved. There are very negligible number of users of E-four wheelers. There are few numbers of two-wheeler users. It isfound from the study that if the awareness level can be improved then the attitude towards the purchase of HEV will also be improved.

In another study "A study on "consumer awareness and perceptiontowards electric vehicles in Bengaluru City", the authors found that for a new technology to be adopted, the consumer should be aware of it and perceive it to have more value than the existing technology. EV and HEV have their opportunities and obstacles, but it all comes down to usas to how the customers choose to see it.

Piyush Sharma (2020) in his study "A study of the viewpoints of average people and EV purchase intent in India" found *that* car producers and the Indian government must make greater investments to increase community acceptability of the vehicle by building more infrastructure, greater battery pack, and putting more emphasis on technology thatcan inspire customer confidence. Government should work hard to raise knowledge of EVs and affect potential customers' attitudes in a positive way.

## **Statement of the Problem**

In the present situation where the world is facing a major threat from global warming, climate change, human induced natural calamities. Electric vehicles are an innovation which is a boon to society. Fossil fuel vehicles emit lots of harmful gasses which are deadly to the environment and do not contribute to sustainable development.

If the same continues it have serious repercussions on the society and the future generation. So, the EV revolution offers a solution in the conservation of natural resources. However, the mindset of the automobile users has not adapted to this new concept. This study is an attempt to find out the perceived benefits of Electric Vehicles from the point of view of Automobile users. An attempt has been made to analyse their willingness to migrate from carbon fueled combustion engine to Electric fueled vehicles.

### **Objectives of the Study**

1. To study the impact of costs and perceived benefits on demand for Electric vehicles
2. To analyze various aspects which influence or hinder consumers from switching to the electric fueled vehicle from carbon fueled vehicles.
3. To determine the level of awareness about electric fuel vehicles and the EV Industry.
4. To determine various aspects where the government and private players should work on so as to make this EV revolution a major game changer.

### **Scope of the Study**

The outcome from this study can be used by different users to line their various services that are in line with this EV VEHICLE INDUSTRY

This research can also be enlarged to a greater extent in terms of geography, population, commercial vehicles, etc.

### **Research Methodology**

#### ***Research Design***

The study uses a descriptive research method to measure, evaluate, and analyze the study on consumer perception of switching from carbon fuel vehicles to electric fuel vehicles.

#### ***Sources of Data***

This research is predominantly based on primary data, however secondary data from past publications, journals, and websites have been used to substantiate the research findings.

#### ***Primary data:***

The Primary data for this study was collected through questionnaires and responses collected through a google form. The survey was conducted to understand various aspects of the individual sample unit's perceptions, opinions, and understanding on EVs

A sample of 250 individuals was selected through the method of purposive convenience sampling techniques which was sufficiently representative of the large diverse population so as to get a conclusive review on the EVs.

#### ***Secondary data:***

Secondary data was collected from external sources like Websites, Journals in the form of a review of the literature with references.

**Geographical location of the study:**

The Respondents are from Indians residing in India and also NRI s residing in UAE.

Statistical Techniques used:

Percentage analysis

Chi Square analysis

**Hypothesis of the Study**

Customers’ undermine the perceived benefits of Electric Vehicles and this prevents them from buying them.

**Data Analysis & Interpretation**

The data collected from a sample of 250 individuals was selected through the method of purposive convenience sampling techniques which was sufficiently representative of the large diverse population so as to get a conclusive review on the EVs. The data was subjected to statistical analysis and below is the illustration of the analysis and findings.

**Statistical Testing of Collected Data for Relevance of Data**

***Testing Relevance between Buying Preferences With Knowing More***

Buying Preference	Know more			Total
	1	2	3	
Yes	156	32	27	215
No	23	6	6	35
Total	179	38	33	250

***Testing Relevance Between Buying Preference with Fuel Price***

Buying Preference	FUEL PRICE			Total
	1	2	3	
Yes	78	55	82	215
No	9	11	15	35
Total	87	66	97	250

***Testing Relevance Between Buying Preference With Income Tax Benefit***

Buying Preference	Income Tax Benefit		Total
	1	2	
Yes	64	151	215
No	7	28	35
Total	71	179	250

**Testing Relevance Between Buying Preference With Environmental Conscious**

Buying Preference	environmental conscious			Total
	1	2	3	
Yes	168	2	45	215
No	25	3	7	35
Total	193	5	52	250

**Testing Relevance Between Buying Preference with Lower GST**

Buying Preference	Lower GST		Total
	1	2	
Yes	61	154	215
No	8	27	35
Total	69	181	250

**Testing Relevance Between Buying Preference With Lower Registration Cost Road Tax**

Buying Preference	Lower registration cost Road Tax		Total
	1	2	
Yes	168	47	215
No	27	8	35
Total	195	55	250

**Testing Relevance Between Buying Preference with Lower Insurance Premium**

Buying Preference	Lower Insurance Premium		Total
	1	2	
Yes	150	65	215
No	25	10	35
Total	175	75	250

**Testing Relevance Between Buying Preference with Lower Maintenance**

Buying Preference	Lower Maintenance		Total
	1	2	
Yes	165	50	215
No	30	5	35
Total	195	55	250

**Testing Relevance Between Buying Preference with High Financial Assistance**

Buying Preference	High Financial Assistance		Total
	1	2	
Yes	128	87	215
No	23	12	35
Total	151	99	250

**Testing Relevance Between Buying Preference with Trust Level**

Buying Preference	Trust Level					Total
	1	2	3	4	5	
Yes	5	16	55	57	82	215
No	0	1	13	6	15	35
Total	5	17	68	63	97	250

**Testing Relevance Between Buying Preference with Same Price as its Petrol Diesel**

Buying Preference	Same price as its petrol/diesel			Total
	1	2	3	
Yes	166	15	34	215
No	22	3	10	35
Total	188	18	44	250

**Table Representing Testing of Hypothesis Using Pearson Chi-Square Test**

	Pearson Chi- Square	df	Asymp. Sig. (2-sided)
Know more	0.777 <sup>a</sup>	2	0.678
Fuel price	1.528 <sup>a</sup>	2	0.046
Environmental consciousness	8.975 <sup>a</sup>	2	0.011
Income Tax Benefit	1.412 <sup>a</sup>	1	0.235
Lower GST	0.458 <sup>a</sup>	1	0.498
Lower registration cost Road Tax	0.017 <sup>a</sup>	1	0.895
Lower Insurance Premium	0.040 <sup>a</sup>	1	0.842
Lower Maintenance	1.411 <sup>a</sup>	1	0.235
High Financial Assistance	0.481 <sup>a</sup>	1	0.488
Trust Level	4.445 <sup>a</sup>	4	0.349
Same price as its petrol diesel	3.714 <sup>a</sup>	2	0.045

1. Testing Hypothesis using Pearson Chi-Square between buying preference and knowing more about electronically fuelled vehicle.

H0: There is no significant association between buying preference and knowing more about electric vehicles.

H1: There is a significant association between buying preference and knowing more about electric vehicles.

In the above table, we can see the value that was ascertained by testing those two variables under Pearson Chi-Square, as we see that the Chi-Square value is 0.777 and the significance level value or p-value is 0.678 which is more than 0.05 which is the standard significance, so we accept the null hypothesis and reject the alternative hypothesis.

So, we can strongly say that there is no significant association between buying preference and knowing more about electric vehicles.

2. Testing Hypothesis using Pearson Chi-Square between buying preference and raise fuel price for choosing the electric car

H0: There is no significant association between buying preference and Barrier for choosing the electric car.

H1: There is a significant association between buying preference and Barriers for choosing the electric car.

In the above table, we can see the value that was ascertained by testing those two variables under Pearson Chi-Square, as we see that the Chi-Square value 13.24 is and the significance level value or p-value is 0.046 which is less than the 0.05 which is the standard significance, so we reject the null hypothesis and

accept the alternative hypothesis.

So, we can strongly say that there is a significant association between buying preference and rise in fuel price.

3. Testing Hypothesis using Pearson Chi-Square between buying preference and are you environmental conscious?

H0: There is no significant association between buying preference and environmental conscious

H1: There is a significant association between buying preference and environmental conscious

In the above table, we can see the value that was ascertained by testing those two variables under Pearson Chi-Square, as we see that the Chi-Square value is 8.975 and the significance level value or p-value is 0.11 which is less than the 0.05 which is the standard significance, so we reject the null hypothesis and accept the alternative hypothesis.

So, we can strongly say that there is significant association between buying preference and knowing more about electric vehicles.

4. Testing Hypothesis using Pearson Chi-Square between buying preference and how informed are you? [Income Tax Benefit (80EEB)]

H0: There is no significant association between buying preference and how informed are you? [Income Tax Benefit (80EEB)]

H1: There is a significant association between buying preference and how informed are you? [Income Tax Benefit (80EEB)]

In the above table, we can see the value that was ascertained by testing those two variables under Pearson Chi-Square, as we see that the Chi-Square value is 1.412 and the significance level value or p-value is 0.235 which is greater than the 0.05 which is the standard significance, so we accept the null hypothesis and reject the alternative hypothesis.

So, we can strongly say that there is no significant association between buying preference and knowing more about Electric Vehicles.

5. Testing Hypothesis using Pearson Chi-Square between buying preference and how informed are you? [Lower GST (5%)]

H0: There is no significant association between buying preference and how informed are you? [Lower GST (5%)]

H1: There is a significant association between buying preference and how informed are you? [Lower GST (5%)]

In the above table, we can see the value that was ascertained by testing those two variables under Pearson Chi-Square, as we see that the Chi-Square value is 0.458 and the significance level value or p-value is 0.498 which is greater than the 0.05 which is the standard significance, so we accept the null hypothesis and reject the alternative hypothesis.



So, we can strongly say that there is no significant association between buying preference and knowing more about electric vehicles.

6. Testing Hypothesis using Pearson Chi-Square between buying preference and how informed are you? [Lower registration cost & Road Tax]

H0: There is no significant association between buying preference and how informed are you? [Lower registration cost & Road Tax]

H1: There is a significant association between buying preference and how informed are you? [Lower registration cost & Road Tax]

In the above table, we can see the value that was ascertained by testing those two variables under Pearson Chi-Square, as we see that the Chi-Square value is 0.017 and the significance level value or p-value is 0.895 which is greater than the 0.05 which is the standard significance, so we accept the null hypothesis and reject the alternative hypothesis.

So, we can strongly say that there is no significant association between buying preference and knowing more about electric vehicles.

7. Testing Hypothesis using Pearson Chi-Square between buying preference and how informed are you? [Lower Insurance Premium]

H0: There is no significant association between buying preference and how informed are you? [Lower Insurance Premium]

H1: There is a significant association between buying preference and how informed are you? [Lower Insurance Premium]

In the above table, we can see the value that was ascertained by testing those two variables under Pearson Chi-Square, as we see that the Chi-Square value is 0.040 and the significance level value or p-value is 0.842 which is greater than the 0.05 which is the standard significance, so we accept the null hypothesis and reject the alternative hypothesis.

So, we can strongly say that there is no significant association between buying preference and knowing more about electric vehicles.

8. Testing Hypothesis using Pearson Chi-Square between buying preference and how informed are you? [Lower Maintenance]

H0: There is no significant association between buying preference and how informed are you? [Lower Maintenance]

H1: There is a significant association between buying preference and how informed are you? [Lower Maintenance]

In the above table, we can see the value that was ascertained by testing those two variables under Pearson Chi-Square, as we see that the Chi-Square value is 1.411 and the significance level value or p-value is 0.235 which is greater than the 0.05 which is the standard significance, so we accept the null hypothesis and reject the alternative hypothesis.

So, we can strongly say that there is no significant association between buying preference and knowing more about electric vehicles.

9. Testing Hypothesis using Pearson Chi-Square between buying preference and how informed are you? [High Financial Assistance]

H0: There is no significant association between buying preference and how informed are you? [High Financial Assistance]

H1: There is a significant association between buying preference and how informed are you? [High Financial Assistance]

In the above table, we can see the value that was ascertained by testing those two variables under Pearson Chi-Square, as we see that the Chi-Square value is 0.481 and the significance level value or p-value is 0.488 which is greater than the 0.05 which is the standard significance, so we accept the null hypothesis and reject the alternative hypothesis.

So, we can strongly say that there is no significant association between buying preference and knowing more about electric vehicles.

10. Testing Hypothesis using Pearson Chi-Square between buying preference and What is the Trust Level on Indian EV's?

H0: There is no significant association between buying preference and What is the Trust Level on Indian EV's?

H1: There is a significant association between buying preference and What is the Trust Level on Indian EV's?

In the above table, we can see the value that was ascertained by testing those two variables under Pearson Chi-Square, as we see that the Chi-Square value is 4.445 and the significance level value or p-value is 0.349 which is greater than the 0.05 which is the standard significance, so we accept the null hypothesis and reject the alternative hypothesis.

So, we can strongly say that there is no significant association between buying preference and knowing more about electric vehicles.

11. Testing Hypothesis using Pearson Chi-Square between buying preference and if an electric car was offered to you at the same price as its petrol/diesel counterpart, would you buy it?

H0: There is no significant association between buying preference and if an electric car was offered to you at the same price as its petrol/diesel counterpart, would you buy it?

H1: There is a significant association between buying preference and if an electric car was offered to you at the same price as its petrol/diesel counterpart, would you buy it?

In the above table, we can see the value that was ascertained by testing those two variables under Pearson Chi-Square, as we see that the Chi-Square value is 3.714 and the significance level value or p-value is 0.045 which is less than the 0.05 which is the standard significance, so we reject the null hypothesis and accept the alternative hypothesis.

So, we can strongly say that there is a significant association between buying preference and knowing more about electric vehicles.

### Findings

1. The recent developments which have happened in the modern-day world like the war, covid, crippling of economies of various different countries, inflation, etc. are having an adverse effect on the global fossil fuel price.
2. This sudden and drastic increase in fossil fuel price is having an adverse effect on the lives of people because of which we see that in this report that about 85.2% of people are showing their intention to switch from carbon fuel vehicles to electric fuel vehicles.
3. When the data so collected for the purpose of this report was looked at closely, we are able to see that unlike before (that is before 2019) where people were not much aware of the EV so their behavior towards buying an EV was driven by the level of understanding on EVs and awareness about various different factors which are directly or indirectly aiding the EV sales.
4. With reference to this report we see that 85.2% of the people (213 people out of 250 people) are willing to buy an EV but this Purchase behaviour has nothing to do with various factors which were thought that are driving force to purchase decision like
  - Purchase decision is not influenced by or has nothing to do with
    - (a) Wanting to know more about electric vehicles.
    - (b) Awareness about Income Tax Benefit.
    - (c) Awareness about Lower GST Rate.
    - (d) Awareness about Lower Registration Cost / Road Tax.
    - (e) Awareness about Lower Insurance Premium.
    - (f) Awareness about Lower Maintenance.
    - (g) Awareness about High Financial Assistance
    - (h) Trust Level on Indian EV Industry
5. Now the mind of people has changed have changed and now we can observe that the people's purchasing preference is majorly influenced by the increase in fossil fuel prices, the increase in fuel price has influenced the people to think of EVs as an alternative to combustion engine vehicles.
6. We come across one more finding that the people's perception towards buying an EV is influenced by the person being environmental conscious.
7. one more finding which we can draw from this project is that the people's perception towards buying an EV is influenced by price of EV because when we tested chi square, we understood that people willingness to buy has a greater association with the price tag of the EVs.

### Conclusion

Now in present times the perception towards EV is in favor of government and corporates as the collective view of the people towards EV is that it is the best alternative to the combustion engine vehicle.

Various Uncontrollable events in the world are acting as a catalyst to drive the world towards EVs.

It is seen that this EV revolution would be a success if and only if the energy drawn for the revolution is from a clean energy source.

People are becoming aware of the climate change, and it seems like they are cautious about it.

People who have purchased as well as yet to purchase the EV are very traumatized by the concept of Range Anxiety.

With reference to the interaction with the expert in this EV field he addressed a concept of battery swap technology to eradicate range anxiety.

### **Suggestions**

The government should cash in this opportunity where the people are willing to purchase the EV even though there is not much awareness, by providing subsidies to people who purchase EVs.

Government should strengthen the combustion engine vehicle scrappage policy to fuel this EV revolution.

To reduce or eradicate the range anxiety government as well as corporate should work together to create a network of charging stations across the country.

As lithium-ion batteries are used in the EVs those are very harmful to the environment so government as well as corporates should work together to set up a research facility to find out the best way to dispose off as well as recycle these lithium-ion batteries.

Presently the grids in India are not capable of handling this EV revolution because the grids can't take a high load at once.

This EV revolution would be a major success if and only if the energy generated to fuel this EV is produced from a clean energy source.

Whenever there is a discussion on viable and possible solutions for range anxiety there comes a concept of battery swap so the government and corporates should develop this battery swapping technology.

As the EV needs more of technology integration it requires a huge number of semiconductor chips, as we can see a global shortage of semiconductor chips the government should try to solve this problem as soon as possible.

The car manufactures should find some ways to reduce the cost of manufacture of EVs and also bring out more variants for capturing different demography as well as diversified interest people.

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