

A Study to Examine Consumer Adaptation Towards EV

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Abstract

The first electric vehicle, or EV for short, appeared in 1828. Electric vehicles, on the other hand, have just recently experienced a surge in popularity. A variety of factors, including heightened awareness of climate change, technological breakthroughs, and the ascent of well-known figures in the electric car business; have contributed to the recent expansion of the electric vehicle. It is of great importance for whole world to switch from non-renewable energy vehicles to clean energy for transportation. Electric vehicle is the major fillip on that, and the research divisions of various automobiles are experimenting with the viability of hydrogen vehicles and it yet to be found feasible. In this study, we are attempting to comprehend the most crucial elements in customer adoption of electric vehicle technology, and how those factors of performance, cost and charging infrastructure, negatively affect consumers to buy electric vehicles. A quantitative study is been exercised using structured and standard questionnaire, using Statistical software package (SPSS). The study identified a number of variables that affect the adoption of electric vehicles, including financial limits, vehicle performance constraints, a lack of equipment for supplying electric vehicles, environmental concerns, societal influence, and social awareness of electric vehicles. The study's findings assist policymakers in changing the present approach to electric vehicles in developing countries.

Keywords: Consumer Intentions; Electric vehicle; Consumer adoptions; Charging infrastructure; Performance barrier; Financial barrier and Incentives.

INTRODUCTION

Issues related to climate change and its effects have risen to the top of political agendas everywhere. One of the greenhouse gases, carbon dioxide, has had a tremendous impact on our environment,

reducing water supplies, increasing coastal floods, and increasing famine. Consumers have been adopting green practises to improve air quality by reducing greenhouse gas (GHG) emissions due to the growing awareness of environmental concerns in light of climatic changes and global warming. Private automobiles are responsible for about 12% of the global greenhouse gas emissions. The transportation industry as a whole is responsible for about 22% of the total GHG emissions. The amount of work being done to cut harmful emissions from this industry is increasing quickly.¹

Due to resource scarcity and climate change, the automotive industry has started to reevaluate traditional modes of transportation. The transition

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from internal combustion engines (ICE) to electric vehicles (EVs) is one such move that is gaining support among customers.²

The resurgence of electric vehicles on the market is a result of factors like improved battery technology and government regulations to uphold standards for vehicle efficiency and air quality. In order to reduce greenhouse gas emissions, local air pollution, and traffic noise pollution, electric vehicles are an important technology.^{3,4} Because of these advantages, nations all over the world have established targets for EV adoption.⁵

Internal combustion engine cars (ICEVs) and electric vehicles (EVs) are compared. It is found that EVs offer significant environmental and financial benefits by switching from fossil fuels to electricity.^{6,7} Electricity, a clean fuel, is employed as the vehicle's propulsion system in electric vehicles, and it drives a large battery. The EVs must be plugged into an electrical source to be recharged due to their limited energy storage capacity. Plug-in hybrid electric vehicles (PHEVs), battery electric vehicles (BEVs), extended range battery electric vehicles (E-REVs), and hybrid electric vehicles are some of the numerous types of EVs that can be categorised based on the technology they utilise (HEVs).

Despite the fact that EVs are environmentally friendly and have positive effects on the environment, there are a number of obstacles that restrict customers from embracing and using them. While much work has gone into improving the technology utilised in electric vehicles, little thought has been given to the variables influencing consumer acceptability of this technology.⁸ The majority of consumers continue to view electric vehicles as inferior to conventional cars.

However, without customer adoption, there won't be a technological advancement or long-term viability of sustainable transportation systems.⁹ Therefore, it is crucial to comprehend consumer perceptions of electric vehicles as well as potential drivers of and obstacles to consumer adoption of electric vehicle technology. By comprehending the impact the elements have on consumers' intentions to purchase electric vehicles; this would further enable improved promotion of the adoption of electric vehicles.

High levels of environmental advantages provided by EVs depend heavily on customer uptake and a good grasp of the driving forces behind their commercial adoption. Economic, technological, political, social, and environmental variables are a

few of the previously noted factors. Anxiety over driving range, charging times, price sensitivity, a lack of infrastructure (such as charging stations), individual traits, governmental regulations, demography, and environmental concerns.¹⁰

Government initiative towards use of Electric Vehicles

Government continues to promote the usage of electric vehicles because they are more affordable in the long term and environmentally good. For a very long time, electric power has been used to power numerous trains, including metros. Trains operated by Indian Railways are virtually entirely powered by electricity presently.¹¹ There are already electric vehicles including bikes, cars, and rickshaws available. The use of traditional petrol and diesel automobiles should be replaced with electric vehicles more often now. A campaign to encourage the adoption of electric vehicles has been launched by the government. Additionally, the government offers some tax credits and subsidies for buying electric cars. The recent "Switch Delhi" initiative by the Delhi government to encourage the adoption of electric vehicles.

Government Arrangements and Motivations for Electric Vehicles in India

The Indian government is never giving up on its goal of becoming India a global leader in the EV industry. The government has launched a few initiatives and programmes to increase demand for electric vehicles and to encourage manufacturers to invest in the R & D of electric vehicles and related infrastructure.^{12,13}

The FAME-II, PLI Conspire, Battery Swapping Approach, Extraordinary Electric Versatility Zone, and Assess Lessening on EVs initiatives have all been driven by the Indian government.

Obligation Lessening on Electric Vehicles

The budget includes a proposal to reduce historical requirements on nickel metal and concentrates from 5% to 0%, nickel oxide from 10% to 0%, and ferronickel from 15% to 2.5%. In the lithium-ion batteries used in electric vehicles, nickel manganese cobalt (NMC) may play a vital role (EVs)¹⁴. India has limited reserves of these metals, and battery production is greatly dependent on them.

Extraordinary E-mobility Zone

The government intends to create dedicated zones with adaptability for electric vehicles. Electric or

equivalent cars will be permitted to operate under the zone's special management.¹⁵

OBJECTIVES OF THE STUDY

- To be aware of and comprehend the public's degree of awareness regarding electric automobiles.
- To gauge public awareness of the current government initiatives promoting the expansion of electric vehicles.
- To determine whether respondents would be willing to buy an electric vehicle.
- To understand how the general public feels about owning an electric vehicle.
- To gain knowledge of the advantages those electric vehicles might have for the environment.

NEED OF THE STUDY

One of the most important poisons mentioned is the harmful emissions from internal combustion engines. Electric vehicles (EVs) are being aggressively promoted around the world in an effort to reduce the effects of fossil fuel emissions and address environmental concerns (ECS). Different governments are encouraging people to switch to electric vehicles by providing incentives for doing so. Studies from the past indicate that the high cost of electric cars, the lack of charging stations, the long wait times, and prolonged unease are all barriers to consumer choice. By 2030, the Indian government wants "only electric vehicles" on the roads. This cutting edge study examines the general perception and distinctive factors that affect a consumer's decision to buy an EV.

METHODOLOGY:

Research refers to search for knowledge. It is a systematic method of collecting and recording the facts in the form of data relevant to the formulated problem and arriving a certain conclusion over the problem based on collected data.

RESEARCH DESIGN

To draw conclusions and recommendations from the study that are significant, a thorough research investigation is required. As a result, the descriptive approach should be used in research designs. Employee attitudes are independent factors in

this situation, while performance evaluation is the dependent variable.

We conducted convenience sampling; samples are gathered from respondents at the time and place that is most convenient for the researcher. Convenience Sampling was the sampling technique we employed for this investigation. There were 135 responders in the sample, which is large.

DATA ANALYSIS AND INTERPRETATION

Particulars	Frequency	Percent
25 and younger	109	73.6%
26-30	12	8.1%
31-40	5	3.4%
51 or older	9	6.1%
Total	135	100.0

Table Showing the Age of the Respondents

From the table it is clear that 73.6% of respondents are below the age of 25 and younger. 8.1% of respondents are of the age of 26-30 years of old. 3.4% of respondents are of the age of 31-40 years of age. 6.1% of respondents are of the age of above 51.

Particulars	Frequency	Percentage
High School	5	3.4%
Bachelor's Degree	72	48.6%
Master's Degree	54	46.5%
Phd	4	2.7%
Total	135	100%

Table Showing the Education Level of the Respondents

From the table it is clear that 3.4% of respondents are High School students. 48.6% of respondents are Under Graduates. 46.5% of the respondents have done their Master's Degree and 2.7% of the respondents are doing their PhD.

Particulars	Frequency	Percentage
Less Than 1 Lakh	38	28.7%
2 Lac - 3 Lac	35	23.6%
4 Lac - 5 Lac	24	16.2%
Above 10 Lacs	24	16.2%
Total	121	89.6%

Table Showing Approximate Yearly Income of The Respondents

From the table it is clear that 28.7% of the respondents have responded with Less than one lakh, 23.6% of the respondents chose two to three

lakhs, . 16.2% of the respondents chose the category of four to five lakhs and 16.2% of the respondents above ten lakhs.

Particulars	Frequency	Percentage
Strongly Disagree	5	3.4%
Disagree	26	17.6%
Neutral	54	36.5%
Agree	43	29.1%
Strongly Agree	7	4.7%
Total	84	100%

Table Showing Financial Incentives [I Know A Lot About The Government Policy Of Electric Vehicles]

From the table it is clear that 3.4% of the respondents Strongly Disagree. 17.6% of the respondents Disagree. 36.5% of the respondents chose Neutral. 29.1% of the respondents Agree. 4.7% of the respondents for Strongly Agree.

Particulars	Frequency	Percentage
Strongly Disagree	34	23.0
Disagree	35	23.6
Neutral	26	17.6
Agree	32	21.6
Strongly Agree	8	5.4
Total	135	91.2

Table Showing Charging Initiatives (There are enough charging stations in my neighborhood).

From the table it is clear 23.0% of the respondents opted Strongly Disagree. 23.6% of respondents opted Disagree. 17.6% of respondents opted Neutral. 21.6% of the respondents opted Agree. 5.4% of the respondents opted Strongly Agree.

Particulars	Frequency	Percentage
Strongly Disagree	12	8.1
Disagree	22	14.9
Neutral	54	36.5
Agree	34	23.0
Strongly Agree	13	8.8
Total	135	91.2

Table showing Social Reinforcement (Other people are positively impressed that I drive electric vehicle).

From the table it is clear 8.1% of the respondents opted Strongly Disagree. 14.9% of respondents opted Disagree. 36.5% of respondents opted Neutral. 23.0% of the respondents opted Agree. 8.8% of the respondents opted Strongly Agree.

Particulars	Frequency	Percentage
Strongly Disagree	12	8.1
Disagree	9	6.1
Neutral	34	23.0
Agree	74	50.0
Strongly Agree	6	4.1
Total	135	91.2

Table Showing Environmental Concern [I think that electric vehicles are helpful for environmental protection.]

From the table it is clear 8.1% of the respondents opted Strongly Disagree. 6.1% of respondents opted Disagree. 23.0% of respondents opted Neutral. 50.0% of the respondents opted Agree. 4.1% of the respondents opted Strongly Agree.

Particulars	Frequency	Percentage
Stronglydisagree	13	8.8
Disagree	19	12.8
Neutral	55	37.2
Agree	42	28.4
Strongly Agree	6	4.1
Total	135	91.2

Table Showing Price (I can afford an electric vehicle).

From the table it is clear that 8.8% of the respondents opted Strongly Disagree. 12.8% of respondents opted Disagree. 37.2% of respondents opted Neutral. 28.4% of the respondents opted Agree. 4.1% of the respondents opted Strongly Agree

Particulars	Frequency	Percentage
Strongly Disagree	10	6.8
Disagree	15	10.1
Neutral	43	29.1
Agree	63	42.6
Strongly Agree	4	2.7
Total	135	91.2

Table Showing Willingness To Buy / Adopt (I am willing to buy an electric vehicle).

From the table it is clear that 6.8% of the respondents opted Strongly Disagree. 10.1% of respondents opted Disagree. 29.1% of respondents opted Neutral. 42.6% of the respondents opted Agree. 2.7% of the respondents opted Strongly Agree.

Particulars	Frequency	Percentage
Strongly Disagree	9	6.1
Disagree	9	6.1
Neutral	51	34.5
Agree	54	36.5
Strongly Disagree	12	8.1
Total	135	91.2

Table Showing Attitude

(I am favourably inclined to switch to an electric vehicle)

From the table it is clear that 6.1% of the respondents opted Strongly Disagree. 6.1% of the respondents opted Disagree. 34.5% of the respondents opted Neutral. 36.5% of the respondents opted Agree. 8.1% of respondents opted Strongly Agree.

Statistical Analysis

Reliability Analysis:

Reliability Statistics	
Cronbach's Alpha	N of Items
.806	29

The cronbach's alpha coefficient for 29 items is 0.806 suggesting that the items have high level of internal consistency.

Oneway Anova-1

Null Hypothesis (H_0): there is no significance difference between the gender and financial incentives which support electric vehicles.

Alternate Hypothesis (H_1): There is significance difference between the gender and financial incentives which support electric vehicles.

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
1. Financial Incentives (I know a lot about the government policy of electric vehicles)	Between Groups	4.151	3	1.384	1.654	.180
	Within Groups	109.582	131	.837		
	Total	113.733	134	-	-	-
2. Financial Incentives (I am with the financial incentives provided to buy electric vehicles)	Between Groups	8.683	3	2.894	3.081	.030
	Within Groups	123.050	131	.939		
	Total	131.733	134	-	-	-
3. Financial Incentives (The financial incentives of the Indian Government are a positive influence to develop electric vehicles)	Between Groups	3.105	3	1.035	1.163	.327
	Within Groups	116.628	131	.890		
	Total	119.733	134	-	-	-
4. Financial Incentives (I think the government financial incentives of Electric Vehicles are easy to understand)	Between Groups	1.390	3	.463	.478	.698
	Within Groups	126.936	131	.969		
	Total	128.326	134	-	-	-
5. Financial Incentives (Government policies make me think that electric vehicles are the trend in the future)	Between Groups	1.635	3	.545	.456	.714
	Within Groups	156.691	131	1.196		
	Total	158.326	134	-	-	-

Since the p value is greater than 0.05. Hence accept Null Hypothesis. There is no significance difference between the age and financial incentives which support electric vehicles.

One Way Anova-2

Null Hypothesis (H_0): There is no significance

relationship between gender and charging initiatives that support electric vehicles.

Alternate Hypothesis (H_1): There is significance relationship between gender and charging initiatives that support electric vehicles.

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
1. Charging Initiatives (I have the possibility/ room to install a charging station at home)	Between Groups	13.604	3	4.535	3.300	.022
	Within Groups	179.996	131	1.374	-	-
	Total	193.600	134	-	-	-
2. Charging Initiatives (I can charge my car at my workplace)	Between Groups	4.767	3	1.589	1.201	.312
	Within Groups	173.336	131	1.323	-	-
	Total	178.104	134	-	-	-

3. Charging Initiatives (There are enough charging stations in my neighborhood).	Between Groups	3.727	3	1.242	.779	.508
	Within Groups	208.866	131	1.594	-	-
	Total	212.593	134	-	-	-
4. Charging Initiatives (I am satisfied with current situation of public charging-points in India).	Between Groups	7.239	3	2.413	1.561	.202
	Within Groups	202.495	131	1.546	-	-
	Total	209.733	134	-	-	-

Since the p value is more than 0.05. Accept null hypothesis because the significance value is of 0.01. There is significance relationship between gender and the motivation and job satisfaction of the employee.

Independent Sample T-Test:

Null Hypothesis (Ho): There is no significant relationship between age and social reinforcement that support electric vehicles.

Alternate Hypothesis (H₁): There is significant relationship between age and social reinforcement that support electric vehicles.

		t-test for Equality of Means		
		df	Sig. (2-tailed)	Mean Difference
1. Social Reinforcement (Other people are positively impressed that I drive electric vehicle)	Equal variances assumed	133	.262	-.2232
	Equal variances not assumed	102.132	.223	-.2232
2. Social Reinforcement (Driving an electric vehicle improves my image in society)	Equal variances assumed	133	.163	-.2824
	Equal variances not assumed	89.224	.150	-.2824
3. Social Reinforcement (I feel proud when I am driving an electric vehicle)	Equal variances assumed	133	.316	-.1936
	Equal variances not assumed	90.704	.298	-.1936
4. Social Reinforcement (I am perceived as a rich person when I am driving an electric vehicle)	Equal variances assumed	133	.498	-.1416
	Equal variances not assumed	79.803	.504	-.1416
5. Social Reinforcement (I am perceived as a person with high sense of Fashion when I am driving an electric vehicle)	Equal variances assumed	133	.298	-.2315
	Equal variances not assumed	85.938	.290	-.2315

Since the p value is more than 0.05. There is no significant relationship between age and social reinforcement that support electric vehicles.

SUGGESTIONS

- In my opinion, the general public has to be informed about the advantages of owning or using an electric vehicle. This study sought to understand the public's perspective of electric vehicles, the factors that influence their purchase, their growth through time, and their beneficial effects on the environment.
- I believe that we need to be more environmentally conscious, socially responsible, and knowledgeable about the advantages of using electric vehicles.
- The upfront cost of vehicles could be a significant barrier for purchasers, but producers are seeing improvements in energy efficiency that will help to lower these prices.

Every nation needs to make sure that it supports the development of electric vehicles because doing so will make them more modern and advanced, which will benefit the economy of the country in the near future. In our country, there aren't nearly enough charging stations, which is a huge setback for those who already possess electric vehicles, according to around 23.6% of respondents. To achieve higher vehicle quality, electric vehicle makers and manufacturers must:

Superior car quality will increase sales.

Significantly superior automobiles ensure customer trust.

CONCLUSIONS

Electric car development and current adoption have been fraught with difficulties and roadblocks. Countries' perspectives on how to deal with the transition away from traditional oil fired cars have altered because to global concern over preventing the harmful impacts of vehicle emissions and

climate intolerance. As a result of global oil shortages and rising prices, many nations are already preparing for the usage of electric vehicles. Numerous e-vehicle related onroad scenarios and conditions are being researched, and numerous technical and theoretical solutions are constantly being advanced.

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