Customer Perception and Purchase Behaviour on Electric Vehicles in India- A Study on Selected Cities

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Abstract: This study examines customer perception and purchase behaviour towards EVs in selected Indian cities, with a focus on understanding the factors influencing adoption. A descriptive study approach was used to gather primary data from 547 participants, ranging in age from 24 to 40, using a structured questionnaire. Secondary sources, such journals and papers, were also consulted. Descriptional statistics, t-tests, analysis of variance, chi-square tests, and regression analysis were some of the instruments employed by statisticians to investigate the hypotheses. Despite customers' favourable impressions of electric vehicles—especially when it comes to their potential good impact on the environment, sustainability, and technical progress—the results show that this impression does not transfer into actual purchases. When it comes to making a purchase, factors like pricing, charging infrastructure, government subsidies, and brand recognition are still quite important. The study highlights the gap between awareness and actual adoption, offering insights for policymakers and manufacturers to strengthen strategies that encourage wider acceptance of electric vehicles in India.

Keywords: Customer Perception, EVs, Purchase Behaviour, India, Regression Analysis.

1. INTRODUCTION

Vehicles that use electric motors and are propelled by batteries, fuel cells, or external charging systems are known as electric vehicles (EVs). They are capable of running on their own electricity, whether that's from charging stations, gasoline conversion devices, or solar panels. Electric propulsion is being investigated for application in several forms of transportation, not limited to automobiles. owing to their less noise and easier mechanics, electric cars (EVs) were an early competitor to gasoline vehicles. However, in the end, internal combustion engines (ICEs) were more popular owing to their longer range and better infrastructure for refueling. With the 3rd largest road network in the world, 60% of India's population uses roads for transportation, which is a major cause of air pollution and climate change [1].

Improvements in battery technology, stronger government restrictions, and the need to decrease air pollution are propelling the rising demand for electric vehicles [2]. Electric cars provide a potential alternative to traditional vehicles in terms of their impact on the environment because to their reduced reliance on fossil fuels, cheaper running costs, and reduced number of moving parts. They contribute to solving problems like pollution, climate change, and resource depletion while producing almost no emissions from their tailpipes [3][4].

There is a pressing demand for environmentally friendly modes of transportation in India due to the country's growing fuel costs and heavy traffic. To hasten the adoption of electric vehicles, improve fuel security, and encourage environmentally friendly transportation, the government has launched programs including the NEMMP- 2020 [5][6]. Because attitudes, knowledge, and perceived advantages greatly impact the readiness to transition from conventional cars, it is vital to understand customer perception and buying behavior in order to promote adoption [7][8]. Strategies for greater EV adoption may be informed by this research, which focuses on customer perception and buying behavior in selected Indian cities.

2. OBJECTIVES

- To find out the customer perception towards electronic vehicles.
- To find out the purchase behaviour towards electronic vehicles.

3. HYPOTHESIS

- **HO1:** There is no significant effect of customer perception on electric vehicles.
- **HA1:** There is a significant effect of customer perception on electric vehicles.
- **HO2:** There is no significant effect of purchase behaviour on electric vehicles.
- **HA2:** There is a significant effect of purchase behaviour on electric vehicles.

4. METHODOLOGY

4.1 Research Design

The study defines and analyses electric vehicle buyer attitude and behaviour using a descriptive research technique. The study's predetermined goals and hypotheses make the

descriptive research design appropriate. The study is well-organized and pre-planned, using pre-established techniques and samples for data collection and analysis. Primary observations and theoretical knowledge from the body of existing literature form the basis of the investigation, which is then followed by data collecting and hypothesis testing.

4.2 Data Collection

- **Primary Data:** Using a standardised questionnaire, primary data was gathered from respondents in designated cities. The poll was out to collect data on people's attitudes and purchasing habits about electric automobiles. Online surveys were conducted using Google Forms.
- Secondary Data: Secondary data on consumer perceptions and purchasing patterns of electric cars were gathered from both public and unpublished sources, including journals, research papers, articles, reports, and internet resources.

4.3 Sample Design

The research used a non-probability sampling approach known as a convenience sampling strategy. Their availability and eagerness to take part in the survey were the deciding factors in their selection as respondents. Customers between the ages of 24 and 40 were the only ones included in the survey because of budget and time restrictions. The sample size of the study was 547 participants.

4.4 Research Instrument

The study tool used was a structured questionnaire. To guarantee participant comprehension and correct answers, the questionnaire was created in a straightforward and uncomplicated manner. The questions were designed to focus on broad areas of consumer attitudes and purchasing patterns regarding electric automobiles.

4.5 Analysis Tools

In order to analyse the data according to the study's requirements, descriptive statistics tools and advanced research statistical techniques were used.

1. Chi-Square Test

Using the following formula, the test was used to see if there was a connection between the two methods of classifying respondents:

$$\chi 2 = \sum \frac{(O-E)2}{O}$$

The statistical metric used to determine whether there is a significant discrepancy between the predicted and actual frequencies is X^2, which stands for chi-square value. The values that would be predicted in the absence of any relationship between the variables are denoted by E (predicted Frequency), while O (Observed Frequency) denotes the actual values that were acquired from the data. To get the final Chi-square statistic, the computed values across all categories are added together, as shown by the symbol $\sum$ (summation).

2. Analysis of Variance

We used ANOVA to analyze three age groups' means simultaneously, rather than just two. The purpose of this was to compare a parameter across three age groups of children.

$$F = \frac{MST}{MSE}$$

The test statistic used in analysis of variance to ascertain whether there are notable disparities among the means of the groups is F, which stands for analysis of variance coefficient. With MST, we can see how much of the observed variation is attributable to the treatment or independent variable, and with MSE, we can see how much of the observed variation is attributable to random error or other unexplained variables.

3. Regression Analysis

"To evaluate the effect of several independent variables on a single dependent variable, log-linear and multiple regression analysis were used. The algebraic version of the regression equations is given by:

Linear Regression Model

$$Y = a + b_1x_1 + b_2x_2 + b_3x_3 + \ldots + b_nx_n + \mu$$

Log–Linear Regression Model

$$\ln Y = a + b_1 \ln x_1 + b_2 \ln x_2 + b_3 \ln x_3 + \ldots + b_n \ln x_n + \mu$$

Here, Y represents the dependent variable of the study, while x_1 to x_n denote the independent variables included in the model. b_1 to b_n are the regression coefficients associated with each independent variable, indicating the magnitude and direction of their influence on Y. The term a refers to the constant or intercept of the regression equation, and μ represents the random error term capturing the effect of unobserved factors. The linear functional form was adopted for the study considering a higher value of R^2, the economic significance of the explanatory variables, and the logical relevance of the selected factors."

5. RESULTS

Table 1: The demographic profile of the respondent

Variables	Category	Frequency	(%)	Cumulative (%)
Age group	18-24	85	15.5	15.5
	25-34	58	10.6	26.1
	35-44	83	15.2	41.3
	45-54	93	17.0	58.3
	55-64	70	12.8	71.1
	65 or older	77	14.1	85.2
	Under 18	81	14.8	100.0
Gender	Female	150	27.4	27.4
	Male	143	26.1	53.6
	Non-binary	127	23.2	76.8
	Prefer not to say	127	23.2	100.0
Education	Bachelor's degree	65	11.9	11.9

	Doctoral degree	91	16.6	28.5
	High school graduate	63	11.5	40.0
	Less than high school	76	13.9	53.9
	Master's degree	86	15.7	69.7
	Other	89	16.3	85.9
	Some college	77	14.1	100.0
Employment Status	Employed part-time	67	15.2	28.0
	Employed full-time	86	12.7	15.7
	Other	71	13.0	41.0
	Retired	79	14.4	55.4
	Self-employed	84	15.4	70.7
	Student	78	14.3	85.0
	Unemployed	82	15.0	100.0
Annual Household Income	$100,000 or more	94	17.2	17.2
	$20,000-$39,999	79	14.4	31.6
	$40,000-$59,999	81	14.8	46.4
	$60,000-$79,999	107	19.6	66.0
	$80,000-$99,999	102	18.6	84.6
	Less than $20,000	84	15.4	100.0
Marital Status	Divorced	100	18.3	18.3
	In a relationship	97	17.7	36.0
	Married	87	15.9	51.9
	Prefer not to say	85	15.5	67.5
	Single	89	16.3	83.7
	Widowed	89	16.3	100.0
Current Living Situation	Living alone	107	19.6	19.6
	Living with parents	98	17.9	37.5
	Living with roommates	118	21.6	59.0

	Living with spouse/partner	114	20.8	79.9
	Other	110	20.1	100.0
Occupation	Clerical/Administrative	83	15.2	15.2
	Other	77	14.1	29.3
	Professional/Managerial	82	15.0	44.2
	Retired	64	11.7	55.9
	Service worker	69	12.6	68.6
	Skilled worker/Technician	95	17.4	85.9
	Student	77	14.1	100.0
Place of Residence	Rural	185	33.8	33.8
	Suburban	182	33.3	67.1
	Urban	180	32.9	100.0
Numbers of Vehicles Own	None	124	22.7	22.7
	One	133	24.3	47.0
	Three or more	137	25.0	72.0
	Two	153	28.0	100.0

The table provides a summary of the respondent demographics, including age, gender, education, income, profession, and residence. This diverse profile offers a representative sample, which is essential for researching customer attitudes and behavior regarding electric vehicles.

Table 2: Customer Perception towards Electric Vehicles

Statement	Response Category	Frequency	(%)
Electric vehicles are better for the environment than traditional vehicles	Strongly Agree	98	17.9
	Agree	114	20.8
	Neutral	127	23.2

	Disagree	108	19.7
	Strongly Disagree	100	18.3
Electric vehicles are a sustainable solution for future transportation	Strongly Agree	98	17.9
	Agree	123	22.5
	Neutral	121	22.1
	Disagree	107	19.6
	Strongly Disagree	98	17.9
Electric vehicles offer the same or better performance than conventional vehicles	Strongly Agree	96	17.6
	Agree	127	23.2
	Neutral	125	22.9
	Disagree	99	18.1
	Strongly Disagree	100	18.3
Electric vehicles help in reducing air pollution and improving air quality	Strongly Agree	98	17.9
	Agree	110	20.1
	Neutral	124	22.7
	Disagree	113	20.7
	Strongly Disagree	102	18.6
Electric vehicles are technologically advanced and innovative	Strongly Agree	94	17.2
	Agree	92	16.8
	Neutral	124	22.7
	Disagree	132	24.1
	Strongly Disagree	105	19.2
Electric vehicles are a good long-term investment	Strongly Agree	95	17.4
	Agree	104	19.0
	Neutral	126	23.0

	Disagree	116	21.2
	Strongly Disagree	106	19.4

Source: Primary data, SPSS output (N = 547)

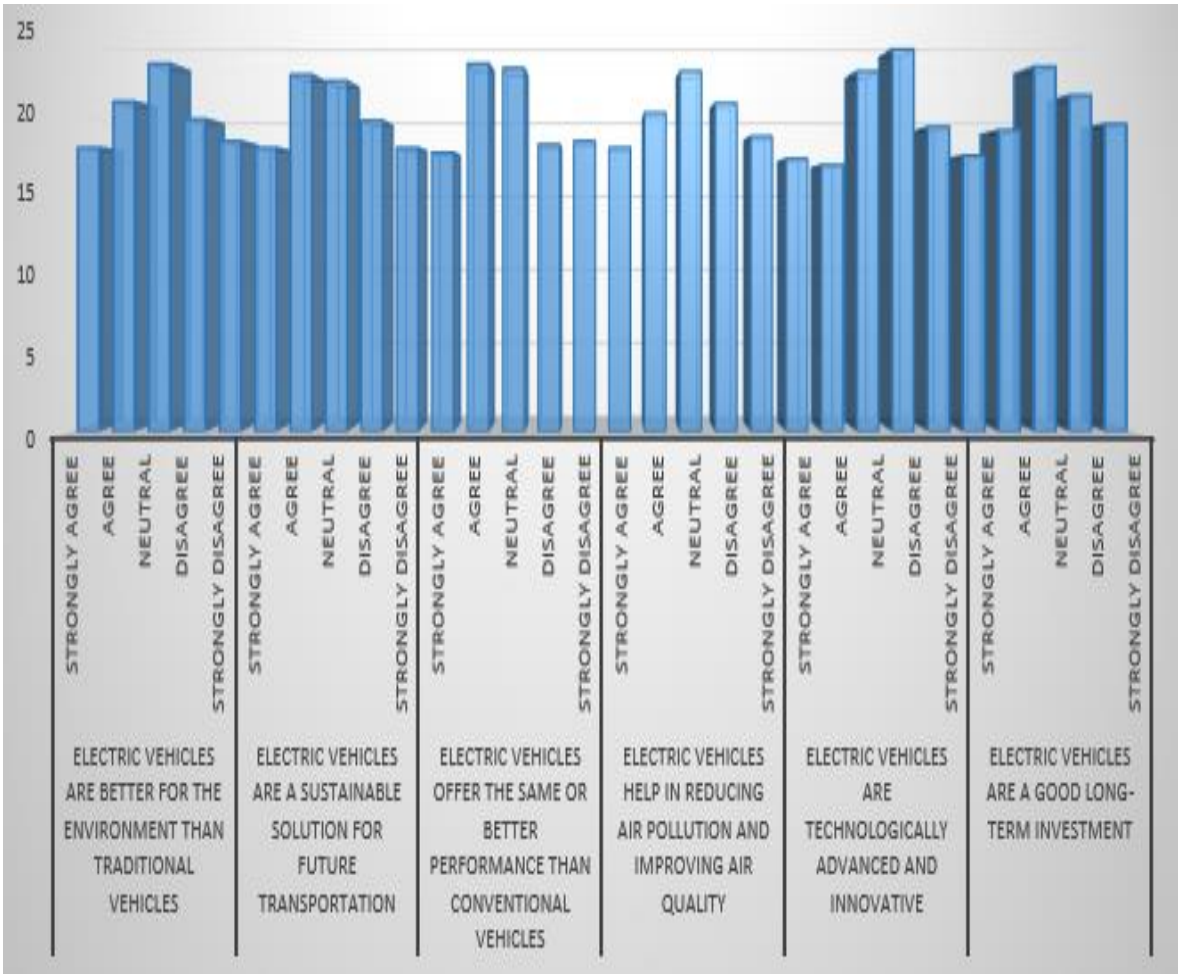

Figure 1: Customer Perception towards Electric Vehicles

The table shows how people think electric cars are doing in terms of environmental impact, performance, sustainability, and technical progress. The findings show that customers have a divided but overall favorable impression.

Table 3: Reliability Statistics (Customer Perception)

Cronbach's Alpha	N of Items
.893	52

The dependability of the customer impression scale is shown by a Cronbach's Alpha score of 0.893, as seen in the table. This shows that the measurement objects are quite reliable and consistent with one another.

Table 4: ANOVA Results for Customer Perception towards Electric Vehicles

		Sum of Squares	df	Mean Square	F	Sig.
I believe that the public perception of electric vehicles is largely positive.	Between Groups	4.751	6	.792	.385	.888
	Within Groups	1109.516	540	2.055		
	Total	1114.267	546			
I think electric vehicles will eventually become more popular than gasoline-powered cars.	Between Groups	4.890	6	.815	.421	.865
	Within Groups	1046.517	540	1.938		
	Total	1051.408	546			
I perceive electric vehicles as technologically advanced and innovative.	Between Groups	9.427	6	1.571	.845	.536
	Within Groups	1004.309	540	1.860		
	Total	1013.737	546			

The table presents the ANOVA findings used to assess variations in customer impression. The negligible p-values indicate a lack of substantial variance across groups, resulting in the acceptance of the null hypothesis (H_{01}).

Table 5: Purchase Behaviour towards Electric Vehicles

Statement	Response Category	Frequency	Percentage (%)
I would prefer an electric vehicle over a traditional gasoline-powered vehicle if the price difference were not significant	Strongly Agree	96	17.6
	Agree	105	19.2

	Neutral	121	22.1
	Disagree	129	23.6
	Strongly Disagree	96	17.6
The price of electric vehicles is a major factor in my purchase decision	Strongly Agree	94	17.2
	Agree	125	22.9
	Neutral	116	21.2
	Disagree	117	21.4
	Strongly Disagree	95	17.4
Availability of charging stations influences my decision to buy an electric vehicle	Strongly Agree	100	18.3
	Agree	125	22.9
	Neutral	124	22.7
	Disagree	101	18.5
	Strongly Disagree	97	17.7
Government incentives or subsidies increase my likelihood of purchasing an electric vehicle	Strongly Agree	103	18.8
	Agree	142	26.0
	Neutral	121	22.1
	Disagree	88	16.1
	Strongly Disagree	93	17.0
I am willing to pay a premium for an electric vehicle with superior performance and features	Strongly Agree	101	18.5
	Agree	134	24.5
	Neutral	123	22.5
	Disagree	95	17.4

	Strongly Disagree	94	17.2
Long-term cost savings influence my decision to purchase an electric vehicle	Strongly Agree	101	18.5
	Agree	111	20.3
	Neutral	119	21.8
	Disagree	120	21.9
	Strongly Disagree	96	17.6
Brand reputation influences my decision to purchase an electric vehicle	Strongly Agree	95	17.4
	Agree	115	21.0
	Neutral	119	21.8
	Disagree	123	22.5
	Strongly Disagree	95	17.4

Source: Primary data, SPSS output (N = 547)

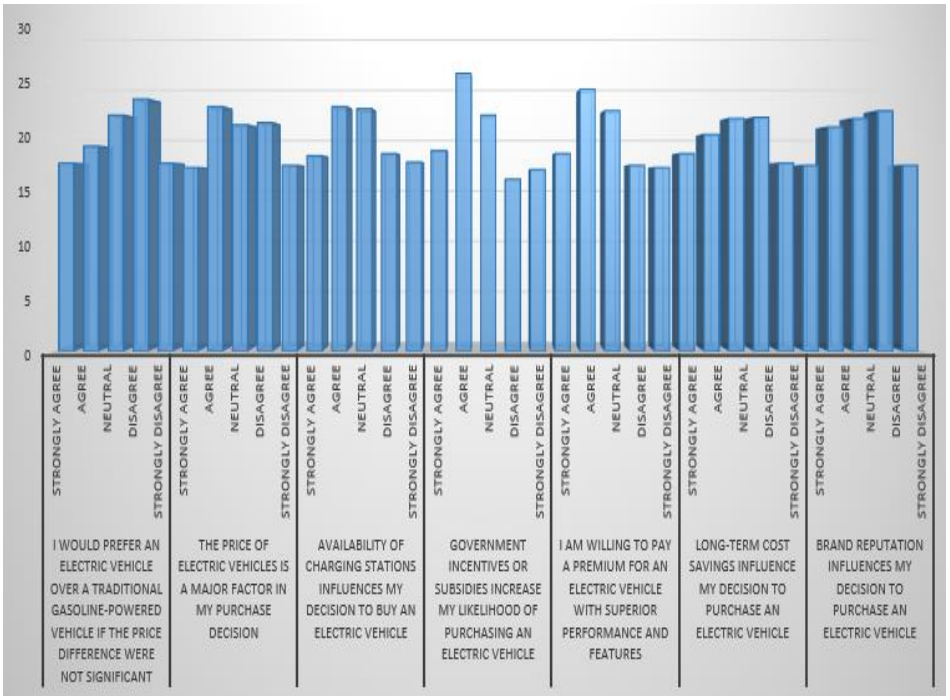

Figure 2: Purchase Behaviour towards Electric Vehicles

The table delineates respondents' purchasing behavior concerning price, charging infrastructure, government incentives, and brand impact. The results indicate that several variables jointly affect purchasing choices.

Table 6: Chi-Square Test Results for Purchase Behaviour Towards Electric Vehicles

	Value	df	Asymptotic Significance (2-sided)
Likelihood Ratio	10.291	20	.963
Linear-by-Linear Association	.844	1	.358
Pearson Chi-Square	10.154a	20	.965
N of Valid Cases	547		
a. The predicted count is fewer than 5 in 0 cells (or 0%). A count of at least 13.58 is anticipated.			

The results of the Chi-Square test, which examines the connection between factors related to purchasing behaviour, are shown in the table. The findings demonstrate no statistically significant correlation, hence supporting the adoption of the null hypothesis (H_{02}).

Table 7: Independent Samples t-Test Results for Purchase Behaviour towards Electric Vehicles

	Levene's Test for Equality of Variances		t-test for Equality of Means						
	F	Sig.	t	df	Sig. (2-tailed)	MD	SD	95% Confidence Interval of the Difference	
								Lower	Upper

I would prefer an electric vehicle over a traditional gasoline-powered vehicle if the price difference were not significant.	Equal variances assumed	.655	.419	-.775	291	.439	-.121	.156	-.427	.186
	Equal variances not assumed			-.775	289.525	.439	-.121	.156	-.427	.186
I would consider purchasing an electric vehicle if it offered better fuel efficiency than traditional vehicles.	Equal variances assumed	.964	.327	-.253	291	.801	-.042	.165	-.367	.284
	Equal variances not assumed			-.252	287.685	.801	-.042	.166	-.368	.284
I would be more likely to purchase an electric vehicle if it were available in a variety of models to suit different needs.	Equal variances assumed	.204	.652	1.151	291	.250	.188	.163	-.133	.509
	Equal variances not assumed			1.152	290.568	.250	.188	.163	-.133	.509

There is no statistically significant difference between the group averages, since all of the p-values are more than 0.05, according to the table displaying the results of the t-test comparing the purchase behaviours of various groups.

Table 8: Reliability Statistics (Purchase Behaviour)

Cronbach's Alpha	N of Items
.787	3

Here you may see the results of the reliability study conducted on the purchasing behaviour scale. The Cronbach's Alpha score for the scale is 0.787. It has been verified that the scale has strong internal consistency.

There are individual differences, but the survey shows that people generally think electric cars are great, especially when it comes to the environmental advantages and sustainability. Nevertheless, statistical research reveals that there is no substantial impact from consumer perception or purchasing behavior. This suggests that elements like pricing, infrastructure, and incentives still play a role in adoption choices. Researchers found that people are becoming more aware of electric cars, but that this knowledge has had little effect on people's decisions to buy one.

6. CONCLUSION

Despite an increase in consumer awareness and positive sentiments about EVs in a few of Indian cities, the study found that these factors alone were insufficient to significantly influence buyers' choices. We accept the null hypothesis since we did not find any evidence of a correlation between EV adoption and factors pertaining to consumers' opinions or consumption habits. High initial prices, inadequate charging infrastructure, and dependence on government subsidies continue to be barriers to adoption. So, although everyone agrees that electric automobiles are good for the environment and the planet, practical concerns still take precedence. The findings suggest that in order to achieve successful large-scale adoption, manufacturers and politicians should prioritise decreasing costs, improving infrastructure, and bolstering incentive programs. This would help reduce the gap between customers' perceptions and their actual purchasing decisions.

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