A Study on Customer Satisfaction Towards Electric Vehicles with Special Reference to Kozhikode District

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Abstract

This study investigates customer satisfaction toward electric vehicles (EVs) in Kozhikode, with a focus on consumer awareness, perception, and the key factors influencing EV preference and adoption. In the context of rising fuel prices and environmental concerns, EVs have emerged as a sustainable alternative to internal combustion engine vehicles. The Indian government's efforts to promote EV adoption further underscore the relevance of this research.A total of 75 respondents were surveyed using a structured questionnaire, and data were analyzed using various statistical tools such as the Friedman Test, One-Way and Two-Way ANOVA, and the Kruskal-Wallis Test. The findings reveal that range and charging time, price, environmental sustainability, and safety features significantly influence consumer preferences based on monthly income levels. Performance dissatisfaction and inadequate public charging infrastructure remain key concerns for EV users, while technological advertisements and word-of-mouth serve as primary awareness sources.The study offers valuable insights for policymakers, EV manufacturers, and stakeholders by identifying actionable strategies to improve satisfaction and accelerate EV adoption. It also contributes to existing literature by presenting a structured approach to understanding EV consumer behavior in a semi-urban Indian context.

Key words: Electric Vehicles (EVs), Customer Satisfaction, Consumer Perception, EV Preference Factors, Charging Infrastructure, Battery Performance, Environmental Sustainability.

Introduction

An electric vehicle (EV) is defined as a vehicle powered by an electric motor that draws energy from a battery and can be charged from an external source. EVs may be either fully electric, known as battery electric vehicles (BEVs), or partially electric, such as plug-in hybrid electric vehicles (PHEVs). Although some EVs still use liquid fuels alongside electricity, they are commonly referred to as electric cars or simply EVs. These vehicles are known for their instant torque and quiet driving experience.The Indian government has been promoting the adoption of electric vehicles to combat severe air pollution in urban areas and reduce carbon emissions from fossil fuels. It aimed for at least 15% of all vehicles on the road to be electric within five years starting in 2018.Widespread adoption of EVs has the potential to address issues like environmental pollution, global warming, and reliance on oil. Despite strong promotional policies by various governments, EV market penetration remains relatively low.

This paper offers a comprehensive review of studies on consumer preferences regarding EVs to guide policymakers and future research. It compares economic and psychological approaches to understanding EV adoption and introduces a conceptual framework to organize the review. The paper also examines modeling techniques used in these studies and reviews consumer preferences related to financial, technical, infrastructural, and policy-related attributes. Finally, it categorizes influential factors—such as socio-economic variables, psychological aspects, mobility conditions, and social influences—and discusses their effects on consumer decision-making.

Review of Literature

John Matias and T.C. Yalcin (2017) conducted a study titled "Consumer Perceptions of Electric Vehicles: An Exploratory Study." This research utilized a survey to examine consumer perceptions of electric vehicles in the United States. The findings revealed that while some consumers viewed EVs positively, there were notable concerns—particularly regarding range anxiety, inadequate charging infrastructure, and the high purchase cost. These factors were identified as major barriers to widespread EV adoption
Adoption of Electric Vehicles in India," examined how political strategies influence EV adoption. The study aimed to assist both **Liao (2017),** in his research report titled *"*Impact of Government Policies on the governments and automobile manufacturers in understanding consumer preferences. It identified key factors affecting purchasing decisions, including driving range, charging time, and overall ownership costs.

David Layzell and Sara Hastings-Simon (2016), in their research report titled *"*The Role of Government Incentives in Supporting the Adoption of Electric Vehicles: Insights from a Canadian Study,*"* examined how government incentives influence consumer preferences for electric vehicles in Canada. The study concluded that financial incentives—such as tax credits and rebates—play a significant role in encouraging consumers to choose EVs.

Scope of the study

This research aims to conduct a comprehensive analysis of customer satisfaction with electric vehicles (EVs) in the Kozhikode. It seeks to identify the key factors influencing satisfaction, examine their relationship with overall customer contentment, and develop a model to measure satisfaction levels. The study will also explore various dimensions of EV ownership and usage. Based on the findings, the research will offer actionable recommendations to policymakers, industry stakeholders, and EV manufacturers to promote EV adoption and improve customer satisfaction in the region.

Statement of the problem

With the depletion of fossil fuels and the continuous rise in fuel prices, there is an urgent need for a transition to alternative energy sources in the Indian transportation sector. In response, the government has initiated efforts to combat pollution by promoting electric vehicles (EVs) and offering subsidies to encourage their purchase. Collaboration between the government and manufacturers is essential to develop the necessary infrastructure and foster a supportive environment for EV adoption.

Today's consumers are increasingly aware of global climate challenges and are more willing to shift from conventional vehicles to eco-friendly alternatives. However, cost remains a significant factor in the decision-making process when purchasing an EV. This study aims to identify the key factors that influence consumer decisions to purchase electric vehicles and to assess the level of customer satisfaction associated with EV ownership.

Significance of the study

The primary objective of this study is to identify the key factors influencing the adoption of electric vehicles (EVs). The findings aim to support the government in formulating effective policies and to assist automakers in better understanding the needs and preferences of consumers. Additionally, the study evaluates the level of customer satisfaction with EVs, providing valuable insights that can guide manufacturers in tailoring their products to align with consumer interests. This research also serves as a useful resource for future studies, offering primary data and insights into the significance and adoption of electric vehicles.

Objectives of the study

The objectives of the study are:

- To analyze the awareness of consumers about the E-vehicles

- To identify the factors driving customers to purchase E-vehicles
- To analyze the level of satisfaction of consumers towards E-vehicles

Methodological Framework

Research Design: The present study is descriptive and analytical in nature.

Population of the study: Population of the study comprises of to the residents who use Electric vehicles in Kozhikode district.

Sample of the study: A sample of 75 respondents is taken on the basis of convenience sampling.

Source of data

Primary data : The primary data is collected through Questionnaire from respondents.

Secondary data : Secondary data has been collected from book, magazines, newspaper and various websites.

Tools for collection

Questionnaire are used to obtain information from sample

Tools for analysis: Appropriate mathematical and statistical tools will be applied for analysis of data. The data is analyzed with the help of SPSS and MS EXCEL.

a) K Sample Friedman test

Friedman test is a nonparametric test that compares two or more variables. In this test, first ranks the values in each from low to high. The ranks assigned by the respondents for the variables are averaged and tested to find out whether the mean rank is significant or not. In this study, this non parametric test is applied for testing the variation of EV perception factors, EV knowledge source and EV satisfaction level.

b)One Way ANOVA

The One Way ANOVA is used to determine whether there are any significant difference among the means of three or more independent groups (populations). It is the way used to test the equality of three or more means at a time by using variances. Here ,it is used to test the variation in the mean score on the problems faced by the customers while using electric vehicles.

c) Two Way ANOVA

In statistics, the Two Way Analysis of variance (Two Way ANOVA) test in an extension of the One Way ANOVA test that examines the influence of different categorical independent variables one dependent variables. While One Way ANOVA measures the significant effect on one independent variable, the Two Way ANOVA is used when there is more than one and multiple observations for each. Here the test is used to test the variation in mean score on the aspects of electric vehicles with respect to EV ownership duration and EV brand.

d) Kruskal Wallis test

The Kruskal Wallis test is a non-parametric test equivalent to One Way ANOVA and an extension of Man Whitney U Test. It explores the outcome of a single dependent variable, across three or more distinct groups of a categorical independent variable. Compared with parametric tests, there are very few assumptions and restrictions for the test. The only restriction for the dependent variable is that the data must be on at least ordinal ranking scale. The independent variable must be categorical and be represented by at least three distinct groups: no one can appear in more than one group at a time. The test is most likely to be used is the dependent variable data are not normally distributed and or those data

are original. In this study, the test is used to test the mean rank of Electric vehicles preference factors on the basis of monthly income

Introduction of Electric Vehicles

An electric vehicle (EV) is a mode of transportation powered by one or more electric or traction motors. These vehicles can utilize onboard energy sources like batteries, solar panels, fuel cells, or gasoline-powered generators that convert fuel into electricity. Alternatively, they can be charged using external power sources through a collector system. EVs are used across many types of transport, including road and rail systems, watercraft (both surface and underwater), electric aircraft, and even spacecraft. Electric vehicles first appeared in the mid-1800s, appreciated for their smooth operation and ease of use—features early gasoline cars lacked. Despite this early promise, internal combustion engines became dominant in cars and trucks throughout the 20th century, while electric power remained mainly in use for trains and smaller vehicles.

Evolution of Electric Vehicles

The concept of electric vehicles (EVs) dates back to the early 19th century, with some of the first small-scale electric cars appearing in the 1820s and 1830s. By the late 1800s, electric vehicles became more practical and gained popularity, especially in urban areas, due to their quiet operation and ease of use compared to gasoline-powered cars. In fact, by the early 1900s, electric cars were competing with steam and gasoline vehicles in the marketplace. However, with the mass production of the Ford Model T and the discovery of large petroleum reserves, internal combustion engine vehicles quickly became cheaper and more efficient, leading to a decline in electric vehicle development.

The resurgence of electric vehicles began in the late 20th century as concerns over air pollution, oil dependency, and climate change grew. Breakthroughs in battery technology, such as the development of lithium-ion batteries, improved the range and performance of EVs. Companies like Tesla, Nissan, and Chevrolet played a major role in revolutionizing the market with consumer-friendly electric models. Today, electric vehicles are becoming more mainstream, supported by government incentives, growing environmental awareness, and the expansion of charging infrastructure. With ongoing advancements in autonomous driving and sustainable energy integration, EVs are set to play a crucial role in the future of global transportation.

Electric Vehicle Development In India

The United Kingdom recently announced a ban on the sale of new petrol and diesel cars starting in 2030. As part of its green initiative, the UK is also investing in EV infrastructure to support this transition. This bold move could influence the global push toward sustainable transportation. Similarly, the Indian government has shown interest in shifting from fossil-fuel vehicles to electric alternatives. In 2017, it set an ambitious goal of making all vehicles electric by 2030. However, due to resistance from the auto industry and concerns over job losses, the target had to be scaled back. Transforming the mobility sector will remain a challenge unless the government invests directly in EV infrastructure, rather than placing the financial burden on automakers and consumers.

Advantages Of Electric Vehicle

Electric vehicles offer numerous benefits over traditional gasoline-powered cars. One of the main advantages is their eco-friendliness, as EVs produce zero tailpipe emissions, helping reduce air pollution and combat climate change. They are also more energy-efficient and cost-effective in the long run due to lower fuel and maintenance costs. Additionally, EVs operate quietly, reducing noise pollution in urban areas. With advancements in battery technology and increasing availability of charging infrastructure, electric vehicles are becoming a practical and sustainable choice for the future of transportation.

Major Players in EV Market

1.Tesla: : Founded in 2003 in California, Tesla is a major EV manufacturer known for high-performance electric cars like the Model 3, which became a top seller in the U.S. The company also focuses on energy storage and generation. Tesla is expanding globally, including building a major factory in Shanghai to strengthen its presence in Asia.

2.BMW: Established in 1916 and based in Munich, Germany, BMW produces cars, motorcycles, and financial services. Its electric lineup includes the BMW i3 and i8 plug-in hybrids. BMW plans to launch 25 electrified models by 2025, 12 of which will be fully electric.

3.NissanMotors: Founded in 1933 in Japan, Nissan is known for its Nissan, Infiniti, and Datsun brands. Its Nissan Leaf has been a global leader in EV sales. In 2019, it launched the Leaf Plus with an extended range and improved power, strengthening its EV offerings.

4.Volkswagen: Founded in 1937 in Germany, Volkswagen owns multiple brands including Audi, Porsche, and Bentley. It offers electric models like the e-Golf and e-Up. In 2019, it launched pre-orders for the ID.3, a full-electric vehicle. The company aims to release over 70 all-electric models globally by 2028.

5.BYDGroup:BYD, founded in 1995 in China, specializes in commercial electric vehicles and batteries. It operates across China, the U.S., Europe, and India. Known for strong global partnerships, BYD supplies electric buses, including to Swedish operator Nobina.

Different types of E-Vehicles

Generally there are three main types of electric vehicles: hybrid electric vehicles (HEV), plug- in hybrid electric vehicles (PHEV) and battery electric vehicles (BEV).

EVs Vs ICEVs

Rising petrol and diesel prices are making electric vehicles (EVs) a more attractive option, especially for city dwellers. While EVs were once seen as futuristic, they are now challenging Internal Combustion Engine Vehicles (ICEVs) like petrol and diesel cars. In cities, where EVs are more practical, fuel costs for EVs are significantly lower—about ₹0.8 per km—compared to ICEVs, which cost 3 to 5 times more. However, widespread EV adoption still faces challenges, mainly due to limited charging infrastructure. As of March 2021, India had only 1,800 EV charging stations compared to over 78,000 fuel stations. To meet the goal of 2 million EVs by 2026, over 4 lakh charging stations will be needed. This requires strong public and private sector involvement to expand the charging network.

Batteries

Batteries are crucial for EV adoption, much like fuel tanks in traditional cars. While battery technology has improved significantly—becoming smaller and more energy-dense—it still has limitations. Early EVs used lithium-ion batteries, which are highly explosive. Today, lithium-polymer batteries are more common, offering faster charging and improved safety, though they remain expensive. Battery quality directly impacts an EV's range and charging speed, with some models supporting rapid charging up to 80%.

Environmental Impact

The environmental impact of EVs depends on how electricity is produced. In India, as of 2018, 0.82 kg of CO_2 was emitted per unit (kWh) of electricity. For an EV with a 30 kWh battery and 312 km range, this equals about 0.07 kg of CO_2 per km. In comparison, petrol cars under 1400 cc emit 0.130–0.140 kg/km, and similar diesel cars emit about 0.117 kg/km. This shows that EVs produce significantly lower emissions per kilometre, even when powered by a fossil-fuel-heavy grid.

Analysis and Interpretation of Data

1. Demographic Profile

Table 1: Classification of respondents on the basis of profile of respondents.

Particulars	Categories	No of respondents	Per cent
Gender	Male	43	57.3
	Female	32	42.7
Age	Below 20	10	13.3
	20 - 30	37	49.3
	30 - 40	18	24.0

	40 - 50	7	9.3
	Above 50	3	4.0
Educational qualification	SSLC	3	4.0
	+2	14	18.7
	Graduate	39	52.0
	Post graduate	11	14.7
	Professional qualification	8	10.7
Occupation	Student	25	33.3
	Government employee	8	10.7
	Private employee	26	34.7
	Homemaker	1	1.3
	Other	15	20.0
Average monthly salary	Below 20,000	23	30.7
	20,000 - 40,000	33	44.0
	40,000 - 60,000	6	8.0
	60,000 - 80,000	3	4.0
	Above 80,000	10	13.3

Source :Primary Data

Table 1 presents the demographic profile of the 75 respondents selected for the study. In terms of gender, 57.3% are male and 42.7% are female. The majority of respondents (49.3%) fall within the age group of 20–30 years. Regarding educational qualifications, 4.0% have completed SSLC, 18.7% have completed +2, 52.0% hold a graduation degree, 14.7% are postgraduates, and 10.7% possess a professional qualification. Occupation-wise, 33.3% of the respondents are students, 10.7% are government employees, 34.7% work in the private sector, 1.3% are homemakers, and 2.0% fall under the ‘others’ category. As for average monthly income, 44.0% of the respondents earn between ₹20,000 and ₹40,000.

2. Awareness and perception

Table 2: Classification of respondents on Awareness and Perception of Electric Vehicles

Particulars	**Categories**	**No of respondents**	**Per cent**
EV ownership duration	Less than 6 months	26	34.7
	6 months to 1 year	18	24.0
	1 year to 2 year	21	28.0
	more than 2 year	10	13.3
EV brand	Tesla	30	40.0
	Nissan	18	24.0
	BMW	4	5.3
	Volkswagen	3	4.0
	Hyundai / kia	20	26.7
Commute frequency on EVs	Daily	49	65.3
	Weekly	14	18.7
	Occasionally	9	12.0
	Rarely	3	4.0

Source : Primary Data

In terms of EV ownership duration, the majority of respondents (34.7%) have owned their EV for less than 6 months. This is followed by 28.0% who have had their EV for 1 to 2 years, 24.0% for 6 months to 1 year, and only 13.3% for more than 2 years. This indicates that most users are relatively new to EV ownership.When it comes to preferred EV brands, 40.0% of the respondents own a Tesla, making it the most popular brand among the sample. Hyundai/Kia follows at 26.7%, while Nissan accounts for 24.0%. BMW and Volkswagen represent smaller shares, at 5.3% and 4.0% respectively.

Regarding commute frequency using EVs**,** a significant majority (65.3%) use their electric vehicle daily, indicating high dependence on EVs for routine travel. Weekly users make up 18.7%, occasional users 12.0%, and only 4.0% use their EVs rarely.These findings reflect a growing trend in EV adoption and daily use, with Tesla leading in brand preference among respondents.

3. EV Preference Factors

Various EV preference factors are available for electric vehicle brand. The following table contains the most and least preferred electric vehicle brand. Kruskal Wallis test is used to find out the most commonly felt reason and test the following hypothesis too.

Hypothesis can be tested as:

H0: There is no significant difference in the preference in the EV preference factors with respect of monthly income.

H1: There is a significant difference in the preference in the EV preference factors with respect of monthly income.

Table 3.1 Kruskal Wallis test – Mean ranks

		N	**Mean Rank**
Range and charging time	Below 20,000	23	39.15
	20,000 - 40,000	33	43.73
	40,000 - 60,000	6	18.00
	60,000 - 80,000	3	25.50
	Above 80,000	10	32.20
	Total	75	
Price	Below 20,000	23	37.61
	20,000 - 40,000	33	33.18
	40,000 - 60,000	6	29.50
	60,000 - 80,000	3	62.50
	Above 80,000	10	52.55
	Total	75	
Environmental sustainability	Below 20,000	23	20.74
	20,000 - 40,000	33	44.33
	40,000 - 60,000	6	38.08
	60,000 - 80,000	3	47.67
	Above 80,000	10	53.85
	Total	75	
Brand reputation and customer support	Below 20,000	23	33.52
	20,000 - 40,000	33	39.53
	40,000 - 60,000	6	40.25
	60,000 - 80,000	3	46.67
	Above 80,000	10	39.30
	Total	75	
	Below 20,000	23	47.80

Safety features and reliability	20,000 - 40,000	33	37.14
	40,000 - 60,000	6	29.92
	60,000 - 80,000	3	20.67
	Above 80,000	10	28.35
	Total	75	

Source : Primary Data

Table 3.2 Kruskal Wallis – Test statistics

	Range and charging time	Price	Environmental sustainability	Brand reputation and customer support	Safety features and reliability
Chi-Square	9.844	11.467	24.888	1.797	10.024
df	4	4	4	4	4
Asymp. Sig.	**.043****	**.022****	**.000*****	.773	**.040****

Source :Calculated value *significant at 5 per cent

The table 4.3.1 shows the rank mean ranks of dependence of various EV preference factors. The result of the Kruskal Wallis – Test for the variable EV preference factors among the respondents, Range and charging time**(0.43)**, Price**(.022)**, Environmental sustainability**(.000)**, Safety features and reliability**(.040)**. This implies that there is significant difference in the mean rank obtained for the various EV preference factors in brand in relation to their monthly income. Least rank indicates higher preference towards EV brands. Therefore Range and charging time(having mean 18.00), Price(having mean 29.50), Environmental sustainability(having mean 20.74), Safety features and reliability(20.67) are the most important reasons that influence the respondents regarding the preference of EV brand.

4. **EV Perception factors**

The EV perception factors is analyzed using Friedman test and its output is presented in below table.

H0: There is no significant difference in preference on the EV perception factors.

H1: There is a significant difference in preference on the EV perception factors.

Table 4.1 Mean Ranks On the EV Perception Factors

Factors	Mean Rank	Rank
Environmental impact	2.72	3
Cost effectiveness	2.16	2
Technological advancement	**2.03**	**1**
Government policies and incentives	3.09	4

Source: Primary Data

Table 4.2 Test statistics of Friedman test on EV perception factors

No.of respondents	75
Chi-Square	33.304
df	3
Asymp. Sig.	**.000*****

Source: Primary Data *significant at 5 per cent

The x^2 statistics shows provide a value of 33.304 which is significant at 5 per cent (p>0.005). Therefore null hypothesis is rejected. This indicates that there is a variation in the EV perception factors. Lowest mean is considered as the most significant reason. Here **"Offers"(2.03)** is found to be the most voted reason.

5. **EV Knowledge Source**

Following hypothesis are made for the EV knowledge source of respondents**.**

H0: There is no significant difference in preference on the EV knowledge source.

H1: There is a significant difference in preference on the EV knowledge source.

Table 5.1 Mean Rank On the EV Knowledge Source

Sources	Mean Rank	Rank
Newspaper	3.16	4
Magazines	3.79	5
Advertisement	2.91	2
Social media	3.05	3
Family and friends	**2.83**	**1**
Other	5.27	6

Source: Primary Data

Table 5.2 Test statistics of Friedman test on EV knowledge source

No.of respondents	75
Chi-Square	92.653
df	5
Asymp. Sig.	**.000*** **

Source: Primary Data *significant at 5 per cent

The x^2 statistics shows provide a value of 92.653 which is significant at 5 per cent ($p>0.005$). Therefore null hypothesis is rejected. This indicates that there is a variation in the EV knowledge source. Lowest mean is considered as the most significant reason. Here **"Offers"(2.83)** is found to be the most voted reason.

6 Aspects of Electric Vehicle

6.1 Two Way ANOVA on financial aspects of electric vehicles by EV ownership duration and EV brand.

The variations in financial aspects of electric vehicles are analyzed with Two Way ANOVA and output is presented in the following tables.

H0: There is no significant difference in the financial aspects of electric vehicles of respondents with respect of EV ownership duration and EV brand.

H1: There is a significant difference in the financial aspects of electric vehicles of respondents with respect of EV ownership and EV brand.

Table 6.1.1 Estimated marginal means – financial aspects based on EV ownership duration

1. EV ownership duration				
Dependent Variable: Financial Aspects				
Ev ownership duration	**Mean**	**Std. Error**	**95% Confidence Interval**	
			Lower Bound	**Upper Bound**
Less than 6 months	2.453	.158	2.139	2.768
6 months to 1 year	2.268	.193	1.883	2.653
1 year to 2 year	2.044	.192	1.661	2.428
more than 2 year	1.925	.229	1.467	2.382

Source: Primary Data

Table 6.1.2. Estimated marginal means – financial aspects based on EV brand

2. Ev brand			
Dependent Variable: Financial Aspects			
Ev brand	**Mean**	**Std. Error**	**95% Confidence Interval**

			Lower Bound	Upper Bound
Tesla	2.000	.131	1.739	2.262
Nissan	2.105	.168	1.769	2.440
BMW	3.039	.361	2.318	3.760
Volkswagen	1.457	.406	.647	2.267
Hyundai / kia	2.261	.162	1.937	2.585

Source: Primary Data

Table 6.1.3. Two Way ANOVA – Financial Aspects

Tests of Between-Subjects Effects					
Dependent Variable: Financial Aspects					
Source	**Type I Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
EV ownership duration	360.856	4	90.214	185.058	**.000*** **
EV brand	5.233	4	1.308	2.683	**.039****
Error	32.662	67	.487		
Total	398.750	75			

Source: Primary Data *significant at 5 per cent

The above table shows that the mean variation in the scores for financial aspects between EV ownership duration and EV brand shows that the both ownership and brand wise variation of the mean score is statistically significant at 5 per cent level(value of **F 185.058 df 4 with P=.000<0.05, F value 2.683 df 4 with P=..039<0.05).** There is a considerable variations in the level of financial aspects related to EV ownership duration and EV brand. Therefore it may be found that respondents belonging to more than 2 years have more financial aspects(**Lowest mean 1.868**) than others. While considering EV brand, the respondents belonging to EV brand of Volkswagen have more financial aspects as to lowest mean score of **1.457.**

6.2 Two Way ANOVA on Non financial aspects of electric vehicles by EV ownership duration and EV brand.

The variations in non financial aspects of electric vehicles are analyzed with Two Way ANOVA and output is presented in the following tables.

H0: There is no significant difference in the non financial aspects of electric vehicles of respondents with respect of EV ownership duration and EV brand.

H1: There is a significant difference in the non financial aspects of electric vehicles of respondents with respect of EV ownership duration and EV brand.

Table 6.2.1 Estimated marginal means – Non financial aspects based on EV ownership duration

1. Ev ownership duration				
Dependent Variable: Non Financial Aspects				
Ev ownership duration	**Mean**	**Std. Error**	**95% Confidence Interval**	
			Lower Bound	**Upper Bound**
Less than 6 months	2.393	.161	2.071	2.716
6 months to 1 year	2.075	.198	1.680	2.470
1 year to 2 year	1.885	.197	1.492	2.278

more than 2 year	1.868	.235	1.400	2.337

Source: Primary Data

Table 6.2.2 Estimated marginal means – Non financial aspects based on EV brand

2. EV brand				
Dependent Variable: Non Financial Aspects				
			95% Confidence Interval	
Ev brand	**Mean**	**Std. Error**	**Lower Bound**	**Upper Bound**
Tesla	1.992	.134	1.724	2.260
Nissan	2.071	.172	1.727	2.415
BMW	2.835	.370	2.096	3.574
Volkswagen	1.165	.416	.335	1.996
Hyundai / kia	2.214	.166	1.882	2.546

Source: Calculated value

Table 6.2.3 Two Way ANOVA – Non Financial Aspects

Tests of Between-Subjects Effects					
Dependent Variable: Non Financial Aspects					
Source	**Type I Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
EV ownership duration	345.930	4	86.483	168.877	**.000*** **
EV brand	5.175	4	1.294	2.526	**.049** **
Error	34.311	67	.512		
Total	385.417	75			

Source: Primary Data *significant at 5 per cent

The mean variation in the scores for non financial aspects between EV ownership duration and EV brand shows that the both ownership and brand wise variation of the mean score is statistically significant at 5 per cent level (**value of F 168.877 df 4 with P=.000<0.005, F value 2.526 df 4 with P=.049<0.05)**. There is considerable variation in the level of non financial aspects related to EV ownership duration and EV brand. As to table 4.6.2.3, it is observed that the respondents belonging to 1 year to 2 year have more non financial aspects (**lowest mean 1.885**) than others. While considering EV brand, the respondents belonging to EV brand of Volkswagen have more non financial aspects as to lowest mean score of **1.165**.

7 EV Satisfaction Level

The EV satisfaction level is analyzed using Friedman test and its output is presented in below table .

H0: There is no significant difference in preference on the EV satisfaction level.

H1: There is a significant difference in preference on the EV satisfaction level.

Table 7.1 Mean Rank On the EV satisfaction level

Particulars	**Mean Rank**	**Rank**
Performance	**4.00**	**1**
Range	3.55	3

Charging experience	3.09	6
Maintenance cost	3.25	5
Over-all experience	3.67	2
After-sale services	3.44	4

Source: Primary Data

Table 7.2 Test statistics of Friedman test on EV satisfaction level

No. of respondents	75
Chi-Square	20.035
df	5
Asymp. Sig.	**.001*** **

Source: Primary Data *significant at 5 per cent level

The x^2 statistics shows provide a value of 20.035 which is significant at 5 per cent ($p>0.005$). Therefore null hypothesis is rejected. This indicates that there is a variation in the EV satisfaction level. Highest mean is considered as the most significant reason. Here **"Offers"(4.00)** is found to be the most voted reason.

8 EV Problem severity

The variation in the problem faced by the consumers while using electric vehicles is analyzed with One Way ANOVA and output is presented in the following tables.

Hypothesis is stated as:

H0: There is no variation in the mean score obtained for the variables related to the problem severity of electric vehicle consumers with respect to EV ownership duration.

H1: There is a variation in the mean score obtained for the variables related to the problem severity of electric vehicle consumers with respect to EV ownership duration.

Table 8.1 Descriptive statistics

Category		**N**	**Mean**	**Std. Deviation**
Inability to go for long drive	Less than 6 months	26	2.46	1.363
	6 months to 1 year	18	3.28	1.179
	1 year to 2 year	21	3.24	1.136
	more than 2 year	10	3.60	1.430
	Total	75	3.03	1.315
Failure to travel high speed	Less than 6 months	26	2.77	1.070
	6 months to 1 year	18	2.72	1.179
	1 year to 2 year	21	2.71	.956
	more than 2 year	10	3.50	.972
	Total	75	2.84	1.066
Low battery life	Less than 6 months	26	3.08	1.129
	6 months to 1 year	18	3.72	1.179
	1 year to 2 year	21	3.57	1.076
	more than 2 year	10	4.30	.823
	Total	75	3.53	1.143
Unable to carry heavy luggage	Less than 6 months	26	3.19	.939
	6 months to 1 year	18	3.00	1.085

	1 year to 2 year	21	2.52	.680
	more than 2 year	10	3.30	1.160
	Total	75	2.97	.972
Cost of vehicle is high	Less than 6 months	26	3.42	1.027
	6 months to 1 year	18	3.33	.767
	1 year to 2 year	21	2.90	.995
	more than 2 year	10	3.50	.707
	Total	75	3.27	.935
Charging time is too long	Less than 6 months	26	3.69	1.123
	6 months to 1 year	18	3.67	1.328
	1 year to 2 year	21	3.48	1.250
	more than 2 year	10	4.00	1.414
	Total	75	3.67	1.234
Lack of public charging stations	Less than 6 months	26	3.65	1.263
	6 months to 1 year	18	4.28	1.018
	1 year to 2 year	21	3.24	1.375
	more than 2 year	10	4.30	.823
	Total	75	3.77	1.247

Source: Primary Data * significant at 5 per cent

Table 8.2 One Way ANOVA

		Sum of Squares	**df**	**Mean Square**	**F**	**Sig.**
Inability to go for long drive	Between Groups	13.664	3	4.555	2.830	**.044****
	Within Groups	114.282	71	1.610		
	Total	127.947	74			
Failure to travel high speed	Between Groups	5.068	3	1.689	1.518	.217
	Within Groups	79.012	71	1.113		
	Total	84.080	74			
Low battery life	Between Groups	11.967	3	3.989	3.344	**.024****
	Within Groups	84.700	71	1.193		
	Total	96.667	74			
Unable to carry heavy luggage	Between Groups	6.570	3	2.190	2.453	.070
	Within Groups	63.377	71	.893		
	Total	69.947	74			
Cost of vehicle is high	Between Groups	4.011	3	1.337	1.565	.205
	Within Groups	60.656	71	.854		
	Total	64.667	74			
Charging time is too long	Between Groups	1.890	3	.630	.404	.751
	Within Groups	110.777	71	1.560		
	Total	112.667	74			
Lack of public charging stations	Between Groups	13.741	3	4.580	3.207	**.028****
	Within Groups	101.405	71	1.428		
	Total	115.147	74			

Source: Primary Data * significant at 5 per cent

The result of One Way ANOVA with respect to the EV problem severity based on EV ownership duration shows that there is significant difference in the case of Inability to go for long drive, Low battery life, Lack of public charging stations(**F value of 2.830 P=.044, F value of 3.344 P=.024 and F value of 3.207 P=.028**). Therefore the null hypothesis is rejected at 5 per cent level. In the case of Inability to go for long drive(having mean 3.60), Low battery life(having mean 4.30), Lack of public stations(having mean 4.30) respondents who use electric vehicles more than 2 years facing more problems.

Findings

This section presents the key outcomes of the study, offering insights gained from the analysis of customer satisfaction towards electric vehicles (EVs), without drawing conclusions or recommendations.

1.Demographic profile

The gender distribution shows that 57.3% of the respondents are male. A majority belong to the 20–30 age group. Among the respondents, 34.7% are employed in the private sector, and 52.0% of them are graduates. Regarding monthly income, 44.0% earn between ₹20,000 and ₹40,000.

2. Awareness and perception of electric vehicles

Most respondents have owned an electric vehicle for less than six months. Tesla is the most commonly used EV brand, preferred by 40.0% of respondents. Additionally, 65.3% of users drive their EVs daily, indicating regular usage.

3. EV preference factors T

he Kruskal-Wallis test revealed significant differences in EV preference factors based on monthly income. The most influential factors are Range and Charging Time ($p = 0.043$),Price ($p = 0.022$), Environmental Sustainability ($p = 0.000$) and Safety Features and Reliability ($p = 0.040$)These factors play a key role in influencing consumers' decisions when selecting an EV.

4. EV perception factors

Among various perception factors, technological advertisements were identified as the most influential (mean rank = 2.03), while Government policies and incentives were the least influential (mean rank = 3.09).

5. EV knowledge source

Family and friends were reported as the most common source of EV-related information (mean rank = 2.83). Other sources were considered less impactful, with the lowest mean rank of 5.27.

6. EV Aspects of electric vehicles

The test on Aspects of respondents regarding to the preference of EV, on the financial factor there is significant difference between more than 2 year and Volkswagen and on the non financial factor there is a significant difference between I year to 2 year and Volkswagen .These are the factors that are agreed by the respondents .

7. EV satisfaction level

Performance was the most dissatisfying factor (mean rank = 4.00), while charging experience ranked as the most satisfying aspect (mean rank = 3.09).

8. EV problem severity

After analyzing electric vehicle problem severity with respect of EV ownership duration most of the respondents are facing the problems inability to go for long drive**(.044)**, Low battery life**(.024)**, Lack of public charging stations**(.028)**.

Suggestions

- Since price is a major barrier, EV manufacturers should work to lower the cost of vehicles, making them more accessible to middle-income groups.
- To address dissatisfaction related to EV performance, manufacturers should enhance vehicle range, acceleration, and efficiency by investing in advanced battery and motor technologies.
- To overcome challenges like short driving range and limited charging infrastructure, efforts must be made to improve battery life and expand charging networks, enabling longer trips without range anxiety.

- Given the weak influence of government policies on user perception, authorities should consider promoting EV benefits through influencers, experts, and digital media to increase public awareness and trust.

Conclusion

The findings of this study highlight several critical factors influencing consumer satisfaction and adoption of electric vehicles in Kozhikode. While there is growing awareness and daily usage of EVs, particularly among younger and middle-income groups, significant challenges remain. Key preference factors such as range, charging time, and cost continue to shape consumer decisions.The study found that dissatisfaction persists in terms of vehicle performance and long-distance travel capabilities, primarily due to low battery life and the limited availability of charging stations. Furthermore, government policies and incentives, although well-intentioned, are perceived as less influential, indicating a need for better communication and outreach.To encourage broader EV adoption and enhance user satisfaction, manufacturers must focus on affordability, performance improvements, and the expansion of charging infrastructure. Simultaneously, policymakers should implement more effective promotional strategies and collaborate with industry players to build a robust EV ecosystem.

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