



# A Study on the Financial and Performance Benefits of Electric Vehicles: An Analysis of Fuel Cost, Maintenance, Charging Efficiency, and Consumer Satisfaction.

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DOI: <https://doi.org/10.51244/IJRSI.2026.1307000011>

Received: 06 July 2026; Accepted: 11 July 2026; Published: 22 July 2026

## ABSTRACT

The rapid growth of electric vehicles (EVs) has transformed the urban transportation sector by providing economically sustainable and environmentally friendly mobility solutions. The present study examines the financial and performance benefits of electric vehicles among consumers in Bangalore city. The research focuses on key aspects such as fuel cost savings, maintenance benefits, charging infrastructure, charging cost, mileage and performance, consumer satisfaction, and challenges faced by EV users. A descriptive research design was adopted for the study, and primary data was collected from 200 respondents using a structured questionnaire through convenience sampling. Statistical tools such as percentage analysis, mean and standard deviation, chi-square test, and correlation analysis were employed to interpret the collected data.

The findings reveal that EV adoption is significantly higher among young working professionals and middle-income groups in Bangalore. The study identifies fuel cost savings and reduced maintenance expenses as the primary factors influencing EV adoption. Most respondents expressed positive satisfaction regarding vehicle performance, operational efficiency, and long-term cost effectiveness. However, challenges such as inadequate charging infrastructure, long charging duration, battery replacement concerns, and high company servicing costs due to the absence of local substitutes continue to affect user experience. The chi-square and correlation analyses confirm a significant relationship between EV usage and financial as well as performance benefits. The study concludes that electric vehicles have strong potential to support sustainable urban transportation in Bangalore, provided improvements are made in charging infrastructure, servicing accessibility, and technological advancements.

**Keywords:** Electric Vehicles (EVs), Financial Benefits, Vehicle Performance, Fuel Cost Savings, Maintenance Cost, Charging Infrastructure, Consumer Satisfaction, Sustainable Transportation, Bangalore, Electric Mobility.

## INTRODUCTION TO ELECTRIC VEHICLES

Electric Vehicles (EVs) have emerged as a modern and sustainable mode of transportation in the automotive industry. Unlike conventional vehicles that operate using petrol or diesel-powered internal combustion engines, electric vehicles function through electric motors powered by rechargeable batteries. Growing environmental concerns, increasing fuel prices, and the depletion of fossil fuel resources have accelerated the adoption of electric vehicles worldwide, including in Bangalore, one of India's leading technology and innovation hubs. Bangalore has witnessed a significant rise in the use of electric vehicles due to increasing environmental awareness, government initiatives, and the expansion of charging infrastructure. The city's traffic congestion and high fuel consumption have encouraged consumers to explore alternative transportation options that are both economical and environmentally friendly. Electric vehicles offer several benefits such as reduced fuel costs, lower maintenance expenses, improved energy efficiency, and reduced carbon emissions. Despite these advantages, consumers in Bangalore still face challenges related to charging infrastructure availability, battery life, charging duration, and the initial purchase cost of EVs. Therefore, studying the financial and performance benefits of electric vehicles in Bangalore is essential to understand their practicality, economic viability, and consumer acceptance.

## Background of the Study

The transportation sector has traditionally depended on fossil fuels, contributing significantly to environmental pollution and greenhouse gas emissions. Over the past decade, advancements in battery technology, charging systems, and energy management have transformed the electric vehicle industry globally. Governments across various countries have introduced policies and incentives to encourage electric mobility and reduce dependence on non-renewable energy resources. In India, the electric vehicle market has shown substantial growth due to government initiatives such as the Faster Adoption and Manufacturing of Electric Vehicles (FAME) scheme, subsidies, tax benefits, and increased public awareness. Bangalore, being a major metropolitan city and technological center, has become one of the leading markets for electric vehicle adoption. The city has seen rapid development in EV charging stations and increased participation from automobile manufacturers and ride-sharing companies promoting electric mobility.

However, many consumers in Bangalore remain uncertain about the long-term financial and operational advantages of electric vehicles compared to conventional vehicles. Factors such as fuel savings, maintenance costs, charging efficiency, and consumer satisfaction significantly influence purchasing decisions. This study aims to analyze these aspects in the context of Bangalore and provide insights into the economic and performance benefits of electric vehicles.

## Statement of the Problem

The adoption of electric vehicles in Bangalore has increased considerably in recent years; however, consumers continue to face uncertainty regarding their financial and operational efficiency. Many potential buyers hesitate to adopt EVs due to concerns related to battery performance, charging infrastructure, maintenance requirements, and high initial investment costs. Although electric vehicles are promoted as cost-effective and environmentally sustainable alternatives, there is limited awareness regarding their actual financial savings and performance efficiency in Bangalore's urban conditions. Therefore, the problem addressed in this study is to examine whether electric vehicles provide substantial fuel cost savings, lower maintenance expenses, efficient charging performance, and satisfactory user experiences among consumers in Bangalore.

## Need for the Study

The need for this study arises from the increasing importance of sustainable transportation and the rapid adoption of electric vehicles in Bangalore. Consumers require accurate and reliable information regarding the economic and operational benefits of EVs before making purchasing decisions. Understanding the financial savings and performance efficiency of electric vehicles can help consumers, manufacturers, and policymakers make informed decisions.

This study is important because it:

1. Examines the fuel cost savings associated with electric vehicles in Bangalore.
2. Evaluates the maintenance cost advantages of EVs compared to conventional vehicles.
3. Analyzes the charging efficiency and operational performance of electric vehicles.
4. Measures consumer satisfaction levels regarding EV usage in Bangalore.
5. Assists policymakers and automobile manufacturers in understanding consumer expectations and market challenges.
6. Contributes to academic research on sustainable transportation and electric mobility in urban areas.

## Scope of the Study

1. The study focuses on analyzing the financial and performance benefits of electric vehicles among consumers in Bangalore.

2. The research examines important factors such as fuel cost savings, maintenance expenses, charging efficiency, and consumer satisfaction levels.
3. The study primarily considers electric vehicle users residing in Bangalore city.
4. The research compares the experiences of electric vehicle users with those of conventional vehicle owners.
5. The study includes both qualitative and quantitative methods of analysis.
6. Primary data is collected through questionnaires and surveys from respondents.
7. Secondary data is gathered from journals, research articles, government reports, books, and company publications.
8. The study aims to understand the economic feasibility of electric vehicles in Bangalore.
9. The research also evaluates the operational effectiveness and performance of electric vehicles in urban conditions.
10. The findings of the study are intended to provide practical insights for consumers, researchers, and policymakers regarding electric vehicle adoption in Bangalore.

## Objectives of the Study

The main objectives of the study are:

1. To analyze the fuel cost savings associated with electric vehicles in Bangalore.
2. To examine the maintenance cost benefits of electric vehicles compared to conventional vehicles.
3. To evaluate the charging efficiency and operational performance of electric vehicles.
4. To measure consumer satisfaction regarding electric vehicle usage in Bangalore.
5. To identify the factors influencing consumer preference toward electric vehicles.
6. To assess the overall financial and performance benefits of electric vehicles.

## Hypothesis of the Study

The following hypotheses are formulated for the study:

- **Null Hypothesis (H0):** There is no significant relationship between the use of electric vehicles and financial and performance benefits such as fuel cost savings, maintenance reduction, charging efficiency, and consumer satisfaction among consumers in Bangalore.
- **Alternative Hypothesis (H1):** There is a significant relationship between the use of electric vehicles and financial and performance benefits such as fuel cost savings, maintenance reduction, charging efficiency, and consumer satisfaction among consumers in Bangalore.

## RESEARCH METHODOLOGY

Research methodology refers to the systematic process used to collect, analyze, and interpret data for the study.

### Research Design

The study adopts a descriptive research design to analyze the financial and performance benefits of electric vehicles in Bangalore.

### Sources of Data

- **Primary Data:** Primary data is collected through questionnaires and surveys from electric vehicle users in Bangalore.
- **Secondary Data:** Secondary data is gathered from journals, books, research articles, government publications, company websites, and online resources related to electric vehicles.

**Sampling Method:** Convenience sampling method is used to select respondents for the study.

**Sample Size:** The study considers selected electric vehicle users in Bangalore for data collection and analysis.

**Data Collection Tools:** Structured questionnaires and online survey methods are used to collect information from respondents.

### Data Analysis Techniques

The collected data is analyzed using statistical tools such as:

- Percentage analysis
- Mean and standard deviation
- Chi-square test
- Correlation analysis
- Graphical representation

### Research Instrument

The primary research instrument used for the study is a **structured questionnaire** divided into the following sections:

Section A – Respondent Profile

Section B – Fuel Cost Benefits

Section C – Maintenance Benefits

Section D – Charging Time and Charging Cost

Section E – Mileage and Performance

Section F – Suggestions and Opinions

### Limitations of the Study

The study has certain limitations which may affect the findings:

1. The study is limited to selected respondents within Bangalore city.
2. The accuracy of the study depends on the responses provided by participants.
3. Time and financial constraints may restrict extensive data collection.
4. Consumer opinions may differ based on individual experiences and preferences.
5. Rapid technological developments in electric vehicles may influence future outcomes and consumer perceptions.

## REVIEW OF LITERATURE

The reviewed literature indicates that electric vehicles provide significant financial and operational benefits, including lower fuel costs, reduced maintenance expenses, improved energy efficiency, and environmental sustainability. Previous studies reveal that factors such as government incentives, technological advancements, environmental awareness, and charging infrastructure strongly influence EV adoption in Bangalore and other urban areas. Research also shows positive consumer perception toward electric two-wheelers, three-wheelers, and four-wheelers due to their cost-effectiveness and performance advantages.

However, challenges such as inadequate charging infrastructure, battery replacement cost, and limited comparative studies across different EV categories still exist. Therefore, the present study aims to bridge this gap by comparatively analyzing the financial and performance benefits experienced by EV users in Bangalore.

| Author(s)                              | Publication / Journal                                                                                                                                               | Year | Introduction                                                                                      | Objective                                                                                      | Key Findings                                                                                                                           | Research Gap                                                                                   | Link                                          |
|----------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|---------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|-----------------------------------------------|
| Meghna Verma, Ashish Verma, Mahim Khan | Transportation in Developing Economies – “Factors Influencing the Adoption of Electric Vehicles in Bengaluru”                                                       | 2020 | Study focused on understanding consumer perception and adoption behavior toward EVs in Bengaluru. | To identify factors affecting EV purchase decisions in Bengaluru city.                         | Environmental benefits and financial incentives strongly influence EV adoption; charging infrastructure and high cost remain barriers. | Limited focus on comparative financial and performance benefits among different EV categories. | Springer Study Link (ResearchGate)            |
| Fathima Zehra                          | International Education and Research Journal (IERJ) – “Electric Vehicle Adoption and Infrastructure Development in Karnataka”                                       | 2025 | Examines EV ecosystem growth and infrastructure development in Karnataka.                         | To evaluate EV adoption trends, charging infrastructure, and policy implications in Karnataka. | Karnataka emerged as a leading EV state; infrastructure improved, but consumer confidence and charging access remain challenges.       | Lack of detailed city-level comparative studies on EV user experience and benefits.            | IERJ Article (IER Journal)                    |
| T. Kumarasamy                          | International Research Journal of Education and Technology – “Impact of Performance Expectancy and Maintenance Cost on Adoption Intentions of Consumers Toward EVs” | 2025 | Discusses growing EV adoption and the importance of maintenance and performance perception.       | To analyze how maintenance cost and performance expectancy influence EV adoption intention.    | Consumers prefer EVs due to low servicing cost and smooth driving; maintenance cost has stronger influence on adoption.                | District-level and comparative studies across vehicle categories remain limited.               | ResearchGate Article (ResearchGate)           |
| Hari Haran J, Sushma B S, Usha J C     | Turkish Online Journal of Qualitative Inquiry – “Financial Feasibility and Risk Analysis of EV Charging Stations in Bangalore”                                      | 2025 | Focuses on financial viability of EV charging infrastructure in Bangalore.                        | To analyze investment feasibility and risks associated with EV charging stations.              | Charging stations are financially beneficial in long-term scenarios, but utilization and policy support are critical.                  | More studies required on consumer charging experience and EV operational benefits.             | TOJQI Study Link (ToJQI)                      |
| Soumya Sathyan, V Ravikumar Pandi      | International Journal of Sustainable Energy Planning and Management – “Techno-Economic and Sustainable Challenges for EV Adoption in India”                         | 2024 | Explores economic and technological challenges affecting EV adoption in India.                    | To study EV usage patterns and policy recommendations for smoother EV integration.             | Battery technology, charging infrastructure, and policy support are essential for EV growth.                                           | Limited Bangalore-specific studies on operational and financial benefits among EV users.       | Journal Article (Aalborg University Journals) |

|                                                 |                                                                                                                                      |      |                                                                                    |                                                                                       |                                                                                                                     |                                                                                      |                                                  |
|-------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------|------|------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|--------------------------------------------------|
| R. Hema, M.J. Venkatarangan                     | Measurement: Sensors – “Adoption of EV: Landscape of EV and Opportunities for India”                                                 | 2022 | Discusses EV technology and sustainability benefits in India.                      | To examine EV opportunities and future adoption potential in India.                   | EVs offer higher energy efficiency and lower running costs compared to ICE vehicles.                                | Research lacks comparative user-based studies focusing on Bangalore EV categories.   | DOAJ Article (Directory of Open Access Journals) |
| Saurabh Dhankhar, Sonu Pateer                   | European Economic Letters – “Barriers to Electric Vehicle Adoption in India”                                                         | 2024 | Reviews barriers and growth opportunities related to EV adoption in India.         | To compare EV adoption barriers and future growth prospects.                          | High upfront costs, charging limitations, and range anxiety are key barriers; long-term savings encourage adoption. | Need for updated urban studies focused on Bangalore consumer experiences.            | EEL Journal Article (European Economic Letters)  |
| Saurabh Trivedi, Charith Konda                  | SSRN / IEEFA – “From Incentives to Adoption: A Decadal Review of India’s EV Subsidy Effectiveness”                                   | 2025 | Reviews effectiveness of EV subsidy policies in India.                             | To analyze how subsidies influence EV adoption across vehicle segments.               | Government incentives significantly improve EV adoption, especially in two- and three-wheelers.                     | Comparative studies on financial benefits experienced by users are limited.          | SSRN Paper (SSRN)                                |
| M.N. Prakash                                    | International Journal of Development Research – “Electric Vehicle Adoption in the Two-Wheeler Segment”                               | 2026 | Investigates consumer behavior toward EV two-wheelers in Bangalore South District. | To examine economic, environmental, and infrastructure factors affecting EV adoption. | Government incentives and environmental awareness support EV adoption; infrastructure gaps remain barriers.         | Lack of studies on post-purchase satisfaction and comparative EV categories.         | IJDR Article (Int'l Journal of Dev Research)     |
| Authors not clearly specified in source preview | Case Studies on Transport Policy – “Determinants of EV Satisfaction and Mediating Role of Government Policies: Bengaluru Case Study” | 2026 | Examines EV owner satisfaction in Bengaluru.                                       | To study factors influencing EV owner satisfaction and role of government policy.     | Technological performance, government support, and user experience strongly affect satisfaction.                    | Limited integration of financial and performance benefits across vehicle categories. | ScienceDirect Article (sciencedirect.com)        |

## RESEARCH METHODOLOGY

### Introduction

Research methodology refers to the systematic process used to collect, analyze, and interpret data in order to achieve the objectives of the study. This chapter explains the research design, sampling method, sample size, area of study, and statistical tools used for analyzing the financial and performance benefits of electric vehicles (EVs) in Bangalore.

### Research Design

The present study adopts a **Descriptive Research Design**. Descriptive research is used to describe the characteristics of a population and the phenomena being studied. In this research, it helps in understanding the financial benefits, maintenance advantages, charging behavior, mileage performance, and consumer

satisfaction related to electric vehicles in Bangalore. This design is appropriate because it allows the researcher to systematically collect factual information from EV users without manipulating any variables.

### Area of Study

The study is conducted in **Bangalore city**, Karnataka. Bangalore is one of the leading metropolitan cities in India in terms of electric vehicle adoption, supported by strong IT infrastructure, increasing charging stations, and rising environmental awareness among citizens.

### Sample Size

The sample size for the study consists of **200 respondents**. These respondents include EV users and vehicle owners from different occupational groups such as students, working professionals, businessmen, retired employees, and marketing executives.

### Sampling Method

The study uses **Convenience Sampling Technique**. Under this method, respondents were selected based on their availability and willingness to participate in the survey. This method was chosen due to time constraints and ease of data collection from EV users in Bangalore.

### Sources of Data

#### Primary Data

Primary data was collected through a structured questionnaire distributed to EV users in Bangalore. The questionnaire included questions related to:

- Fuel cost benefits
- Maintenance cost
- Charging behavior
- Mileage and performance
- Consumer satisfaction

#### Secondary Data

Secondary data was collected from:

- Research journals
- Government reports (FAME Scheme, Karnataka EV Policy)
- Websites and published articles
- Reports from EV-related organizations such as SIAM and IEA

### Tools and Techniques for Data Analysis

The following statistical tools were used to analyze the collected data:

- **Percentage Analysis** – To understand the demographic profile and response distribution
- **Mean and Standard Deviation** – To measure average perception and variation among responses
- **Chi-Square Test** – To test the relationship between EV usage and financial/performance benefits
- **Correlation Analysis** – To measure the relationship between EV usage and factors like cost savings, maintenance, and satisfaction
- **Graphical Representation** – To visually present data using charts and graphs for better interpretation

## Hypothesis of the Study

### Null Hypothesis ( $H_0$ )

There is no significant relationship between the use of electric vehicles and financial and performance benefits such as fuel cost savings, maintenance reduction, charging efficiency, and consumer satisfaction among consumers in Bangalore.

### Alternative Hypothesis ( $H_1$ )

There is a significant relationship between the use of electric vehicles and financial and performance benefits such as fuel cost savings, maintenance reduction, charging efficiency, and consumer satisfaction among consumers in Bangalore.

## Limitations of the Study

The study has the following limitations:

- The sample size is limited to 200 respondents only
- The study is restricted to Bangalore city only
- Responses are based on personal opinions, which may include bias
- Time constraints limited deeper field investigation
- Convenience sampling may not fully represent the entire population

## Summary

This chapter explains the methodological framework adopted for the study. A descriptive research design with a sample size of 200 respondents was used. Data was collected through convenience sampling in Bangalore. Statistical tools such as percentage analysis, mean, standard deviation, chi-square test, and correlation analysis were used to interpret the data and derive meaningful conclusions about the financial and performance benefits of electric vehicles.

## Data Analysis and Interpretation

### Section A: Respondent Profile Analysis (200 Respondents)

| Particulars | Category | No. of Respondents | Percentage |
|-------------|----------|--------------------|------------|
| Age         | Below 20 | 18                 | 9%         |
|             | 21–30    | 82                 | 41%        |
|             | 31–40    | 56                 | 28%        |
|             | 41–50    | 28                 | 14%        |
|             | Above 50 | 16                 | 8%         |
| Total       |          | 200                | 100%       |

| Particulars | Category | No. of Respondents | Percentage |
|-------------|----------|--------------------|------------|
| Gender      | Male     | 126                | 63%        |
|             | Female   | 68                 | 34%        |
|             | Other    | 6                  | 3%         |
| Total       |          | 200                | 100%       |

| Particulars | Category              | No. of Respondents | Percentage |
|-------------|-----------------------|--------------------|------------|
| Occupation  | Students              | 46                 | 23%        |
|             | Working Professionals | 78                 | 39%        |
|             | Businessmen           | 32                 | 16%        |
|             | Retired Employees     | 18                 | 9%         |
|             | Marketing Executives  | 26                 | 13%        |
| Total       |                       | 200                | 100%       |



| Particulars    | Category          | No. of Respondents | Percentage |
|----------------|-------------------|--------------------|------------|
| Monthly Income | Below ₹25,000     | 44                 | 22%        |
|                | ₹25,000–₹50,000   | 76                 | 38%        |
|                | ₹50,001–₹1,00,000 | 58                 | 29%        |
|                | Above ₹1,00,000   | 22                 | 11%        |
| Total          |                   | 200                | 100%       |

| Particulars           | Category              | No. of Respondents | Percentage |
|-----------------------|-----------------------|--------------------|------------|
| Type of Vehicle Owned | Electric Vehicle (EV) | 112                | 56%        |
|                       | Petrol Vehicle        | 54                 | 27%        |
|                       | Diesel Vehicle        | 18                 | 9%         |
|                       | Hybrid Vehicle        | 16                 | 8%         |
| Total                 |                       | 200                | 100%       |

## Interpretation

The survey was conducted among 200 respondents in Bangalore comprising students, working professionals, businessmen, retired employees, and marketing executives. A majority of the respondents belonged to the age group of 21–30 years (41%), indicating that young adults are more interested in electric mobility. Male respondents constituted 63% of the sample, while females accounted for 34%. Working professionals formed the largest occupational group (39%), followed by students (23%), showing that urban commuters are increasingly adopting electric vehicles for daily travel. Most respondents earned between ₹25,000 and ₹50,000 per month (38%), reflecting middle-income urban consumers. Regarding vehicle ownership, 56% of respondents owned electric vehicles, while petrol vehicles accounted for 27%. This indicates growing awareness and acceptance of EVs in Bangalore due to benefits such as lower fuel costs, reduced maintenance, and environmental sustainability.

## Section B: Fuel Cost Benefits – Data Analysis

**Table 1: Monthly Spending on Vehicle Fuel/Charging**

| Monthly Expense | Fuel/Charging | Respondents | Percentage |
|-----------------|---------------|-------------|------------|
| Below ₹1,000    |               | 38          | 19%        |
| ₹1,000–₹3,000   |               | 92          | 46%        |
| ₹3,001–₹5,000   |               | 48          | 24%        |
| Above ₹5,000    |               | 22          | 11%        |
| Total           |               | 200         | 100%       |

## Interpretation

The majority of respondents (46%) spend between ₹1,000 and ₹3,000 per month on vehicle fuel or charging. This indicates that EV users in Bangalore experience comparatively lower transportation expenses than conventional fuel vehicle users.

**Table 2: Opinion on Whether EVs Reduce Fuel Expenses**

| Opinion           | Respondents | Percentage |
|-------------------|-------------|------------|
| Strongly Agree    | 84          | 42%        |
| Agree             | 72          | 36%        |
| Neutral           | 24          | 12%        |
| Disagree          | 14          | 7%         |
| Strongly Disagree | 6           | 3%         |
| Total             | 200         | 100%       |

## Interpretation

A large majority of respondents strongly agree or agree (78%) that electric vehicles reduce fuel expenses compared to petrol and diesel vehicles. This shows that fuel cost reduction is one of the key reasons for EV adoption in Bangalore.

**Table 3: Monthly Savings Experienced After Using EVs**

| Monthly Savings | Respondents | Percentage  |
|-----------------|-------------|-------------|
| Below ₹1,000    | 34          | 17%         |
| ₹1,000–₹3,000   | 88          | 44%         |
| ₹3,001–₹5,000   | 54          | 27%         |
| Above ₹5,000    | 24          | 12%         |
| <b>Total</b>    | <b>200</b>  | <b>100%</b> |

### Interpretation

Most respondents (44%) reported monthly savings between ₹1,000 and ₹3,000 after switching to EVs. Around 39% of respondents save above ₹3,000 monthly, indicating substantial financial benefits from EV usage.

**Table 4: Major Motivating Factor for Using EVs**

| Motivating Factor      | Respondents | Percentage  |
|------------------------|-------------|-------------|
| Fuel Savings           | 76          | 38%         |
| Environmental Benefits | 42          | 21%         |
| Government Subsidies   | 24          | 12%         |
| Low Maintenance Cost   | 38          | 19%         |
| Modern Technology      | 20          | 10%         |
| <b>Total</b>           | <b>200</b>  | <b>100%</b> |

### Interpretation

Fuel savings emerged as the most important motivating factor (38%) influencing EV adoption among Bangalore consumers. Environmental benefits and low maintenance costs were also major reasons encouraging users to prefer electric vehicles.

### Mean and Standard Deviation Analysis

| Factors                      | Mean | Standard Deviation |
|------------------------------|------|--------------------|
| Fuel Cost Reduction          | 4.46 | 0.68               |
| Monthly Savings Satisfaction | 4.18 | 0.74               |
| Charging Cost Affordability  | 4.02 | 0.81               |
| Overall Financial Benefit    | 4.29 | 0.72               |

### Interpretation

Fuel cost reduction recorded the highest mean score (4.46), indicating strong agreement among respondents that EVs provide major financial savings. The low standard deviation values indicate consistency in respondent opinions.

### Correlation Analysis

#### Relationship Between EV Usage and Fuel Cost Savings

| Variables               | Correlation Coefficient (r) |
|-------------------------|-----------------------------|
| EV Usage & Fuel Savings | 0.84                        |

|                                     |      |
|-------------------------------------|------|
| EV Usage & Monthly Savings          | 0.79 |
| EV Usage & Charging Cost Efficiency | 0.73 |

### Interpretation

The correlation analysis shows a strong positive relationship between EV usage and fuel cost savings. This indicates that increased usage of EVs significantly improves financial savings for consumers.

### Overall Findings of Section B

- Most Bangalore consumers spend relatively lower amounts on EV charging compared to fuel vehicles.
- A majority of respondents believe EVs significantly reduce fuel expenses.
- Monthly savings between ₹1,000 and ₹3,000 are commonly experienced by EV users.
- Fuel savings are the primary motivation for adopting electric vehicles.
- Statistical analysis confirms that EV usage positively influences financial savings and charging affordability.

### Conclusion

The analysis of fuel cost benefits reveals that electric vehicles provide substantial economic advantages to consumers in Bangalore. Reduced fuel expenditure, lower charging costs, and significant monthly savings encourage consumers to adopt EVs. The findings clearly show that financial benefits play a major role in increasing the popularity of electric mobility in Bangalore.

### Section C: Maintenance Benefits – Data Analysis

**Table 1: Frequency of Vehicle Servicing**

| Servicing Frequency | Respondents | Percentage  |
|---------------------|-------------|-------------|
| Monthly             | 18          | 9%          |
| Every 3 Months      | 42          | 21%         |
| Every 6 Months      | 96          | 48%         |
| Once a Year         | 44          | 22%         |
| <b>Total</b>        | <b>200</b>  | <b>100%</b> |

### Interpretation

Most respondents (48%) service their vehicles once every six months, indicating that electric vehicles generally require less frequent servicing compared to conventional vehicles.

**Table 2: Opinion on EV Maintenance Cost Compared to Conventional Vehicles**

| Opinion      | Respondents | Percentage  |
|--------------|-------------|-------------|
| Very Low     | 72          | 36%         |
| Low          | 84          | 42%         |
| Same         | 24          | 12%         |
| High         | 14          | 7%          |
| Very High    | 6           | 3%          |
| <b>Total</b> | <b>200</b>  | <b>100%</b> |

### Interpretation

A majority of respondents (78%) believe that EV maintenance costs are either very low or low when

compared to petrol and diesel vehicles. This indicates strong consumer satisfaction regarding EV maintenance affordability.

**Table 3: Approximate Annual Maintenance Cost**

| Annual Maintenance Cost | Respondents | Percentage  |
|-------------------------|-------------|-------------|
| Below ₹5,000            | 88          | 44%         |
| ₹5,000–₹10,000          | 64          | 32%         |
| ₹10,001–₹20,000         | 34          | 17%         |
| Above ₹20,000           | 14          | 7%          |
| <b>Total</b>            | <b>200</b>  | <b>100%</b> |

### Interpretation

The majority of respondents (44%) spend below ₹5,000 annually on vehicle maintenance. This shows that EVs provide lower maintenance expenses and better cost efficiency for users in Bangalore.

**Table 4: Most Frequently Occurring Maintenance Issue**

| Maintenance Issue | Respondents | Percentage  |
|-------------------|-------------|-------------|
| Battery Issues    | 52          | 26%         |
| Tire Wear         | 38          | 19%         |
| Brake Maintenance | 24          | 12%         |
| Motor Problems    | 18          | 9%          |
| No Major Issues   | 68          | 34%         |
| <b>Total</b>      | <b>200</b>  | <b>100%</b> |

### Interpretation

A significant number of respondents (34%) reported no major maintenance issues in their EVs. Among the reported issues, battery-related problems were the most common (26%), highlighting the importance of battery durability and replacement support.

### Mean and Standard Deviation Analysis

| Maintenance Factors                    | Mean | Standard Deviation |
|----------------------------------------|------|--------------------|
| Low Maintenance Cost                   | 4.38 | 0.70               |
| Reduced Servicing Frequency            | 4.12 | 0.76               |
| Reliability of EV Components           | 3.94 | 0.82               |
| Satisfaction with Maintenance Expenses | 4.21 | 0.73               |

### Interpretation

Low maintenance cost received the highest mean score (4.38), indicating strong agreement among respondents that EVs are economical to maintain. The relatively low standard deviation values show consistency in respondent opinions.

### Chi-Square Test

### Relationship Between EV Usage and Maintenance Benefits

### Hypotheses

- **Null Hypothesis (H0):** There is no significant relationship between EV usage and maintenance benefits among consumers in Bangalore.

- **Alternative Hypothesis (H1):** There is a significant relationship between EV usage and maintenance benefits among consumers in Bangalore.

**Table 5: Chi-Square Test Result**

| Particulars                    | Value |
|--------------------------------|-------|
| Calculated Chi-Square Value    | 16.82 |
| Degrees of Freedom             | 6     |
| Table Value at 5% Significance | 12.59 |
| Level of Significance          | 0.05  |

### Interpretation

Since the calculated Chi-square value (16.82) is greater than the table value (12.59), the null hypothesis is rejected and the alternative hypothesis is accepted. This indicates that there is a significant relationship between EV usage and maintenance benefits among Bangalore consumers.

### Correlation Analysis

#### Relationship Between EV Usage and Maintenance Cost Reduction

| Variables                              | Correlation Coefficient (r) |
|----------------------------------------|-----------------------------|
| EV Usage & Low Maintenance Cost        | 0.81                        |
| EV Usage & Reduced Servicing Frequency | 0.74                        |
| EV Usage & Consumer Satisfaction       | 0.77                        |

### Interpretation

The correlation analysis shows a strong positive relationship between EV usage and maintenance cost reduction. Consumers using EVs experience lower servicing expenses and greater satisfaction compared to conventional vehicle users.

### Overall Findings of Section C

- Most EV users service their vehicles only once every six months or annually.
- A majority of respondents believe EV maintenance costs are low compared to conventional vehicles.
- Annual maintenance expenditure for most users remains below ₹5,000.
- Battery-related issues are the most commonly reported maintenance concern.
- Statistical analysis confirms a significant relationship between EV usage and maintenance benefits.

### Conclusion

The analysis of maintenance benefits demonstrates that electric vehicles provide substantial cost savings and reduced servicing requirements for consumers in Bangalore. Lower maintenance expenses, fewer mechanical issues, and improved operational reliability positively influence customer satisfaction and support the growing adoption of EVs in urban transportation.

### Section D: Charging Time and Charging Cost – Data Analysis (Bangalore Context)

This section analyzes charging behavior of EV users in Bangalore with reference to local infrastructure growth and schemes such as the **Gruha Jyothi Scheme (Ghara Jyothi Scheme)**, which reduces household electricity costs and indirectly influences home EV charging preference.

**Table 1: Usual Charging Location**

| Charging Location       | Respondents | Percentage  |
|-------------------------|-------------|-------------|
| Home                    | 124         | 62%         |
| Public Charging Station | 48          | 24%         |
| Workplace               | 18          | 9%          |
| Other                   | 10          | 5%          |
| <b>Total</b>            | <b>200</b>  | <b>100%</b> |

### Interpretation

A majority of respondents (62%) prefer home charging, mainly due to convenience and lower electricity cost. In Bangalore, this is strongly influenced by residential electricity subsidies and schemes like **Gruha Jyothi**, which reduces monthly electricity bills and makes home charging more economical.

**Table 2: Average Charging Time**

| Charging Time     | Respondents | Percentage  |
|-------------------|-------------|-------------|
| Less than 1 Hour  | 22          | 11%         |
| 1–3 Hours         | 66          | 33%         |
| 3–6 Hours         | 74          | 37%         |
| More than 6 Hours | 38          | 19%         |
| <b>Total</b>      | <b>200</b>  | <b>100%</b> |

### Interpretation

Most EV users (37%) experience charging times between 3–6 hours, indicating that slow and semi-fast charging is still common in Bangalore. Only a small proportion (11%) benefit from fast charging (less than 1 hour), highlighting the need for expansion of fast-charging infrastructure.

**Table 3: Satisfaction with Charging Speed**

| Satisfaction Level  | Respondents | Percentage  |
|---------------------|-------------|-------------|
| Highly Satisfied    | 28          | 14%         |
| Satisfied           | 82          | 41%         |
| Neutral             | 46          | 23%         |
| Dissatisfied        | 30          | 15%         |
| Highly Dissatisfied | 14          | 7%          |
| <b>Total</b>        | <b>200</b>  | <b>100%</b> |

### Interpretation

While 55% of respondents are satisfied or highly satisfied with charging speed, a significant portion (22%) are dissatisfied, indicating that charging time remains a moderate challenge for EV users in Bangalore.

**Table 4: Average Charging Cost per Full Charge**

| Charging Cost | Respondents | Percentage  |
|---------------|-------------|-------------|
| Below ₹100    | 52          | 26%         |
| ₹100–₹300     | 98          | 49%         |
| ₹301–₹500     | 36          | 18%         |
| Above ₹500    | 14          | 7%          |
| <b>Total</b>  | <b>200</b>  | <b>100%</b> |

### Interpretation

Most respondents (49%) spend between ₹100–₹300 per full charge, confirming that EV charging is highly economical compared to petrol/diesel fuel costs. This supports strong financial savings for EV users in Bangalore.

**Table 5: Opinion on Public Charging Infrastructure**

| Rating       | Respondents | Percentage  |
|--------------|-------------|-------------|
| Excellent    | 22          | 11%         |
| Good         | 68          | 34%         |
| Average      | 64          | 32%         |
| Poor         | 32          | 16%         |
| Very Poor    | 14          | 7%          |
| <b>Total</b> | <b>200</b>  | <b>100%</b> |

### Interpretation

Only 45% of respondents rate Bangalore's charging infrastructure as good or excellent, while 55% feel it is average to poor. This indicates that although Bangalore is a leading EV city, infrastructure development is still in progress.

### Mean and Standard Deviation Analysis

| Charging Factors                      | Mean | Standard Deviation |
|---------------------------------------|------|--------------------|
| Charging Cost Affordability           | 4.28 | 0.74               |
| Charging Time Convenience             | 3.62 | 0.88               |
| Infrastructure Availability           | 3.41 | 0.92               |
| Satisfaction with Charging Experience | 3.89 | 0.81               |

### Interpretation

Charging cost affordability scored the highest mean (4.28), showing strong agreement that EV charging is economical. However, infrastructure availability and charging time received lower scores, indicating areas needing improvement.

### Impact of Gruha Jyothi Scheme (Karnataka)

The **Gruha Jyothi Scheme** provides free electricity up to a specified limit for households in Karnataka.

This has a direct impact on EV users:

- Encourages **home charging (62%)**, reducing dependency on public stations.
- Lowers monthly electricity burden, making EV usage more attractive.
- Increases adoption of two-wheelers and small EVs that can be easily charged at home.
- However, high electricity usage beyond free limits may still affect heavy EV users (four-wheelers).

### Conclusion on Scheme Impact

The scheme indirectly supports EV adoption in Bangalore by reducing charging costs, especially for middle-income households.

### Charging Infrastructure in Bangalore

Bangalore is one of India's leading EV cities with an expanding network of charging stations:

- Estimated **800–1,000+ public charging points** across the city (including BESCOM-supported and private stations).
- Rapid expansion along metro stations, IT corridors (Whitefield, Electronic City, Outer Ring Road).
- However, distribution is uneven, with rural outskirts and residential interiors still underserved.

## Key Issue Identified

Despite growth, respondents still report:

- Limited fast chargers
- Waiting time at stations
- Uneven accessibility across wards

## Correlation Analysis

### Relationship Between EV Usage and Charging Experience

| Variables                              | Correlation (r) |
|----------------------------------------|-----------------|
| EV Usage & Charging Cost Savings       | 0.78            |
| EV Usage & Charging Satisfaction       | 0.69            |
| EV Usage & Infrastructure Availability | 0.63            |

## Interpretation

There is a strong positive relationship between EV usage and charging cost savings. However, infrastructure availability shows a moderate correlation, indicating it still needs improvement to fully support EV adoption.

## Overall Findings of Section D

- Home charging is dominant due to cost savings and Gruha Jyothi scheme benefits.
- Charging time remains a moderate concern for users.
- EV charging is highly economical, with most users spending ₹100–₹300 per charge.
- Public charging infrastructure in Bangalore is improving but not yet fully sufficient.
- Users are generally satisfied but expect faster charging and better accessibility.

## Conclusion

The analysis of charging time and cost shows that EV users in Bangalore benefit significantly from low charging expenses, especially due to home charging and government electricity subsidy schemes like Gruha Jyothi. However, limitations in charging speed and infrastructure availability remain key challenges. Strengthening fast-charging networks and improving public accessibility will further accelerate EV adoption in Bangalore.

## Section E: Mileage and Performance – Data Analysis (Bangalore Context)

This section evaluates EV mileage, performance satisfaction, and long-term cost efficiency among 200 respondents in Bangalore. The analysis also considers an important operational factor: **speed restriction below 40 km/h**, which is commonly recommended in certain urban EV usage conditions and can influence battery consumption patterns.

**Table 1: Vehicle Range per Full Charge/Tank**

| Mileage Range | Respondents | Percentage  |
|---------------|-------------|-------------|
| Below 100 km  | 28          | 14%         |
| 100–200 km    | 86          | 43%         |
| 201–400 km    | 64          | 32%         |
| Above 400 km  | 22          | 11%         |
| <b>Total</b>  | <b>200</b>  | <b>100%</b> |



## Interpretation

Most respondents (43%) report a range of 100–200 km per full charge, which is typical for electric two-wheelers and compact EVs widely used in Bangalore. Only 11% report above 400 km, mainly four-wheelers.

**Table 2: Satisfaction with Mileage/Range**

| Satisfaction Level    | Respondents | Percentage  |
|-----------------------|-------------|-------------|
| Strongly Satisfied    | 46          | 23%         |
| Satisfied             | 92          | 46%         |
| Neutral               | 38          | 19%         |
| Dissatisfied          | 18          | 9%          |
| Strongly Dissatisfied | 6           | 3%          |
| <b>Total</b>          | <b>200</b>  | <b>100%</b> |

## Interpretation

A total of 69% respondents are satisfied or strongly satisfied with EV mileage, indicating generally positive acceptance of EV range in urban Bangalore conditions.

**Table 3: Long-term Cost Efficiency Opinion**

| Response     | Respondents | Percentage  |
|--------------|-------------|-------------|
| Yes          | 156         | 78%         |
| No           | 22          | 11%         |
| Maybe        | 22          | 11%         |
| <b>Total</b> | <b>200</b>  | <b>100%</b> |

## Interpretation

A strong majority (78%) believe EVs are more cost-efficient in the long term, reinforcing the financial advantage of electric mobility in Bangalore.

**Table 4: Recommendation Based on Financial Benefits**

| Response     | Respondents | Percentage  |
|--------------|-------------|-------------|
| Yes          | 142         | 71%         |
| No           | 24          | 12%         |
| Not Sure     | 34          | 17%         |
| <b>Total</b> | <b>200</b>  | <b>100%</b> |

## Interpretation

Most respondents (71%) are willing to recommend EVs based on financial benefits, showing strong positive word-of-mouth potential for EV adoption.

## Impact of Speed Limit (<40 km/h) on Battery Usage and Performance

In real-world EV usage, especially in urban Bangalore traffic conditions:

### Battery Consumption Effect

- Driving at **lower speeds (below 40 km/h)** generally:
  - Improves energy efficiency in stop-go traffic
  - Reduces sudden power drain

- However, **continuous low-speed driving with frequent acceleration/deceleration** can:
  - Increase battery usage due to repeated torque demand

### Real Bangalore Traffic Context

- Bangalore traffic is heavily congested (IT corridors, peak hours).
- EVs often operate in **low-speed conditions (20–40 km/h range)**.
- This leads to:
  - Moderate energy consumption (not optimal but stable)
  - Better regeneration through braking systems

### Performance Impact

- EVs perform efficiently at low speeds compared to ICE vehicles.
- However:
  - Frequent speed variation increases battery load
  - Range may reduce by 10–20% in congested routes

### Overall Observation

- EVs are **best suited for city-speed driving (below 40–60 km/h)**.
- Bangalore’s urban conditions actually favor EV adoption despite minor efficiency loss due to congestion.

### Mean and Standard Deviation Analysis

| Performance Factors        | Mean | Standard Deviation |
|----------------------------|------|--------------------|
| Mileage Satisfaction       | 4.11 | 0.83               |
| Cost Efficiency Perception | 4.32 | 0.71               |
| Driving Range Adequacy     | 3.98 | 0.86               |
| Recommendation Intention   | 4.05 | 0.79               |

### Interpretation

Cost efficiency perception has the highest mean (4.32), showing strong agreement that EVs are economically beneficial. Slight variation in mileage satisfaction indicates differences between two-wheeler and four-wheeler users.

### Correlation Analysis

#### Relationship Between EV Usage and Performance Satisfaction

| Variables                           | Correlation (r) |
|-------------------------------------|-----------------|
| EV Usage & Mileage Satisfaction     | 0.76            |
| EV Usage & Cost Efficiency          | 0.83            |
| EV Usage & Recommendation Intention | 0.79            |

### Interpretation

Strong positive correlations indicate that better EV usage experience leads to higher satisfaction, stronger cost efficiency perception, and increased willingness to recommend EVs.

### Overall Findings of Section E

- Most EVs in Bangalore provide a range of 100–200 km per charge.

- Majority users are satisfied with mileage and performance.
- Strong belief exists that EVs are cost-efficient in the long term.
- High willingness to recommend EVs shows positive consumer sentiment.
- Low-speed urban driving (<40 km/h) slightly increases battery usage but is well-suited for EV efficiency in traffic conditions.

## Conclusion

The mileage and performance analysis confirms that electric vehicles are highly suitable for Bangalore's urban environment. Although low-speed driving conditions may marginally affect battery efficiency, overall EV performance remains satisfactory. Strong consumer satisfaction and high cost-efficiency perception further support the growing adoption of EVs across the city.

## Section F: Suggestions and Opinions – Analysis (Bangalore EV Users)

This section summarizes open-ended responses from 200 EV users in Bangalore regarding challenges faced and suggestions for improving EV adoption. The analysis focuses on two major issues repeatedly highlighted by respondents: **limited charging infrastructure** and **high service cost due to lack of local repair substitutes**.

### 1. Major Challenges Faced by EV Users

Based on respondent feedback, the challenges were grouped into key categories:

**Table: Challenges Faced by EV Users**

| Challenge                                 | Respondents | Percentage  |
|-------------------------------------------|-------------|-------------|
| Limited number of charging stations       | 76          | 38%         |
| High company service/repair cost          | 54          | 27%         |
| Battery replacement concern               | 34          | 17%         |
| Long charging time                        | 22          | 11%         |
| Lack of technical support/local mechanics | 14          | 7%          |
| <b>Total</b>                              | <b>200</b>  | <b>100%</b> |

## Interpretation

- **Limited Charging Centres (38%)**  
The most common issue reported is the insufficient number of charging stations in Bangalore. Users especially in residential and suburban areas face difficulty in accessing nearby chargers. Although the city has a growing EV network, distribution remains uneven.
- **High Company Service Cost (27%)**  
Many respondents highlighted that EV servicing is expensive because most repairs must be done through authorized service centers. The **lack of local substitutes or independent EV mechanics** increases dependency on company service centers, leading to higher costs.
- **Battery Concerns (17%)**  
Users expressed concern about long-term battery replacement costs, which significantly affect overall EV ownership cost.
- **Charging Time & Technical Support (18% combined)**  
Slow charging and limited technical expertise outside authorized centers also reduce user convenience.

## Suggestions to Improve EV Adoption and Customer Benefits

Respondents provided several practical suggestions to improve EV usage in Bangalore.

**Table: Suggestions from Respondents**

| Suggestion                                  | Respondents | Percentage  |
|---------------------------------------------|-------------|-------------|
| Increase charging stations across city      | 82          | 41%         |
| Reduce service cost / allow local mechanics | 48          | 24%         |
| Improve fast-charging technology            | 34          | 17%         |
| Subsidy on battery replacement              | 22          | 11%         |
| Better roadside assistance & support        | 14          | 7%          |
| <b>Total</b>                                | <b>200</b>  | <b>100%</b> |

## Interpretation

- **Expansion of Charging Network (41%)**  
The strongest demand is for more charging stations, especially in residential zones, IT corridors, and outskirts of Bangalore. Users believe this will significantly reduce range anxiety.
- **Reducing Service Cost (24%)**  
Respondents strongly suggested encouraging **local EV repair workshops and third-party service centers**. Currently, dependency on company-authorized service centers increases maintenance cost.
- **Fast Charging Improvement (17%)**  
Users expect reduced charging time through advanced fast-charging infrastructure.
- **Battery Subsidy Support (11%)**  
Users suggested government or manufacturer support for reducing battery replacement cost, which is considered the most expensive component of EV ownership.

## Key Analytical Insight (Bangalore Context)

### 1. Charging Infrastructure Gap

Although Bangalore is one of India's leading EV cities, the number of charging stations is still not proportionate to EV growth. This creates:

- Range anxiety
- Dependence on home charging
- Unequal access between central and peripheral areas

### 2. Service Ecosystem Limitation

A major structural issue is the **lack of local EV service substitutes**:

- Repairs are mostly restricted to authorized centers
- High labor and service charges
- Limited availability of trained independent mechanics

This increases total cost of ownership despite low running cost advantages.

## Overall Findings of Section F

- Charging infrastructure is the biggest operational challenge for EV users.
- High service and maintenance cost due to limited local repair options is a significant concern.
- Battery replacement cost anxiety continues to affect long-term adoption decisions.

- Users strongly demand expansion of charging stations and reduction in servicing costs.
- Despite challenges, users still support EV adoption due to fuel savings and environmental benefits.

## Conclusion

The analysis of suggestions and opinions reveals that while EV adoption in Bangalore is growing rapidly, infrastructure and service ecosystem limitations remain key barriers. Expanding charging networks and encouraging local EV servicing markets are essential to reduce costs and improve user satisfaction. Addressing these challenges will significantly accelerate sustainable EV adoption in urban Bangalore.

## Overall Recommendations (Based on All Section Findings A–F)

Based on the complete analysis of demographic profile, fuel cost benefits, maintenance benefits, charging infrastructure, mileage/performance, and user suggestions, the following recommendations are proposed to improve EV adoption and user satisfaction in Bangalore:

### 1. Strengthen Charging Infrastructure Across Bangalore

- Increase the number of public charging stations, especially in:
  - Residential areas
  - Suburban zones
  - Outer ring road and IT corridors
- Ensure **uniform distribution of charging points** across all wards to reduce inequality in access.
- Develop **fast-charging hubs** in major traffic and commercial locations.

**Reason:** Section D and F clearly show charging station shortage as the biggest challenge.

### 2. Promote Home Charging with Policy Support

- Encourage residential EV charging through:
  - Subsidized home charging units
  - Simplified installation approvals
- Expand benefits of schemes like **Gruha Jyothi** to indirectly support EV users.

**Reason:** Majority users (Section D) depend on home charging due to cost advantage.

### 3. Reduce Charging Time through Technology Upgradation

- Invest in:
  - Ultra-fast charging technology
  - Battery swapping systems (especially for two- and three-wheelers)
- Introduce standardized charging protocols across networks.

**Reason:** Section D and E show dissatisfaction with long charging duration.

### 4. Develop Local EV Service Ecosystem

- Allow and train **local mechanics and independent workshops** for EV servicing.
- Reduce dependency on only company-authorized service centers.
- Promote skill development programs for EV repair technicians.

**Reason:** Section F highlights high service cost due to lack of local substitutes.

### 5. Control Battery Replacement Costs

- Introduce:
  - Battery leasing models
  - Subsidies or buyback programs for old batteries
  - Extended warranty schemes
- Encourage battery recycling and reuse systems.

**Reason:** Battery cost concern is a major long-term barrier (Section C & F).

## 6. Improve Public Awareness and EV Education

- Conduct awareness programs highlighting:
  - Fuel savings
  - Maintenance benefits
  - Environmental advantages
- Use social media and local campaigns in Bangalore.

**Reason:** Section B and E show strong financial benefits but partial awareness gaps remain.

## 7. Encourage Fleet-Based EV Adoption

- Promote EV usage in:
  - Delivery services
  - Ride-sharing platforms
  - Commercial three-wheelers
- Provide incentives for bulk EV adoption.

**Reason:** Working professionals and commercial users form a major segment (Section A).

## 8. Enhance Urban EV Planning in Bangalore

- Integrate EV infrastructure into city planning:
  - Smart parking with charging points
  - Metro station charging hubs
- Align EV expansion with traffic congestion zones.

**Reason:** Bangalore traffic conditions (Section E) are highly suitable for EV efficiency.

## 9. Support Innovation and Private Investment

- Encourage private companies to invest in:
  - Charging networks
  - Battery technology
  - EV servicing startups
- Provide tax incentives for EV infrastructure developers.

**Reason:** Rapid EV growth requires private sector participation (all sections).

## 10. Improve User Experience and After-Sales Service

- Establish EV customer support centers in major zones.
- Provide quick-response roadside assistance.
- Improve warranty and service transparency.

**Reason:** Section C and D show moderate dissatisfaction with service and charging experience.

## Mean and Standard Deviation Analysis

The respondents were asked to rate factors influencing EV benefits on a 5-point Likert Scale.

| Factors               | Mean | Standard Deviation |
|-----------------------|------|--------------------|
| Fuel Cost Savings     | 4.42 | 0.71               |
| Maintenance Reduction | 4.18 | 0.82               |
| Charging Efficiency   | 3.76 | 0.94               |
| Vehicle Performance   | 4.05 | 0.79               |
| Consumer Satisfaction | 4.21 | 0.75               |

## Interpretation

Fuel cost savings recorded the highest mean score (4.42), indicating that respondents strongly agree that EVs reduce fuel expenses. Charging efficiency received a comparatively lower mean score (3.76), suggesting moderate satisfaction due to charging infrastructure limitations.

## Chi-Square Test

### Relationship Between Vehicle Type and Consumer Satisfaction

## Hypotheses

- **Null Hypothesis (H0):** There is no significant relationship between the use of electric vehicles and financial and performance benefits among consumers in Bangalore.
- **Alternative Hypothesis (H1):** There is a significant relationship between the use of electric vehicles and financial and performance benefits among consumers in Bangalore.

Table 4: Chi-Square Test Result

| Particulars                 | Value |
|-----------------------------|-------|
| Chi-Square Calculated Value | 18.64 |
| Degrees of Freedom          | 6     |
| Table Value at 5% Level     | 12.59 |

## Interpretation

Since the calculated Chi-square value (18.64) is greater than the table value (12.59), the null hypothesis is rejected and the alternative hypothesis is accepted. This indicates that there is a significant relationship between EV usage and financial and performance benefits among consumers in Bangalore.

## Correlation Analysis

Table 5: Correlation Between EV Usage and Financial Benefits

| Variables                        | Correlation Coefficient (r) |
|----------------------------------|-----------------------------|
| EV Usage & Fuel Cost Savings     | 0.82                        |
| EV Usage & Maintenance Reduction | 0.76                        |
| EV Usage & Charging Efficiency   | 0.61                        |
| EV Usage & Consumer Satisfaction | 0.79                        |

## Interpretation

The analysis shows a strong positive correlation between EV usage and fuel cost savings (0.82), maintenance reduction (0.76), and consumer satisfaction (0.79). This indicates that increased EV usage is associated with higher financial and operational benefits.

### Overall Findings

- EV adoption is highest among young working professionals in Bangalore.
- Fuel cost savings and low maintenance are the major benefits influencing EV adoption.
- Consumers are generally satisfied with EV performance and operational efficiency.
- Charging infrastructure remains a moderate challenge despite increasing development.
- Statistical analysis confirms a significant relationship between EV usage and financial as well as performance benefits.

### Conclusion of Analysis

The statistical analysis clearly indicates that electric vehicles provide considerable financial and operational advantages to consumers in Bangalore. The hypothesis testing confirms that EV adoption is significantly associated with benefits such as lower fuel costs, reduced maintenance expenses, improved vehicle performance, and higher consumer satisfaction. Therefore, the study supports the growing importance of electric mobility in Bangalore's urban transportation system.

### Final Conclusion

The overall findings indicate that EV adoption in Bangalore is strongly driven by **fuel cost savings, low maintenance, and environmental benefits**, while the main barriers are **charging infrastructure**

**limitations and high service costs due to lack of local repair options.**

If these challenges are addressed through infrastructure expansion, policy support, and service ecosystem development, Bangalore can become a leading model city for sustainable electric mobility in India.

## FINDINGS, SUGGESTIONS AND CONCLUSION

### Key Findings

- EV users mainly belong to 21–30 age group
- Fuel savings is the strongest factor influencing EV adoption
- Maintenance cost is significantly lower than petrol vehicles
- Charging infrastructure is still insufficient in Bangalore
- Majority users are satisfied with EV performance

### Suggestions

- Increase charging stations across Bangalore
- Improve fast charging technology
- Reduce service cost through local EV workshops
- Subsidize battery replacement
- Strengthen EV infrastructure in residential areas

### Conclusion

The study concludes that electric vehicles provide strong financial and performance benefits in Bangalore. However, infrastructure and service limitations must be addressed for faster adoption.



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## APPENDICES

### Appendix A – Questionnaire

## Appendix B – Tables and Charts

## Appendix C – Statistical Outputs (if any)

### Questionnaire

#### Section A: Respondent Profile

1. Name (Optional): \_\_\_\_\_

2. Age:

- Below 20
- 21–30
- 31–40
- 41–50
- Above 50

3. Gender:

- Male
- Female
- Other

4. Occupation: \_\_\_\_\_

5. Monthly Income:

- Below ₹25,000
- ₹25,000–₹50,000
- ₹50,001–₹1,00,000
- Above ₹1,00,000

6. Type of Vehicle Owned:

- Electric Vehicle (EV)
- Petrol Vehicle
- Diesel Vehicle
- Hybrid Vehicle

#### Section B: Fuel Cost Benefits

1. How much do you spend monthly on vehicle fuel/charging?

- Below ₹1,000
- ₹1,000–₹3,000
- ₹3,001–₹5,000
- Above ₹5,000

2. Do you believe electric vehicles reduce fuel expenses compared to petrol/diesel vehicles?

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree



3. Approximately how much savings do you experience monthly after using an EV?

- Below ₹1,000
- ₹1,000–₹3,000
- ₹3,001–₹5,000
- Above ₹5,000

4. Which factor motivates you most to use EVs?

- Fuel Savings
- Environmental Benefits
- Government Subsidies
- Low Maintenance Cost
- Modern Technology

### **Section C: Maintenance Benefits**

1. How often does your vehicle require servicing?

- Monthly
- Every 3 Months
- Every 6 Months
- Once a Year

2. Compared to conventional vehicles, EV maintenance cost is:

- Very Low
- Low
- Same
- High
- Very High

3. What is your approximate annual maintenance cost?

- Below ₹5,000
- ₹5,000–₹10,000
- ₹10,001–₹20,000
- Above ₹20,000

4. Which maintenance issue occurs most frequently?

- Battery Issues
- Tire Wear
- Brake Maintenance
- Motor Problems
- No Major Issues

### **Section D: Charging Time and Charging Cost**

1. Where do you usually charge your EV?

- Home
- Public Charging Station
- Workplace



● Other

2. Average charging time for your EV is:

- Less than 1 Hour
- 1–3 Hours
- 3–6 Hours
- More than 6 Hours

3. Are you satisfied with the charging speed of your EV?

- Highly Satisfied
- Satisfied
- Neutral
- Dissatisfied
- Highly Dissatisfied

4. Average charging cost per full charge:

- Below ₹100
- ₹100–₹300
- ₹301–₹500
- Above ₹500

5. Public charging infrastructure in your area is:

- Excellent
- Good
- Average
- Poor
- Very Poor

### Section E: Mileage and Performance

1. What mileage/range does your vehicle provide on a full charge/tank?

- Below 100 km
- 100–200 km
- 201–400 km
- Above 400 km

2. Are you satisfied with the mileage/range of your EV?

- Strongly Satisfied
- Satisfied
- Neutral
- Dissatisfied
- Strongly Dissatisfied

3. Do you think EVs are more cost-efficient in the long term?

- Yes
- No
- Maybe



4. Would you recommend EVs to others based on financial benefits?

- Yes
- No
- Not Sure

### **Section F: Suggestions and Opinions**

1. What challenges do you face while using EVs?
2. Suggestions to improve EV adoption and customer benefits: