Project Report
On

A QUANTITATIVE STUDY BETWEEN ELECTRIC VEHICLES AND FUEL VEHICLES

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CERTIFICATE

This to certify that the dissertation entitled, **A QUANTITATIVE STUDY BETWEEN ELECTRIC VEHICLES AND FUEL VEHICLES** is a bonafide record of the work done by **Ms. KRISHNENDU** under my guidance in partial fulfillment of the award of the degree of **Bachelor of Science in Mathematics** at **St. Teresa's College (Autonomous), Ernakulam** affiliated to **Mahatma Gandhi University, Kottayam**. No part of this work has been submitted for any other degree elsewhere.

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INTRODUCTION

1.1 ABSTRACT

The study of electric vehicles (EVs) and fuel vehicles (FVs) is a comprehensive examination of the distinguishing technologies and environmental impacts associated with these two types of vehicles. EVs, which are powered by electricity stored in batteries, have gained significant attention in recent years due to their potential for sustainability and reduced emissions. On the other hand, FVs, which rely on traditional fuels such as gasoline or diesel, present challenges in terms of pollution and limited resources. The study delves into the ongoing transition towards efficient transportation, which involves a shift from FVs to EVs. It examines the technological advancements, advantages, and challenges associated with both vehicle types. By understanding the distinguishing features and environmental impacts of EVs and FVs, researchers and policymakers can make informed decisions to promote sustainable and efficient transportation systems.

Key Words:

EV = Electric Vehicle

FV = Fuel Vehicle

1.2 INTRODUCTION

Electric vehicles (EVs) have emerged as a promising solution in response to the growing scrutiny faced by the transportation sector due to its contribution to climate change and environmental degradation. As the world continues to tackle these challenges, there has been a rising interest in sustainable alternatives to traditional fuel vehicles.

EVs, powered by electricity stored in rechargeable batteries, offer numerous advantages over conventional vehicles. Firstly, they produce zero tailpipe emissions, reducing air pollution and improving air quality in urban areas. This is particularly crucial as transportation is a major source of greenhouse gas emissions, which contribute to global warming and climate change. By transitioning to EVs, countries can significantly reduce their carbon footprint and work towards achieving their climate goals.

Moreover, EVs also have the potential to reduce dependence on fossil fuels, which are finite resources and subject to price volatility. By utilizing electricity from renewable sources such as solar or wind power, EVs can contribute to a more sustainable and resilient energy system. This transition to clean energy not only reduces greenhouse gas emissions but also enhances energy security and reduces the geopolitical tensions associated with fossil fuel imports.

In addition to their environmental benefits, EVs offer economic advantages as well. With advancements in technology and economies of scale, the cost of EVs has been steadily decreasing, making them more affordable and accessible to a wider range of consumers. Furthermore, the maintenance and operational costs of EVs are generally lower compared to traditional vehicles, as they have fewer moving parts and require less frequent servicing. This can lead to significant savings for individuals and businesses in the long run.

To support the widespread adoption of EVs, governments and policymakers have implemented various incentives and initiatives. These include financial incentives such as tax credits, rebates, and grants, as well as the development of charging infrastructure networks. The expansion of charging stations in public spaces, workplaces, and residential areas is crucial to alleviate range anxiety and provide convenient charging options for EV owners.

However, challenges still exist in the transition to electric mobility. The limited range of some EV models and the time required for recharging compared to refueling conventional vehicles can be perceived as barriers for potential buyers. Additionally, the production and disposal of EV batteries raise concerns about the environmental impact of their lifecycle. Addressing these challenges requires

continued research and development to improve battery technology, increase charging speeds, and establish efficient recycling systems

Overall, electric vehicles have emerged as a promising solution to address the environmental and climate challenges faced by the transportation sector. With their zero emissions, potential for renewable energy integration, and economic benefits, EVs offer a sustainable alternative.

Fuel vehicles have played a significant part in forming cutting edge society and have gotten to be profoundly imbued in our day by day lives. They have given people with the opportunity to travel long separations, commute to work, and transport products on an expansive scale. The comfort and unwavering quality of fuel vehicles have made them a staple in family units and businesses worldwide.

One of the key preferences of fuel vehicles is their broad framework. Gasoline and diesel fueling stations are promptly accessible in most zones, permitting drivers to refuel their vehicles rapidly and effectively. This availability has made fuel vehicles a viable choice for people who depend on their cars for day-by-day commuting or long-distance travel.

In addition, fuel vehicles have customarily been more reasonable than their electric or elective fuel partners. The mass generation of inside combustion motors has driven to economies of scale, making fuel vehicles more open to a more extensive extend of shoppers. Also, the nature of clients with the inner combustion motor and the ease of upkeep and repair have contributed to their proceeded popularity.

Be that as it may, the natural effects of fuel vehicles have gotten to be a developing concern for a long time. The combustion of gasoline and diesel discharges greenhouse gases and other poisons into the environment, contributing to climate change and contamination. Governments and producers are recognizing the need to address these issues and are contributing to the investigation and improvement of cleaner and more maintainable alternatives.

Electric vehicles (EVs) have emerged as a promising alternative to fuel vehicles. They are fueled by power put away in batteries and deliver zero tailpipe emanations. The headways in battery innovation have essentially made strides in the development and execution of EVs, making them a practical choice for numerous

buyers. Furthermore, the advancement of the charging foundation has made it less demanding for EV proprietors to revive their vehicles.

Other elective fuel innovations, such as hydrogen fuel cells and biofuels, are too being investigated as potential substitutions for conventional fuel vehicles. Hydrogen fuel cells create power by combining hydrogen and oxygen, emanating as it were water vapor as a byproduct. Biofuels, on the other hand, are determined from renewable sources such as corn or sugarcane and can be utilized as a substitute for gasoline or diesel. As the world gets to be more cognizant of the natural affect of transportation, the car industry is continuously transitioning towards greener advances. Governments are actualizing stricter emanations directions, and producers are contributing in inquire about and improvement to move forward the productivity and maintainability of their vehicles. This move towards cleaner options is anticipated to diminish the reliance on fuel vehicles within the future. Be that as it may, it is vital to recognize that fuel vehicles will proceed to play a critical part within the transportation scene for the predictable future.

The objective of this research is to conduct a comparative analysis between electric vehicles and traditional fuel vehicles in terms of sustainability. Various factors such as greenhouse gas emissions, energy efficiency, and overall environmental impact will be taken into consideration. By thoroughly examining the entire life cycle of both vehicle types, including manufacturing, operation, and disposal, we aim to present a comprehensive evaluation of their sustainability profiles. This study intends to contribute to the ongoing discussion on sustainable transportation and offer valuable insights for policymakers, industry stakeholders, and consumers. Ultimately, our aim is to facilitate informed decision-making and encourage the widespread adoption of eco-friendly transportation alternatives.

1.3 ELECTRIC VEHICLES

The world's main ways of getting around are facing two major issues: rising oil prices and rising carbon emissions. Electric vehicles are becoming more popular because they are not dependent on oil and don't produce greenhouse gases. Despite their advantages, there are still some operational issues that need to be addressed

before EVs can be widely adopted. This research looks at how EVs have evolved over time and outlines their advantages, such as reducing carbon emissions and improving air quality. It also looks at the challenges and difficulties that have been encountered in their adoption, like the high cost of charging infrastructure, lack of charging stations, range anxiety, and battery performance. Solutions to these issues include improving the charging infrastructure, more charging stations, battery swapping, and battery technology to reduce range anxiety and charging times. To help promote EV adoption, governments can offer tax credits or subsidies to encourage consumers to purchase EVs and invest in a strong charging infrastructure. Stakeholders can work with governments to help reduce carbon emissions and improve air pollution.

In light of climate change and environmental concerns, the transition to sustainable transport has become a vital priority. Electric vehicles (EVs) have proven to be a promising alternative to traditional fuel-powered vehicles, with the potential to reduce greenhouse gas emissions and minimize environmental impact. The purpose of this study is to comprehensively evaluate the sustainability of electric vehicles compared to conventional vehicles. This study aims to provide a comprehensive analysis of the environmental and social impacts of electric vehicles and conventional fuel vehicles by examining their entire life cycle, including manufacturing, operation, and disposal. The results of this study are expected to provide valuable insights to policy makers, industry stakeholders, and consumers, facilitating informed decision-making and accelerating the adoption of sustainable transport solutions. As technology continues to advance, cars are equipped with features that focus on passenger and pedestrian safety. As we move forward, it is important to focus on finding solutions to reduce the negative impact of the automotive industry on the planet. For remote energy customers, the transport sector generally has the greatest natural impact, with over 25% of global energy use and greenhouse gas emissions coming from road transport. To address the problem of oil dependence and reduce emissions, the term ``practical transport" is used. The word was coined as a favor. Electric vehicles with the "tank to wheels" (TCW) concept are often three times more powerful than internal combustion engines (ICV).

Electric cars also reduce noise and vibration. Further development of electric vehicles could be a key element in combating climate change and ensuring energy security, prompting some countries to make use of them. There are more than 275,000 plug-in electric vehicles (PEVs) on the road in the United States, a significant increase since 2011. They predict that electric vehicles will account for 20% of all Hyundai car sales by 2025, and the long-term goal is for every Hyundai car sold in China to be "green energy." (NEV) by 2035. This includes both pure electric vehicles and plug-in heterohybrid vehicles. However, despite the promotional approaches and different focuses on electric vehicles (EVs), their flagship share in trade remains significantly low. Limited range, long charging times, and high direct costs make electric vehicles less attractive to the average consumer. In addition, limited access to charging stations is also a key challenge for the widespread adoption of electric vehicles, creating the well-known chicken-and-egg problem in establishing an EV framework. It can be a challenge to do so. This is particularly important for the widespread adoption of electric vehicles (EVs) in the market, and it is the responsibility of states to play a key role in building the electric vehicle industry.

Nevertheless, the widespread adoption of electric vehicles comes with many challenges and uncertainties. These include the expensive infrastructure required, the high cost of electric vehicles themselves, limited charging stations available, and limited range of electric vehicles. The biggest concern remains the batteries used in electric cars. In the coming years, electric vehicles will play a key role in smart cities, alongside connected transportation systems, public transport and other components. Scientists are actively working to develop improved battery technology that increases range while reducing weight, cost, and charging time. This study addresses the main challenges and risks associated with the use of electric vehicles in smart cities and proposes solutions to overcome these obstacles.

1.3.1 Environmental sustainability:

EVs are often hailed as a cleaner and greener alternative to traditional internal combustion engine vehicles. With zero tailpipe emissions, EVs contribute significantly to reducing air pollutants and greenhouse gas emissions, especially when coupled with a power grid fueled by renewable energy sources.

1.3.2 Economic Sustainability:

The growing EV market has led to advancements in battery technology, driving down costs and increasing the affordability of EVs. Additionally, the maintenance costs of EVs are generally lower due to fewer moving parts and less frequent servicing requirements.

1.3.3 Social Sustainability:

The adoption of EVs fosters innovation, creating new employment opportunities in industries related to renewable energy, battery manufacturing, and charging infrastructure. Moreover, EVs contribute to improved air quality, positively impacting public health.

1.4 FUEL VEHICLES

The consideration of economical fuel vehicles has become increasingly critical as the world grapples with the urgent need to address natural challenges and diminish carbon outflows. Conventional fuel vehicles have long been a staple of transportation, but their natural effects and commitment to climate change have incited a basic reevaluation of their sustainability. This think-about points to a comprehensive survey of the maintainability of conventional fuel vehicles, taking into consideration their whole life cycle, from fabrication to operation and end-of-life transfer. By analyzing variables such as vitality proficiency, carbon emanations, asset utilization, and generally natural impressions, this research aims to provide an exhaustive investigation of the natural and social impacts of conventional fuel vehicles. The discoveries of this ponder are expected to offer important bits of knowledge for policymakers, industry partners, and customers, encouraging educated decision-making and directing the advance.

1.4.1 Environmental sustainability:

Conventional fuel vehicles rely on combustion engines powered by gasoline or diesel, resulting in the release of pollutants such as carbon dioxide (CO2), nitrogen oxides (NOx), and particulate matter. The extraction, refining, and transportation of fossil fuels further contribute to environmental degradation.

1.4.2 Economic Sustainability:

Traditional fuel vehicles face economic challenges due to fluctuating fuel prices, dependence on geopolitically sensitive regions for oil, and the associated costs of environmental damage and health issues caused by pollution.

1.4.3 Social Sustainability:

The social implications of fuel vehicles include health risks associated with air pollution, geopolitical tensions related to oil production, and the need for continued investment in exhaust treatment technologies.

1.5 OBJECTIVES

1) To determine and compare the energy consumption of electric vehicles and gas vehicles by collecting data and analyzing the energy consumption patterns of different vehicle types.

2) Determine the mode of transportation of electric vehicles and gasoline vehicles, compare products such as fuel consumption, emissions, travel time and distance of gasoline vehicles.

3) Compare the environmental impacts of electric vehicles and fuel vehicles, including things like greenhouse gas emissions, air pollution, and resource use.

4) Determine the government's electric vehicle policy through in-depth research and analysis of various policies, incentives, and strategies developed by the government to promote the adoption and use of electric vehicles to create a safe and good environment.

1.6 SIGNIFICANCE

A qualitative study comparing electric vehicles (EVs) and fuel vehicles can yield valuable insights into the nuanced aspects of consumer perceptions, preferences, and experiences. Qualitative research enables a thorough exploration of the underlying

factors that influence individuals' choices between these two vehicle types. The following points highlight the significance of such a study:

a) Consumer Perspectives: Qualitative research uncovers the attitudes, beliefs, and motivations that drive consumers to select electric or fuel vehicles. Understanding these perspectives is crucial for automakers, policymakers, and marketers to effectively tailor their strategies.

b) Barriers and Drivers: Qualitative insights identify the barriers that impede the widespread adoption of electric vehicles and the drivers that encourage consumers to make the switch. This information is vital for addressing challenges and promoting factors that contribute to the acceptance of EVs.

c) User Experience: Exploring the experiences of individuals who own or have considered both electric and fuel vehicles reveals crucial details about practical aspects such as charging infrastructure, range anxiety, and overall satisfaction. This knowledge aids in improving the design and functionality of electric vehicles.

d) Policy Implications: Qualitative findings inform policymakers about the public's perceptions of electric vehicles. This information guides the development of supportive policies, incentives, and infrastructure to promote the adoption of sustainable transportation options.

e) Market Trends: Qualitative data helps anticipate and understand evolving consumer preferences and trends in the automotive market. This insight is valuable for industry players to align their offerings with market demands.

In summary, a qualitative study provides a comprehensive understanding of the human and contextual factors influencing the choice between electric and fuel vehicles, offering essential information for industry stakeholders.

1.7 LIMITATIONS

Electric vehicles (EVs) encounter various limitations, such as range anxiety caused by a lack of charging infrastructure, longer refueling times, and higher initial costs. Additionally, batteries have environmental implications in terms of resource

extraction and disposal. On the other hand, fuel vehicles are restricted by their reliance on fossil fuels, which contribute to air pollution and climate change. They also face challenges related to finite resources, geopolitical issues, and fluctuating fuel prices. Both EVs and fuel vehicles require continuous advancements to tackle environmental impacts, infrastructure concerns, and economic considerations. These challenges underscore the intricate trade-offs involved in transitioning towards more sustainable transportation solutions.

1.7.1 Limitations of electric vehicles

Electric vehicles (EVs) with several limitations:

a) Restricted Driving Range: Many EVs have a limited range on a single charge, which can lead to range anxiety, especially in areas with a sparse charging infrastructure.
b) Charging Station Availability: The availability and accessibility of charging stations still pose a challenge, which hampers the widespread adoption of EVs.
c) Longer Charging Time: Charging an electric vehicle typically takes longer compared to refueling a conventional vehicle, which can impact user convenience.
d) Battery Degradation: Over time, the batteries in EVs degrade, which can affect the overall range and performance of the vehicle.
e) Higher Initial Cost: The upfront cost of purchasing an electric vehicle is often higher than that of traditional fuel vehicles.
f) Resource-Intensive Manufacturing: The manufacturing process of batteries for EVs involves resource-intensive processes that have environmental implications.

1.7.2 Limitations of Fuel Vehicles

Fuel vehicles with several limitations:

a) Environmental Impact: The combustion engines in fuel vehicles contribute to the emission of air pollutants and greenhouse gases, thereby playing a role in climate change.

b) Dependence on Fossil Fuels: Fuel vehicles heavily rely on finite and non-renewable fossil fuels, making them vulnerable to price fluctuations and geopolitical tensions.

c) Fuel Efficiency: Combustion engines are less efficient in converting fuel into usable energy when compared to electric vehicles, resulting in lower overall efficiency.

d) Noise Pollution: Internal combustion engines produce noise pollution, which not only affects the environment but also impacts the quality of life in urban areas.

e) Maintenance Complexity: Fuel vehicles often have more intricate mechanical systems, necessitating regular maintenance and repairs.

f) Limited Energy Recovery: Traditional vehicles offer fewer opportunities for energy recovery, such as regenerative braking, in comparison to electric vehicles.

Chapter 2

LITERATURE REVIEW

Various worldwide ponders have been conducted to pick up experiences into the appropriation of electric vehicles (EVs) by buyers. These considers have inspected different variables such as the taken a toll of EVs, driving run per charge, battery revive time, accessibility of charging focuses, and battery taken a toll. Also, analysts have moreover investigated the affect of run uneasiness and the motivations advertised, both money related and non-financial, on shopper inclinations for EVs. In 2016, Bahamonde Birke and Hanappi centered on driving extend as their consider variable, considering innovation as the quality in their paper titled "The Potential of Electromobility in Austria." On the other hand, Axsen Bailey and Castro, in their 2015 article "Inclination and Way of life Heterogeneity Among Potential Plug-in Electric Vehicle Buyers," chose charging time as their ponder variable. Additionally, Valeri and Daneilis, in 2015, explored charging stations as their consider variable, with framework as the quality, in their term paper titled "A Think about of Buyer Inclinations for Electric Vehicles." In 2013, Refrain, Koetse, and Hoen received monetary motivations as the consider variable and approach as they trait in their diary article "Buyer Inclinations for Elective Fuel Vehicles: Comparing a Utility Maximization and a Lament Minimization Model."

The term "technology" pertains to the technical features of a vehicle. Previous research has shown that "range anxiety," which refers to the limited distance a vehicle can travel on a full battery charge, is the main obstacle to the widespread adoption of electric vehicles (EVs). Infrastructure attributes, on the other hand, concentrate on the accessibility of charging infrastructure. Studies have reported a positive impact of this factor. Having sufficient charging facilities will not only save time and reduce the effort of searching for charging stations but also alleviate consumers' concerns about the limited range of EVs.

EV adoption may be hindered by the higher price of electric vehicles. There are strong evidences supporting the effectiveness of financial policies such as tax reduction or rebate in promoting EV adoption. However, non-financial incentives like free parking and toll reduction lack sufficient supporting evidence. Additionally, the non-availability of EVs and the lack of diverse EV models are identified as barriers to adoption. Literature suggests that a lack of knowledge and unqualified car dealerships can also discourage individuals from adopting EVs.

The majority of research is conducted in North American and European countries. Additional research is needed to understand the impact of individual-specific variables on the adoption of electric vehicles (EVs). Numerous studies have demonstrated the consistent and established influence of psychological factors. However, there is a scarcity of studies conducted in India, and this article specifically concentrates on electric cars, which are merely a subset of EVs

EVs have not been widely adopted in India, and a majority of individuals lack experience in handling them. Despite the higher initial purchase price, the running and maintenance costs of EVs are relatively low compared to traditional vehicles powered by internal combustion engines. The perceived economic benefit (PEB) plays a significant role in influencing the adoption of EVs, as individuals become more aware of the environmental benefits. Additionally, self-image (IM) and social influence (SoC.In) can also impact the adoption of EVs, especially for high involvement products. Attitude (ATT) serves as the mediating variable, with behavioral intention (BI) being the dependent variable.

Chapter 3

METHODOLOGY

Our research methodology combines both qualitative and quantitative approaches to investigate the relationship between electric vehicles and fuel vehicles. By employing a mixed-methods design, we ensure a comprehensive exploration of various aspects. Initially, we conduct an in-depth literature review and develop a conceptual framework to establish the foundation of our study. To gain a holistic perspective, we collect data through surveys and interviews, incorporating participant experiences and statistical trends. By utilizing statistical analysis tools, we aim to identify patterns and correlations, enhancing the qualitative insights we have gathered. Throughout the study, we maintain strict adherence to ethical considerations to uphold the integrity of our research. The integration of these methodologies allows us to overcome the limitations of individual approaches, leading to a nuanced understanding of statistical study between electric vehicles and fuel vehicles and contributing to the broader knowledge in this field.

3.1 MICROSOFT EXCEL

Microsoft Excel is a robust spreadsheet software that plays a vital role in various aspects of project management and data analysis. It offers a user-friendly interface for organizing, calculating, and presenting data, making it an invaluable tool for project work. In project management, Excel can be utilized to create project timelines, Gantt charts, and track project progress. The software's formulas and functions enable automatic calculations, assisting in budgeting, resource allocation, and financial analysis. The software's formulas, such as SUM, AVERAGE, and IF, enable users to perform complex calculations and automate repetitive tasks.

Moreover, Excel excels in handling large datasets, performing data validation, and generating insightful visualizations such as charts and graphs. This enables project managers to make informed decisions based on trends and patterns within the data. Excel also facilitates collaboration through features like data sharing and commenting, enhancing teamwork on project-related tasks.

In conclusion, Excel's versatility makes it an essential tool for project planning, tracking, and analysis, significantly contributing to the efficiency and success of project-related endeavors.

3.2 DATA COLLECTION

Data collection is an essential stage in every project, which entails the methodical accumulation of relevant information to tackle research inquiries or project goals. The procedure is devised to guarantee the precision, dependability, and comprehensiveness of the data. Here is a summary of data collection within a project:

3.2.1. Define Objectives:

Precisely articulate the objectives and research inquiries of the project in order to direct the process of gathering data. Specify the desired data type (quantitative, qualitative, or a combination) and the variables that are of significance.

3.2.2. Select Data Sources:

Determine the origins of data, which could encompass surveys, interviews, observations, pre-existing databases, or archival records. Depending on the nature of the project, primary data (gathered firsthand) or secondary data (previously collected by others) may be employed.

3.2.3. Choose Methods for Collecting Data:

- Surveys/Questionnaires: Obtain structured responses from a representative group of individuals.

- Interviews: Acquire comprehensive information by conducting structured, semi structured, or unstructured interviews.
- Observations: Systematically observe and document behaviors or occurrences.
- Experiments: Manipulate variables to investigate cause-and-effect connections.
- Document Analysis: Evaluate and analyze pre-existing documents, reports, or records

  .

3.2.4. Designing Instruments:

Create various instruments like survey questionnaires, interview guides, or observation checklists. Make sure they are in line with the research objectives and easily understandable for the participants.

3.2.5. Conducting Pilot Testing:

Carry out a small-scale trial of the data collection instruments to identify and address any potential issues before implementing them on a larger scale.

3.2.6. Sampling:

Define the target population and choose a representative sample if it is not feasible to study the entire population. Ensure that the sample size is sufficient for statistical significance.

3.2.7. Ethical Considerations:

Obtain informed consent from participants, ensuring that their rights and privacy are protected. Adhere to ethical guidelines and standards.

3.2.8. Execution of Data Collection:

Implement the selected methods, following the research plan and timeline. Train data collectors if necessary to maintain consistency.

3.2.9. Quality Control:

Monitor and ensure the quality of data throughout the collection process. Address any issues promptly to maintain accuracy.

3.2.10. Recording of Data:

Systematically record the collected data using appropriate formats and tools. Maintain a clear audit trail for traceability.

Surveys/Questionnaires: Obtain structured responses from a representative group of individuals.

Interviews: Acquire comprehensive information by conducting structured, semistructured, or unstructured interviews.

Observations: Systematically observe and document behaviors or occurrences.

Experiments: Manipulate variables to investigate cause-and-effect connections.

Document Analysis: Evaluate and analyze pre-existing documents, reports, or records.

3.2.11. Data Validation:

Verify data entries to identify and correct errors. Ensure the accuracy and reliability of the data.

3.3 SPSS

SPSS, also known as Statistical Package for the Social Sciences, is a powerful software extensively utilized in research endeavors

to conduct efficient data analysis. Renowned for its user-friendly interface, SPSS caters to researchers and analysts from various fields. The software excels in managing data, allowing for seamless entry and importation of datasets from diverse sources. It facilitates data cleaning by addressing missing values and outliers, ensuring the quality of the data.

SPSS empowers users to perform a wide range of statistical analyses, including hypothesis testing (such as t-tests, ANOVA, and chi-square, regression analysis, factor analysis, and cluster analysis). It supports advanced analytics through machine learning algorithms for predictive modeling and text analytics for interpreting unstructured data.

One of the notable strengths of SPSS lies in its ability to create visually appealing charts and graphs, enabling users to present insightful information. The software generates structured outputs that are suitable for reports and presentations. With customization options and scripting capabilities, SPSS enhances efficiency by automating repetitive tasks.

Whether exploring descriptive statistics or conducting complex analyses, SPSS remains an essential tool for researchers aiming to derive meaningful insights from their data. Its versatility and extensive features make SPSS an invaluable asset in projects spanning social sciences, healthcare, business, and other research domains.

3.4 QUESTIONNAIRE

A questionnaire serves as a systematic tool utilized in research endeavors to gather standardized data from participants. It is organized with a series of inquiries specifically designed to acquire information that is pertinent to the research objectives. The primary aim of a questionnaire is to obtain consistent and comparable data, thereby enhancing the reliability and validity of the study.

An effectively crafted questionnaire commences with clear objectives, ensuring that each question directly contributes to the research goals. Questions can be either closed-ended, providing predefined response options for quantitative analysis, or open-ended, allowing respondents to express their opinions in their own words for qualitative insights.

The design of the questionnaire involves careful considerations for clarity, simplicity, and neutrality in order to avoid bias. It is crucial to conduct a pilot-test of the questionnaire on a small sample size to identify any potential issues and refine it before administering it on a larger scale.

Questionnaires can encompass various aspects, such as demographic information, attitudes, behaviors, preferences, or perceptions. Well-constructed questions, logical flow, and appropriate response formats all contribute to the effectiveness of the questionnaire. In conclusion, a questionnaire is a structured instrument that plays a vital role in systematically collecting data for a project. Its design and administration significantly impact the quality and relevance of the data, making it an essential component of the research methodology.

3.5 FREQUENCY ANALYSIS

This project conducts a thorough frequency analysis to examine the occurrence of specific variables within our dataset. This statistical technique is essential as it reveals patterns, trends, and distributions in the data, offering valuable insights for our research objectives. By counting the frequency of distinct values or value ranges, we can identify prevalent patterns and outliers.

Through systematic organization and categorization of data points, the goal is to identify the most common occurrences, leading to a nuanced understanding of the research domain. The frequency analysis is crucial in uncovering underlying patterns and variations, shedding light on key aspects of the dataset. Not only does this approach efficiently summarize the data, but it also provides a solid foundation for subsequent statistical analyses and informed decision-making.

As one embarks on this frequency analysis journey, one anticipates discovering valuable information that will significantly contribute to the overall goals of this project. By meticulously examining and interpreting frequencies, the project aims to derive meaningful insights that enhance the understanding of the phenomena being investigated. This will ultimately drive the project towards informed conclusions and actionable recommendations.

3.6 CORELATION

Correlation analysis is a statistical technique commonly used in projects to evaluate the magnitude and direction of a linear relationship between two quantitative variables. The correlation coefficient, often represented as "r," ranges from -1 to 1. A positive correlation (closer to 1) indicates a direct relationship, where an increase in one variable is typically accompanied by an increase in the other. Conversely, a negative correlation (closer to -1) suggests an inverse relationship.

Within the context of a project, correlation analysis can be employed to investigate the associations between variables such as sales and marketing expenses, temperature and consumer behavior, or any other measurable factors. The strength of the correlation assists project managers in comprehending the extent to which

changes in one variable correspond to changes in another. It is crucial to recognize that correlation does not imply causation. Even if variables are correlated, it does not necessarily mean that one variable causes the other. Nonetheless, identifying correlations is valuable for making informed decisions, predicting outcomes, and gaining insights into potential patterns within project.

3.7 CHI-SQUARE TEST

The Chi-square test is a statistical technique utilized to evaluate the correlation between categorical variables in a project or research study. It proves particularly useful when dealing with nominal or ordinal data, where variables are categorized rather than represented by numerical values. This test compares the observed distribution of data with the expected distribution if there were no connection between the variables. Within a project context, the Chi-square test can be employed to analyze survey responses, compare proportions, or explore the independence of variables. For instance, it can be utilized to investigate whether there is a significant correlation between gender (male/female) and the preference for a specific product (yes/no).

The test produces a Chi-square statistic and a p-value. A low p-value indicates a significant correlation between the variables, while a high p-value suggests that any observed correlation could be attributed to chance. This statistical tool assists researchers and project managers in making informed decisions regarding the relationships within their data, thereby enhancing the overall validity and reliability of the project findings.

Chapter 4

CHI-SQUARE TEST

The Chi-square test is a statistical technique that evaluates the connection between categorical variables. It is extensively utilized in research to compare observed and expected distributions, aiming to identify any significant relationship between the variables. This test is commonly employed in survey analysis or studies involving nominal or ordinal data, enabling researchers to comprehend patterns and dependencies. By examining the independence or association of categorical variables, the Chi-square test offers valuable insights that contribute to informed decision-making across diverse fields such as social sciences, marketing, and healthcare. Although the Chi-square test for independence is a valuable tool for analyzing categorical data, it requires specific equations to determine if there is a significant association between variables. The Chi-square statistic $\chi 2$ is calculated using the following formula:

$$\chi 2 = \sum \frac{(O_i - E_i)^2}{E_i}$$

O_i represents the observed frequency in each category

E_i is the expected frequency assuming independence

The summation $(\sum)$ occurs over all categories.

Once the Chi-square statistic is calculated, researchers compare it to a critical value from the Chi-square distribution or use it to determine the p-value. The p-value indicates the probability of obtaining such results by chance. A low p-value suggests a significant association, while a high p-value suggests independence.

The Chi-square test is a valuable tool in qualitative research for comparing attitudes towards electric vehicles (EVs) and fuel vehicles. By applying this test, researchers

can examine potential associations between categorical variables, such as vehicle preference (EV or fuel), and factors like age group, income level, or environmental consciousness. This statistical analysis helps to identify patterns and dependencies in qualitative data, providing insights into nuanced aspects of consumer perceptions. However, it is important to note that the Chi-square test assesses association, not causation. Nonetheless, it offers valuable insights into the complex interplay of factors that influence preferences in the context of EVs and fuel vehicles.

The procedure entails developing hypotheses, gathering categorical data on vehicle preferences and relevant attributes, and computing the Chi-square statistic ($\chi 2$). The null hypothesis (H_0) asserts that there is no noteworthy correlation between vehicle preference and the selected characteristic, whereas the alternative hypothesis (H_1) proposes the existence of a significant correlation.

For example, let's explore the possibility of a notable correlation between the inclination towards electric vehicles (EVs) or traditional fuel vehicles and different age groups. We compare the actual frequencies of individuals in each category with the expected frequencies under the assumption of independence. To calculate the Chi-square statistic, we employ a specific formula, and its significance is determined by comparing it to critical values or calculating the p-value.

If the Chi-square value calculated exceeds the critical value or if the p-value is less than the selected significance level (e.g., 0.05), researchers will reject the null hypothesis, thereby indicating a statistically significant correlation between age groups and vehicle preference.

This statistical methodology adds a numerical aspect to the analysis, providing valuable understanding of the connections between different categories of variables associated with electric and fuel vehicles. It enables researchers to go beyond subjective observations and conduct a thorough investigation into the factors that impact decision-making in the automotive industry.

Chapter 5

CORRELATION

Correlation is a statistical metric that examines the connection between two variables, revealing the intensity and direction of their association. Spanning from -1 to 1, the correlation coefficient measures the extent of linear dependence. A positive correlation implies that variables move in the same direction, whereas a negative correlation signifies an opposite relationship. Extensively employed in research and data analysis, correlation offers valuable insights into patterns, aiding in the identification of links between variables. Nevertheless, it is crucial to acknowledge that correlation does not establish causation, underscoring the necessity for a nuanced interpretation when exploring connections between diverse phenomena.

Correlation is a statistical method utilized to measure and quantify the magnitude and direction of a linear connection between two variables. Here are several important points to consider:

1. Range of Correlation Coefficient (r):
   The correlation coefficient r varies from -1 to 1. A value of 1 indicates a perfect positive linear relationship, -1 indicates a perfect negative linear relationship, and 0 suggests no linear relationship.
2. Interpretation of Correlation Coefficient:
   - $r>0$: Positive correlation, where one variable tends to increase as the other variable increases.
   - $r<0$: Negative correlation, where one variable tends to decrease as the other variable increases.
   - $r=0$: No linear correlation.
3. Strength of Correlation:
   - $|r| < 0.3$: Weak correlation.
   - $0.3 \leq |r| < 0.7$: Moderate correlation.

- $|r| \geq 0.7$: Strong correlation

4. Scatterplots:

   Correlation is often visualized using scatterplots, where each point represents a pair of values for the two variables. The pattern in the scatterplot aids in visually assessing the strength and direction of the relationship.

5. Pearson vs. Spearman Correlation:
   - Pearson Correlation (r): Assumes a linear relationship between variables and is sensitive to outliers.
   - Spearman Correlation (ρ): Based on rank order, making it less sensitive to outliers and suitable for non-linear relationships.

6. Limitations of Correlation:
   - Correlation does not imply causation. The presence of correlation between two variables does not necessarily mean that one variable causes the other.
   - Correlation coefficients may be influenced by outliers.
   - It only captures linear relationships and may not capture non-linear associations.

7. Use Cases:
   - In finance, correlation is used to evaluate the relationship between the returns of different assets.

Relationship examination plays a noteworthy part as a measurable instrument in looking at the connections between factors, making it exceedingly pertinent in a study that compares electric vehicles (EVs) and fuel vehicles. The relationship coefficient, commonly spoken to as "r," measures the quality and course of the direct affiliation between these two sets of information. Analysts can utilize relationship investigation to explore the associations between factors such as buyer inclinations, natural demeanors, and financial factors.

For occurrence, by assessing the relationship between the rate of EV appropriation and the scores of natural awareness among customers, analysts can decide the degree of a positive or negative relationship. A positive relationship may show that people with higher natural awareness are more slanted to select electric vehicles.

It is imperative to note that relationship does not suggest causation. In spite of the fact that a relationship may exist, it does not affirm that one variable causes the other. Within the setting of EVs and fuel vehicles, relationship investigation makes a difference distinguish patterns and potential impacting components, giving experiences into the complex elements that shape buyer choices in maintainable transportation.

Moreover, relationship investigation contributes to predictive modeling. By understanding the quality and course of connections, analysts can create models to estimate the selection of electric vehicles based on different affecting variables. This helps policymakers, producers, and other partners in making key decisions.

In conclusion, relationship investigation empowers a quantitative investigation of the affiliations between electric vehicles and fuel vehicles, advertising a comprehensive understanding of the interconnected factors that impact shopper inclinations and appropriation designs within the automotive industry.

Chapter 6

PILOT STUDY

Pilot data, within the context of a statistical project, refers to an initial and small-scale gathering of data that takes place prior to the full-scale implementation of the research study. The purpose of pilot data is to examine and improve the research methodology, data collection tools, and procedures. It assists researchers in identifying potential issues, ensuring clarity in survey questions, evaluating the feasibility of data collection methods, and estimating the time and resources needed for the main study.

During the pilot phase, a subset of the target population or a similar group is selected to collect a limited amount of data. This pilot data is then analyzed by researchers to identify any challenges, uncertainties, or biases in the research instruments. Adjustments can be made based on the insights gained from the pilot data, thereby enhancing the reliability and validity of the full-scale data collection.

In summary, pilot data plays a vital role in optimizing the research process, minimizing errors, and ensuring the effectiveness of the statistical project by providing a valuable opportunity for refinement before the main study commences.

Pilot data is crucial for collecting large-scale data. It helps researchers understand potential challenges, refine their approach, and identify any issues with instruments, participant recruitment, and data collection. Adjustments can then be made to improve survey questions, participant engagement, and logistical processes. Insights from the pilot data inform the research design, minimizing errors and increasing reliability and validity. This strategic planning phase ensures streamlined and efficient data collection, aligned with research objectives, contributing to the success and credibility of the study on electric and fuel vehicles.

Let us consider a hypothetical situation regarding pilot data in a study that compares preferences between electric vehicles (EVs) and fuel vehicles:

Assumption:

Initially, it was assumed that the majority of participants would favor electric vehicles due to environmental concerns and technological advancements.

Findings from Pilot Data:

After gathering pilot data from a sample of 50 participants, the results revealed unexpected trends that contradicted the initial assumption. The preferences were distributed as follows:

- Electric Vehicles: 5%
- Fuel Vehicles: 10%

This unforeseen pattern indicates that a significant portion of participants in the pilot study expressed a preference for traditional fuel vehicles over electric ones. This discovery emphasizes the importance of investigating the underlying factors that influence this preference reversal, thereby prompting the necessity for further exploration in the main study.

Furthermore, the pilot data could unveil specific demographic characteristics or concerns that may contribute to the observed preferences. This information can guide the refinement of survey questions and data collection strategies for the comprehensive study.

Chapter 7

DATA ANALYSIS

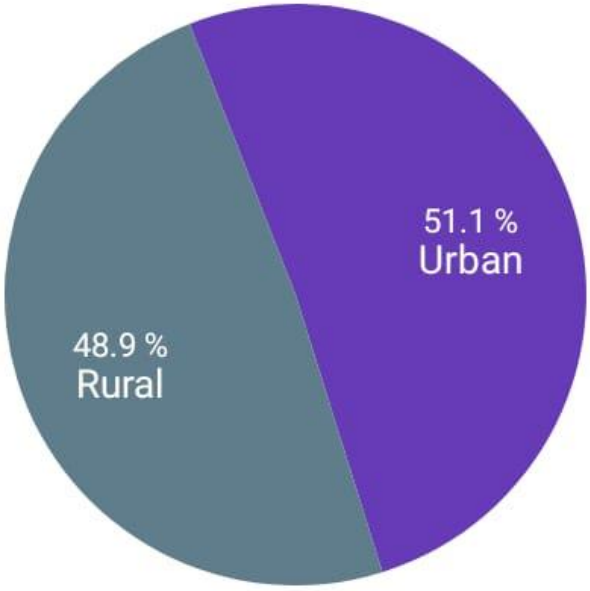
Data analysis is a structured procedure that involves examining, purifying, converting, and interpreting unprocessed data in order to extract valuable insights and make informed conclusions. Within a project, data analysis entails the utilization of statistical methods, mathematical models, and visualization tools to uncover patterns, trends, and connections within the dataset. The analysis phase typically encompasses the use of descriptive statistics to summarize important characteristics, inferential statistics to make predictions or inferences, and advanced techniques such as regression or clustering to delve into more intricate relationships. Effective data analysis not only addresses specific research inquiries but also guides decision-making, informs strategies, and contributes to the overall objectives of the project. It is a critical step that converts raw information into actionable knowledge, providing a solid basis for informed decision-making and a deeper comprehension of theproject's underlying dynamics.

7.1 FREQUENCY ANALYSIS

1) PLACE OF RESIDENCE

About 51.1% of responses were from urban area while 48.9% were from rural area

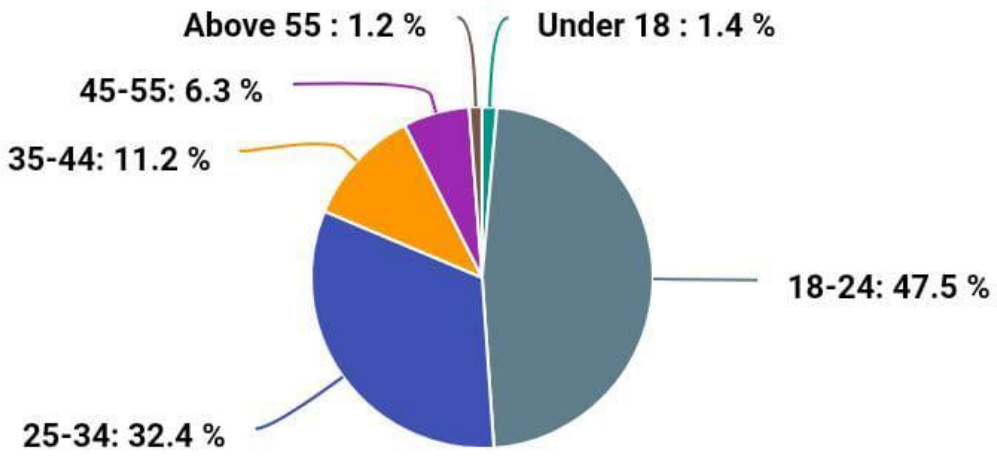
Area	No: of responses
Urban	261
Rural	250



2) AGE CATEGORY

About 1.4% of the respondents belong to below 18 category, 47.5% belongs to 18-24 category, 32.4% belongs to 25-34 category, 11.2% belongs to 35- 44 category, 6.3% belongs to 45-55 category and 1.2% above 55 category.

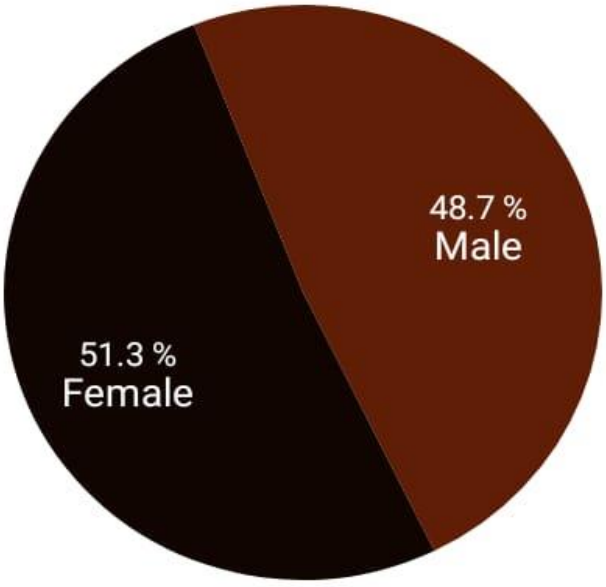
Age	No: of responses
Under 18	7
18-24	243
25-34	166
35-44	57
45-55	32
Above 55	6



3) GENDER

About 51.3% responses were received from female category and 48.7% responses were received from male category.

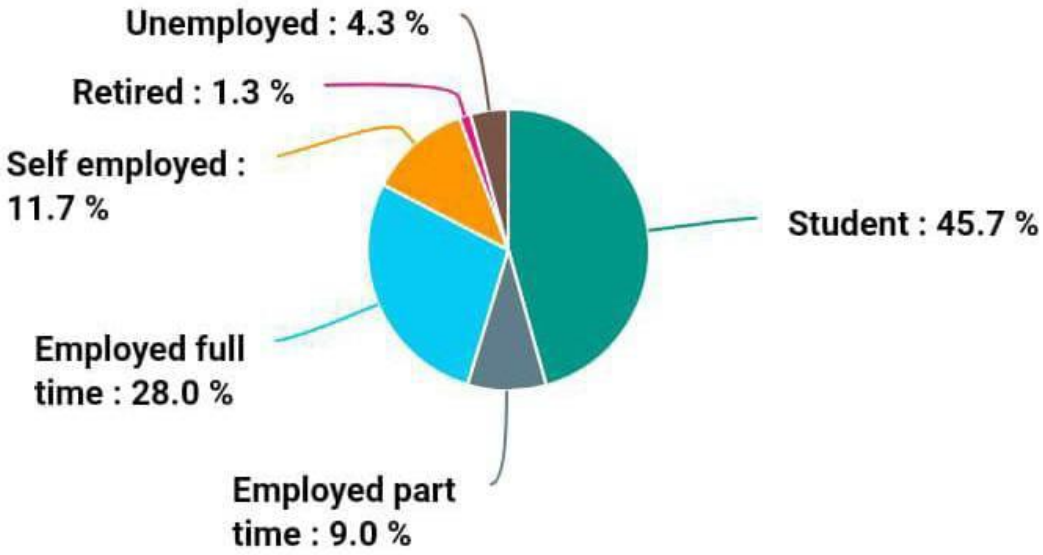
Gender	No: of responses
Male	249
Female	262



4) JOB PROFILE

About 49.5% of respondents are students,9.8% are employed part time , 30.3% are employedfull time,12.7% are self employed,1.4% are retired and 4.7% are unemployed.

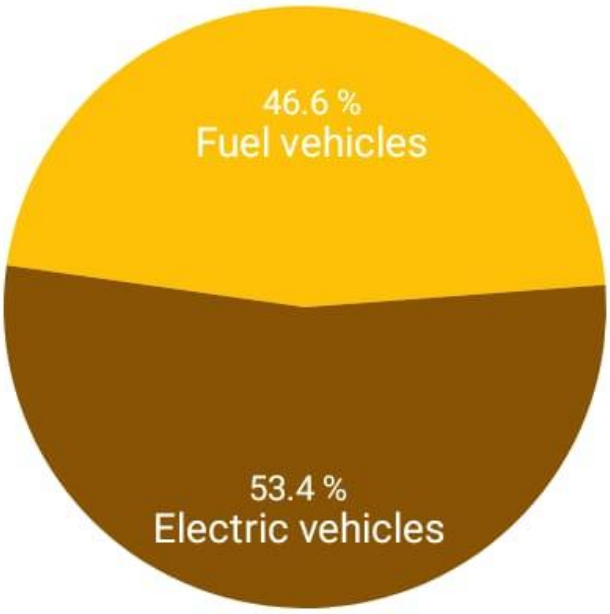
Job profile	No: of responses
Student	253
Employed part-time	50
Employed full time	155
Self employed	65
Retired	7
Unemployed	24


Unemployed : 4.3 %
Retired : 1.3 %
Self employed : 11.7 %
Student : 45.7 %
Employed full time : 28.0 %
Employed part time : 9.0 %

5) VEHICLE PREFERENCE

About 53.4% of the respondents preferred electric vehicle and 46.6% of the respondentspreferred fuel vehicle.

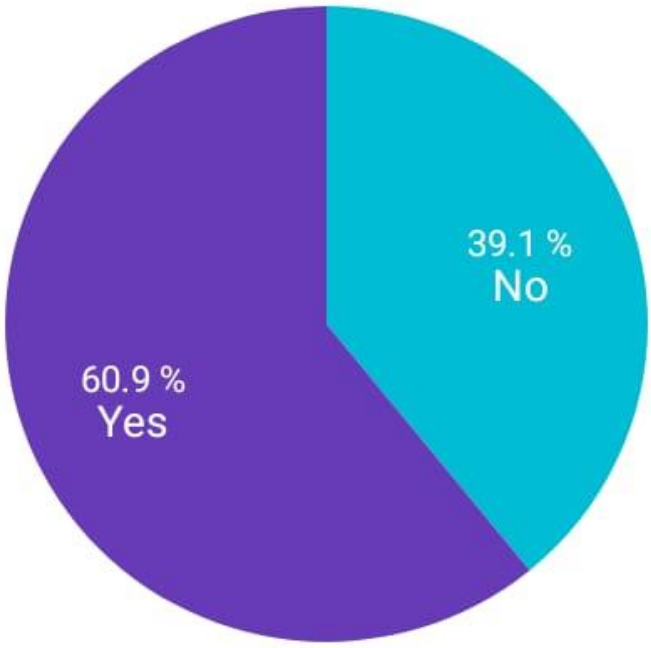
Vehicle preference	No: of responses
Electric vehicles	238
Fuel vehicles	273



6) OWNERSHIP OF VEHICLE

About 60.9% of the respondents owns a vehicle and 39.1% of the respondents do not own a vehicle.

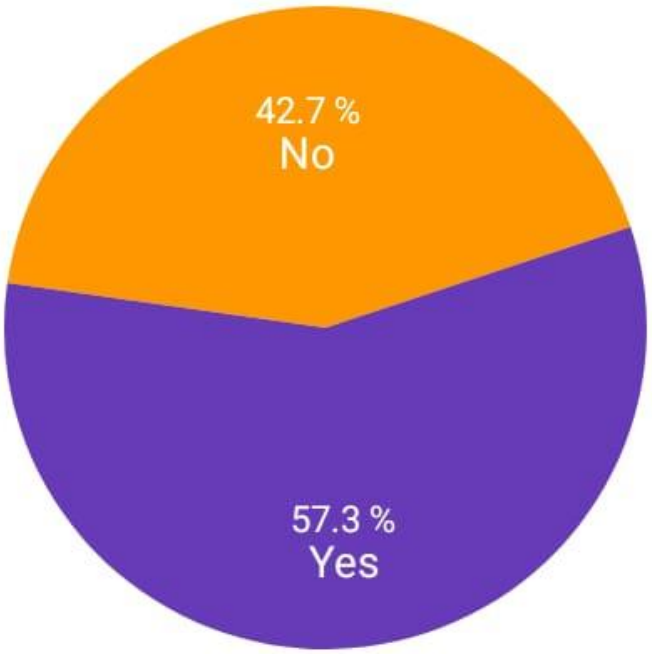
Ownership	No: of responses
Yes	311
No	200



Q7) Have you ever driven or ridden in an electric vehicle?

About 57.3% of the respondents have ridden/driven in an electric vehicle and 42.7% of therespondents haven't ridden/driven in an electric vehicle.

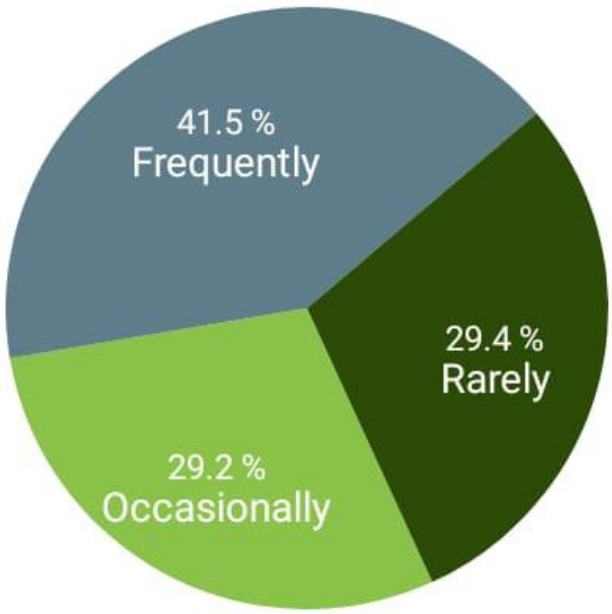
Driven electric vehicles	No: of responses
Yes	293
No	218



Q8) How often do you drive in heavy traffic?

About 41.5% of the respondents drive frequently in heavy traffic,29.2% drive occasionally and 29.4% drive rarely in heavy traffic.

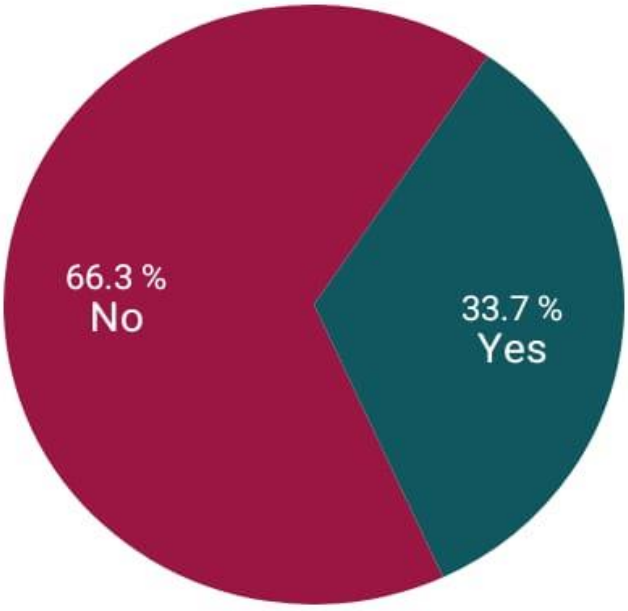
Drive in heavy traffic	No: of responses
Rarely	150
Occasionally	149
Frequently	212



Q9) Are you aware of any government policies or initiatives that promote the use/purchase of electric vehicles?

About 66.3% of the respondents are not aware of the government policies and 33.7% are aware of the policies.

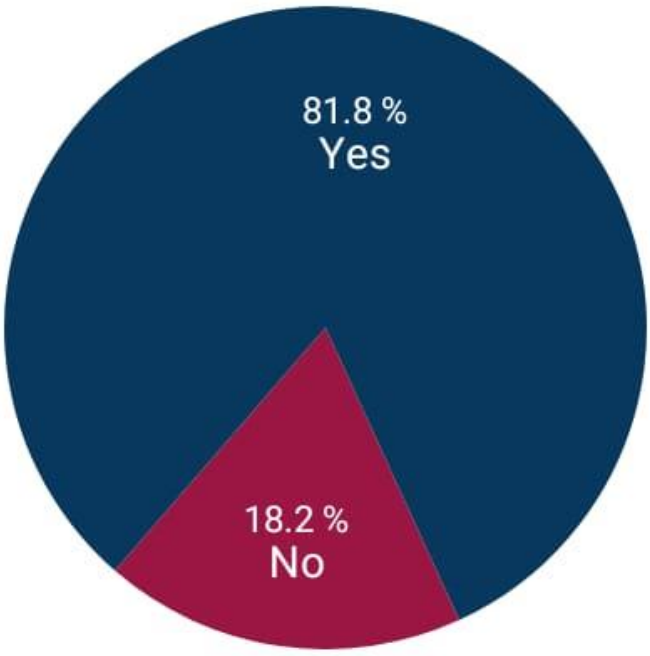
Aware of govt. policy	No: of responses
Yes	172
No	339



Q10) Do you think that the government should provide initiatives to encourage the adoptionof electric vehicle?

About 81.8% of the respondents think that the government should provide initiative to adopt electric vehicles and 18.2% does not think that the government should provide initiative to
adopt electric vehicles.

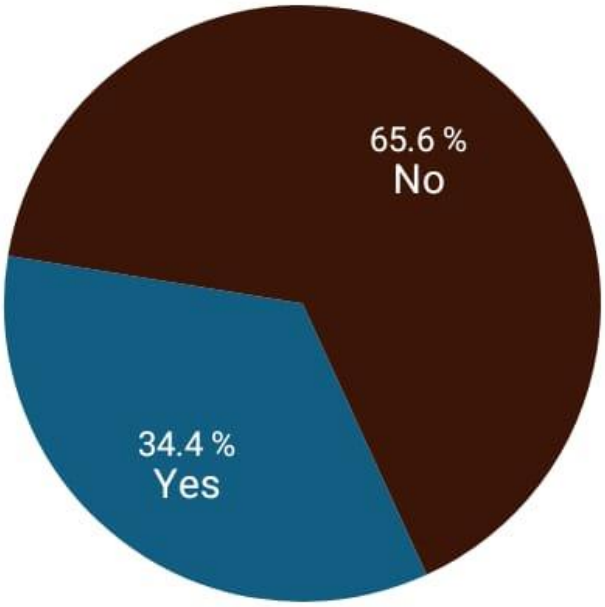
Should govt. encourage adoption of EVs	No: of responses
Yes	418
No	93



Q11) You have no access to renewable energy sources for charging an electric vehicles

About 34.4% of the respondents have access to renewable energy sources and 65.6% doesnot have access to renewable energy sources.

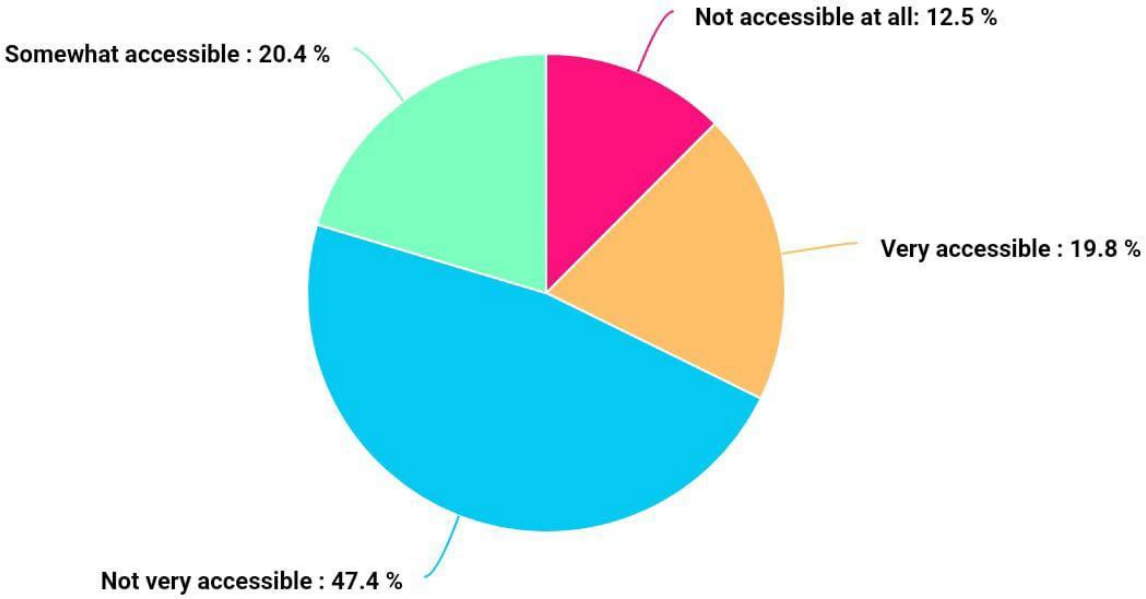
Has access to renewable energy sources	No: of responses
Yes	176
No	335



Q12) Electric vehicle charging infrastructure is not accessible in your area

About 47.4% of the respondents are not very accessible in their charging infrastructure, 20.4%somewhat accessible,19.8% very accessible and 12.5% not accessible at all.

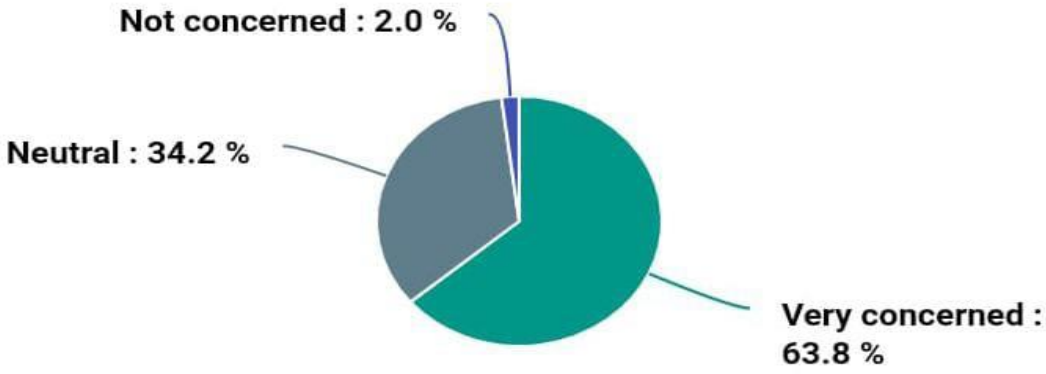
Charging infrastructure	No: of responses
Very accessible	101
Not very accessible	242
Somewhat accessible	104
Not accessible at all	64



Q13) How concerned are you about the environmental impact of your transportation choice?

About 63.8% of the respondents are very concerned about the environmental impact,34.2%are neutral and 2% are not concerned.

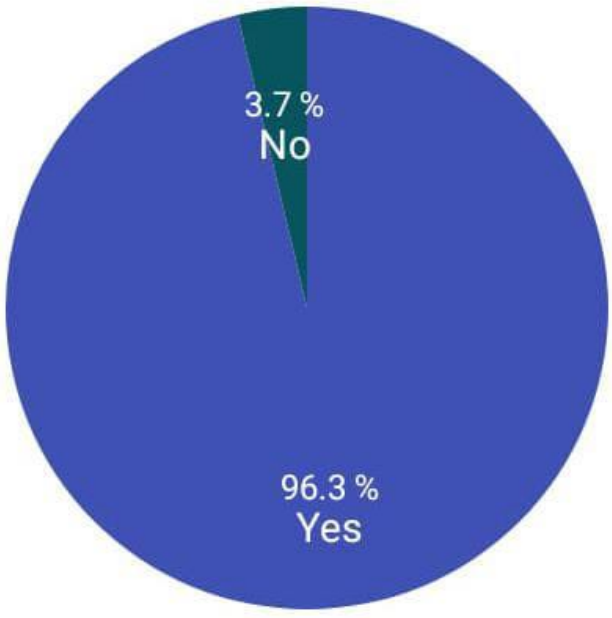
Concerned about environmental impact	No:of responses
Very concerned	326
Neutral	175
Not concerned	10



Q14) Electric vehicles generally produce less noise pollution compared to fuel vehicles?

About 96.3% of the respondents say electric vehicles produce less noise pollution compared to fuel vehicles and 3.7% does not say electric vehicles produce less noise pollution compared to fuel vehicles.

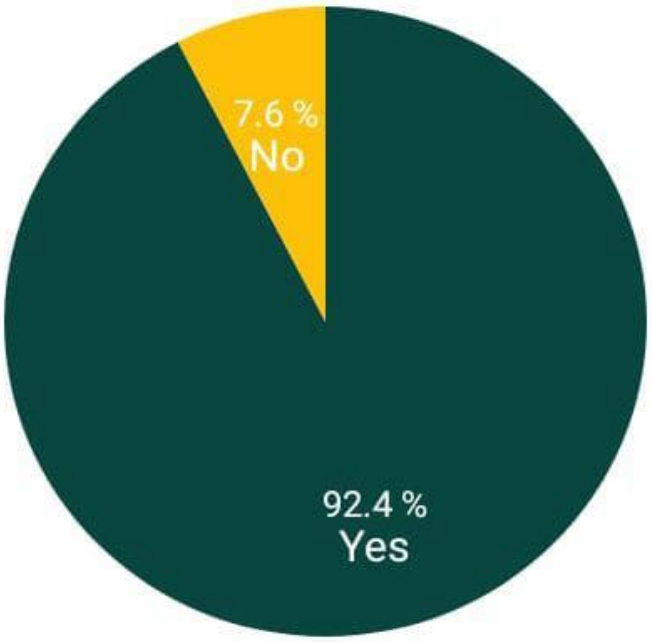
EVs produce less noise pollution	No: of responses
Yes	492
No	19



Q15) Do you think electric vehicle are more effective than fuel vehicle in reducing greenhouse gas emission?

About 92.4% of the respondents think that electric vehicles are more effective than fuel vehicles in reducing greenhouse gas emission and 7.6% does not think electric vehicles are more effective than fuel vehicles in reducing greenhouse gas emissions.

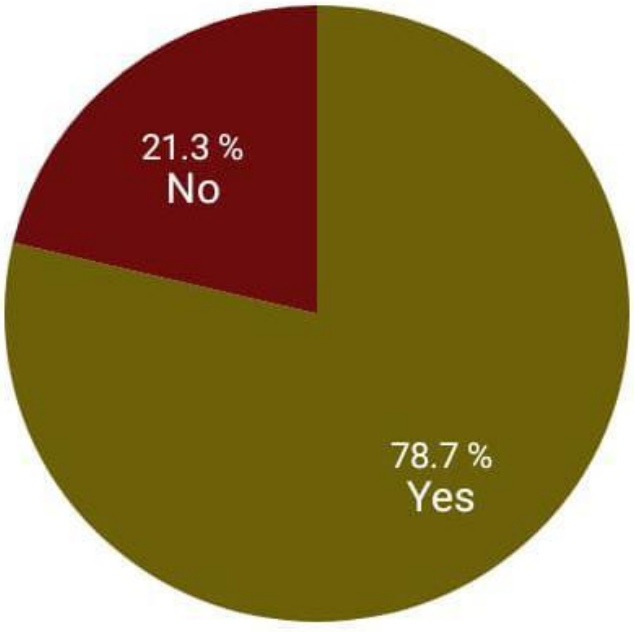
EVs reduces greenhouse gases	No: of responses
Yes	472
No	39



Q16) Are you aware of the key factors that determine the environment impact of the both the type of vehicle ?

About 78.7% of the respondents are aware of the key factors that determine the environment impact of both the vehicles and 21.3% are not aware.

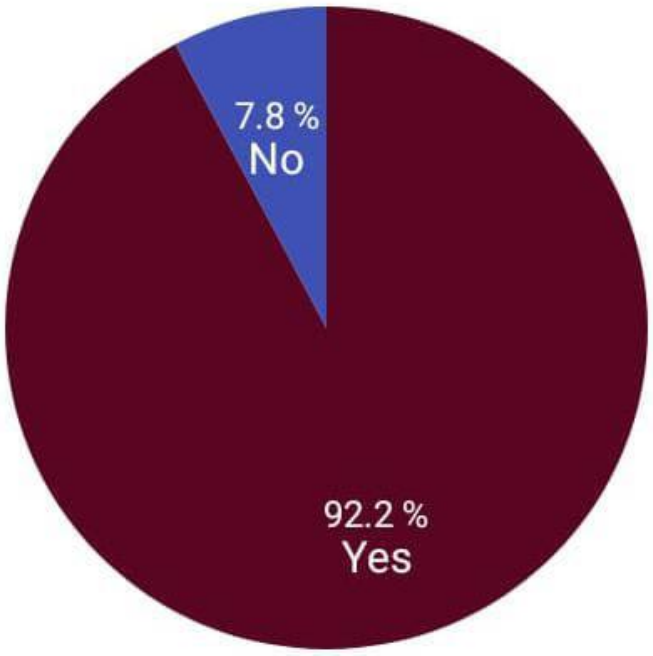
Aware of the key factors	No: of responses
Yes	402
Yes	109



Q17) Overall, do you believe that electric vehicles have a positive impact on environment compared to fuel vehicle?

About 92.2% of the respondents believe that electric vehicles have a positive impact on environment and 7.8% does not believe that electric vehicles have a positive impact on environment.

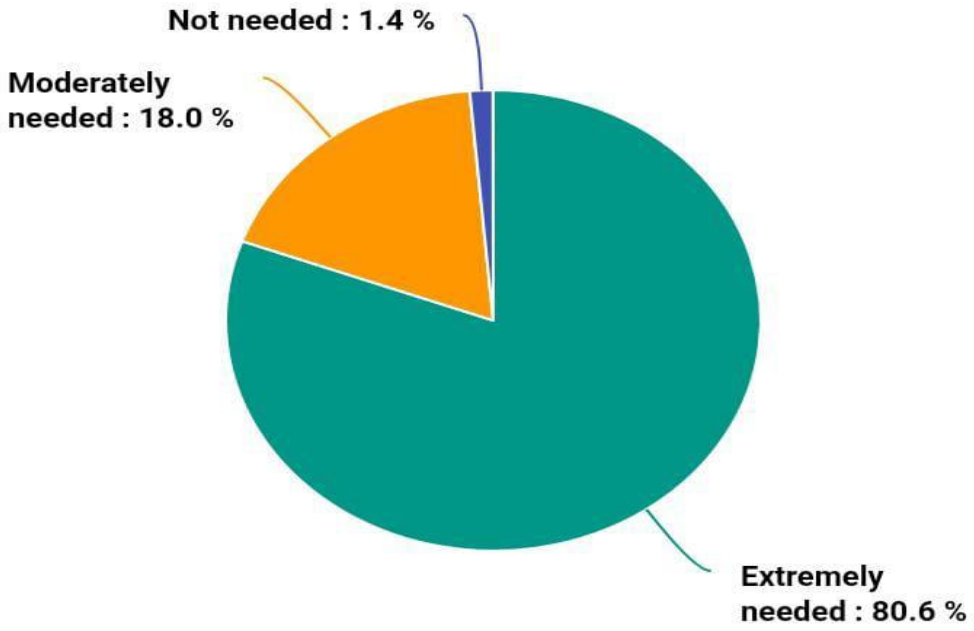
EVs have positive impact on environment	No: of responses
Yes	471
No	40



Q18) How important is the need of the charging stations is not near your usual routes ?

About 80.6% of the respondents say it is very important in the availability of charging station,18% say moderately important and 1.4% say not important.

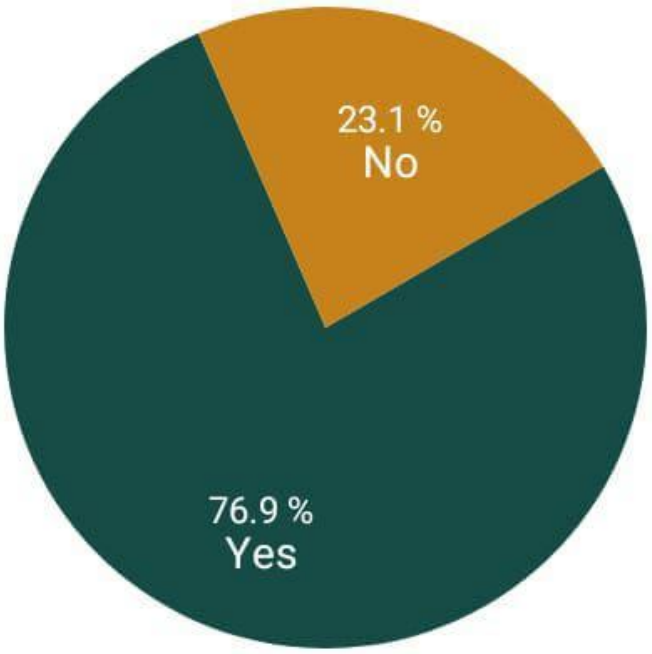
Need of charging stations	No: of responses
Extremely needed	412
Moderately needed	92
Not needed	7



Q19) Are you open to alternatives like public transportation or carpooling for transportation?

About 76.9% of the respondents are open to alternatives like public transportation or carpooling and 23.1% are not open to public transportation or carpooling.

Open to public transport	No: of responses
Yes	393
No	118



7.2 CORRELATION

7.2.1 Relationship between the government should incentivize electric vehicle adoption and support related programs.

H_0 : The government should provide initiatives to encourage the adoption of electric vehicles and any government policies or initiatives that do not promote the use or purchase of electric vehicles.

H_1 : The government should provide initiatives to encourage the adoption of electric vehicles and any government policies or initiatives that promote the use or purchase of electric vehicles.

	H_0	H_1
H_0	1	0.17577063
H_1	0.17577063	1

Table 7.1

Correlation value = 0.17577063

H_0 is rejected.

This indicates that the government should provide initiatives to encourage the adoption of electric vehicles and any government policies or initiatives that promote the use or purchase of electric vehicles.

7.2.2 Relationship between the environmental consequences of electric vehicles and assessing their impact.

H_0 : The potential negative environment consequences associated with adoption of electric vehicle and it does not determine the environment impact of the both the type of vehicle.

H_1 : The potential negative environment consequences associated with adoption of electric vehicle and to determine the environment impact of the both the type of vehicle.

	H_0	H_1
H_0	1	0.611613926
H_1	0.611613926	1

Table 7.2

Correlation value = 0.611613926

H_0 is accepted.

This indicates that there is no potential negative environment consequences associated with the adoption of an electric vehicle.

7.2.3 The relationship between government policies and initiatives can influence individuals' vehicle choices towards electric vehicles.

H_0: Any government policies or initiative that promote the use/purchase of electric vehicle and the government's initiatives for electric vehicles do not influence individuals vehicle choice.

H_1: Any government policies or initiatives that promote the use/ purchase of electric vehicle and the government's initiatives for electric vehicles influence individuals vehicle choice.

	H_0	H_1
H_0	1	0.492581816
H_1	0.492581816	1

Table 7.3

Correlation value = 0.492581816

H_0 is rejected.

This indicates that any government policies or initiatives that promote the use/ purchase of electric vehicle and the government's initiatives for electric vehicles influence individuals vehicle choice.

7.3.4 Relationship between driving in traffic and manoeuvring through busy roads or at high speeds.

H_0: Drive in heavy traffic and do not drive on highways or at high speeds.

H_1: Drive in heavy traffic and drive on highways or at high speeds.

	H_0	H_1
H_0	1	0.48264
H_1	0.48264	1

Table 7.4

Correlation value = 0.48264

H_0 is rejected.

This indicates that there is a moderate relationship between driving in heavy traffic and maneuvering through busy roads or at high speed.

7.3.5 The relationship between electric vehicles and fuel vehicles, better reducing greenhouse gas emissions, benefiting the environment.

H_0: Electric vehicles are more effective than fuel vehicle in reducing greenhouse gas emission and electric vehicles do not have a positive impact on the environment compared to fuel vehicles.

H_1: Electric vehicles are more effective than fuel vehicle in reducing greenhouse gas emission and electric vehicles have a positive impact on the environment compared to fuel vehicles.

	H_0	H_1
H_0	1	0.355264444
H_1	0.355264444	1

Table 7.5

Correlation value = 0.355264444

H_0 is rejected.

This indicates that electric vehicles are more effective than fuel vehicles in reducing greenhouse gas emissions, and electric vehicles have a positive impact on the environment compared to fuel vehicles.

7.2.6 Relationship between driving at high speed due to lack of time.

H_0: Do not drive at high speed due to lack of time.

H_1 : Drive at high speed due to lack of time

	H_0	H_1
H_0	1	-0.4243623
H_1	-0.4243623	1

Table 7.6

Correlation value = -0.4243623

H_0 is rejected.

This indicates that people drive at high speed due to lack of time.

7.3 CHI-SQUARE TEST

7.3.1 Relationship between electric vehicles charging infrastructure is nearby, but renewable energy sources for charging are not accessible.

H_0: Electric vehicle charging infrastructure is not accessible in your area and accessible to renewable energy sources for charging an electric vehicle.

H_1: Electric vehicle charging infrastructure is not accessible in your area and not accessible to renewable energy sources for charging an electric vehicle.

						Total
	You have no access to renewable energy sources for charging an electric vehicle	Not accessible at all	Not very accessible	Some-what accessible	Very accessible	
Electric charging infrastructure is not accessible in your area	1	0	0	0	0	1
No	0	56	174	67	38	335
Yes	0	8	68	37	63	176
Total	1	64	242	104	101	512

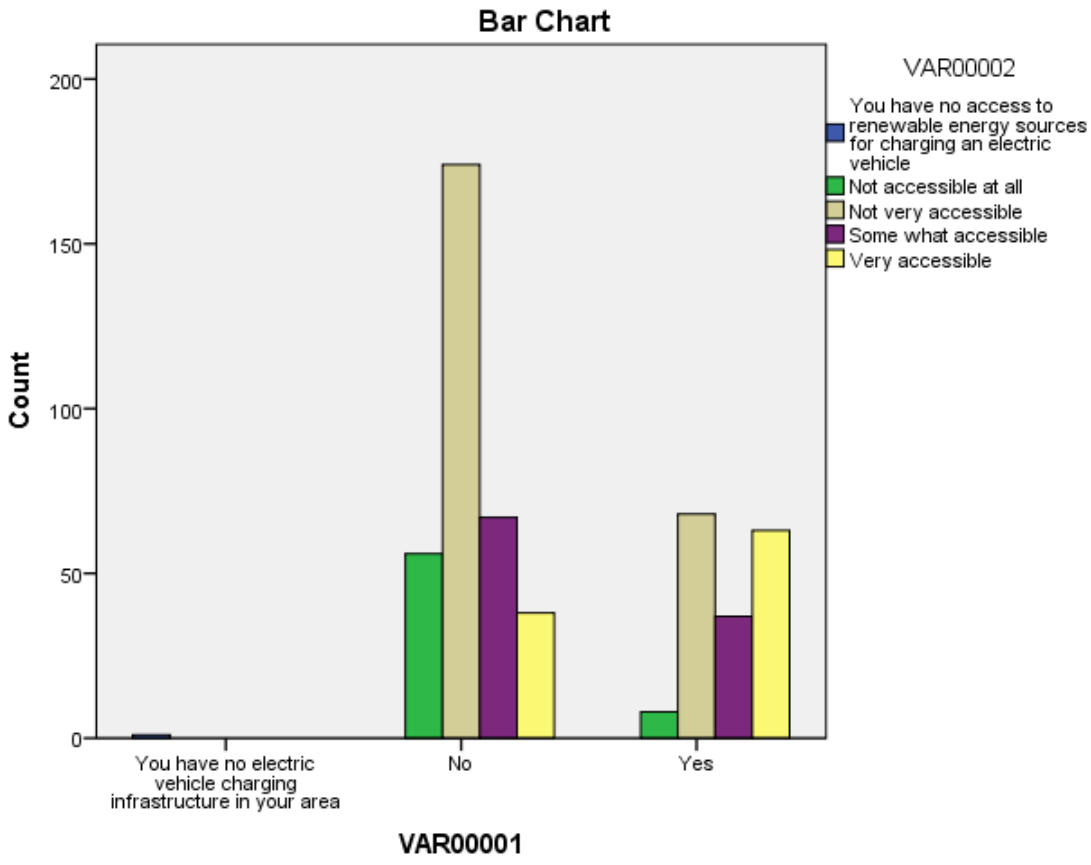
Table 7.7

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	516.938[a]	6	.000
Likelihood Ratio	19.343	6	.004
N of Valid Cases	512		

a. 6 cells (50.0%) have expected count less than 5. The minimum expected count is .00.

H_0 IS REJECTED



Conclusion : From the table above, the p-value is 0.00 which is less than 0.05. So we reject null hypothesis at a 5 percent level of significance. So it is clear that electric vehicle charging infrastructure is not accessible in your area and not accessible to renewable energy sources for charging an electric vehicle.

7.3.2 Relationship between driving in heavy traffic and driving on highways in high speed.

H_0: Drive in heavy traffic and do not drive on highways or high speed.

H_1: Drive in heavy traffic and drive on highways in highspeed.

					Total
	How often do you drive on highways in high speed?	Frequently	Occasionally	Rarely	
How often do you drive in heavy traffic?	0	125	0	0	1
Frequently	1	0	60	27	211
Occasionally	0	21	99	29	149
Rarely	0	6	28	116	150
Total	1	152	187	172	512

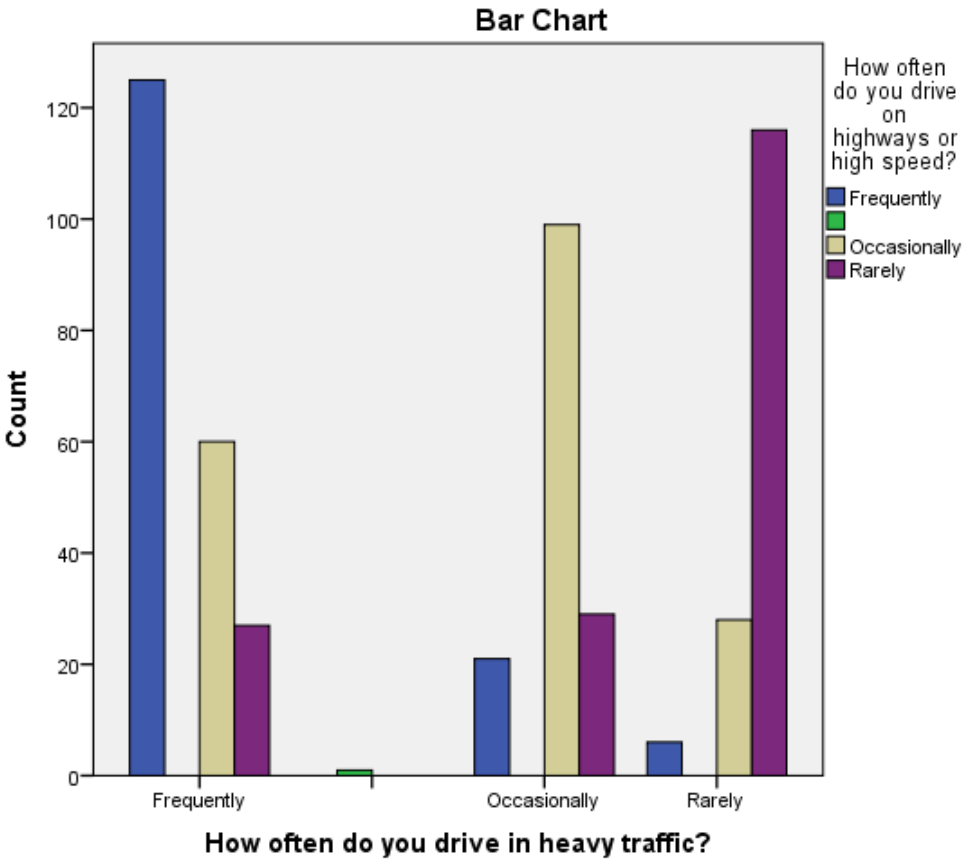
Table 7.8

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	794.015[a]	9	.000
Likelihood Ratio	288.372	9	.000
N of Valid Cases	512		

a. 7 cells (43.8%) have expected count less than 5. The minimum expected count is .00.

H0 IS REJECTED



Conclusion: From the table above, the p-value is 0 which is less than 0.05, we reject the null hypothesis at a 5 percent level of significance. So it is clear that people drive in heavy traffic and drive on highways in high speed.

7.3.3 Relationship between potential environment consequences associated with adoption of electric vehicle and effectiveness of electric vehicles compared to fuel vehicles in reducing greenhouse gas emission.

H_0: Aware of the potential negative environment consequences associated with adoption of electric vehicle and do not think electric vehicle are more effective than fuel vehicle in reducing greenhouse gas emission

H_1: Aware of the potential negative environment consequences associated with adoption of electric vehicle and think electric vehicle are more effective than fuel vehicle in reducing greenhouse gas emission.

				Total
	Are you aware of the potential negative environment consequences associated with adoption of electric vehicle?	No	Yes	
Do you think electric vehicle are more effective than fuel vehicle in reducing greenhouse gas emission?	1	0	0	1
No	0	14	25	39
Yes	0	129	343	472
Total	1	143	368	512

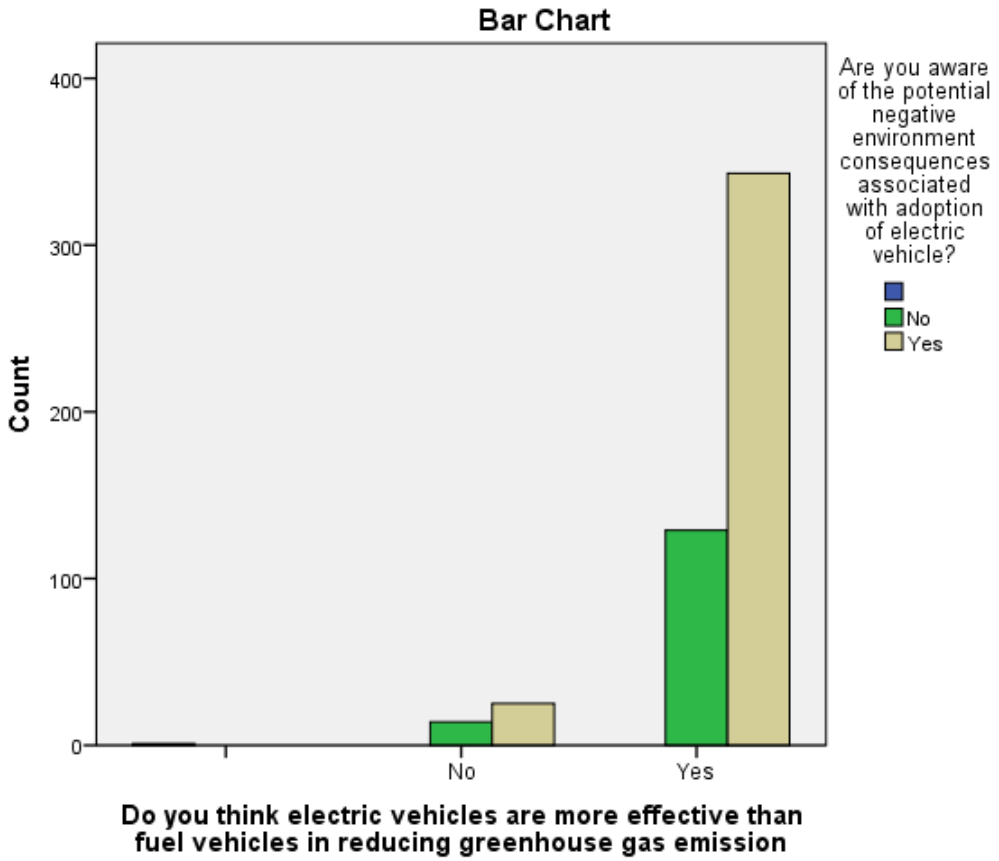
Table 7.9

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	513.314[a]	4	.000
Likelihood Ratio	15.728	4	.003
N of Valid Cases	512		

a. 5 cells (55.6%) have expected count less than 5. The minimum expected count is .00.

H_0 IS REJECTED



Conclusion: From the table above, the p-value is 0 which is less than 0.05, we reject the null hypothesis at a 5 percent level of significance .So it is clear that people are aware of the potential environment consequences associated with adoption of electric vehicles and they think electric vehicles.

7.3.4 Relationship between electric vehicles is that they are less loud and emit fewer greenhouse gases than traditional fuel vehicles.

H_0: Electric vehicles generally produce less noise pollution compared to fuel vehicles and electric vehicle are not more effective than fuel vehicle in reducing greenhouse gas emission.

H_1: Electric vehicles generally produce less noise pollution compared to fuel vehicles and electric vehicles are more effective than fuel vehicle in reducing greenhouse gas emission.

					Total
		Electric vehicles generally produce less noise pollution compared to fuel vehicles	No	Yes	
	Do you think electric vehicle are more effective than fuel vehicle in reducing greenhouse gas emission?	1	0	0	1
	No	0	5	34	39
	Yes	0	14	458	472
Total		1	19	492	512

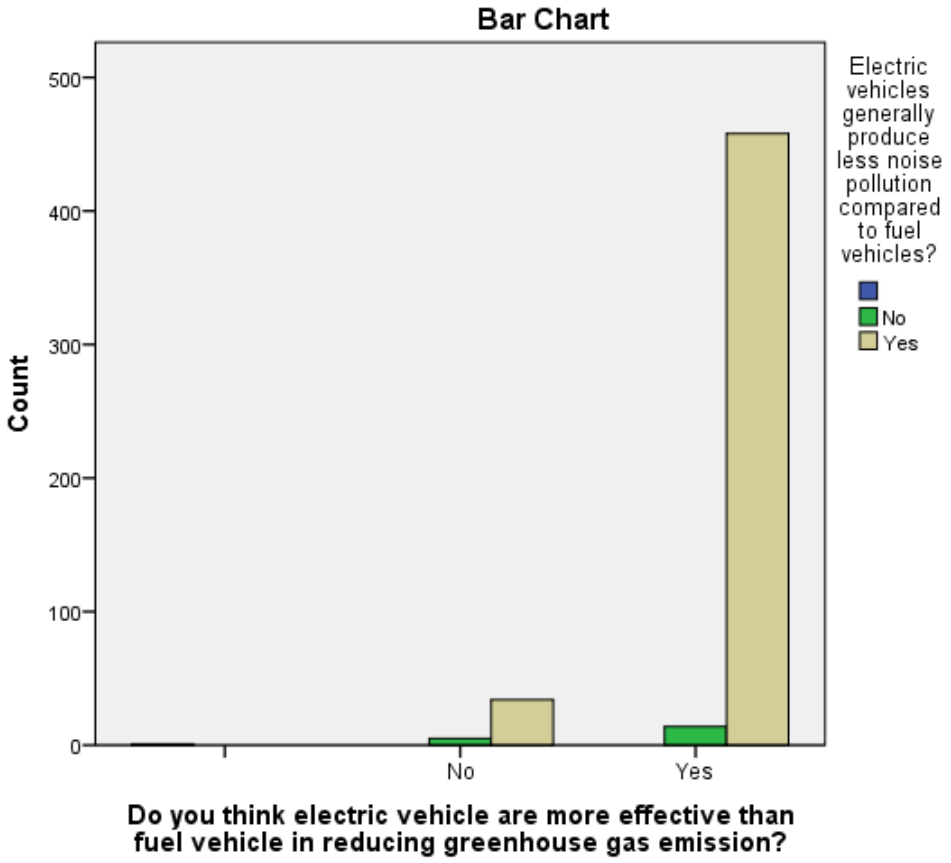
Table 7.10

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	521.791[a]	4	.000
Likelihood Ratio	20.899	4	.000
N of Valid Cases	512		

a. 6 cells (66.7%) have expected count less than 5. The minimum expected count is .00.

H_0 IS REJECTED



Conclusion: From the table above ,the p-value is 0 which is less than 0.05,we reject the null hypothesis at a 5 percent level of significance. So it is clear that electric vehicles generally produce less noise pollution and are more effective in reducing greenhouse gas emissions than fuel vehicles.

7.3.5 Relationship between private space for overnight vehicle charging and the availability of the charging stations or fuel station is near your usual area

H_0:There is no private space for overnight vehicle charging and the availability of the charging stations or fuel station is near your usual routes.

H_1: There is no private space for overnight vehicle charging and the availability of the charging stations or fuel station is not near your usual routes.

				Total
	There is no private space for overnight vehicle charging?	No	Yes	
	How important is the availability of the charging stations or fuel station is not near your usual routes ?	1	0	0	1
	Moderately important	0	74	18	92
	Not important	0	5	2	7
	Very important	0	287	125	412
Total		1	366	145	512

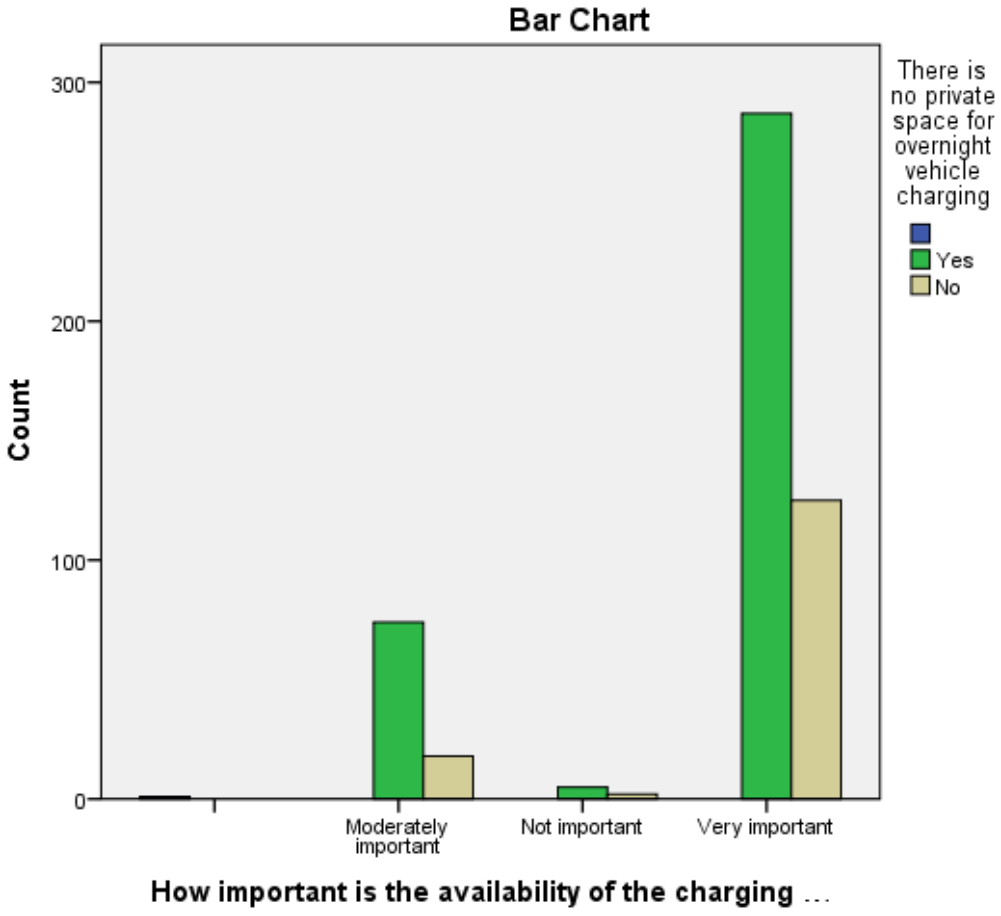
Table 7.11

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	516.304[a]	6	.000
Likelihood Ratio	19.032	6	.004
N of Valid Cases	512		

a. 7 cells (58.3%) have expected count less than 5. The minimum expected count is .00.

H_0 IS REJECTED



Conclusion: From the above table the p-value is 0 which is less than 0.05,we reject null hypothesis at a 5 percent level of significance. So it is clear that there is no private space for overnight vehicle charging and the availability of the charging stations or fuel station is not near your usual routes.

Chapter 8

CONCLUSION

The comparative analysis between electric vehicles (EVs) and fuel vehicles in a qualitative study uncovers intricate findings. Participants expressed contentment with the environmental advantages of EVs, while also raising concerns about the availability of charging infrastructure. On the other hand, users of fuel vehicles appreciated the convenience they offer but acknowledged the escalating fuel expenses. Both groups emphasized the necessity for heightened awareness and support from the government. Ultimately, the study highlights the significance of a well-rounded shift towards sustainable transportation, taking into account user preferences, infrastructure advancements, and policy interventions.

8.1 FINDINGS

The disparity between our hypothesis and the real inclination for fuel vehicles among participants might arise from a multitude of factors. It could be impacted by the constraints of current infrastructure for electric vehicles, apprehensions regarding charging accessibility, or the well-established familiarity and convenience linked to fuel vehicles. By delving into these set of reasons via supplementary research and taking into account feedback from participants, we can gain valuable insights to tailor strategies that effectively encourage the adoption of electric vehicles.

The surprising discovery, where the majority of participants were found to be users of fuel vehicles rather than electric vehicles, indicates a possible disparity between people's perceptions and the actual rate of adoption. It is crucial to delve deeper into this matter in order to comprehend the factors that contribute to this inconsistency, such as potential obstacles to electric vehicle adoption and the factors that shape

people's preferences for fuel vehicles. This valuable insight can serve as a compass for future research endeavors and policy initiatives, ensuring they are in line with the prevailing vehicle.

8.2 SUGGESTIONS

1. Enhance Charging Infrastructure:
   Boost the quantity of charging stations, particularly in urban and rural regions, to alleviate concerns about limited driving range and promote the adoption of electric vehicles on a larger scale.
2. Rapid Charging Technology:
   Consider investing in rapid charging technologies to decrease charging durations, thereby increasing the attractiveness of electric vehicles for individuals with limited time availability.
3. Government Incentives:
   Enforce or strengthen incentives, such as tax deductions, reimbursements, or lowered registration costs, to enhance the financial appeal of electric vehicles.
4. Public Awareness Initiatives:
   Initiate informative campaigns to debunk misconceptions, enlighten consumers about the advantages of electric vehicles, and tackle apprehensions regarding range, charging infrastructure, and environmental implications.
5. Research and Development:
   Promote ongoing advancements in battery technology to enhance energy density, minimize expenses, and prolong the overall durability of electric vehicle batteries.
6. Collaboration with Industries:
   Cultivate partnerships among electric vehicle manufacturers, energy companies, and technology firms to develop comprehensive solutions, fostering smooth connectivity and initiatives for intelligent power grids.
7. Encourage Fleet Electrification:
   Implement incentives for businesses to transition their fleets to electric vehicles, stimulating the demand for electric vehicles in the commercial sector.

8. Supportive Policies :

   Establish regulations that encourage the use of sustainable transportation, including the creation of exclusive lanes for electric vehicles, offering incentives for electric vehicle parking, and implementing emissions standards that prioritize electric vehicles.

9. Engaging the community:

   Encourage active participation from local communities in the planning and implementation of electric vehicle initiatives, addressing their specific concerns and fostering a sense of ownership and enthusiasm.

10. Utilizing used electric vehicle batteries:

    Explore potential opportunities to repurpose used electric vehicle batteries for secondary applications, such as energy storage systems, thereby contributing to the overall sustainability efforts.

By implementing a combination of these strategies, a more favorable environment for the widespread adoption of electric vehicles can be created.

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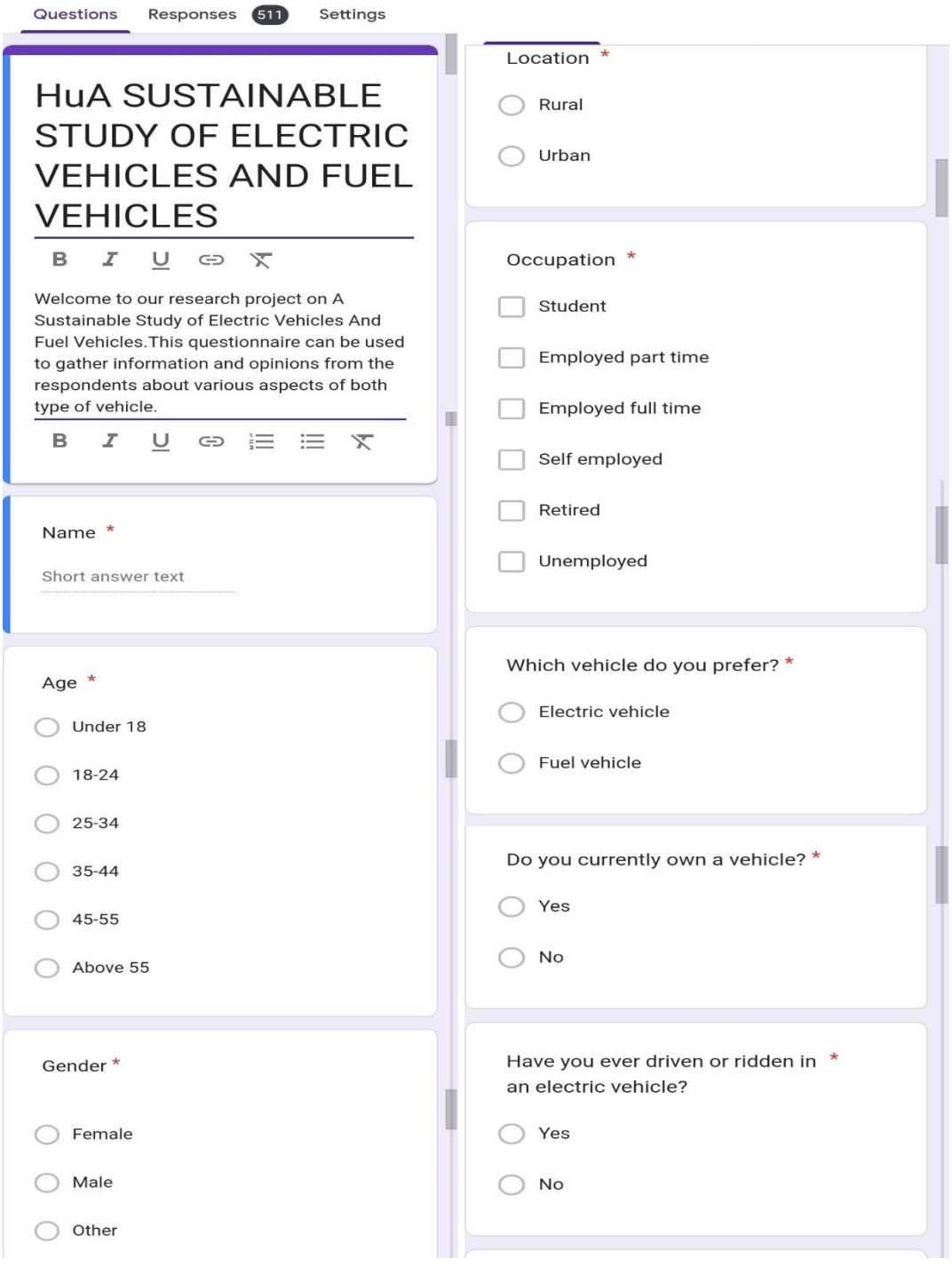
[3]Ali, Saqlain. “AN OVERVIEW ON WHY ELECTRIC CARS ARE THE FUTURE OF TRANSPORTATION.” (2021).

[4]Goel, Sonali, Renu Sharma, and Akshay Kumar Rathore. “A review on barrier and challenges of electric vehicle in India and vehicle to grid optimization.” Transportation engineering 4 (2021): 100057.

ANNEXURE



Questions Responses 511 Settings

HuA SUSTAINABLE STUDY OF ELECTRIC VEHICLES AND FUEL VEHICLES

Welcome to our research project on A Sustainable Study of Electric Vehicles And Fuel Vehicles.This questionnaire can be used to gather information and opinions from the respondents about various aspects of both type of vehicle.

Name *

Short answer text

Age *

- Under 18
- 18-24
- 25-34
- 35-44
- 45-55
- Above 55

Gender *

- Female
- Male
- Other

Location *

- Rural
- Urban

Occupation *

- Student
- Employed part time
- Employed full time
- Self employed
- Retired
- Unemployed

Which vehicle do you prefer? *

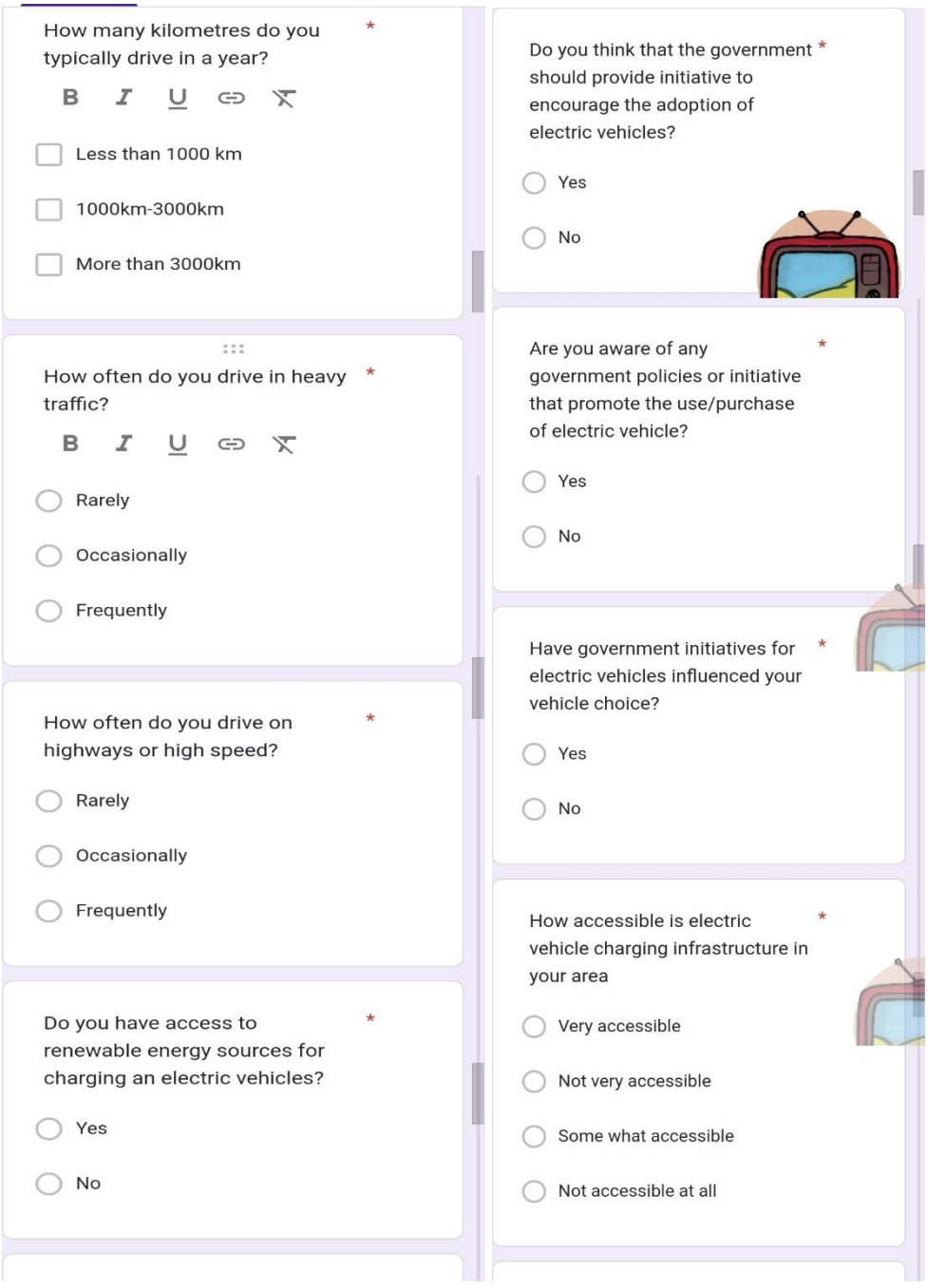
- Electric vehicle
- Fuel vehicle

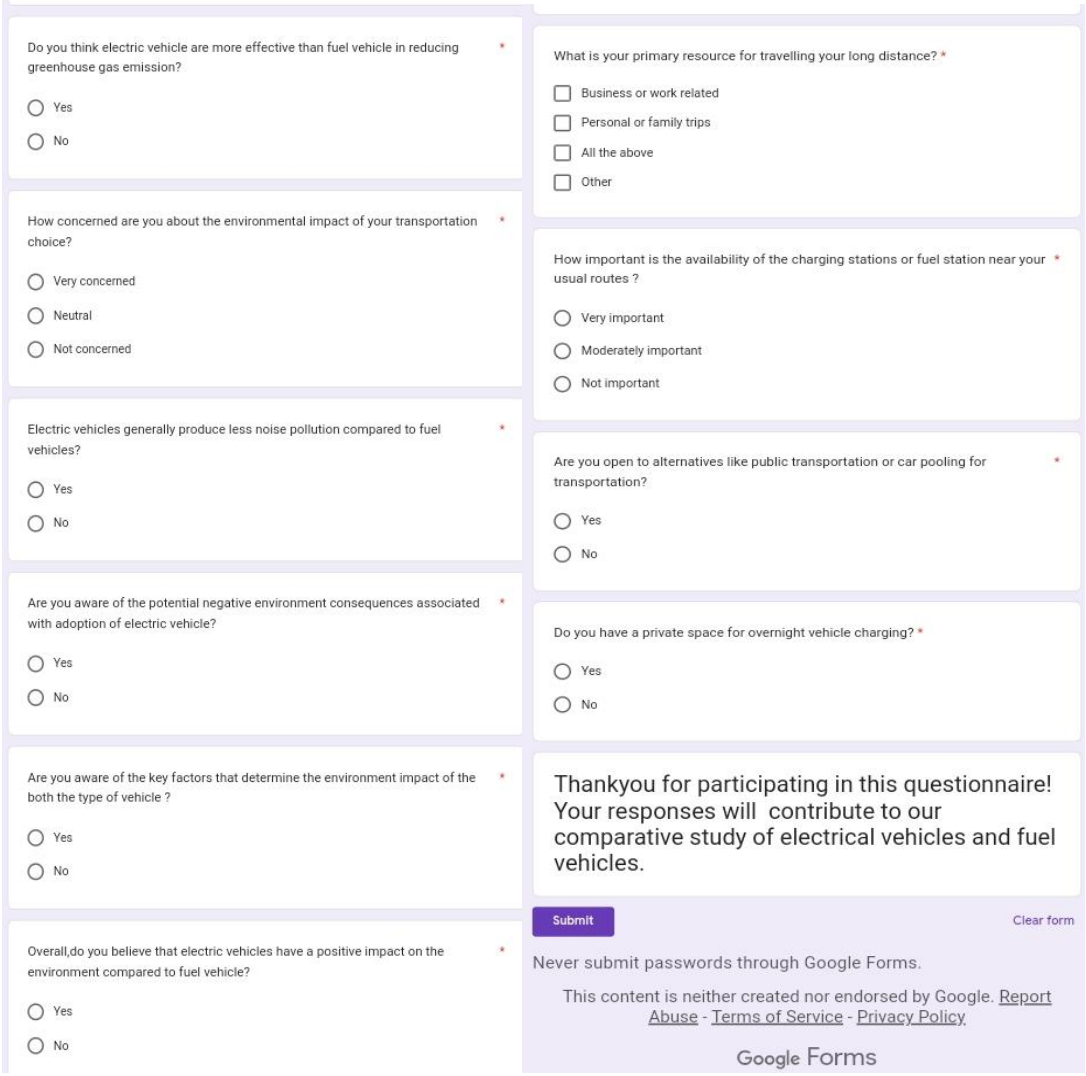
Do you currently own a vehicle? *

- Yes
- No

Have you ever driven or ridden in an electric vehicle? *

- Yes
- No


How many kilometres do you typically drive in a year? *
Less than 1000 km
1000km-3000km
More than 3000km
How often do you drive in heavy traffic? *
Rarely
Occasionally
Frequently
How often do you drive on highways or high speed? *
Rarely
Occasionally
Frequently
Do you have access to renewable energy sources for charging an electric vehicles? *
Yes
No
Do you think that the government should provide initiative to encourage the adoption of electric vehicles? *
Yes
No
Are you aware of any government policies or initiative that promote the use/purchase of electric vehicle? *
Yes
No
Have government initiatives for electric vehicles influenced your vehicle choice? *
Yes
No
How accessible is electric vehicle charging infrastructure in your area *
Very accessible
Not very accessible
Some what accessible
Not accessible at all



Do you think electric vehicle are more effective than fuel vehicle in reducing greenhouse gas emission? *

- Yes
- No

How concerned are you about the environmental impact of your transportation choice? *

- Very concerned
- Neutral
- Not concerned

Electric vehicles generally produce less noise pollution compared to fuel vehicles? *

- Yes
- No

Are you aware of the potential negative environment consequences associated with adoption of electric vehicle? *

- Yes
- No

Are you aware of the key factors that determine the environment impact of the both the type of vehicle ? *

- Yes
- No

Overall,do you believe that electric vehicles have a positive impact on the environment compared to fuel vehicle? *

- Yes
- No

What is your primary resource for travelling your long distance? *

- [ ] Business or work related
- [ ] Personal or family trips
- [ ] All the above
- [ ] Other

How important is the availability of the charging stations or fuel station near your usual routes ? *

- Very important
- Moderately important
- Not important

Are you open to alternatives like public transportation or car pooling for transportation? *

- Yes
- No

Do you have a private space for overnight vehicle charging? *

- Yes
- No

Thankyou for participating in this questionnaire! Your responses will contribute to our comparative study of electrical vehicles and fuel vehicles.

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