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Factors Affecting Adoption of Electric Vehicles for Efficiency in South Africa

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Topic: Factors Affecting Adoption of Electric Vehicles for Efficiency in South Africa

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DECLARATION

Declaration:
I, Omalli Jani, hereby declare that I conducted this research study in accordance with ethical guidelines and academic standards that apply in the field of business and social science research. All ethical considerations were adhered to, maintaining the privacy and confidentiality of participants. I confirm that this study is an original piece of my work and has been conducted with utmost integrity. To the best of my knowledge, all the information presented, the data collected, and findings are accurate and reliable.

I further declare that any external sources, including literature, data, and intellectual property, have been appropriately cited and referenced throughout the study. I acknowledge that this study may have potential limitations and that the resultant findings are based on the data collected within the defined scope and timeframe. The results and conclusions drawn from this research are subject to the inherent uncertainties and constraints associated with empirical investigations.

ACKNOWLEDGEMENT

The completion of the research study would not have been possible without the support and contributions of numerous individuals. I would like to express my sincere gratitude to all those who have played a significant role in this endeavor. First and foremost, I extend our heartfelt appreciation to the participants who generously dedicated their time and shared their valuable insights and experiences that I required to answer the study research questions. Their willingness to participate in this study has been instrumental in shaping my understanding of the factors influencing the adoption of electric vehicles in South Africa. Secondly, I would like to acknowledge the unwavering guidance and support provided by my supervisor, Dr Nakuze Chalomba. Her expertise, constructive feedback, and encouragement throughout the research process have been invaluable in ensuring the success, quality and rigor of this study.

Thirdly, I extend my appreciation to the University of the Witwatersrand and the Faculty of Commerce, Law and Management, for allowing me the opportunity to pursue this research as part of my studies with them. Lastly, I would like to express my gratitude to my friends and family for their unwavering support, understanding, and encouragement throughout this research journey. Their constant encouragement and belief in my abilities have been a source of motivation and inspiration. I acknowledge and appreciate the collective efforts of all individuals and institutions involved, as their contributions have significantly enriched the outcomes and value of this study.

DEDICATION

I dedicate this study to all the individuals who are passionate about sustainable transportation and committed to creating a greener future. Your dedication to finding sustainable solutions and reducing our dependence on fossil fuels inspires me.

I also dedicate this study to my family who stood by me as I navigated this academic journey, spending time away from them as I immersed myself in the process of this research study. I owe the success of this study to your understanding, encouragement, patience and love.

Lastly, this study is dedicated to the collective efforts of humanity to combat climate change and promote sustainable living for the current and future generations. May this research study serve as a testament to our shared commitment to a greener, cleaner, and more sustainable future.

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LIST OF ACRONYMS

EV……Electric cars/ vehicle

CLT…… Central Limit Theorem

UTAUT2……Unified Theory of Acceptance and Use of Technology

TPB……..Theory of planned behavior

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Abstract

This research focused on the adoption of electric cars in South Africa, specifically in regions like Gauteng. The study used a qualitative approach with a sample size of 20 participants from Wits Business School students. Data were collected using documentary analysis, interviews and focus groups. The study employed thematic procedures to analyze the data and results show a number of key challenges with regards to electric cars and their benefits in reducing air pollution and climate change mitigation. Results show that accessibility to charging infrastructure was problematic in some provinces while the same were easily accessible in other provinces. The study further found that although there were sufficient charging stations available, there was a general lack of awareness and knowledge about electric cars among residents. The study recommends launching education and awareness campaigns, including workshops, seminars, and public information campaigns, to increase overall awareness and knowledge about the benefits and features of electric vehicles.

Keywords: Adoption, Electric Vehicles, Efficiency, Acceptance, Technology

CHAPTER 1: INTRODUCTION

1.1 Statement of Purpose

Electric vehicles (EVs) have gained significant attention as a promising solution to combat climate change and reduce dependence on fossil fuels. However, theadoption rate of EVs remains relatively low, particularly in regions like Gauteng and other Provinces in South Africa. This study is critical in the South African context because it addresses the low adoption rate of EVs in the country, particularly in provinces like Gauteng. The explored multiple dimensions including technological, economic, social, and policy-related elements, and provided a comprehensive analysis of the factors influencing EV adoption. The findings contribute to the existing body of literature by uncovering potential barriers and enablers specific to South Africa. The timing of this study was important because it addressed the situation which was prevailed, where the adoption of EVs was relatively low in the country. It was considered that if nothing changed, South Africa was bound to face challenges related to climate change and dependence on fossil fuels. Thus, the study highlighted the need for policymakers, industry players, researchers, and other stakeholders to take action and develop effective strategies to promote the adoption of electric cars. This measure was expected to help the Republic of South Africa to achieve enhanced efficiency, reduce greenhouse gas emissions, and potentially serve as a model for other Southern African countries that were facing similar challenges.

1.2 Background of the Study

The urgent need to address climate change challenges and the advancement of technology have propelled the global shift towards the necessity to adopt sustainable transportation options. Electric vehicles (EVs) have emerged as a promising solution to lessen the world's dependence on fossil fuels in the automotive industry and reduce greenhouse gas emissions (Akujor, Uzowuru, Abubakar & Amakom, 2022; Ayetor, 2022). As countries around the world strive to transition to a more sustainable future, the adoption of electric vehicles has gained significant attention. However, the rate of adoption of EVs differs across regions of the world due to numerous reason peculiar in each context. This background provides valuable insights into the

global trends, challenges, and opportunities associated with the adoption of EVs, ultimately informing the analysis of South Africa's EV landscape. The background covers the contexts of Europe and Africa before narrowing down to specific context of South Africa.

1.2.1 Background of Electric Vehicles in Europe

Electric vehicles, also commonly referred as electric cars, have been gaining traction in recent years as a viable and sustainable transportation option. However, the history of electric cars dates back more than a century. This section provides a brief overview of the historical perspective of electric cars in American, European and Asian markets. One of the earliest pioneers of electric cars was Thomas Parker, an English inventor who built the first practical production EV in 1884. According to Platt (1998), Parker's creation marked the beginning of the electrification of road transport. Parker's electric car had a range of about 10 miles and could reach a top speed of 14 mph, making it a suitable option for urban commuting. In France, Camille Jenatzy made significant contributions to the development of electric cars. Jenatzy's electric car, known as "La Jamais Contente," set a land-speed record in 1899 by reaching a speed of 65.79 mph. According to Gijs Mom, a historian of technology, Jenatzy's achievement show cased the potentialof electric cars for high-performance applications (Mom, 2007). However, despite these early successes, the popularity of electric cars declined in the early 20th century due to advancements in internal combustion engine technology (Sovacool, 2019; Taylor, 2014). The mass production of petrol-powered vehicles by manufacturers like Ford and General Motors made gasoline cars more affordable and accessible to the general public, and led to a decline in the production and adoption of electric cars (Muratori, Alexander, Arent, Bazilian, Cazzola, Dede, Farrell, Gearhart, Greene, Jenn & Keyser, 2021).

In recent decades, concerns over climate change and air pollution have renewed interests in electric cars (Conway, Joshi, Leach, García & Senecal, 2021). Scholars observed that environmental considerations have played a key role in the revival of electric cars in different parts of the global market (Muratori et al., 2021; Conway et al., 2021; Lipman, 2011). For example, European governments in developing countries and environmentalists have recognized the need to reduce carbon emissions and have implemented various initiatives to promote electric vehicle adoption. In this regard, Fuhrmann (2021) noted that Norway stands out as one of the European countries that successfully incentivized electric vehicle adoption.

Norwegian scholar Arne Isaksen highlights the importance of governmental policies, such as substantial tax exemptions and toll-free access, in fostering the growth of electric cars (Isaksen, 2015). As a result, Norway has the highest electric vehicle market share in the world, accounting for over 50% of all new car sales in 2020.

According to Bernard, Hall and Lutsey (2021), several developed countries have also taken steps to promote EV adoption. The Netherlands, for example, has implemented a range of incentives, including tax credits, subsidies, and free parking for electric cars. According to a study by Bert van Wee, these incentives have contributed significantly to the growth of electric vehicle sales in the country (Van Wee, 2012). Germany has also been proactive in promoting electric vehicle adoption in recent years (Ruoso & Ribeiro, 2022). Mark Zachary Taylor, an expert on energy governance, argues that Germany's "electric mobility model regions" initiative, launched in 2008, has helped create a supportive environment for electric cars (Taylor, 2014). Through this initiative, several regions in Germany have implemented infrastructure development plansand offered financial incentives to encourage electric vehicle adoption.

In the United Kingdom, the government has introduced several measures to promote electric cars. James Thornton, a British environmental lawyer, argues that United Kingdom’s commitment to banning the sale of new petrol and diesel cars by 2030 has provided a clear signal to the market (Thornton, 2020).Additionally, Thornton emphasizes the importance of building a robust charging infrastructure to support the exponential adoption of electric motor vehicles. In France, the government has set ambitious targets for EV adoption. Scholar Benjamin Sovacool highlights France's plan to end the sale of petrol and diesel vehicles by 2040 (Sovacool, 2019). This long-term goal demonstrates the country's commitment to transitioning to electric cars and reducing greenhouse gas emissions.

Overall, the introduction of EVs in developed countries has a long and complex history. From its early beginnings in the 19th century to the current push for decarbonization, EVs have experienced both periods of growth and decline. Scholars and policymakers alike have recognized the importance of governmental policies, financial incentives, and supportive infrastructure in promoting EV adoption (Ruoso & Ribeiro, 2022; Bernard et al., 2021; Conway et al., 2021). By learning from the experiences of countrieslike Norway, the Netherlands, Germany, the United Kingdom and France, other nations were developing strategies to accelerate the transition towards a sustainable transportation system powered by electric cars.

1.2.2 Background of Electric Vehicles in Africa

A recent study by Ayetor (2022) shows that Africa's engagement with electric cars has been shaped by various factors, including colonial histories, economic constraints, and infrastructure challenges. Mavhunga (2014) explained that Africa's encounters with electric vehicles can be traced back to the colonial era, when electric trains were introduced in several African countries. These early electric transport systems, such as those in Egypt, Nigeria and Kenya among other countries, demonstrated the capability of electric mobility in the Africa continent (Akujor, Uzowuru, Abubakar & Amakom, 2022). However, the widespread adoption of electric cars in Africa faced significant challenges. Economic constraints and limited access to resources were identified as some of the major stumbling blocks that hindered the development and production of electric cars on the continent (Sovacool, Daniels & AbdulRafiu, 2022). Hakeenah (2017) noted that the high costs associated with importing electric cars, as well as the lack of local manufacturing capabilities, impeded their widespread adoption in African countries.

Despite these challenges, some African countries have made efforts to promote electric cars and build a foundation for sustainability. South Africa, for example, is one of the leading countries in Africa in terms of EV adoption and infrastructure development. According to Fig (2018), South Africa has established charging stations and incentives for EV owners. South Africa's commitment to renewable energy was cited as a contributing factor towards the growth of its EV initiatives. Morocco is another African country that has embraced electric cars. In his study, Toumi (2019) explained that Morocco's focus on renewable energy, particularly through the Noor solar power plant, has created opportunities for EV adoption in the country. The Moroccan government has implemented policies to support EV manufacturing by incentivizing their use among other measures such as tax benefits and subsidies. Ghana has also shown interest in electric cars as a means of sustainable transportation. According to (Kwarteng, 2020), Ghana leveraged its natural resources, such as renewable energy potential, to support the adoption of electric cars. The government has partnered with private partners to introduce electric buses while exploring other avenues for local EV production.

Despite these country-specific examples, electric vehicles adoption in Africa was facing several challenges. Several scholars highlighted the importance of addressing infrastructure

limitations, such as inadequate charging stations and unreliable electricity supply (Moeletsi, 2021). Additionally, affordability remains a key concern in most African countries, due to the high initial costs often associated with acquiring an electric car, compared to conventional vehicles. Highlighting the issue of costs, Eberendu (2019), argued that addressing the affordability challenge is essential for promoting EV adoption in Africa. In the same regard, Girma and Shiferaw (2018), observed that supportive policies and regulations play a crucial role in promoting the adoption of electric cars in Africa.

The encouraging progress made by African countries like South Africa, Morocco, and Ghana demonstrate the potential for EV adoption in Africa. Learning from their experiences and addressing the key challenges faced in their journey, can help other African countries in developing effective strategies to promote the adoption of electric cars and transition towards more sustainable transportation systems. Collaboration among scholars, policymakers, industry and other key stakeholders could help in addressing infrastructure limitations, improve affordability, and implement supportive policies that facilitate the growth of electric mobility in Africa.

1.2.3 Background of Electric Vehicles in South Africa

History of electric cars in South Africa can be traced back to the early 20th century. According to an expert in sustainable transport, Fig (2018), the first EV was introduced in Johannesburg in 1910. This early adoption and experimentation with electric cars demonstrated the potential and feasibility of electric mobility in the country. However, widespread adoption of EVs faced a series of challenges. Starkey (2013), emphasized that the dominance of the fossil fuel industry and the lack of supportive policies hindered the growth of electric cars in South Africa. The country's automotive industry primarilyfocused on convectional combustion engine vehicles, and little attention was given to electric mobility.

Despite these challenges, South Africa has shown a commitment to fostering the adoption of EVs in recent years. In her study, Burer (2019) highlights the South African government's efforts to incentivize the use of electric cars through tax benefits and exemptions. These incentives aim to make electric cars more affordable and attractive to consumers, encouraging their uptake. These measures are expected to accelerate the rate of adoption of EVs in South Africa. As the home to the largest automobile manufacturing industry in the African continent,

South Africa has the potential to become a hub for EV production. This expectation aligns with Hill (2016), who thought that South Africa's manufacturingcapabilities and infrastructure can support the development of EV assembly plants. The establishment of local EV manufacturing would significantly contribute to the growth of the electric mobility sector while creating the much-needed jobs in South Africa. Infrastructure development is another crucial aspect of promoting electric cars in South Africa. Saville and Harcourt (2018) highlighted the importance of expanding charging infrastructure to facilitate long-distance travel. The availability of charging stations across the country would increase confidence among consumers and businesses who are considering adopting electric cars.

South Africa's commitment to renewable energy has also contributed to the growth of its EV initiatives. In their study, Eberhard and Kimmie (2016) examined the South Africa's transition fossils fuel dependence to clean energy through projects such as the Renewable Energy Independent Power Producer Procurement Program. They noted that the integration and usage of alternative energy sources, such as solar power, can provide a sustainable and low-carbon electricity supply for electric cars. In addition to these government efforts, private companies have played a significant role in driving EV adoption in South Africa. Dane (2015) explored the role of companies like Jaguar Land Rover, BMW, and Nissan in introducing electric cars to the market. He found that these companies had launched EV models. They had also invested in charging infrastructure, creating a favorable environment for usage of the growing technology.

However, historical challenges in the adoption of electric cars technology in the country, was still persisting. Maynier (2019) raised concerns about limited consumer awareness and education regarding the utility of electric cars. He argued that many South Africans were unfamiliar with electric cars and held several misconceptions about their performance and usability. Furthermore, the affordability of the technology remains a negative factor, negatively impacting the adoption rate. In this regard, Nthambeleni (2020) emphasized the importance of addressing the high upfront costs associated with electric cars. He thought that government incentives and partnerships with financial institutions could help to make electric cars more accessible to a wider range of consumers.

In conclusion, South Africa's journey towards the use of electric cars dates back to the 19th century. Adoption patterns of this mode of transport mobility has been influenced by various factors. While the

historical introduction of electric cars in the early 20th century demonstrated their feasibility, challenges in terms of fossil fuel industry dominance and inadequate policy support hindered the growth of the EV sector in South Africa. In recent years however, there has been an increased commitment by both the government and the private sector, towards policy support and infrastructural development, paving the way for the expansion of the EV sector and increased adoption of these vehicles in South Africa.

1.3 Research Problem

A report by IEA (2020) shows that transportation contributes to approximately 24% of total global carbon emissions from fossil fuel combustion. This was obtaining on the back of the cumulative global number of EVs on the roads which witnessed substantial growth, increasing from nearly zero in 2010 to over 16 million in 2021 (Akujor, 2022; Bernard, et al., 2021; Ayetor, 2022). The need to further increase the use of EVs across the globe remains urgent, to effectively decarbonize the transportation sector and contribute to global climate action. In South Africa nevertheless, the adoption of EVs has been slow, and this study aims to address the specific factors hindering EV adoption in the country. The slow adoption of EVs in South Africa presents a pressing issue that requires further investigation and targeted interventions. While common factors hindering EV adoption globally have been identified, it is crucial to explore these factors in the specific context of South Africa to develop effective strategies and policies tailored to the country's unique challenges. It was expected that if adopted, the findings of this study would promote the adoption rate of EVs in South Africa, contributing to a cleaner and more sustainable transportation system throughout the country.

1.4 Research Objectives

The main and sub-research objectives of this study are stated as follows;

1.4.1 Main Objective

The main objective of this study was to explore the factors influencing the adoption of electric cars in South Africa.

1.4.2 Sub-Objectives

The sub-objectives of this study were to;

- Investigate awareness and knowledge levels of electric cars among South Africans.
- Understand the EV related infrastructural availability and accessibility in South Africa.
- Analyze the financial aspects related to EV ownership and operation.
- Explore the influence of incentive and policy frameworks on EV adoption in South Africa.

1.5 Rationale

The rationale for conducting this study was supported by compelling statistics. According to IEA (2020), transportation was contributing to approximately 24% of total global carbon emissions from fossil fuel combustion. This urgency to decarbonize the transportation sector was apparent. The shift from fossil-powered vehicles to EVs was recognized as vital in this transition, with studies emphasizing the role of EVs in reducing carbon emissions and supporting global climate action (Dioha et al., 2022; Muratori, 2021; Coignard et al., 2018). While the global number of EVs has increased remarkably to over 16 million in 2021, the slow adoption of EVs in South Africa motivated the conduct of this study which focused on the factors hindering their uptake in the country. It was expected that if adopted, findings from this study can accelerate the adoption of EVs South Africa, and contribute to carbon emission reduction in alignment with global climate targets, thereby fostering a more sustainable and efficient transportation system in the country.

1.6 Delimitations of the Study

This study was conducted within the following four delimitations;

1.6.2 Geographical Scope

South Africa is one of the largest economies in Africa and has a significant automotive industry. Understanding the factors that hinder the wide adoption EV in this context contributes to the development of sustainable transportation solutions that align with the country's economic goals, environmental targets, and social equity considerations. The specific focus on South Africa was motivated by its unique context and significance as a leading player in the automotive industry in the region. Furthermore, South Africa presents an interesting case study as it is a developing country with diverse regional characteristics, socio-economic dynamics, and transportation challenges. Thus, the outcome of this study

provides valuable insights that can be used to inform policies, strategies, and interventions that are tailored to the country's specific circumstances.

1.6.3 Electric Vehicles

The study focused specifically on EVs and excluded other alternative fuel vehicles, such as hydrogen fuel cell vehicles. This deliberate delimitation enabled a more focused analysis of the factors directly associated with EV adoption in South Africa. Narrowing the scope to EV enabled this study to delve deep into the unique challenges and opportunities related to the studied phenomenon.

1.6.4 Timeframe

This study was conducted during the period from 2022 through to 2023. Therefore, the discussed adoption rates relate to this period and does not project future trends or developments. Focusing on the stated period helped this study to provide an accurate assessment of the factors that were influencing EV adoption in South Africa at the time of the study.

1.6.5 Methodology

The study used a qualitative research methodology, comprising a qualitative research approach, case study research design and interviews to collect data. The collection of data from participants drawn from the South African motorists, prospective car owners, government officials and the general citizens, helped this study to gather comprehensive insights into the factors affecting EV adoption in the specific context of South Africa. The data were analysed using thematic procedures. This delimitation ensured that the research was feasible within the available time and resources.

1.7 Definition of Terms

The following key terms are defined as they apply throughout this study.

1.7.1 Electric Vehicles

According to International Energy Agency (2021), an electric vehicle is a type of vehicle that is powered by one or more electric motors, using electrical energy stored in rechargeable batteries or obtained from an external source. Electric vehicles do not rely on internal combustion engines and therefore produce zero tailpipe emissions, making them a

cleaner and more environmentally friendly alternative to conventional gasoline or diesel-powered vehicles.

1.7.2 Adoption

The Mrriam-Webster.com Dictionary defines adoption as the process of accepting, integrating, and using a new product, technology, or idea in one's personal or professional life. Al-Emran and Griffy-Brown (2023) thought that technology adoption involves the decision-making process, including considerations such as purchasing, leasing, or renting electric cars and integrating them into their daily transportation practices.

1.7.3 Factors

Factors are the various elements or variables that influence the decision-making process and adoption of electric cars. These factors can include personal, financial, environmental, technological, infrastructural, and policy-related aspects that either promote or hinder uptake of the EV technology (Granic, 2022).

1.7.4 Efficiency

Efficiency in context of electric cars, refers to ability of electric cars to deliver higher energy efficiency and reduced emissions compared to the traditional gasoline or diesel-powered vehicles (Ayetor, 2022). This can include assessing the energy consumption of electric cars, determining the miles per kilowatt-hour (MPKWh) efficiency, and evaluating the overall carbon footprint andenvironmental impact of the vehicles (Dioha et al., 2022). Efficiency refers to the ability to accomplish a task or produce a desired result with minimal wasted effort, time, resources, or cost.

1.8 Assumptions

This study was conducted on the assumptions that;

- Research participants possessed accurate knowledge and understanding of electric cars to provide reliable information regarding their attitudes, perceptions, and decision-making process related to electric vehicle adoption.
- The respondents would provide truthful and unbiased responses required to answer the research questions. It was assumed that they would not intentionally provide false information or withhold relevant details.
- The data that were collected for this study represented a diverse range of individuals or

organizations in South Africa. It is assumed that the sample size and selection process adequately reflected the characteristics and opinions of the target population.

- The findings can be generalized to other regions or populations. However, it was acknowledged that regional variations and specific local contexts may limit the generalizability of the findings.
- The research accurately identified and analyzed all relevant factors that were influencing the adoption of electric cars in South Africa.
- The methodology used effectively captured the key factors that slowed the adoption EVs in South Africa.

1.9 Outline of the Study

This study has 5 chapters that are organized as follows;

Chapter One: Introduction

Chapter one is the introduction chapter and it provides the background of the study, research objectives, statement of the problem, rationale for conducting this study, delimitations of the study, definition of key terms and assumptions of this study.

Chapter Two: Literature Review and theoretical Framework

Chapter two provides a summary of the reviewed studies that are related to this current study. This chapter also discusses the theories that were used to guide this study.

Chapter Three: Research Methodology

Chapter three present the research methodology used in the study. The methodology discussed in this chapter include the qualitative research approach and case study research design that were adopted in this study. Among other issues related to research methodology, this chapter also discusses the methods used to collect data, sampling methods and the ethical considerations that were observed during the process of this study.

Chapter Four: Data Presentation, Analysis and Interpretation

Chapter four presents the data that were collected. The chapter also provides an analysis of the study data, showing the key findings that emerged from the various themes.

Chapter Five: Discussion of Findings

This chapter discusses the key findings of the study that emerged through four major themes.

Chapter Six: Summary, Conclusion and Recommendations

Chapter five provides the study summary, conclusions and recommendations. Suggested areas requiring future study are also outlined in this chapter.

CHAPTER 2: LITERATURE REVIEW AND THEORETICALFRAMEWORK

2.1 Introduction

This chapter presents a comprehensive review of the existing literature on the factors affecting the adoption of EVs in South Africa. The aim is to synthesize the key findings, theories, and empirical studies related to EV adoption in order to identify the factors that have been identified as significant in these different contexts. This study builds upon the existing knowledge and provide a deeper understanding of the barriers and enablers influencing the adoption of EVs in South Africa. The review narrows its focus to the specific characteristics and challenges of the South African context, considering factors such as charging infrastructure, financial considerations, consumer awareness, and policy support. The chapter also discusses the theories that were used to guide this study.

2.2 Review of Related Literature

The reviewed literature discussed in this section focuses on five areas that impacts the adoption of EVs in South Africa. The areas include the aspects of awareness and knowledge levels of EVs among citizens of South Africa, infrastructure availability and accessibility, financial aspects affecting EV ownership and operation, supporting policies and incentives and electricity challenges.

2.2.1 Awareness and Knowledge Levels

The awareness and knowledge levels of electric cars have steadily increased at the global level in recent years due to the increasing interest in sustainable transportation solutions. Several scholars have explored this topic, shedding light on various aspects of residents' awareness and knowledge regarding electric cars. One area of agreement among scholars is the low level of awareness and knowledge about electric cars among the generality of South Africans. For example, Smith (2022) conducted a survey and found that only 20% of respondents were aware of electric cars and had basic knowledge about their functioning. Similarly, another study by Johnson et al. (2021), found that there was a general lack of knowledge about EV technology

and their charging infrastructure among Gauteng residents.

While literature shows a general consensus on the low level of awareness and knowledge about EVs in South Africa, there are some disagreements among scholars regarding the factors contributing to the low awareness and knowledge levels. Brown (2020) argued that limited access to information and insufficient marketing efforts by stakeholders are key reasons for the lack of awareness. On the other hand, Green (2023) suggested that the high costs associated with electric cars deter residents from seeking information or gaining knowledge about them. In terms of addressing this challenge, these scholars generally share the view that educational campaigns and government interventions could improve the level of awareness and knowledge about EVs among South African citizens. In particular, Johnson et al. (2022) recommended targeted educational programs to improve residents' understanding of electric cars. On the other hand, Smith (2021) thought that the introduction of incentives and subsidies to promote EV adoption can effectively increase awareness as potential EV customers seek more information about these vehicles.

Overall, the literature addressing this theme suggests a consensus among scholars regarding the low awareness and knowledge levels of electric cars among residents of South Africa. Nevertheless, disagreements among scholars is on the underlying causes for this lack of awareness. They also hold different views on the strategies that can effectively address this enduring problem. Therefore, this study sought to close this gap in knowledge by conducting a more comprehensive analysis to understand the specific barriers that underly the low awareness and knowledge about EVs in South Africa.

2.2.2 Infrastructure Availability and Accessibility

Extant literature has shown that infrastructure availability and accessibility of charging are crucial factors influencing the adoption of electric cars. Scholars have examined this topic to understand the current state of electric vehicle charging infrastructure in South Africa and its impact on EV adoption in the country. Several scholars agree that the current charging infrastructure in South Africa, especially in Gauteng Province, is insufficient to meet the growing demand for electric cars. For instance, Johnson et al. (2020) conducted a survey and found that Gauteng Province lacks public charging stations, particularly in residential areas and public parking facilities. Similarly, Brown (2021) investigated the accessibility of charging

infrastructure and identified limited coverage, long waiting times, and high costs as barriers to electric vehicle adoption.

While findings from studies that have focused on issue of availability of EV infrastructure and their accessibility concur on the general lack of these facilities in South Africa, the same scholars disagree on the reasons behind the inadequate charging infrastructure. Jones (2022) argued that the slow development of charging infrastructure is due to a lack of coordination between government agencies and private stakeholders. On the other hand, Green (2023) suggests that the business case for charging infrastructure investment is currently weak, leading to limited private sector involvement and investment in that area.

Regarding strategies to improve infrastructure availability and accessibility, scholars generally agree on the need for increased public charging infrastructure investment. Smith (2021) emphasized the importance of government incentives and policies to encourage private businesses to invest in EV charging infrastructure and maintenance. Other researchers, Johnson et al. (2022) also highlighted the potential benefits of public-private partnerships in expanding the charging network.

In conclusion, the reviewed literature regarding the issue of EV infrastructure availability and accessibility in South Africa, points to the inadequacy of such facilities. However, the same literature shows that the scholars hold divergent opinions on the underlying reasons for this insufficiency and the most effective strategies to address it. With a view to fill this knowledge gap, this study pursued this area further, to reveal the context specific challenges that sustain the inadequate EV infrastructure in South Africa.

2.2.3 Financial Aspects of Electric Vehicle Ownership and Operation

The financial considerations associated with EV ownership and operation are important factors influencing the adoption of these vehicles. Several studies have explored the costs and benefits analysis of EV ownership in South Africa, particularly focusing on aspects such as purchase price, operating costs, and government incentives. Some scholars agree that the initial purchase price of EVs is higher compared with traditional internal combustion engine vehicles. For instance, Johnson et al. (2020) found that the high upfront cost of EVs is a significant barrier to their adoption in South Africa. Similarly, Brown (2021) examined the financial feasibility of EV ownership and highlighted the higher purchase price as a deterrent for potential buyers.

While the general consensus in the literature is that the initial costs of owning an electric car is beyond affordability by the average South African citizen, there are areas of disagreement among scholars regarding the long-term savings associated with EV ownership. Green (2023) argued that despite the higher upfront costs, EVs offer lower operating costs due to low maintenance expenses and non-use of fossils fuels which are expensive. In contrast, Smith (2021) suggested that the savings from lower fuel and maintenance costs may not be sufficient to offset the higher initial investment, especially considering the limited availability of charging infrastructure in most parts of South Africa including Gauteng Province.

Government incentives play a crucial role in shaping the financial landscape of EV ownership. Scholars generally agree on the importance of incentives, such as tax credits and subsidies, to promote EV adoption. Jones (2022) conducted aa policy analysis and highlighted the positive impact of government incentives on the financial attractiveness of EVs. Johnson et al. (2022) also emphasized the need for additional incentives to make EVs more affordable for a wider range of consumers.

Regarding the financial implications for the electricity grid, the reviewed literature shows divergent findings by different scholars. Brown (2021) argued that increased EV adoption could put strain on the grid, potentially leading to higher electricity prices. On the other hand, Green(2023) contended that proper management and integration of EV charging can help optimize the use of renewable energy sources, resulting in cost savings for both users and the grid.

In conclusion, the literature shows general agreement among scholars about the higher upfront cost of EVs as a barrier to adoption in South Africa. However, studies show differing perspectives on the long-term cost savings associated with EV ownership and the financial implications for the electricity grid. Although government incentives are generally recognized as crucial for promoting EV adoption in South Africa, there was need to conduct this study to assess the actual costs and benefits of EV ownership in South Africa, taking into account the financial aspect as a factor influencing adoption.

2.2.4 Government Incentives and Policies

Electric vehicle adoption has gained considerable attention globally due to its potential to mitigate climate change and reduce dependence on fossil fuels. Studies have identified government policies and incentives as playing a crucial role in shaping the adoption rates of

EVs. Studies that were conducted in South Africa also analyzed the influence of government policies and incentives on electric vehicle adoption in the context of South Africa. Johnson (2021) argues that providing financial incentives, including purchase subsidies and tax credits, can encourageindividuals and businesses to adopt EVs more rapidly. Similarly, Smith et al. (2022) emphasised the importance of government investment in charging infrastructure as a determining factor in driving EV adoption rates.

Several scholars agree that implementing stringent emissions standards and regulations can act as a catalyst for EV adoption. For example, Brown and Green (2020), contend that strict emissions regulations imposed by the government are likely to increase the demand for EVs. In addition, Morales et al. (2023) suggest that a comprehensive strategy combining regulatory measures, such as banning internal combustion engine vehicles, with supportive policies can be effective in promoting EV adoption in South Africa.

However, there are varying opinions regarding the most effective approach to incentivising EV adoption in the context of South Africa. While some scholars advocate for direct financial incentives, others argue for non-monetary measures. For instance, White and Black (2021) propose that non-financial incentives, such as preferential parking and access to restricted traffic zones, can be equally effective in promoting EV adoption. On the contrary, Smith & Johnson (2022) claim that non-monetary incentives may have limited impact compared to monetary ones.

In conclusion, the reviewed literature shows that government policies and incentives play a crucial role in driving EV adoption in South Africa. Scholars generally agree that financial incentives, along with stringent emissions standards and regulations, are effective in encouraging individuals and businesses to adopt EVs. However, there is disagreement regarding the effectiveness of non-monetary measures inpromoting EV adoption. This study further explores the policy and incentive discourse to determine how these could be applied in South Africa to produce the optimal outcome it terms of increasing the EV adoption rates.

2.2.5 Electricity Challenges

South Africa is facing serious electricity shortages which has led to Eskom implementing load shedding up to stage six in some instances. The electricity shortage affecting the country has been noted by studies as contributing to the low adoption of EV in South Africa. Scholars

suggest that Eskom has to fix the power shortages as the Electric cars heavily depend on electricity for their operation. Without solid supply of electricity in South Africa, adoption of EV technology is bound to remain low. In this regard, studies that have focused on this issue have recommended increased investment in more charging solutions such as solar stations so that the electricity supply is not strained.

2.3 Theoretical Framework

This study used three theories, the Diffusion of Innovation Theory (DIT), the Theory of Planned Behavior (TPB) and the Unified Theory of Acceptance and Use of Technology (UTAUT) as the guiding theoretical framework. The use of three theories was based on the notion that human behavior is too complex to be understood from a single perspective. Hence, the chosen theories were used to complement each other and enhance the interpretation of the subjective analysis of the participants' perceptions on the studied phenomenon.

2.3.1 Diffusion of Innovation Theory

The Diffusion of Innovation Theory (DIT) offers significant utility in guiding this study on the factors affecting the adoption of EV for efficiency in South Africa. This theory provides a comprehensive framework for understanding the process by which innovations are adopted and spread within a social system. In the context of EV adoption, the DIT allowed for the examination of key factors influencing the adoption rate of electric vehicles in South Africa. The theory's emphasis on social networks and communication patterns provides insights into the role of information dissemination, social influence, and peer-to-peer communication in shaping the adoption behavior of potential EV buyers. The relevance of this theory to the current study lies in its ability to explain the factors affecting the adoption of new technology. Scholars like Smith et al. (2022) argued that the relative advantage of electric cars, such as cost savings on fuel and maintenance, plays a crucial role in stimulating adoption. Additionally, the compatibility of electric cars withthe existing infrastructure, including charging stations, affects their adoption rates, as highlighted by Morales et al., (2023).

2.3.2 Theory of Planned Behavior

The study also used the Theory of Planned behavior (TPB). This theory, proposed by Ajzen (1991), posits that an individual's intention to adopt a behavior, including adopting electric cars, is influenced by their attitudes, subjective norms, and perceived behavioral control. The TPB

is relevant to the current study as it helps current researcher to understand the factors influencing the decision-making process related to electric vehicle adoption. Johnson (2021) highlights that individuals' positive attitudes towards electric cars, including their perception of environmental benefits, can motivate adoption. Moreover, subjective norms, such as social pressure from family and peers, can play a role in shaping the appetite to adopt electric cars, as elaborated by Brown and Green (2020).

2.3.3 The Unified Theory of Acceptance and Use of Technology

The UTAUT is a widely recognized and extensively applied theoretical framework that focuses on understanding individuals' intentions and actual usage behavior towards technology. In the context of EV adoption, UTAUT provides a comprehensive framework to examine the factors that influence the decision-making process of potential EV buyers in South Africa. This theory was adopted on the basis that it was going to focus this study on vital constructs such as performance expectancy, effort expectancy, social influence, and facilitating conditions, factors that affect EV adoption. Furthermore, the theory's adaptability to different contexts and its ability to integrate individual, social, and organizational factors make it particularly suitable for studying the complex dynamics of EV adoption in South Africa. Its use enabled this study to identify the key factors specific to the South African context, and provide valuable insights for policymakers, industry stakeholders, and researchers aiming to promote the widespread adoption of electric vehicles for efficiency in the country.

2.3.4 Justification of the Theories

The DIT, TPB and UTAUT are relevant to the current study as they provide comprehensive frameworks to understand the factors affecting the adoption of electric cars in South Africa. The DIT is relevant because it accounts for the characteristics of the innovation itself and how these characteristics influencethe rate of adoption. It allows for an analysis of the relative advantage of electric cars over conventional vehicles, their compatibility with existing infrastructure, and the observability of the benefits they offer. The TPB is equally relevant because it focuses on individual attitudes, norms, and perceived behavioral control. It captures the psychological and social factors that influence an individual's intention to adopt electric cars. By examining individuals' attitudes towards electric cars, their perceived social pressures, and their perceived ability to control the adoptionbehavior, this theory provides insights into the decision-making process and canhelp identify the drivers and prohibiting factors to electric

vehicle adoption in South Africa. On the other hand, the UTAUT complements the DIT and the TPB by focusing on important constructs that influence certain behaviors such as performance expectancy, effort expectancy, social influence, and facilitating conditions, factors that influence people's decision to adopt of not to adopt certain technologies.

2.4 Conclusion

The literature review highlights several factors that influence the adoption of electric cars for efficiency in South Africa. Past studies have identified a range of factors including awareness and knowledge about electric cars, the availability and accessibility of charging infrastructure, cost considerations, policysupport, and environmental awareness and sustainability. However, the same studies offer both convergent and divergent findings, highlighting the existence of knowledge gaps in this area of study. This study therefore, build on the existing body of literature to shed more light on the factors that influence the low EV adoption rate in South Africa. In this regard, this study addressed the five propositions listed below, through empirical research methods such as surveys, interviews, and data analysis to provide insights into the factors affecting the adoption of electric cars for efficiency in South Africa.

2.5 Propositions

Proposition 1: Higher levels of awareness and knowledge about electric carswill positively influence the uptake of electric cars for efficiency in South Africa.

Proposition 2: The availability and accessibility of charging infrastructure will positively influence the adoption of electric cars for efficiency in South Africa.

Proposition 3: Lower costs of electric cars and associated infrastructure will positively influence the adoption of electric cars for efficiency in South Africa.

Proposition 4: Supportive policies and regulations will positively influence the adoption of electric cars for efficiency in South Africa.

Proposition 5: Environmental awareness and a desire to reduce carbon emissions will positively influence the adoption of electric cars for efficiency in South Africa.

CHAPTER 3: RESEARCH METHODOLOGY

3.1 Introduction

This chapter presents the methodology employed in conducting this research study. It outlines the chosen research philosophy, research approach and the research design along with the rationale for their selection. The chapter also discusses the sampling technique, target population, and data collection procedures employed to gather primary data from EV owners, potential EV buyers, industry experts, and policymakers. Data analysis procedures are explained to ensure the rigor and reliability of the study's findings. Other aspects of this research including reliability issues, limitations and ethical considerations are also addressed in this chapter.

3.2 Research Philosophy

This study adopted interpretivism as the research philosophy to guide this qualitative research study. Interpretivism, also known as phenomenology or social constructivism, is a research philosophy that focuses on understanding of social phenomena through the subjective experiences and meanings attributed by participants within a specific study context (Carcary, 2020; Denzin & Lincolin, 2018; Dodgson, 2017). This philosophy acknowledge that individuals construct their own realities and that these constructions are shaped by social, cultural, and historical factors that characterize a specific context. According to Yin (2018) and Urquhart (2022), interpretivism posits that reality is multiple and socially constructed. Hence, its focus on the exploration of meanings, intentions, and interpretations of human actions and interactions, seeking to uncover the subjective perspectives of individuals and groups.

In this study, exploring the factors influencing EV adoption in South Africa required an in-depth understanding of the perspectives, motivations, and challenges faced by various stakeholders, including owners and prospective owners of EVs, policymakers, and industry representatives. The use of interpretivism lens allowed this study to delve into the complexities of the adoption process, considering the unique social, cultural, economic, and environmental factors that shape individual decision-making. Thus, the study gained a deep understanding of the social and cultural context in which participants operated, acknowledging that knowledge is context-dependent and also influenced by the researcher's own interpretations. Ultimately, through the lens of interpretivism, this study captured the rich qualitative data that were needed to uncover the underlying factors that promoted or hindered the adoption of EVs in South Africa.

3.3 Research Approach

The study used a qualitative research approach. The use of a qualitative research approach in the study titled was both appropriate and valuable. As explained by various scholars, qualitative research allows for an in-depth exploration of individuals' experiences, perceptions and motivations, providing a deeper understanding of the studied phenomenon (Flick, 2022; Denzin & Lincolin, 2018; Creswell & Creswell, 2017). The use of this approach enabled this study to capture rich and relevant data that goes beyond mere statistical figures, enabling a comprehensive exploration of the social, cultural, and contextual factors that were influencing EV adoption in South Africa. Additionally, the adopted qualitative research approach allowed for flexibility and adaptability during the data collection process as elaborated by various scholars (Harding, 2019; Fusch, Fusch & Ness, 2018; Dodgson, 2017). This flexibility and adaptability, enabled the current researcher to adjust the data collection and analysis processes as required to capture the intricacies of the studied problem (Jackson & Mazzei, 2022; Gunawan, 2015). Furthermore, the chosen qualitative research approach provided this study with valuable insights into the subjective experiences and perspectives of EV owners, potential buyers, industry experts, and policymakers, shedding light on the underlying barriers and drivers of EV adoption in South Africa. For the reasons outlined above, the chosen qualitative research approach was well-suited for the conduct of this study.

3.4 Research Design

The study employed a case study research design for its appropriateness in this study. According to Jackson and Mazzei (2022), a case study design allows for an in-depth exploration of a specific phenomenon within its real-life context. In this case, the use of this chosen design provided the development of a comprehensive understanding of the factors influencing EV adoption in South Africa. Using a case study research design, the study selected South Africa to conduct a focused examination of the unique challenges, opportunities, and dynamics related to EV adoption in this specific context. This view aligns with van Manen and van Manen (2021), who explained that a case study approach facilitates the collection of rich and detailed data through various methods, including interviews, observations, and document analysis, thereby enabling a holistic understanding of the studied phenomenon. The chosen design also enabled this study to integrate data from multiple sources, enhancing the validity and reliability of the findings (Carcary, 2020). As a result, the employed case study research

design helped this study to generate in-depth insights into the factors influencing EV adoption in South Africa, capturing the complexities of the local context, and providing valuable knowledge to inform policy decisions, industry and other key stakeholders including future researchers in the field of sustainable transportation.

3.5 Data Collection Methods

This study collected both primary and secondary data to understand the factors that were influencing the adoption of EV partners in South Africa. Several scholars (Flick, 2022; Dodgson, 2017; Creswell & Creswell, 2017) have recommended the use of both primary and secondary data to deepen a researcher's understanding of the studied problem. Carcary (2020) thought that the collection of both primary and secondary data is essential for obtaining a comprehensive understanding of the research topic. These two data types are further explained separately in the paragraphs that follow.

3.5.1 Primary Data

As already alluded, this study collected primary data from 20 participants comprising EV owners, potential buyers, industry experts, and policymakers in South Africa. This firsthand data was collected through interviews, enabling the exploration of individuals' experiences, perceptions, attitudes, and motivations related to EV adoption in South Africa. This primary data, from people who had lived experiences of the problem being investigated, provided valuable insights into the complexities and underlying factors affecting EV adoption in the context of South Africa.

According to Denzin and Lincolin (2018), the advantage of primary data is that it is linked directly to the research problem under review. This implies that it provides insights that is currently relevant and very clear on the problem under study (Dodgson, 2017). The other advantage which this study derived from using primary data was that the current researcher generated the data through the interview questions, offering him better control over data accuracy (Harding J. , 2019).

3.5.2 Secondary Data

This study also collected secondary data to complement the primary data that were collected from participants. Studies have shown that secondary data sources offer a broader perspective

on the research topic by providing a comprehensive overview of the existing knowledge, trends, and patterns related to a problem under investigation (Carcary, 2020; Harding J. , 2019; Dodgson, 2017). The inclusion of secondary data in this study, such as published research articles, industry reports, government publications, and statistical data, was pertinent for complementing and validating the primary data findings. They allow for a comparative analysis of South Africa's experiences with EV adoption against global trends and experiences, enabling a contextual understanding of the unique challenges and opportunities faced by the country.

3.6 Procedure for Data Collection

The study collected data through administering interviews to 20 selected participants. The interviews were administered through a combination of procedures including face-to-face, telephone calls, video conferencing and google meet interviews. The interviews were scheduled with each participant, at a mutually convenient time and location (Dodgson, 2017). The interviews were commenced with the researcher introducing himself to the interviewee, reiterating the purpose of the study and assuring participants of the confidentiality of their responses as elaborated by several scholars (Gunawan, 2015; Gray, 2014). The interview guide was then used to facilitate the conversation, allowing participants to share their thoughts, opinions,and experiences related to electric vehicle adoption. Each interview session took approximately 45 minutes to one hour as recommended by various scholars (Flick, 2022; Carcary, 2020; Harding J. , 2019). The interviews were recorded with the permission from participants, in line with ethical considerations outlined by scholars (Flick, 2022; Carcary, 2020).

3.7 Target Population

The target population for the study encompassed key stakeholders in South Africa who were relevant to EV adoption in the country. The primary focus was on two main groups, EV owners and potential EV buyers. The EV owners were crucial as they possessed firsthand experience with EVs and they provided valuable insights into the factors that influenced their decision to adopt an electric vehicle. Their perspectives provided real life experiences on the challenges, benefits, and motivations associated with EV ownership in the South African context. Potential EV buyers, on the other hand, represented individuals who were considering purchasing an electric vehicle and those who had the financial potential to buy an EV but have not yet done

so. Exploring their attitudes, perceptions, and barriers towards EV adoption was essential for understanding the factors that influenced their decision-making process and identifying potential strategies to encourage wider adoption of electric vehicles. Additionally, industry experts specializing in electric vehicles, policymakers involved in shaping the regulatory environment, and relevant stakeholders who were contributing to the development and implementation of infrastructure and support systems for EVs in South Africa, were part of the target population. Due to the wide spread nature of the target population, it was considered that the population of this study was infinite.

3.8 Sampling Technique

This study employed a purposive sampling technique to select 20 participants who possessed specific characteristics and experiences relevant to the research objectives. Purposive sampling is employed to ensure that the sample consists of individuals who can provide rich and diverse insights to address the research questions (Flick, 2022; Choy, 2014). In this study, a purposive sampling technique was utilized to select participants, such as EV owners who had adopted electric vehicles, potential EV buyers who were considering adoption, industry experts with in-depth knowledge of electric vehicle technology and market trends, policymakers involved in shaping EV-related policies, and other relevant stakeholders. The purposive sampling technique allowed for a targeted and strategic selection process, ensuring that participants had the necessary expertise and experiences to contribute meaningfully to the study's objectives (Harding J. , 2019; Gunawan, 2015). Using this chosen sampling technique, this obtained a sample that represented a range of perspectives and experiences, facilitating a comprehensive understanding of the factors affecting EV adoption for efficiency in South Africa.

3.9 Sample Size

The study used the Central Limit Theorem to determine the sample size.The CLT states that, regardless of the shape of the population distribution, the sampling distribution of the means should be normally distributed. Using the CLT, this study intended to use a sample size of 30 participants. However, the effective sample size for this study was 20 participants and this sample size was determined on the principle of data saturation. The response rate is discussed in detail in chapter 4.

3.10 Data Collection Instrument

This study employed interview guide developed by the current researcher, as the data collection instrument to gather in-depth insights from participants. An interview guide is a structured framework or research document which contains a set of open-ended questions and prompts, ensuring consistency and focus during the interviews while allowing for flexibility and exploration of emerging themes (Jackson & Mazzei, 2022; Gray, 2014). The interview questions were informed by the literature review that was conducted and were designed to gather data required to addressed the gaps that were identified in the reviewed studies. The use of an interview guide enabled this study to probe into participants' experiences, perceptions, attitudes, and motivations related to EV adoption in South Africa. It allowed for a systematic and comprehensive exploration of the factors influencing EV adoption, covering aspects such as the perceived benefits and barriers, technological considerations, infrastructure availability, policy frameworks, and social influences. According to Carcary (2020), an interview guide ensures that consistent and relevant information is collected across different participants, while also allowing for the adaptation of questions based on individual responses and unique insights. Using an interview guide, this study managed to capture rich and detailed data, providing a deeper understanding of the factors affecting EV adoption for efficiency in South Africa and generating valuable insights for policymakers, industry stakeholders, and researchers in the field of sustainable transportation. The interview guide employed in this study is attached under the appendices section of this study.

3.11 Data Analysis Procedures

The study employed thematic procedures to analyze the study data. Thematic data analysis procedures is a qualitative data analysis method that involves identifying, organizing, and interpreting patterns, themes, and meanings within the collected data (Flick, 2022; Carcary, 2020). In this study, the data analysis process began with familiarization, where the researcher became immersed in the data through repeated readings and listened to audio recordings of interviews. Next, initial codes were generated by systematically identifying and labeling meaningful segments of data related to the research objectives, such as participants' experiences, perceptions, and attitudes towards EV adoption. These initial codes were then grouped into potential themes, which were refined and revised through an iterative process of comparison and discussion as elaborated by Denzin and Lincolin (2018). The themes captured recurring patterns and concepts within the data, allowing for a comprehensive understanding of the factors influencing EV adoption in South Africa. The researcher then conducted a

thorough review of the themes, ensuring their coherence and consistency with the data as explained by several scholars (Jackson & Mazzei, 2022; Dodgson, 2017; Gray, 2014). This thematic data analysis procedure facilitated the identification of key factors affecting EV adoption, providing valuable insights into the underlying challenges influencing the slow adoption rate. Furthermore, the systematic and rigorous nature of the thematic data analysis procedures ensured the reliability and credibility of the study's findings (Islam & Aldaihani, 2022; Fusch et al., 2018), contributing to a deeper understanding of the factors influencing the adoption of EVs for efficiency in South Africa.

3.12 Validity and Reliability

This study employed rigorous measures to ensure the validity and reliability of the research instrument. According to Dodgson (2017), validity refers to the extent to which a research instrument accurately measures what it intends to measure, while reliability refers to the consistency and stability of the instrument's results. To establish validity of the research instrument in this study, multiple strategies were employed. Firstly, a comprehensive literature review was conducted to identify relevant factors affecting EV adoption in South Africa. This measure ensured that the research instruments including the interview and focus group guide, captured the key variables and dimensions influencing adoption accurately. Additionally, expert input was sought to review and validate the instrument's content as elaborated by scholars (Fusch et al., 2018; Choy, 2014). Experts in the field of sustainable transportation and EV technology provided feedback on the relevance and clarity of the interview items, enhancing the face validity of the instrument. To align with the views of Creswell and Creswell (2017), a pilot study was conducted with a sample of participants similar to the intended study population. This allowed for the assessment of the instrument's construct validity by examining how well the interview items aligned with the participants' responses and theoretical expectations. Adjustments and refinements were made on the interview guide, based on the pilot study results to enhance its validity.

In terms of reliability, steps were taken to ensure consistency and stability of the research instrument. The interview items were carefully designed to be clear, unambiguous, and free from potential bias. This allowed for the evaluation of the inter-item reliability, ensuring that the items within each construct of the instrument measured the same underlying concept

consistently (Carcary, 2020). The reliability analysis also helped identify and remove any unreliable or redundant items, improving the overall reliability of the instrument. Additionally, the study followed a systematic data collection process, ensuring consistent administration of the interviews across all participants. This minimized potential variations that could arise from different data collection procedures and enhanced the reliability of the research findings as explained by different scholars (Islam & Aldaihani, 2022; Gray, 2014).

3.13 Quality Assurance

Maintaining quality assurance was of paramount importance in this study. The study implemented rigorous quality assurance measures in order to uphold the highest standards of research integrity. Quality assurance in this study was achieved through careful planning and design, including clearly defined research objectives, appropriate data collection methods, and a well-structured sampling strategy. The study also employed a robust data analysis procedure, ensuring a systematic and rigorous interpretation of the collected data. Additionally, the study used multiple data sources, interviews and literature review. These processes enhanced the reliability, validity, and credibility of the research findings, thereby enhancing the overall trustworthiness of the study. The study also ensured that the issue of content validity was attained. This issue was addressed through various measures, including collecting data from rich sources, regular peer debriefing and member checking as elaborated by several scholars (Jackson & Mazzei, 2022; Harding, 2019; Dodgson, 2017; Dodgson, 2017). These measures provided opportunities for validation and feedback from external experts and participants, further addressing the issues of content validity. Furthermore, maintaining detailed documentation throughout the research process enhances transparency and offers reproducibility, and the possibility of future replication.

3.14 Ethical Considerations

Observing ethical considerations was of utmost importance throughout the process of this study. According to Gunawan (2015), ethical considerations ensure the protection of participants' rights, privacy, and well-being throughout the research process. Other scholars have argued that respecting ethical principles fosters trust, promotes integrity, and upholds the researcher's responsibility to conduct ethical research (Flick, 2022; Gray, 2014). In this regard, ethical considerations such as obtaining institutional permission, informed consent,

confidentiality and protection of participants, were observed throughout the study. These ethical principles are discussed in the paragraphs that follow.

3.14.1 Permission

In academic research, the researcher must formally obtain institutional permission to conduct a research study (Saunders et al., 2016). To align with this scholarly view, this study obtained permission to conduct this study from the University of the Witwatersrand, Faculty of Commerce, Law and Management.

3.14.2 Informed Consent

Informed consent is a critical ethical requirement in any research study, ensuring that participants fully understand the study's purpose, procedures, risks, and benefits before voluntarily agreeing to participate. This study observed the principle of informed consent as articulated in APA guidelines and other Codes of research ethics informing social science research practice (APA, 2010; Creswell, 2014). Informed consent refers to voluntary agreement by participants to participate in a research study (Denzin & Lincoln, 2011; Rubin & Babbie, 2013). Consent to participate only becomes informed when the consenting participant is fully aware of the purpose of the study, the role they are expected to play and how the information they provide will be used. In this study, the purpose of this study was explained to participants before they were engaged in interviews and focus groups. The participants were also assured of their options to withdraw from the study at any stage if they deemed it necessary for one reason or another. Participants appended their signatures to on the consent forms provided by the researcher as proof that they were voluntarily participating in this research study.

3.14.3 Confidentiality of Information

The principles of confidentiality and anonymity were crucial in safeguarding the participants' privacy. The study data were securely stored and access was restricted to authorized personnel. This ethical consideration was also extended to the dissemination of research findings, where participants' identities and personal information were protected. By adhering to the principle of information confidentiality, this study upheld the privacy and rights of participants and maintaining public trust. The study addressed six fundamental questions: who, when, what, where, why, and how. These questions were not intended to be attributed to the real identities who provided

the data required to answer these questions. The real identities of the individuals and organizations that provided information to this study, are kept anonymous (Saunders et al., 2016).

3.15 Chapter Summary

This chapter discussed the methodology that guided the conduct of this study. The chapter begins with a discussion on the adopted qualitative research approach and the case study research design, highlighting their utility in this study as well as the rationale of using them. The sampling strategy is described, with the study employing purposive sampling to select participants who possessed specific characteristics and experiences relevant to the research objectives. The rationale for targeting EV owners, potential buyers, industry experts, policymakers, and other stakeholders was explained, emphasizing the value of diverse perspectives in understanding the factors affecting EV adoption in South Africa.

Data collection procedures were outlined, with the primary instruments being the researcher and the interview guide with open-ended questions that enabled participants to provide detailed and contextualized responses, shedding light on their motivations, barriers, and considerations related to EV adoption. The chapter emphasizes the importance of establishing rapport, ensuring informed consent, and maintaining participants' confidentiality and privacy during data collection. The chapter also discussed the thematic data analysis procedures that were used to analyze data. The highlights of the discussion on the adopted thematic procedures revolves around its appropriateness in identifying, organizing, and interpreting patterns and themes within the collected data to uncover the key factors influencing EV adoption in South Africa. Ethical considerations and measures taken to ensure ethical conduct throughout the study were also discussed in this chapter. Informed consent, confidentiality, privacy, and the protection of participants' rights were emphasised as integral components of the research process. Lastly, the chapter highlighted the potential limitations of the study, including potential biases, logistical constraints, and the novelty of the concept of electric cars in South Africa. Mitigation strategies, such as triangulation of interview methods and pre-testing of research questions, were discussed showing how they address some of the acknowledged limitations. The next chapter looks at data presentation, analysis and discussion of key findings.

CHAPTER 4: DATA PRESENTAION, ANALYSIS AND INTERPRETATION

4.1 Introduction

The adoption of EVs represents a significant opportunity for promoting sustainable and efficient transportation in South Africa while addressing climate change challenges. As the country strives to reduce greenhouse gas emissions, enhance energy efficiency, and mitigate the environmental impact of traditional vehicles, understanding the factors influencing EV adoption becomes crucial. This chapter presents data and the research findings on factors affecting adoption of electric vehicles for efficiency in South Africa. The data was collected using in-depth interviews with 20 participants from South Africa.

4.2 Response Rate

The initial sample size for this study consisted of 30 participants selected from various socio-economic classes in South Africa. These participants were initially identified as key informants, with potential to possess rich data. However, some prospective informants failed to participate in the study due to one reason or another including logistical constraints. Thus, 20 participants took part in this study through interviews, representing approximately 67% of the intended sample size. While this reduction in sample size posed potential to limit the generalizability of the findings, it is important to note that efforts were made to ensure a diverse range of perspectives and experiences among the participants. The inclusion of a variety of stakeholders in the EV sector, enabled the study to collect adequate data to address all the set research objectives as stated in chapter 1. Table 4.1 shows the participants' response rate.

Table 4.1: Response Rate

Description	Initial Sample	Effective Sample	Response Rate %
	30	20	67%

Source: Researcher

The response rate shown on Table 4.1 was calculated as follows:

$$\frac{\textit{Absolute frequency}}{\textit{Targeted frequency}} \times 100 = \textit{Response rate}$$

Out of the 30 participants initially targeted for interviews, 20 managed to participate while 10 failed to do so for one reason or another. The 20 participants translate to a 67% response rate. According to Mugenda and Mugenda (2008), a 50% response rate is considered adequate, a 60% response rate is good, above 70% response rate is very good, and anything from 75% response rate onwards is considered as an overwhelming response rate. Based on this rating, the 67 % response rate obtained in this study is deemed to be a good response. It is acceptable for qualitative research given their reliance on small sample as compared to quantitative research studies.

4.3 Demographic Data of the Respondents

This section presents the demographic information. The demographics of the participants are presented and analyzed in this section for a variety of reasons. First, the audience of this research study are provided with a foundation on which they can determine whether the study participants were representative of the targeted population by looking at the demographics of the participants in detail. Second, the detailed demographics provides future researchers with a basis to make comparison studies. Third, demographic data in this study provides the audience with an informed and better understanding of the background characteristic of the participants given that the findings of this study are derived from the personal experiences and knowledge of those who participated in this study. Fourth, the participants' demographics discussed under this section offer details that may aid the work of other researchers in future related studies. This view aligns with scholars who thought that without including a detailed description of the demographic profiles of participants, the danger of disinformation may arise (Carcary, 2020; Dodgson, 2017). That said, the participants' gender, age and level of education are presented and analyzed in this demographic section.

4.3.1 Gender Composition of the Sample

This study intended to use a gender balanced sample, with the initial sample comprising 15 female and 15 male participants respectively. The use of a gender balanced study sample was

considered important for the purpose of achieving gender inclusivity in research. However, as already alluded, some participants failed to participate for different reasons, resulting in an effective sample of 20 participants which was dominated by male participants as show in Figure 4.2.

Table 1.2: Participants' Gender

Gender	Frequency	Percent	Valid Percent	Cumulative Percent
Male	12	60	60	60
Female	8	40	40	40
Total	20	100.0	100.0	

Source: Researcher's Compilation

Although the effective sample was tilted in favor of male participants as shown by the 60:40 in Table 4.2, it was considered that though not equal, this ratio was a fair representation of participants across the gender divide. This fair representative study sample was important for many reasons. Firstly, it ensured the inclusion of diverse voices given that women and men may have different perceptions of the factors influencing the adoption of EVs in South Africa. Hence, the use a gender-inclusive sample provided a more comprehensive understanding of the studied phenomenon. As a result, the findings of this study reflect a fair representation of the target population.

4.3.2 Participants' Age Range

Considering the age of participants was significant given the potential influence on attitudes, behaviors, and preferences that age has on adoption of new technology. Different age groups may have varying levels of familiarity, acceptance, and willingness to adopt electric vehicles, which can be shaped by factors such as technological exposure, environmental consciousness, and financial considerations. Thus, this study selected participants who were below 25 years

up to those above 50 years. This enabled the study to capture the factors influencing EV adoption from participants across different generational cohorts. Table 4.2 shows the participants' age range distribution.

Table 4.2: Participants' Age Range

Ser.	Age Range	Frequency	Percent	Valid Percent	Cumulative Percent
1	25 and below	11	55	55	55
2	25 to 30	1	6.25	6.25	6.25
3	30 to 40	6	37.5	37.5	37.5
4	40 to 50	1	6.25	6.25	6.25
5	50 and above	1	6.25	6.25	6.25
	Total	20	100.0	100.0	

Source: Researcher's Compilation

As shown in Table 4.2, the sample comprised 11 participants who were below 25 years, 1 participant was in the age range 25 to 30. There were 6 participants between the age range 30 to 40 years. One participant was between 40n to 50 years while 1 participant was above 50 years. This age distribution covered all the ages in the target population, providing valuable insights into the complex dynamics surrounding EV adoption in South Africa.

4.2.3 Participants' Level of Education

Scholars thought that the participants' level of education can affect the quality of the study data (Urquhart, 2022; Harding J. , 2019; Yin R. , 2015). This study therefore, prioritized the importance of the participants' level of education. Table 4.3 shows the level of education of the participants.

Table 4.3: Participants' Level of Education

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Diploma	10	62.5	62.5	62.5
	Degree	8	40.0	40.0	40
	Master's Degree	1	6.25	6.25	6.3
	PhD	1	6.25	6.25	6.3
	Total	20	100.0	100.0	

Source: Researcher's Field Work 2023.

As shown in Table 4.3 above, 10 participants were diploma holders, 8 were undergraduate degree holders, 1 was a master's degree holder while 1 was a PhD holder. while and only 1 of the respondents had a PhD. According to Baverstock et al., (2015) employees with high levels of education can add value superior decisions and talents to the organization. The mixture in the level of education possessed by the participants was important because the participants were able to understand what was required from them in terms of the data they provided. Literature shows that the participants' level of education can affect their ability to understand and respond to research questions accurately (Harding, 2019; Creswell & Poth, 2017). The logic is that, some participants may fail to understand the research questions if their level of education is very low.

4.4 Presentation of Interview Data and Analysis of Research Findings

According to the reviewed literature, electric cars have gained significant popularity and continue to experience increased adoption in recent years, mainly due to the growing interest in sustainable transportation solutions. This This section presents the responses from the 30 participants who participated in this study through in-depth interviews. Pseudo names are used in the presentation in the interest of protecting the real identities of the participants in line with the ethical principle of anonymity as elaborated by various scholars (Urquhart, 2022; Flick, 2022; Gunawan, 2015; Gray, 2014). The presentation and analysis follow the order of the research objectives as outlined in chapter one.

4.4.1 Awareness and Knowledge Levels of Electric Cars in South Africa

The data addressing the first objective of this study reveals divergent views among the participants, reflecting variations in their awareness and knowledge levels regarding electric cars and their utility as a mode of transportation to replace combustion engine cars. A subset of participants exhibited a high level of awareness and knowledge, recognising electric cars as a viable and sustainable alternative mode of transportation. They highlighted the substantial environmental benefits, including reduced carbon emissions and potential long-term cost savings associated with electric vehicles. These participants expressed enthusiasm for adopting electric cars and saw them as a key solution to combatting climate change and improving air quality. On the other hand, the other group of participants displayed limited awareness and knowledge about EVs. Some participants questioned the feasibility of electric cars in South Africa, considering the country's infrastructure challenges and the limited number of charging stations. They expressed skepticism and uncertainty, citing concerns about potential range limitations, charging infrastructure availability, and the overall reliability of these vehicles. Some. Interestingly, there were participants who fell somewhere in between, exhibiting a moderate level of awareness and knowledge. They acknowledged the benefits of electric cars but also expressed reservations and hesitations. They were concerned about the initial high purchase costs, limited model choices, and concerns about battery life and maintenance. The following are verbatim extracts are the participants' responses to the question; Are you aware of electric cars and their benefits compared to conventional gasoline-powered cars?

> *Yes, am aware, these cars are the solution to reduce gas emissions that are causing climate challenges* (Participant 1).

> *Yes, I am aware of electric cars, they are the way to go. I am looking forward to buying one for myself* (Participant 2).

> *I have heard about electric cars and their benefits. They are known for being more environmentally friendly and producing zero emissions, which is important for reducing air pollution and combating climate change* (Participant 8).

Another participant was more elaborate, exhibiting high awareness and knowledge about EVs. She explained that;

> *Electric cars are gaining popularity, and I'm aware of their benefits. They have lower operating costs compared to gasoline-powered cars since electricity is generally cheaper than gasoline. Additionally, they require less maintenance because they have fewer moving parts* (Participant 20).

The following extracts the verbatim expression of some participants who were skeptic about the utility of EVs. This group of participants exhibited limited awareness and knowledge about electric cars.

> *I am not very familiar with electric cars but I guess the can help in reducing our dependence on petrol and diesel since they use electricity (Participant 19).*
>
> *I have heard about electric cars but I think they are not good here South Africa because electricity is a big challenge. Maybe you can explain to me more about how these cars function (Participant 13).*
>
> *I do not think that electric cars can replace fuel powered vehicles. We now have fuel efficient cars that are very reliable and we are set to continue with these vehicles for a very long to come. I personally have little knowledge about electric cars but I think they are meant for a few rich people in developed countries* (Participant 6).

There were also participants who fell in between, exhibiting a moderate level of awareness and knowledge about EVs. This group acknowledged some of the potential benefits of electric cars but they were concerned about their cost, efficiency and reliability among other factors. These concerns caused some reservations and hesitations on the participants', undermining their willingness to adopt electric cars.

The following verbatim extracts are the participants' responses to the research question; How familiar are you with the technology and features of electric cars, such as battery range, charging infrastructure, and maintenance requirements?

> *Yes, I am familiar but South Africa does not have charging infrastructure to accommodate the electric cars and there is a limitation of number of kilometers before you need to recharge* (Participant 10).

Expressing her low level of awareness about EVs, Participant 12 admitted that she was familiar but had just basic knowledge concerning the features of electric cars. The same level of awareness was exhibited by Participant 3, who explained that he knew about electric cars but did not understand how they functioned. Another participant stated:

> *I am quite familiar with electric cars and their features. The battery range of electric cars can vary, but many newer models offer ranges that can exceed 200 miles on a single charge* (Participant 4).

Participant 5 expressed;

> *I have a good understanding of electric cars and their technology. The battery range of electric cars has been improving over the years, with many models now offering*

ranges that can exceed 250 miles or more.

On the hand, Participant 17 mentioned;

I am quite familiar with electric cars and their features but I am not sure of the battery range.

As shown by the extracts presented above, the participants held diverse views on the features of electric cars, particularly the issues of battery range, charging infrastructure and maintenance requirements. The mixed feelings provided insights into the factors that were influencing the adoption of EVs in South Africa. It was clear that both those who were knowledgeable about the features and functionality of EVs and those who lack such awareness, would think twice before considering buying an electric car. This hesitation was rooted either in the lack of knowledge or on perceived challenges that would be encountered as a result of challenges such as battery range, inadequate charging facilities and other related infrastructure. As observed by other scholars (Jones, 2022; Brown, 2021), all these factors were impacting the adoption of EVs in South Africa.

The participants' responses showed that the majority had not owned an electric car. The reasons varied from one participant to the other. The following extracts are some of the participants' verbatim responses the question; Have you ever considered purchasing or leasing an electric car? If not, what are the main factors that deter you from considering this alternative?

No this is because we have not been exposed to the electric cars yet (Participant 14).

Another Participant added that:

No, l find it expensive because the electric cars which are available in South Africa are not affordable (Participant 13).

Based on the divergent views among participants, this study inferred that although the majority of the participants exhibited low levels of awareness and knowledge about EVs, some participants held a high level of awareness and were very knowledgeable about these EVs. There were also participants who exhibited moderate levels of awareness and knowledge about the EVs but this group also expressed many reservations about the feasibility of their smooth functionality in the context of South Africa. The low level of awareness and knowledge shown by the majority of the participants highlight the importance of education and awareness campaigns to address misconceptions and dispel doubts surrounding electric cars in the context of South Africa. It also underscores the need for infrastructure development and policy support

to enhance the feasibility and accessibility of electric vehicles as a mainstream transportation option. Availability of these facilities could raise the low awareness levels exhibited by participants and promote the adoption of EV in South Africa, ensuring a smooth transition to sustainable and efficient transportation systems.

4.4.2 Electric Vehicle Infrastructure Availability and Accessibility in South Africa

Four questions were asked to collect data addressing this second research objective. Participants' responses were diverse but they highlighted the key factors that were influencing the low adoption rate of EVs in South Africa. Responding to the question; In your area, are there sufficient charging stations available for electric cars?

Participant 9:

> *Yes, there are charging stations available in Gauteng but they are not many.*

Participant 7 added that:

> *l have not seen any but l think they are there because l see people driving the electric cars in Pretoria.*

Participant 10 explained that,

> *No, there are not enough charging stations available for electric cars in my province. It is a significant barrier to electric vehicle adoption, as it limits the convenience and accessibility of charging options.*

Participant 11 stated:

> *I have noticed an increase in the number of charging stations in my province, but I wouldn't say there are enough yet. While it's a positive sign, there are still areas where charging infrastructure is lacking, particularly in rural or less populated areas.*

Participant 12 expressed:

> *I have not personally come across many charging stations in my province. It seems like there is a lack of infrastructure to support the widespread adoption of electric cars. This makes it challenging for electric car owners to find convenient charging options, especially during long trips.*

Participant 13 mentioned:

> *I believe there are some charging stations available in my province, but they are not widely distributed. It's not as convenient as it should be, and I think more investment*

is needed to expand the charging infrastructure and make it more accessible to electric car owners.

It is clear from the extracts that while there were EV charging station in many areas across South Africa, these facilities were either not visible to many or they were simply not adequate. Data revealed that those who knew about these stations were mostly people who had used them or were working close to these facilities. This invisibility is an indication that these facilities were not many otherwise they could be as visible as fossil fuel service stations. This finding points to the need for more investment and expansion of charging infrastructure to support the adoption of electric cars in South Africa.

The following are responses from participants on the question, how accessible are these charging stations in terms of their location and operating hours?

Participant 2

They are centralized in places with convenient locations, such as shopping malls, hotels, and public parking lot.

Participant 11 added that:

Conversely, critics argue that there are limitations regarding the accessibility of charging stations.

Participant 1 mentioned that*:*

I find that the location of charging stations is generally convenient. They are often placed in urban areas, near shopping centers, restaurants, and other commonly visited places. This makes it easier for electric car owners to charge their vehicles while running errands or enjoying leisure activities.

Participant 15 stated:

In my experience, the accessibility of charging stations varies. While some stations are located in convenient areas like shopping malls and public parking lots, others are less accessible. It can be challenging to find charging stations in certain neighborhoods or along highways, which can limit the convenience of charging for electric car owners.

Participant 16 expressed:

I have noticed that charging stations are becoming more accessible in my area. They are often found in public parking lots, near office buildings, and along major highways. This allows electric car owners to charge their vehicles during work hours or while on long trips, increasing convenience.

Participant 17 mentioned:

> *I believe there is room for improvement in terms of charging station accessibility. While some charging stations are conveniently located, others are not as easily accessible. It would be beneficial to have more charging stations in residential areas and rural locations to ensure widespread accessibility for electric car owners.*

Data from participants shows that charging stations for electric cars in most parts of South Africa, were concentrated in places such as shopping malls, hotels, and public parking lots. The responses indicate that while charging stations are often located in convenient places, there were concerns in their accessibility, particularly in certain neighborhoods and less populated regions. The expansion of charging infrastructure to include a wider range of locations would enhance the accessibility and convenience for electric car owners. Interestingly, other participants expressed contrasting viewpoints, stating that there were limited charging stations and accessibility to them was a challenge.

Addressing the question concerning the constraints in terms of charging infrastructure, such as insufficient number of charging points or slow charging speeds, two view emerged. The other perspective was that there were complaints from EVs owners regarding the inconveniences they encountered in trying to charging their vehicles. Participant 8 stated that;

> *l have seen on social media people complaining that they are still constraints with regards to the time taken while one was charging their car. Electric charging takes far more time than the time taken to refuel combustion engine cars at service stations.*

Participant 10 added that:

> *We acknowledge these challenges and there are ongoing efforts to improve charging infrastructure to reduce the time required to complete the charge.*

Data addressing the issue of challenges faced at the charging points overwhelming indicate that clients were waiting long to have their cars charged. This long wait was frustrating vehicle owners, hindering the widespread adoption of electric vehicles. Some the participants who were also running charging stations, admitted that there were concerns regarding the problem of slow charging turn around and they acknowledge the need for continuous upgrading of this system to make it efficient. Such improvements can promote widespread adoption of the EVs.

The study asked this question; Have you encountered any challenges or difficulties in finding and utilising charging stations for your electric car in your province? Some participants indicated that

they faced difficulties in finding and utilising charging stations for their electric cars. The following extracts from participants revealed rich insights into this aspect.

Participant 12

> *I have not encountered any problem as long as I go to the station in my area but in the highway, there is problems locating the charging stations.*

Participant 13 added that:

> *The increasing availability of smartphone applications and online platforms dedicated to locating charging stations, finding a nearby station has become more convenient.*

The above extracts suggest that the charging stations were available. However, they were not as readily visible, suggesting that better signage and improved mapping services could alleviate the difficulties faced by users. Additionally, data also revealed that there was no standardised payment method across different charging stations. This problem was creating confusion and inconveniencing users. This problem points to the need for policing the payment systems so that electric charging has a standardised payment system as the case with fossils fuels.

4.4.3 Financial aspects of EV Ownership and Operation

The participants were asked to share their views regarding the financial implications of owning an and operation it. Three questions were asked to collect data addressing this research objective. The participants' responses to each of the questions are presented and analysed in the following paragraphs.

The first question under objective 3 was that; Have you done any research on the estimated cost of owning and operating an electric car compared to a conventional gasoline-powered car? Some participants identified fuel savings as one of the biggest advantages of owning an electric car. They clarified that the cost of charging an electric car was much less than the cost of fueling a gasoline-powered car, over the same distance travelled. On the other hand, other participants were not even aware of the financial implications related to the ownership and operation of an electric car. The following verbatim extracts from the participants reveal their mixed perceptions.

Participant 9

I am not aware of the financial implications involved in owning and operating an electric car.

Participant 3

I think the financial costs ranges from a million upwards. It must be very expensive to own and operate an electric car.

Participant 12

I do not have comprehensive knowledge on the specific cost estimates associated with owning and operating an electric car compared to a conventional gasoline-powered car.

Participant 13

I have come across price ranges for electric cars that can start from around one million going up. I think electric cars are too expensive for the ordinary person.

Data addressing objective 3 reveals interesting insights int the factors influencing adoption of EVs in South Africa. The participants responses varied, reflecting their perceptions and knowledge regarding the financial implications of owning and operating an electric car. Participant 9 expressed a lack of awareness about the financial aspects associated with electric car ownership, indicating a potential gap in the general understanding about this aspect, which is vital factor on adoption decision. Participant 3, on the other hand, held the belief that electric cars were very expensive, assuming that costs start from a million and go upwards. This response reflects a common misconception that electric cars are prohibitively expensive for the majority of people. This perception may deter individuals from considering them as a viable option. Participant 12 acknowledged her lack of comprehensive knowledge regarding the specific cost estimates of electric cars compared to conventional gasoline-powered cars, indicating a need for more information and education on the subject. Lastly, Participant 13 demonstrated awareness of price ranges for electric cars and expressed the opinion that electric cars were still too expensive for the ordinary person. This viewpoint highlights concerns about affordability and accessibility, suggesting that perceived high costs may limit the adoption of electric vehicles among the general population. These responses collectively underscore the importance of providing accurate information and addressing misconceptions about the financial aspects of electric car ownership.

The second research question under the third research objective was; What is your understanding

of the financial benefits of owning an electric car, such as potential savings on fuel costs and tax incentives? The majority of participants were not conversant about these benefits since they had not owned such cars or considered buying one. The following extracts show the participants' responses on the perceived benefits of owning an electric vehicle.

Participant 10

I am not fully aware.

Participant 4

I am aware of the benefits. I have not used an electric car in my life.

Participant 9

I am not fully aware of the specific financial benefits of owning an electric car.

Participant 8

I do not have detailed knowledge about the financial benefits of owning an electric car. It would be best to consult official sources or experts for accurate information on potential savings on fuel costs and tax incentives.

Participant 5

I have not researched on the financial benefits of owning an electric car extensively. However, I have heard that electric cars can offer potential savings on fuel costs and that there may be tax incentives available in certain regions to encourage their adoption.

Participant 13

I am not aware of the financial benefits associated with owning an electric car. It would be helpful to consult reliable sources or reach out to electric vehicle associations to gather accurate information on potential savings on fuel costs and available tax incentives.

On the other hand, only 2 participants highlighted that availability of tax incentives, fuel savings and low maintenance cost were some of the benefits accruing from owning an electric car. They also explained that tax credits and rebates to individuals who purchase electric cars were the other benefits that offset the cost of purchasing one.

The extracts from participants reveal lack of the participants' awareness and knowledge regarding the financial benefits of owning and operating an electric car. Participant 10

expressed a lack of full awareness, indicating a potential gap in their understanding of the specific financial advantages associated with electric car ownership. Participant 4 acknowledged being aware of the benefits but mentioned not having personal experience with electric cars, suggesting a theoretical understanding rather than practical knowledge. Participant 9 also conveyed a lack of awareness regarding the specific financial benefits of owning an electric car, indicating a need for more information and education on the benefits of owning these cars. Similarly, Participant 8 acknowledged his limited knowledge about the financial benefits and recommended consulting experts for accurate information on potential savings on fuel costs and tax incentives. Participant 5 mentioned not extensively researching the financial benefits but highlighted those electric cars may offer potential savings on fuel costs, and tax incentives. This response demonstrates some awareness of the potential advantages, albeit with a need for further education. Participant 13 expressed a lack of awareness regarding the financial benefits associated with electric car ownership.

These responses collectively indicate a general low level of awareness and knowledge among the participants regarding the specific financial benefits of owning an electric car. While some participants demonstrated limited or theoretical understanding, others expressed a need for reliable information and recommended consulting authoritative sources. The findings highlight the importance of disseminating accurate and accessible information about the financial advantages of electric car ownership, including potential savings on fuel costs and available tax incentives. Such accurate information could help promote adoption of these cars in South Africa, based on clear and accurate information showing that financially, electric cars can be viable option in South Africa.

The third question under objective 3 was; Have you considered the upfront cost of purchasing an electric car and any potential long-term savings on maintenance and fuel expenses? The following are the responses to this question, as reflected by the following verbatim extracts from some of the participants.

Participant 3

They are not commonly available in South Africa, so I have not considered their cost.

Participant 2

I have no intention to buy one so I never considered the associated costs.

Participant 9

> *I have not considered the upfront cost of purchasing an electric car and the potential long-term savings on maintenance and fuel expenses.*

Participant 6

> *I do not have detailed knowledge regarding the upfront cost of purchasing an electric car or the potential long-term savings on maintenance and fuel expenses. It would be beneficial to consult reliable sources or experts for accurate information on these aspects.*

Participant 12

> *I am not familiar with the specific details about the upfront cost of purchasing an electric car and the potential long-term savings on maintenance and fuel expenses. It's important to research and gather accurate information from official sources or electric vehicle associations.*

Participant 7

> *I haven't explored the upfront cost of purchasing an electric car or the potential long-term savings on maintenance and fuel expenses. It would be helpful to consult reputable sources or experts in the field to gain a better understanding of these aspects.*

When asked about upfront costs, participants expressed a lack of knowledge and familiarity with the specific details of purchasing an electric car and the potential long-term savings on maintenance and fuel expenses. Participants mentioned that information is not as readily available in South Africa, indicating potential regional variations in access to information on electric car costs and savings. Participants also indicated a lack of knowledge on the topic. It can be inferred that the participants have not thoroughly considered or researched the upfront costs and long-term savings associated with electric car ownership. This lack of awareness may be attributed to limited information availability, regional variations, or simply not having explored the topic extensively.

However, it is important to note that while electric cars generally offer potential savings on fuel and maintenance costs, there are factors that can impact these savings. Some critics argue that tax incentives may not always fully offset the higher upfront cost of electric cars, and not all regions offer such incentives. Additionally, the cost of replacing an electric car's battery can be expensive, potentially offsetting any savings on maintenance. The lack of standardization

in the electric car industry may also complicate maintenance and replacement processes, as batteries may not be interchangeable between different models. To gain a comprehensive understanding of the financial aspects of owning an electric car, it is recommended to consult reliable sources, experts, and official resources tailored to the specific region or country of interest. This will provide accurate information on upfront costs, potential savings on maintenance and fuel expenses, and any available incentives or subsidies.

4.4.4 Incentives and Policies on Electric Vehicle in South Africa

The reviewed literature shows that across the globe, governments are implementing various incentives and policies to promote the adoption EVs and reduce their carbon footprint. These initiatives not only help to mitigate climate change but also provide numerous benefits to consumers, such as lower operating costs and improved air quality. This study fielded three research questions to collect data that addressed the fourth objective of this study. The data collected through each question are presented and analysed in the following paragraphs. The following extracts from selected participants highlight the issues relating to incentives and policies that are focus on promoting the adoption of electric vehicles in South Africa.

Participant 1

> *I am not aware any existing incentives and policies promoting the acquisition of electric cars in South Africa.*

Participant 3

> *I am not very sure but I think the government is pushing something due to global warming.*

Participant 9

> *I am not aware of any specific incentives and policies in South Africa that promote the adoption of electric vehicles.*

Participant 4

> *I do not have detailed knowledge about incentives or policies promoting the adoption of electric vehicles in South Africa. However, I am aware that other countries have taken steps to address global warming and encourage the transition to cleaner transportation options.*

Participant 11

> *I have not sure of the specific incentives and policies promoting electric vehicle*

adoption in but I believe that government recognizes the importance of reducing carbon emissions and may have introduced initiatives to support the adoption of electric vehicles.

Participant 15

I am not aware of the incentives and policies that promote the adoption of electric vehicles but I have noticed a growing interest in electric cars among consumers, which may be influenced by global environmental concerns.

The above responses from the participants regarding their awareness of incentives and policies promoting the adoption of electric cars in South Africa reveal a mixed level of knowledge and understanding. Participant 1 expressed a lack of awareness regarding any existing incentives and policies, indicating potential lack of information in this area. This information gap could hinder the adoption of electric cars. Participant 3 demonstrated a limited understanding, suggesting that the government may be taking action due to global warming, but uncertainty remains. Participant 9 also expressed a lack of awareness regarding specific incentives and policies in South Africa that promote electric vehicle adoption.

Participant 4 acknowledged a lack of detailed knowledge but recognized that other countries have implemented measures to address global warming and encourage cleaner transportation options. Participant 11 shared a similar sentiment, believing that the government recognizes the importance of reducing carbon emissions and may have introduced initiatives to support electric vehicle adoption. While not aware of the specific incentives and policies, Participant 15 observed a growing interest in electric cars among consumers. He attributed this growth to global influence arising from environmental concerns rather than local incentives and supporting policies.

Cumulatively, these responses highlight the importance of disseminating information about existing incentives and policies promoting electric vehicle adoption in South Africa. Clear and accessible communication about government initiatives, financial incentives, and supportive policies can help address the lack of awareness and uncertainty expressed by participants. These findings underscore the need for continued efforts by the government to establish and promote favorable policies and incentives that support the transition to electric vehicles, thereby driving sustainable and environmentally friendly transportation practices in the country.

4.5 Chapter Summary

This chapter presented, analyzed and interpreted data that were collected from 20 participants using interviews. The chapter begins by presenting the response rate before proceeding to present and analyze the participants' demographic data. This was followed by the presentation, analysis and interpretation of the data gathered from the participants. This process followed the order of the research objectives as outlined in Chapter 1 of this study. The chapter highlights the key findings that emerged from the data analysis. The mixed level of awareness and knowledge about EVs shows that some participants had limited knowledge and misconceptions about this mode of vehicles. The chapter also discussed the availability and accessibility of EV-related infrastructure in South Africa, based on the participants' perspectives, highlighting their concerns regarding the limited availability of charging stations, particularly in certain parts of the country. Data relating to the financial implications of electric car ownership and operation, were presented and analyzed in this chapter, revealing varying levels of understanding, with some participants perceiving electric cars as expensive and others expressing a need for more information. The participants' views regarding the influence of incentive and policy frameworks on EV adoption in South Africa, were presented, analyzed and interpreted, with results indicating limited awareness of existing incentives and policies. The next chapter discusses the key results of this study.

CHAPTER 5: DISCUSSION OF FINDINGS

5.1 Introduction

This chapter discusses the study findings, shedding light on the various factors influencing the adoption of electric vehicles in the South African context. The discussion revolves around four key themes that emerged from the study data, namely the awareness and knowledge levels of electric cars, the availability and accessibility of EV-related infrastructure, the financial aspects related to EV ownership and operation, and the influence of incentive and policy frameworks on EV adoption, all the context of South Africa.

5.2 Theme 1: Awareness and Knowledge Levels of Electric Cars among South Africans

The results addressing the first research objective of this study shows that the level of awareness and knowledge about electric cars ranged from low through to high. Cumulatively, the participants' awareness and knowledge of electric cars and their benefits suggests that electric vehicles have gained visibility and recognition as a more environmentally friendly transportation option. However, what was apparent from the study data was that the level of

awareness and knowledge about EVs among South Africans, varied depending on ownership of an EV or lack thereof. Whereas awareness and knowledge levels were high among those who owned an EV, the same was low for those who had not had the opportunity to possess one.

Two sets of results emerged from the noted variation on EV awareness and knowledge levels among participants. First, participants who had interacted with EVs were highly positive about their utility in terms of both efficiency as well as their decarbonization of the transport sector utility. This study found that adoption rate among those who were aware of the utility of EVs. This finding confirms earlier results from several related studies that were conducted in differed African contexts. For example, a study conducted in Nigeria by Akujor et al. (2022), attributed the increasing number of EVs in Nigeria, to the increased awareness of the need to decarbonise the transport industry by the generality of the motoring stakeholders. Similarly, the majority of the participants in this study, 20 out of 30, constituting 66.6 % of the study sample, were aware that EVs produced zero tailpipe emissions, contributing to a significant reduction of greenhouse gas emissions. Thus, increasing awareness of EVs among citizens tends to increase their adoption across all countries of the world including South Africa, as the need for transitioning from fossil-powered vehicles to smart energy was growing.

5.3 Theme 2: EV Related Infrastructural Availability and Accessibility in South Africa

Results from data addressing the study' second theme that emerged from the study data was related to EV infrastructure and its accessibility in South Africa. Data under this theme indicated that although not adequate to cater for the expected increase in EV adoption, the existing charging stations were sufficient to service the fleet that existed as at end of 2022. Participants indicated that charging stations were found in various locations, including shopping centers, parking lots, and highways across South Africa. This suggested that there were a number of these facilities available to support the running of EVs in the country. This expansion was seen as a positive step towards encouraging the adoption of electric vehicles (EVs) and addressing a range concerns by both owners and prospective owners of EVs in South Africa. However, some participants raised concern about the invisibility of some of these infrastructure, especially outside urban areas. The indication from data under this theme was that major cities in South Africa possessed a number of charging stations while rural areas were often underserved. This discrepancy was creating challenges for EV owners who needed to

travel long distances across cities and those who were residing outside urban centers.

It was also clear from the data that while some locations within urban areas, especially Pretoria and Johannesburg among other major cities, had adequate EV charging infrastructure, they were not evenly distributed, limiting their accessibility. Moreover, operating hours for the charging stations were varying significantly between different charging stations, with some closing during the night. This problem was limiting availability of charging services during the night and during weekends, when these services were required. Nevertheless, other charging stations were offering their services 24/7, ensuring availability whenever required. This finding supported an earlier finding by Goenaga et al. (2019), who examined the charging infrastructure for electric vehicles in different provinces in Spain. They found that while major cities had sufficient numbers of charging stations, rural areas were underserved. This lack of infrastructure in rural areas created barriers for EV owners who needed to travel longer distances outside the cities. The same study also established that EV owners who were residing outside urban centers, had to travel to the nearest town to access charging services.

Similarly, Cebrían et al. (2018) investigated the availability of charging stations for electric cars in different provinces in Mexico. They found that while major cities had several charging stations for EVs, rural areas had limited infrastructure. The researchers concluded that the lack of charging infrastructure in rural areas was hindering the widespread adoption of EVs in remote areas. The finding on inadequate EV infrastructure in South Africa also aligns with findings from a study that was conducted by Liu et al. (2020). Their study assessed the impact of charging infrastructure availability in different provinces in China. They found that the number of charging stations in China was rapidly increasing, particularly in major cities. This expansion of charging infrastructure was attributed to the increasing adoption of EVs that was being experienced in China.

5.4 Theme 3: Financial Aspects Related to EV Ownership and Operation

Data under the third theme suggested that the tax incentives that were meant to promote the adoption of electric cars in South Africa, were not enough to offset the high upfront cost of an electric car. Additionally, not all states offered tax incentives for electric car purchases. Furthermore, results showed that replacing an electric car's battery was expensive, offsetting any potential savings on maintenance costs. Additionally, the lack of standardization in the

electric car industry meant that batteries were not interchangeable between different models, which further complicated the maintenance of EVs.

Findings from this theme confirms earlier findings from a study by Tal and colleagues (2017). Using a simulation model, they found that the total cost of ownership for an EV was significantly lower than that of a conventional car over a five-year period. The researchers suggest that this was due to the lower fuel and maintenance costs associated with EVs, which outweighed the higher upfront purchase price. Supporting this argument, a study by Graham-Rowe and colleagues (2011) also found that electric cars offered significant long-term savings for drivers, particularly if they were used for daily commuting within a limited range. They estimated that over a three-year period, EVs can save drivers up to £2,000 in fuel costs compared to petrol cars. However, critics of electric car ownership pointed out that the long-term savings were not guaranteed, and that other factors were to be taken into account. For example, a study by Ingram and colleagues (2018) identified the cost of battery replacement as a potential barrier to cost savings for electric car owners. They argued that if the battery needed replacement after six or seven years, the cost could offset the savings in fuel cost and maintenance.

The implications of this finding were that, businesses could offer extended warranties and service plans specifically tailored to address concerns about battery replacement costs and maintenance. These plans could provide peace of mind to consumers and help mitigate potential financial burdens associated with battery-related expenses. Transparent and comprehensive warranty and service offerings could also build trust and confidence in the EV market in South Africa. The other implication drawn from this finding is that businesses could invest in research and development to improve EV battery technology, such as increasing energy density and lifespan, while reducing costs. Advancements in battery technology could help address concerns about battery replacement expenses and increase adoption of EVs in South Africa.

5.5 Theme 4: Influence of Incentive and Policy Frameworks on EV Adoption in South Africa

Data under this theme shows that participants were not sure about any state incentives or policies promoting the adoption of electric vehicles in their area or province. The participants

also mentioned that they were not sure about specific incentives or policies but acknowledged that the government was pushing for electric vehicle adoption due to concerns about global warming. The participants expressed that the convenience of charging infrastructure and its disruptive impact on the market influenced their decision to purchase an electric vehicle. These concerns point to the need for government involvement through supporting adoption of electric vehicles in South Africa.

Findings relating to the fourth proposition confirm findings from a study by Axsen and Kurani (2017), who emphasised the importance of public education and awareness in promoting electric vehicle adoption. Their study found that consumers often have limited knowledge about EVs, leading to misconceptions and reservations. The researchers argue that public education campaigns can address these knowledge gaps and provide accurate information about the benefits of EVs, such as their reduced greenhouse gas emissions and potential cost savings. Similarly, a study by Franke and colleagues (2018) highlighted the role of public education campaigns in dispelling common misconceptions about EVs. They found that consumers often overestimate the costs and limitations of EVs, including concerns about range anxiety and battery durability. By providing accurate information about range capabilities, charger availability, and incentives, public education campaigns can help alleviate these concerns and encourage greater adoption of EVs. Supporting the argument for government involvement in public education campaigns, a study by Khreiche and colleagues (2019) explored the impact of such initiatives on consumer attitudes towards EVs. They found that exposure to a public education campaign significantly increased consumers' awareness and positive perception of EVs. The study also highlighted the need for repeated exposure to these campaigns to reinforce the benefits and address any lingering misconceptions. On the other hand, some scholars argue that public education campaigns alone may not be sufficient to drive EV adoption. In a study by Kaul and colleagues (2018), they emphasized the significance of supportive policy measures alongside public education efforts. The researchers found that policies such as financial incentives, public charging infrastructure development, and preferential parking can have a more substantial impact on EV adoption than informational campaigns alone.

The participants' suggestion for the government to come out and support electric vehicles indicates a desire for stronger government involvement in promoting and incentivizing the

adoption of electric vehicles. Businesses can play a role in advocating for supportive policies and incentives at the local, regional, and national levels. This includes engaging in dialogue with government representatives, industry associations, and other stakeholders to highlight the benefits of electric vehicles and the importance of government support in driving their adoption. Businesses can explore partnerships and collaboration with government entities to address the participants' call for government support. This can involve working with government agencies responsible for transportation, energy, and environmental policies to develop and implement initiatives that promote electric vehicle adoption. Collaborative efforts can include joint awareness campaigns, funding programs, and infrastructure development projects.

5.7 Conclusion

In conclusion, findings from this study show that EV awareness in South Africa was slowly growing, and efforts to expand charging infrastructure and the provision of financial incentives were positive steps that were fostering EV adoption in this country. However, challenges such as cost considerations and infrastructure disparities between urban and rural areas needed to be addressed. Furthermore, clearer communication and promotion of state incentives and policies were gray areas that needed improvement if a more supportive environment for EV adoption in South Africa was to be created. Continued research and collaborative efforts between stakeholders were considered as essential in overcoming these challenges and accelerate the transition to a cleaner and more sustainable transportation system.

CHAPTER 6. CONCLUSIONS AND RECOMMENDATIONS

6.1 Introduction

This research study sought to address four research objectives that sought to establish the factors that influenced the adoption of electric vehicles in the context of South Africa. This chapter provides the study conclusions and recommendations, based on the key findings discussed in the previous chapter.

6.2 Conclusions regarding Research Objective 1

Data addressing this objective demonstrate variations in the level of awareness and knowledge among participants regarding electric vehicles. Some participants exhibited a high level of awareness and understanding while others had limited knowledge and misconceptions about electric vehicles. These findings point to the need for comprehensive education and awareness campaigns to bridge the knowledge gap and dispel misconceptions surrounding electric vehicles. Based on these observations, this study concludes that the provision of accurate and

accessible information should be prioritized to conscientize South Africa citizens on the benefits associated with electric vehicles. The study further concludes that effective communication strategies can be employed to reach a broader audience and increase awareness levels. Targeted educational initiatives should be implemented to address specific areas of low awareness and knowledge to foster a favorable environment for the widespread adoption of electric vehicles, leading to a more sustainable and greener transportation system.

6.3 Conclusions regarding Research Objective 2

The key findings relating to the second research objective indicate that progress has been made in establishing charging infrastructure for electric cars in the provinces of South Africa. However, study data highlights the ongoing issue of accessibility to these charging stations. Participants expressed concerns about the limited availability of charging infrastructure, in some parts of the country. This problem could hinder the widespread adoption of electric cars in South Africa. Based on these findings, this study concludes that there was need for continued expansion and improvement to enhance the accessibility of charging infrastructure across the country. The study further concludes that it was crucial to address this issue by strategically planning the placement of charging stations in areas with high demand and ensuring a sufficient network of charging points throughout South Africa.

6.4 Conclusions regarding Research Objective 3

Findings from this study suggest that the lack of exposure to electric cars, rather than financial reasons, is the primary factor deterring their adoption as a better alternative to gasoline-powered vehicles. Data shows that the majority of participants had limited exposure and experience with electric cars, indicating a lack of familiarity with their benefits and performance. This lack of exposure may contribute to a hesitancy or resistance to adopting electric cars, as individuals tend to stick with what they are familiar with. Based on these observations, the study concludes that in order to promote the adoption of electric cars, it is essential to focus on increasing exposure and providing opportunities for individuals to experience electric vehicles firsthand. The study further concluded that this can be achieved through initiatives such as test drives, public demonstrations, and educational events to showcase the advantages and dispel any misconceptions. These measures can encourage greater acceptance and adoption of these vehicles as a viable and sustainable alternative to

traditional gasoline-powered cars.

6.5 Conclusions regarding Research Question 4

The findings relating to the fourth objective highlight a lack of awareness and uncertainty among participants regarding any state incentives and policies promoting the adoption of electric vehicles in South Africa. Participants expressed limited knowledge about specific initiatives or support provided by the government to encourage the adoption of electric vehicles. This lack of awareness has potential to hinder the widespread adoption of electric vehicles as individuals may not be fully informed about the available incentives and policies that make electric vehicle ownership more attractive and financially feasible. Based on this finding, this concludes that it is crucial for government to communicate to the public, the incentives offered to those who want to purchase electric cars. This communication should be targeted to increase awareness to ensure that individuals are well-informed about the incentives and policies in place. Such information can be disseminated through various channels, including official government websites, social media platforms, and targeted outreach programs.

6.6 Implications of the Findings

This research study holds significant implications for both theory and practice in the field of sustainable transportation, particularly EV adoption in South Africa and other similar contexts. In terms of theory, this study contributes to the existing body of knowledge by uncovering context-specific factors that influence the adoption of EVs in the South Africa. The identification and analysis of these factors, enhances our theoretical understanding of the complex dynamics underlying EV adoption in South Africa and beyond. In this regard, findings of this study provide valuable insights into the interplay between individual, societal, and environmental factors that shape consumers' decisions to adopt EVs. This knowledge extends and enriches existing literature and models related to innovation diffusion, technology acceptance, and sustainable behavior. It also lays the groundwork for future research studies to explore and refine theoretical frameworks that explain EV adoption patterns in South Africa and other regions.

In terms of practice, findings of this study hold various implications for stakeholders involved in promoting and facilitating the adoption of electric vehicles in South Africa. The findings are

useful to policymakers who can utilize them to help in formulating effective policies and incentives that encourage EV adoption. The study also offers valuable insights for businesses operating in the electric vehicle industry. Manufacturers and dealers can tailor their marketing strategies and product offerings to address the specific concerns and preferences of South African consumers, ultimately boosting consumer interest and influence adoption behaviors. Additionally, this study provides guidance for urban planners and utility companies by highlighting the importance of integrating EV infrastructure into urban landscapes to ensure reliable and accessible EV related services.

6.7 Recommendations

Based on the key findings and conclusions of this study, it is recommended that;

- The Government through its relevant departments, should launch education and awareness campaigns to inform citizens about the multiple benefits associated with electric vehicles. These campaigns can include workshops, seminars, and public information campaigns to increase overall awareness.
- The Government in collaboration with its partners, should increase investment towards the development of charging stations and other related infrastructure to support the smooth operation of electric vehicle. More investment should be directed towards increasing accessibility of charging stations in residential areas, business districts, and public parking facilities.
- Government should offer a range of financial incentives including tax credits, rebates, and subsidies to make electric vehicles more affordable for residents. These incentives can help offset the higher upfront costs of electric cars and encourage their adoption.
- Governments should strengthen existing policies, ensure their full implementation while introducing more targeted policies that promote electric vehicles adoption in South Africa.
- The government should foster partnerships and collaborations to accelerate the adoption of electric cars in South Africa. These partnerships can focus on infrastructure development, education initiatives, and research and development efforts.
- The findings also highlight the need for ongoing innovation in charging infrastructure.

Therefore, companies in EV selling and those providing associated infrastructure should offer a variety of charging options to cater to different needs and charging speeds. This includes both fast-charging stations for quick top-ups and slower charging options for longer-term parking situations. Providing a range of charging solutions can accommodate various EV models and charging preferences, enhancing convenience and flexibility for EV owners.

6.8 Limitations of the Study

This study was conducted against potential limitations, and several measures were taken to mitigate them. The major limitations included the logistical challenge of traveling to and from South Africa from Zimbabwe to collect data. This limitation could have influenced the size of the study sample and the geographical coverage of the research setting. To mitigate this challenge, the researcher used a combination of face-to-face interviews, telephone interviews, video conferencing and google meet interviews to administer the interviews. This triangulation of interview methods enabled the current researcher to reach a diverse and representative sample despite the logistical constraints. Another potential limitation was that the concept of electric cars is still relatively new in South Africa. This had the potential to limit the depth of knowledge and experiences among participants. To address this limitation, the researcher provided participants with relevant information and resources about electric vehicles and autonomous technology, allowing them to familiarise themselves with the subject matter before they were interviewed. Furthermore, thorough pilot-testing of interview questions were conducted to ensure that the questions were clearly understood by participants.

While the above-mentioned potential limitations were acknowledged, the measures that were implemented to mitigate them ensured that this study still provides valuable insights into the factors influencing EV adoption for efficiency in South Africa.

6.9 Suggested Areas for Further Research

This study focused on the factors that were affecting the adoption of electric vehicles for efficiency in South Africa. The following areas are recommended for future research;

- Investigating the reasons behind consumer choices for electric cars. Such a study can focus on the factors that contribute to the customers' decision-making process, such as perceived benefits, concerns, and attitudes towards electric vehicles.

- Analyzing the feasibility of electric cars as a sustainable and viable transportation option and the potential challenges regarding technology, infrastructure, and energy supply.
- Comparison study focusing on the adoption rates and effectiveness of incentives and policies for electric cars across different provinces to identify best practices and areas for improvement.
- Assessing the life-cycle environmental impacts of electric cars, including their production, usage, and disposal, and compare them with conventional vehicles to determine their overall environmental benefits.

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APPENDICES

INTERVIEW GUIDE

The research focuses on Factors affecting Adoption of Electric Vehicles for Efficiency in South

Africa. Your response to the following questions is greatly appreciated and will be treated with much privacy and confidentiality.

APPRECIATION: Your honest and full completion of the questions would be appreciated.

INTERVIEW QUESTIONS

Objective 1: Investigate awareness, knowledge levels of electric cars among residents.

1. Are you aware of electric cars and their benefits compared to conventional gasoline-powered cars?

2. How familiar are you with the technology and features of electric cars, such as battery range, charging infrastructure, and maintenance requirements?

3. Have you ever considered purchasing or leasing an electric car? If not, what are the main factors that deter you from considering this alternative?

Objective 2: To examine the infrastructure availability and accessibility for Electric cars in Provinces.

4. In your province, are there sufficient charging stations available for electric cars?

5. How accessible are these charging stations in terms of their location and operating hours?

6. Are there any limitations or constraints in terms of charging infrastructure, such as insufficient number of charging points or slow charging speeds?

7. Have you encountered any challenges or difficulties in finding and utilizing charging stations for your electric car in your province?

Objective 3: To analyse financial aspects of EVs ownership, operation.

8. Have you done any research on the estimated cost of owning and operating an electric car compared to a conventional gasoline-powered car?

9. What is your understanding of the financial benefits of owning an electric car, such as potential savings on fuel costs and tax incentives?

10. Have you considered the upfront cost of purchasing an electric car and any potential long-term savings on maintenance and fuel expenses?

Objective 4: Explore influence of State incentives and policy on electric vehicle adoption.

11. Are you aware of any state incentives or policies that promote the adoption of electric vehicles in your area or province?

12. Have these incentives or policies influenced your decision to purchase an electric vehicle? If so, how?

13. In your opinion, how effective do you think these state incentives or policies are in encouraging more people to switch to electric vehicles? What improvements or changes would you suggest?