

https://dspace.org/

The market readiness for electrical vehicles in South Africa

Msomi, Siyabonga

2023
University of the Witwatersrand, Johannesburg
https://hdl.handle.net/10539/40034
Msomi, Siyabonga. (2023). The market readiness for electrical vehicles in South Africa [Master's dissertation, University of the Witwatersrand, Johannesburg]. WireDSpace.

Downloaded from a DSpace repository. https://dspace.org/

THE MARKET READINESS FOR ELECTRIC VEHICLES IN SOUTH AFRICA

SIYABONGA MSOMI

2492664

SUPERVISOR: Prof. Fanny Saruchera

A research project submitted to the Faculty of Commerce, Law and Management, University of the Witwatersrand, in partial fulfilment of the requirements for the Degree of Master of Business Administration.

JOHANNESBURG, 2023

Protocol number: WBS/BA2492664/743

DECLARATION

I, **Siyabonga Msomi**, declare that this research report entitled "The market readiness for electric vehicles in South Africa" is my own unaided work. I have acknowledged, attributed, and referenced all ideas sourced elsewhere. I hereby submit it in partial fulfilment of the requirements of the Degree of Master of Business Administration at the University of the Witwatersrand, Johannesburg. I declare that I have not submitted this report before for any other degree or examination to any other institution.

S. Msomi

Siyabonga Msomi

On the 28th day of February 2023.

Name of candidate	Siyabonga Msomi
Student number	2492664
Telephone numbers	083 2855168
Email address	siyabongamsm@gmail.com
First year of registration	2021
Date of proposal submission	19 June 2022
Date of report submission	28 February 2023
Name of supervisor(s)	Prof. Fanny Saruchera

ABSTRACT

There is an increasing demand for electrical vehicles globally, and markets are embracing the shift to electric vehicles. This has been pushed by several global issues, including the environmental issues that the fossil fuel market is harming the environment with CO2 emission, and there is the belief that the world is running out of oil reserves for the fossil fuel market. The study was guided by the study's objectives, Conceptual framework and literature on electrical vehicles and factors which underpins the market readiness for electrical vehicles, including infrastructure development, government involvement with the department of transport and original manufacturer equipment (OEMs) and public and private transport users in their knowledge about electrical vehicles and how they view this market in South Africa. The study's conceptual framework was auto manufacturers, government, internal and external factors for electric vehicle market readiness in South Africa and extended the framework of the Unified Theory of Acceptance and Use of Technology model (UTAUT). Study adopted exploratory research as there was limited knowledge of electric vehicles in South Africa. The data was collected using online self-completion questionnaires, and questionnaires were formulated around the aim and objectives of the study of electrical vehicles for this study. The self-administered questionnaires for public and private vehicle users, OEMs, and Government employees within the transport and auto manufacturers department. It comprised 66.1% of respondents working in the private sector, including OEM and auto manufacturers, 14.5% working in the government department of transport, 15.3% of respondents were business /entrepreneurs, and 4% were unemployed/preferred not to say. The study found a need to educate consumers about electric vehicles and the benefits of transitioning from internal combustion engines to electric vehicles. The government must collaborate with auto manufacturers and OEMs to create a market readiness for electrical vehicles in the public and private sectors. A clear roadmap for electric vehicle infrastructure and investment in major cities. Cash incentives and rebates are needed to attract customers to purchase electric vehicles. The findings indicate that more work still needs to be done around electric vehicles in South Africa for market readiness, including the cost of ownership and infrastructure investments for public and private spaces to accommodate charging infrastructure.

Keywords: electric vehicles, market readiness, infrastructure, emissions, original equipment manufacturers

Table of Content

DECLARATION ii
ABSTRACT iii
List of Tables vi
List of Figures vi
Acknowledgments vii
CHAPTER 1: Introduction to the research 1
1.1 Introduction 1
1.2 Background and Context 1
1.3 Research Problem Statement 3
1.4 Research Aim and Objectives 4
1.5 Delimitations of the research study 5
1.6 Assumptions of the research study 5
1.7 Significance of the research study 5
1.8 Research Report Structure 6
1.9 Chapter Summary 6
CHAPTER 2: LITERATURE REVIEW 7
2.1 Introduction 8
2.2 Research problem analysis 8
2.3 Factors influencing the market readiness of electric vehicles in South Africa 8
2.4 Examine market readiness of electric vehicles with auto manufacturers and government initiatives to accelerate the market for electric vehicles in South Africa 9
2.5 Establishing the readiness of auto manufacturers and government for electric vehicles 11
2.6 Strategies to enhance the market readiness of EVs 11
2.7 Research knowledge gap analysis [Methods, data, findings, and conclusions of studies and evaluations of market readiness for electrical vehicles in South Africa] 13
2.8 Conceptual Framework 14
2.9 Evolution of Technology Acceptance Models 16
2.10 Framework(s) for interpreting research findings for a market readiness for electric vehicles in South Africa 18
2.11. Chapter Summary 19
CHAPTER 3: Research Methodology 19
3.1 Introduction 19
3.2 Research Approach 20
3.3 Methods 21
3.5 Time Horizon 22
3.6 Population and sample 23
3.6.1 Population size 23
3.7 Data collection methods 24
3.8 The research instrument 24
3.9 Data analysis and interpretation 25
3.10 Limitations of the study 26
3.11 Validity (Quantitative) 26
3.12 Reliability (Quantitative) 26

3.13 Ethical Considerations 27
3.14 Chapter Summary 27
Chapter 4: Presentation of research results 28
4.1 Introduction 28
4.2 Univariate Analysis 29
4.3 Frequency Distribution 29
4.4 Description of the research respondents 29
4.5 Knowledge of electric vehicles, including the type of electric vehicles respondents familiar with 32
4.6 Internal and external factors influence the market readiness for electric vehicles in South Africa. 37
4.7 Auto car manufacturers and government strategies enhance the market readiness for electric vehicles in South Africa. 45
4.8 Comparing results with other similar studies of electric vehicles 50
4.9 Chapter Summary 51
Chapter 5: DISCUSSION OF RESULTS 53
5.1 Introduction 53
5.2 Demographic factors 53
5.3 Descriptive Statistical Analysis 53
5.3.1 Objective one of this study 53
5.3.2 Objective two of this study 54
5.3.3 Objective three of this study 54
5.3.4 Objective four of this study 55
5.4 Discussing the results of the study objectives 56
5.4.1 To establish factors influencing the market readiness of electric vehicles in South Africa 56
5.4.2 Examining market readiness of electric vehicles with auto manufacturers and government initiatives to accelerate the market for electric vehicles in South Africa 56
5.4.3 Establishing the readiness of auto manufacturers and government in South Africa for electric vehicles 57
5.4.4 Strategies to enhance the market readiness of electric vehicles with auto car manufacturers and government playing a critical role 57
5.5 Conclusion 58
Chapter 6: Summary, Conclusions AND RECOMMENDATIONS 59
6.1 Introduction 59
6.3 Conclusions 59
6.3.1 Factors influencing the market readiness of electric vehicles in South Africa 59
6.5 Proposal for future research 61
6.6 Conclusion of the study 62
References 63
Appendices 66

LIST OF TABLES

Table 1: Theoretical Approaches to Electrical Vehicles: An Overview.....18
Table 2: Summary statistics knowledge on electric vehicles, including the type of electric vehicles respondents familiar with.....34
Table 3: Statistics hypothesis of knowledge on electric vehicles, including the type of electric vehicles respondents familiar with.....35
Table 4: Summary statistics on factors influencing electric vehicles. Are they clear and understanding of the market readiness of electric vehicles in South Africa, including internal and external factors?.....39
Table 5: Statistical hypothesis of the influence of the market readiness for electric vehicles in South Africa by internal and external factors.....40
Table 6: Summary statistics on auto manufacturers and government initiatives that accelerate the market for electric vehicles in South Africa. Infrastructure development and investment.....43
Table 7: Statistical hypothesis of auto manufacturers and government initiatives accelerates the market for electric vehicles in South Africa. Infrastructure development and investment.....44
Table 8: Summary statistics on Auto manufacturers and OEMs getting support in South Africa from the government in providing incentives and rebates for producing electric vehicles in the SA market.....47
Table 9: Statistical hypothesis Auto car manufacturers and the government strategies enhance the market readiness for electric vehicles in South Africa.....48

LIST OF FIGURES

Figure 1:Cumulative global passenger EV Sales.....10
Figure 2: Manufacturing transport hubs in SA.....10
Figure 3: Conceptual Framework.....14
Figure 4: UTAUT four determinants.....17
Figure 5: Level of Education of respondents.....30
Figure 6: Gender of respondents.....33
Figure 7: City where respondents reside.....31
Figure 8: Mode of Transport respondents use.....34
Figure 9: Industry of respondents.....35
Figure 10: Knowledge of electric vehicles, including the type of electric vehicles respondents familiar with.....36
Figure 11: The factors influencing electric vehicles, are they clear and understood for the market readiness of electric vehicles in South Africa, including internal and external factors.....41
Figure 12: Auto manufacturers and government initiatives accelerate the market for electric vehicles in South Africa. Infrastructure development and investment.....46
Figure 13: Are Auto manufacturers and OEMs getting support in South Africa from the government in providing incentives and rebates for producing electric vehicles in the SA market.....50

ACKNOWLEDGMENTS

I would like to thank God for giving me the strength to pursue this degree and acknowledge Prof. Fanny Saruchera for his support and patience and for guiding me throughout this journey.

I wish to express my sincere gratitude to my family and friends, who encouraged me to remain focused and resilient throughout this journey, and I appreciate all the people who completed the study questionnaires and made it possible for me to complete this research.

To God, Thank you for your love and grace towards me!

CHAPTER 1: INTRODUCTION TO THE RESEARCH

1.1 Introduction

There is a global trend towards the readiness of electric vehicles in developed and developing countries. This has been necessitated by the damage fossil fuel is causing in our environment globally and locally in South Africa with C02 Emissions. The broader issues in the market of electric vehicles by the public at large with electric vehicle driving range, the charging time, lack of required charging infrastructure, limited vehicle choices and costs associated with electric vehicles. Meeting the sustainable development goals SDGs for climate action with electric vehicles market readiness in SA. The history of EV's dates back to the 1800s, a series of breakthroughs from one inventor or country with the invention of the electric motor battery. English manufactured the first viable electric cars, and French investors in the latter part of the 19th century (Matulka, 2014). According to Matulka (2014), electric cars have no problems with fuel or steam. Compared to other cars at the time, electric cars are simple to use and do not produce offensive pollutants.

1.2 Background and Context

This study and research examined and investigated the market readiness for electric vehicles in SA. Electric vehicles being perceived as a solution to reduce environmental issues in the road transport sector (Thiel, Perujo, & Mercier, 2010). According to Global EV Outlook (2021), there were about 10 million electric vehicles on our roads globally by the end of 2020; there is a trajectory of the rapid growth of electric vehicles globally, with electric vehicle registrations increase of around 41% in 2020 with the pandemic related lockdowns. However, car sales dropped by 16%, and around 3 million electric vehicles were sold globally, about a 4.6% share in sales, with Europe overtaking China as the world's largest electric vehicle market. The expansion of electric buses and trucks in major markets reached about 600 000 and 31 000, respectively (Global EV Outlook, 2021). The vehicle manufacturers are increasingly ambitious in electrification plans, with about the top 20 vehicle manufacturers in the electric vehicle market would increase if the government were to accelerate their efforts in reaching climate goals in their sustainable development goal.

Electric vehicles have an advantage in reducing co2 carbon footprint and reducing the dependence on fossil fuel in the transport sector across the globe. Globally, countries have now set targets for the development of electric vehicles, and countries globally adopted policies to achieve the environmental standards target to alleviate the energy pressure of fossil fuel and air pollution.

There is a drive toward the electric vehicle for its benefit of reducing emissions. The adoption of electric vehicles is increasing in the world. There is an increase in government policies for financial incentives, technology innovation of electric vehicles and infrastructure development of charging stations for electric vehicles. In most cases, the emissions come from burning fossil fuels in the energy and transport sectors both globally and locally. In the United States of America, the government is stimulating the purchase of electric vehicles and encouraging manufacturers to promote the adoption of electric vehicles.

Electrical vehicle role players in auto car manufacturers in South Africa include Toyota SA, BMW SA, Daimler/Mercedes Benz, Volkswagen SA, and Nissan SA, including Auto Manufacturers in South Africa. The auto manufacturing industry plans for investments and market readiness in South Africa include the investment plan by Toyota SA to sell and export to 43 countries in Africa for a sizable investment plan. In the local market, BMW already launched the electric MINI cooper in late Jan 2021. Daimler planned to launch electric trucks in the South African market once local infrastructure could accommodate technology. Energy oil companies like Shell SA had already started infrastructure investment plans and implemented charging stations in retail sites. Bp SA, in their Rosebank offices, had allocated parking bays with charging stations for electric vehicles for employees and customers.

The national government in the SA fuel levy contributes a significant revenue income. The history of electric vehicles started around 1800s, and this was a series of breakthroughs from one inventor or country with the invention of the electric motor battery. In the second half of the 19th century, English and French investors built the first practical electric cars (Matulka, 2014). According to Matulka (2014), electric cars had no issues with steam or gasoline. Electric cars are easy to drive and do not emit smelly pollutants compared to cars of that time. According to Matulka (2014), EVs were popular in urban residences and were perfect for short trips around towns and cities. As more people gained access to electricity in the 1910s, it became easier to charge EVs, increasing the popularity of electric vehicles. According to Matulka (2014), the turning point of the electric vehicle was when Toyota Prius was released in Japan in 1997, Toyota Prius was the amongst the first world's produced hybrid EVs around 2000, and it became a success with influential people in promoting this type vehicle.

Prius used the nickel metal hydride battery – a technology which was supported by the energy department's research, and there was a concern about carbon pollution that pushed the Prius to

become the best-selling hybrid globally during the past decade. Another event that also reshaped electric vehicles was around 2006 when Silicon Valley start-up, Tesla Motors, produced luxury electric sports cars that could go more than 200 miles on a single charge. Consumers in other countries are spoiled for choice when buying electric vehicles, and many plug-in electric charging stations exist. As petrol prices rise, the electric vehicle market is becoming popular with consumers globally, with the investment channelled towards the electric vehicle transition globally is also putting some pressure in the local market to start looking at electric vehicles as the alternate option in the local vehicle market.

1.3 Research Problem Statement

There is a global trend towards the readiness of electric vehicles in developed and developing countries. This has been necessitated by the damage fossil fuel is causing in our environment globally and locally in South Africa with CO2 Emissions. The broader issues in the market of electric vehicles by the public at large with electric vehicle driving range, the charging time, lack of required charging infrastructure, limited vehicle choices and costs associated with electric vehicles. Meeting the sustainable development goals SDGs for climate action with electric vehicles market readiness in South Africa. The ongoing issue of electricity load-shedding in South Africa and the impact it will have on electric vehicle market readiness.

According to Auto Trade CEO Mienie (2021), consumer education plays an important role in the adoption and perception towards electric vehicles and market readiness, and he believes that there is not much given to educate consumers about the difference between electric vehicles' the internal combustion engines and the consumers at large are not fully aware. The market readiness for electric vehicles in South Africa assists in addressing the sustainable development Goals with SDG GOAL 13- Climate action and SDG Goal 7, affordable clean energy by reducing CO2 emissions in communities with car manufacturers and government in addressing the SDG Goals. The electric vehicles aim was also to address the problem of combustion engine cars in the car park for consumers in South Africa. The aim was to reduce climate change and air pollution. EV's efficient compared traditional combustion engine vehicles, and this will be based on surplus electricity or charging infrastructure available for electric vehicles' market readiness.

In a country like South Africa, where it produces its electricity using coal, the efficiency of electric vehicles would be small. The push from global leaders to produce less coal for climate action agenda and some countries are transitioning their coal-fired powered stations and wants to

decommission such coal-powered plant in the future. South Africa still needs to look at the infrastructure and investment needed to address the market readiness for electric vehicles. In South Africa, the electricity supply is made out of coal burning, and there might be a need for a market readiness for electric vehicles. The price of electric vehicles would be an issue in for market in South Africa when it comes to market readiness and considering that electric vehicles in the market are pricey for an average consumer or customer in South Africa and manufacturers of electric vehicles with the likes of Jaguar & Land Rover, BMW, Toyota, and Volvo where the price is a bit out of the range for an average South African.

The market readiness for electric vehicles in South Africa depends on affordability and the awareness of consumers at large where there is still a need to charge the vehicle at home using electricity and public charging points infrastructure availability and with Eskom's load-shedding, which is a concern, there a limited, restricted power supply from Eskom in South Africa due to load-shedding. Against this background, this research investigated market readiness for electric vehicles in South Africa.

1.4 Research Aim and Objectives

The purpose of this study was to investigate the market readiness for electric vehicles in South Africa and how auto car manufacturers and the government in South Africa can effectively improve and accelerate the market readiness of electric vehicles, which will assist in reducing carbon emissions and other factors influencing the market readiness of electric vehicles in South Africa and the research intended to achieve the following objectives:

- ✓ Establish the factors influencing the market readiness of electric vehicles in South Africa.
- ✓ Examine the market readiness of electric vehicles with auto manufacturers and government initiatives to accelerate the market for electric vehicles.
- ✓ Establish the readiness of auto car manufacturers and the government in South Africa for electric vehicles.
- ✓ Recommend strategies to enhance the market readiness of electric vehicles, with auto car manufacturers and the government playing a critical role.

1.7 Research Hypotheses

The study hypothesis adopted were as follows:

$H_1 =$ The SA market is familiar and has adequate knowledge about electrical vehicles.

$H_2 =$ Auto manufacturers and government initiatives accelerate the market for electric vehicles in South Africa.

$H_3 =$ government involvement influences the market readiness for electric vehicles in South Africa.

$H_3 =$ Auto car manufacturers and government strategies enhance the market readiness for electric vehicles in South Africa.

1.5 Delimitations of the research study

According to the definition, delimitations the primarily concerned with the study's scope. Delimitations define the parameters or explain the study's scope. Additionally, delimitations restrict you from asserting that your results apply to the entire population. Unlike limitations, which have inherent restrictions on your approach, delimitations are restrictions you place on your study (Miles & Scott, 2017). The research was delimited to the SA market for electric vehicle readiness for auto car manufacturers, government, and transport users of cars. The study delimited to sample study 152 people in automotive, government and transport users. This research was only focusing on electric vehicle market readiness in South Africa. The geographical areas were for major South African cities, including Johannesburg, Durban, Cape town and Port Elizabeth, and data was collected using online questionnaires.

1.6 Assumptions of the research study

The study assumed consumers seek opportunities to purchase electric vehicles and increase auto manufacturing by producing or importing electric vehicles in South Africa. The benefits of electric vehicles will contribute to environmental and air pollution issues in South Africa and the reduction of CO2 emissions with the introduction of electric vehicles in the SA market. The infrastructure development in public and private spaces for charging ports is not readily available for electric vehicles in South Africa.

1.7 Significance of the research study

The research gives perspective and direction in understanding the market readiness for electric vehicles in South Africa by looking at auto car manufacturers, government, and private and public sectors as key stakeholders. This study of electrical vehicles in South Africa will help provide insights and inform decision-makers in government, OEMs, and auto manufacturers in addressing infrastructure issues, cost of ownership and education and benefits of electric vehicles.

1.8 Research Report Structure

Chapter 1: Introduction

This chapter articulates the history of electric vehicles and the adoption of electric vehicles and the background and context, the invention of electric vehicles, the drive by policymakers and environmental issues, the research problem statement, research aim and objectives.

Chapter 2: Literature Review

This section reviews literatures on electric vehicles globally and in developing countries, looking at the past literature, conceptual frameworks, and past studies of electrical vehicle readiness.

Chapter 3: Methodology

This chapter discusses the research design and approach, reliability and validity measures, research instrument, procedures for data collection and methods with limitations of the study undertaken.

Chapter 4: Data Findings and Presentation of Results

The section looks into survey that were analysed from SPSS software version 28 to understand the market readiness for electric vehicles.

Chapter 5: Interpretation and recommendations

This chapter analyses the data findings regarding market readiness for electrical vehicles in South Africa concerning questionnaires, surveys and recommendations.

Chapter 6: Summary and conclusion

This chapter is essentially a summary with recommendations and a conclusion of the research study.

1.9 Chapter Summary

This chapter looked at the history and invention of electric vehicles, which dates back to the 1800s and where the world is with electric vehicles. The drive by the policymakers and environmentalists for carbon footprints. This chapter looked at what is known about electric vehicles and what is not known by the consumers and the climate action benefits of using electric vehicles. There is a need for consumer education about electric vehicles and their benefits. The above chapter included

the background and context of electric vehicles and the research problem statement with this study's research aim and objectives. This chapter presents the detailed delimitations, assumptions, and significance of this study in the body of knowledge within the transport industry, including auto car manufacturers and OEMs.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

This chapter details literature which underpins the basis of this study undertaken, which reviews the literature on previous studies on electric vehicles, and this study identified and detailed quantitative variables that were key to this study, as well as a conceptual framework that was used to interpret research findings in the previous chapter. The literature review considers the recommendation on how the market readiness for electrical vehicles is being addressed in other markets that have fully embraced electric vehicles with infrastructure development, policymakers within the transport sector, government, OEMs, and auto car manufacturers.

2.2 Research problem analysis

The environmental damage and air pollution that is caused by the fossil fuel and CO2 emission issues in our society and South Africa at large and the alternative for the motor sector is to transition to electric vehicles, which will reduce the air pollution and emissions and pressure from civil society for vehicle manufacturers to take action in protecting the environment by creating and promoting an alternative to traditional fossil fuel vehicles in our car park to electric vehicles adoption in South Africa.

2.3 Factors influencing the market readiness of electric vehicles in South Africa

2.3.1 The carbon footprint and C02 Emission

To establish the factors influencing the market readiness of EVs in South Africa. The transport sector is perceived as one of contributors to CO2 emissions and carbon footprint in the world, and it is growing at an alarming rate. Electric vehicle mobility has not grown fast past to curb the increasing co2 emission and carbon footprint issues the world is experiencing at an alarming rate (M. Verna, A. Verna & Khan 2020). South Africa has been identified as Africa's worst polluter, with an increase in carbon emissions despite the government's efforts to reduce carbon footprints to reduce global warming, which affects climate change.

2.3.2 Financial Factors and Other factors influencing the market readiness.

There are electric vehicle factors influencing the market readiness of electric vehicles with environmental benefits, financial incentives, and internal factors, which consist of charging time, battery costs, actual cost price for electric vehicles and driving range that electric vehicle takes. The

electric vehicle's high price and requirement for electric adoption (Hidrue et al., 2011; Graham-Rowe et al., 2012; Carley et al., 2013). Electric vehicles are generally pricey and costly compared to traditional internal combustion engines.

2.3.3 Market drivers for macro-economic factors

The market drivers for macro-economic drivers factors influencing the market readiness of electric vehicles, the commitment by the transport sector to reducing emissions and the possible loss of the automotive internal combustion engine market in the long run. The increase in South African market consumers that are climate conscious and the rising fuel costs. Government support is needed to allow the transport sector and car auto manufacturers to educate consumers about the benefits of electric vehicles and provide financial support in accelerating the market readiness of electric vehicles in South Africa. According to the electric vehicles market intelligence report 2020, there were many factors the government have for market readiness of electric vehicles, which include the emission reduction commitment, air quality concerns in cities and the volatility of crude oil globally.

The Paris Agreement in 2019 had requiring signatures to reduce emissions, had been endorsed at least by 197 countries and rectified by 187 and that EVs were providing an alternative to internal combustion engines. The report indicated that around 15% of greenhouse emission was caused by the transport sector, with the increase in the car park in cities, which further increased air pollution concerns, and electric vehicles had zero possible direct emission and will improve air quality in cities and communities. Countries were considering the alternative to fossil fuels with the increase in crude oil and rising fuel prices caused by the volatility of crude oil globally, where an electric vehicle could be powered energy solar-powered charging ports at homes, cities, and communities.

2.4 Examine market readiness of electric vehicles with auto manufacturers and government initiatives to accelerate the market for electric vehicles in South Africa

The production of electric vehicles by major original equipment manufacturers (OEMs) in responses to meet greenhouse reduction targets. The Department of Transport in South Africa should demonstrate the business case for electric vehicles as an alternative to fuel costs and further rising fuel costs by encouraging bus manufacturers to manufacture electric buses and introduce them as an alternative for the adoption of electric vehicles to examine the market perception for public transport users as well not only market perception by private transport users. As per Global

EV outlook (2020 global EV market estimated to be worth R1.6 trillion (USD 118.9 billion). Approximately 783 000 electric passenger vehicles were sold globally in 2018/2019.). The report believes that transport sector accounted for the largest portion of the global market with electric vehicles.

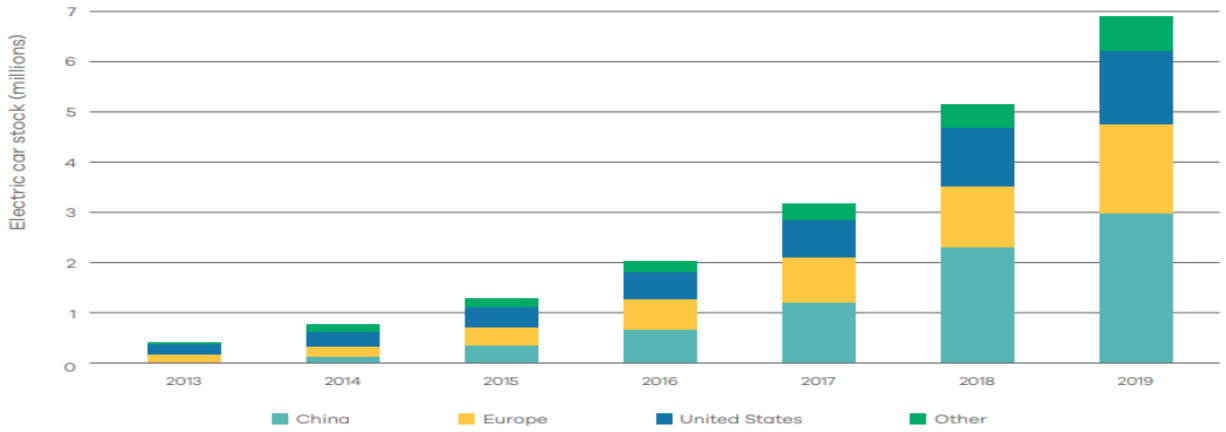

Figure 2: Cumulative global passenger EV sales

Source: IEA and CleanTecchnica

Figure 1:Cumulative global passenger EV Sales

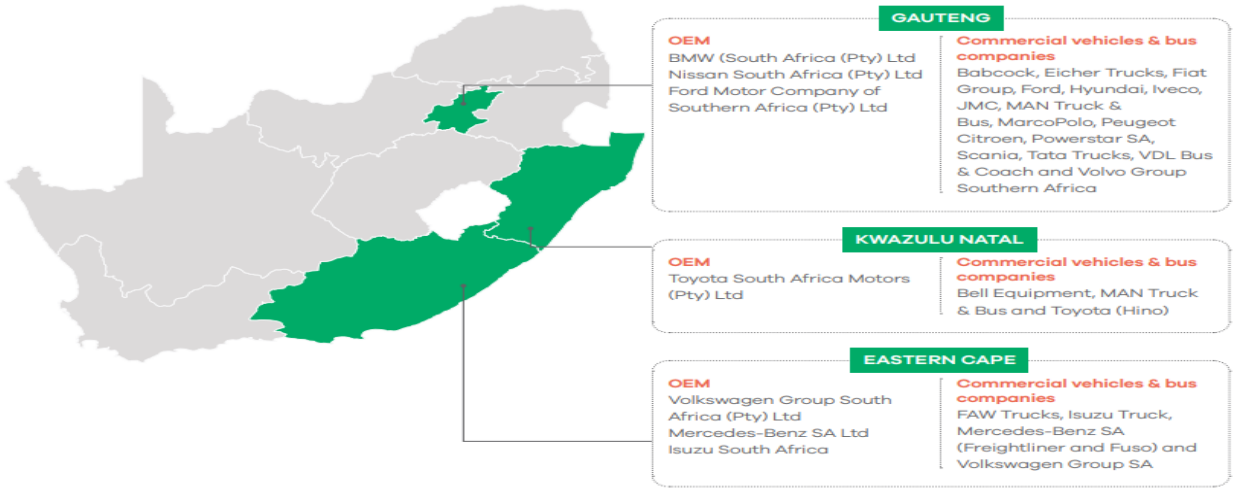

Figure 4: Manufacturing transport hubs in SA

Figure 2: Manufacturing transport hubs in SA

The above figure 2 illustrates an overview of OEMs in South Africa by province, and the map depicts where the major manufacturers in South Africa with commercial vehicles and bus companies in provinces in South Africa (Electric Vehicle Market Intelligence Report, 2020). Department of Trade and Industry (DTI) in South Africa proposed a road map in 2013 with proposed incentives for vehicle manufacturers to start looking into manufacturing locally. There was a cashback incentive investment that DTI put in place of about 35% with the condition that

manufacturers needed to produce a minimum of 5000 electric vehicles annually to qualify for the 35% cash back investment initiative to promote the acceleration of electric vehicles in SA (Electric Vehicle Market Intelligence Report, 2020).

2.5 Establishing the readiness of auto manufacturers and government for electric vehicles.

To establish the readiness of auto manufacturers and the government for EVs in South Africa. The electric vehicle market intelligence report (2020) indicated that for the SA market to grow electric vehicle adoption, the EV market was to radically increase EV uptake by collaborating with the Department of Trade, Industry, and Competition and the National Treasury. Electric vehicles have an environmental impact that is on par with or even greater than internal combustion engine automobiles and for example USA and China, where coal-fired power plants still generate significant electricity. In their study, Liu, Hildebrandt, & Glasser (2012) examined the environmental effects of electric automobiles in South Africa. They discovered that using EV's in South Africa might not assist to reduce greenhouse gas emissions now (2010) or in the future (in 2030 as per IRP 2010 Revision 2, policy-adjusted IRP scenario) and can increase them because the majority of the country's electricity is produced from low-quality coal in the country.

Compared to the internal combustion engine (ICE) market, the market for electric vehicles was still in its infancy, with just a small number of automobile manufacturers starting to produce them on a substantial scale globally. According to Ghasri et al. (2019), the primary reasons why people think EVs are less superior to (ICE) vehicles than they are their short range, the poor density of recharging stations, the high cost of purchase and maintenance, and extraordinarily long recharging times. The cause is that numerous technological developments still need to be made before these vehicles can provide customers with the same levels of enjoyment as ICE automobiles. One problem is that battery technology is developing slowly, and present batteries have a low energy density per weight, which creates a problem.

2.6 Strategies to enhance the market readiness of EVs.

To recommend strategies to enhance the market readiness of EVs in the SA market. The need to educate consumers about electric vehicles and the benefits of EV adoption in South Africa in collaboration with auto car manufacturers and the government.

2.6.1 Consumer education about electric vehicles

The government to work with auto car manufacturers and provide incentives to enhance the market readiness of electric vehicles. Government to ensure that there is research in providing electric batteries for electric vehicles. The need to solve the electricity issues in South Africa caused by Eskom to build confidence in consumers when purchasing electric vehicles, and this will ensure that the consumers are confident that the charging ports for electric vehicles will be sufficient in generating power for EVs in their homes and public charging ports in malls, and forecourts in our communities. There is a need for a drive to inform the public about the benefits of electric vehicles in South Africa, which will increase the benefits to meet the emission reduction targets. The imports of oil expenditure will decrease, and new job opportunities and skills to support the electric vehicles market in South Africa.

2.6.2 Infrastructure Investment

The infrastructure investment into electric vehicles charges ports for private use and public transport electric buses in all major cities and communities. Understanding the commute behaviours and travel of consumers in South Africa will enhance the readiness of electric vehicles; according to the electric vehicle market intelligence report 2020, there are about 12 million vehicles in South Africa Road network park, and Gauteng, Western Cape, and KwaZulu Natal are among the highest vehicle sales and ownership in South Africa. Minibus and taxis are among the dominant choices for public transport. There is an increase in population in major cities in South Africa, and public transport for minibuses and taxis plays a huge role among transport users (Market Intelligence Report, 2020).

EV Charging infrastructure could be an issue with constrained in a technical capacity, and considering the elephant in the room, Eskom load-shedding in the prospect of adding load in the form of EV charging ports infrastructure upliftment in public areas in South Africa (Collett, Hirmer, Dalkamann, Crozier, Mulugetta & McCulloch, 2021). Electricity providers for EV charging ports will allow independent power producers to gain momentum in providing energy to assist the struggling state-owned power generation by Eskom.

2.7 Research knowledge gap analysis [Methods, data, findings, and conclusions of studies and evaluations of market readiness for electrical vehicles in South Africa]

In a study by Moeletsi (2021), the survey was conducted using statistical methods with frequent tables and Chi-squared tests on the contingency tables. The adoption of electric vehicles in the purchase price, battery price and the likelihood of owning a second vehicle as the electric car in Gauteng specifically. The study received positive opinions from the respondents with a high willingness to purchase electric vehicles and concluded that it is government and private sector to give a favourable environment for consumers to purchase electric vehicles. The questions for this study were web-based surveys with a link to emails, social media, Facebook, WhatsApp, which created a snowball sampling approach, and the questions were multiple choice questions which somehow gave the respondents a small-scale latitude to be descriptive in answering the questions on barriers of electric vehicles adoption.

In a study by Kwame (2019), his thesis research unpacks the technical and perception barriers to electric vehicle uptake in South Africa. The finding was that the purchasing of electric vehicles is accelerating at a fast pace globally, with China, Europe, and the United States among the highest growth with the purchase of electric vehicles, and South Africa was behind in the purchase of electric vehicles. His research shows that electric vehicle technology can assist in lowering carbon emissions, stimulate innovation, and decrease the dependency on fossil fuels, leading to lower transportation costs. The research indicated that electric vehicles, compared to internal combustion engine vehicles, face social, infrastructure, and economic challenges early adopters within the country.

Total cost of ownership for EV's is higher than traditional combustion engines, whereas the maintenance costs of electric vehicles are lower than combustion engine vehicles. The conclusion by Kwame (2019) is that South Africa needs to accelerate and intensify its policies on climate action and inform consumers to create a conducive environment for electric vehicle adoption in South Africa, and there is a greater need to catch up with the world in electric vehicles adoption and to accelerate the sustainable development goals for climate action. The research was conducted using a descriptive approach, and the research population targeted experts in the transport sector and various South African of age above 18 for a targeted population with people from various cities, which included Durban, Johannesburg, Nelspruit, Pretoria, and Port Elizabeth as the electric vehicles are known most by the city dwellers.

In the article by Theresa titles (2021): Survey uncovers key insights into SA's perception of electric vehicles according to Auto Trader data, there is an increase in interest in electric vehicles, and there has been a 2010% increase in search for electric vehicles that are available in South Africa. Mienie (2021), Auto Trader CEO, indicated that there are barriers to broader adoption which indicates that electric vehicles are out of financial reach for about two-thirds of the consumers, and half of them responded to the auto trade survey indicated that they would still consider buying electric vehicles over a new one and indicating the cost of purchasing a new vehicle will be higher vs the used vehicle electric vehicle purchase in South Africa.

2.8 Conceptual Framework

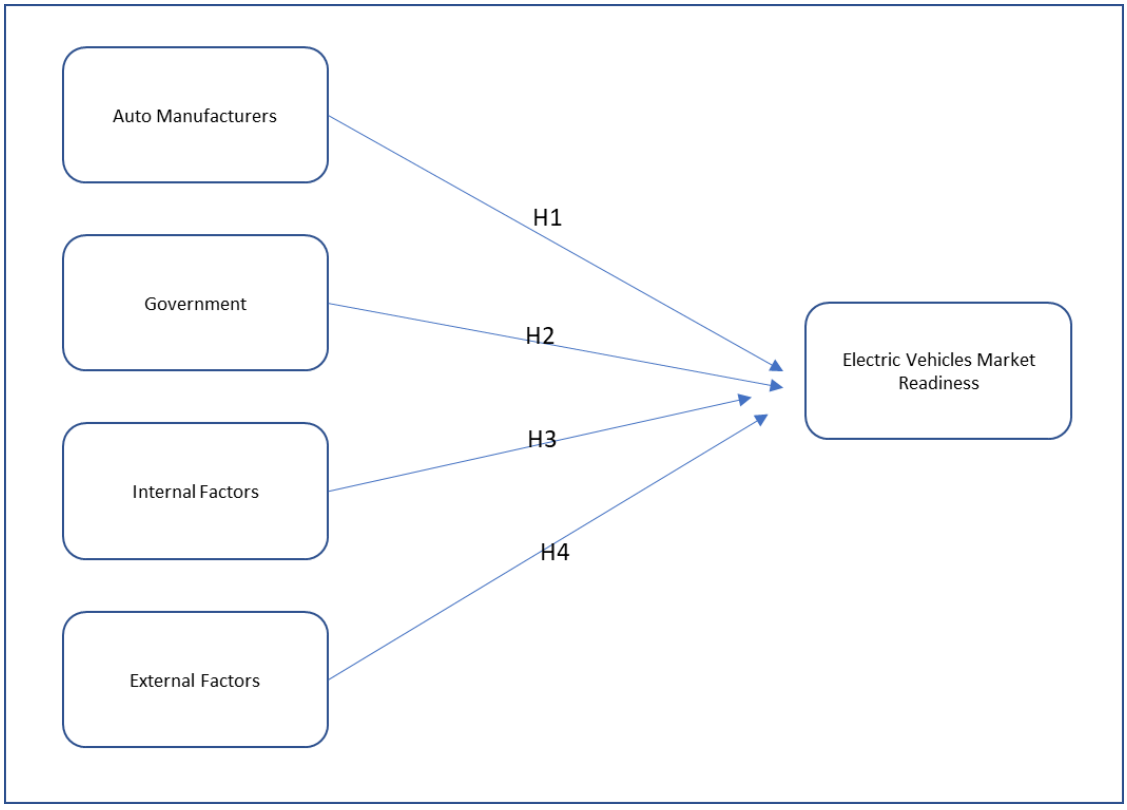

Figure 3: Conceptual Framework

There has been a growing trend globally with the adoption of electric vehicles as an alternative to fossil fuel with the carbon footprint and C02 emission that fossil fuel emits into the climate. Countries like China, the United States and European countries have seen a growth in the acceleration of electric vehicles. The demand for EV's will put pressure on the electricity system demand, and there needs to be a tool to manage the electricity system with increased electric vehicle charging ports (Aunedi & Strbac, 2013). The transport sector or Auto car manufacturers is

perceived as one of the contributors in regards to CO2 emissions and carbon footprint in the world, and it is growing at an alarming rate. Electric vehicle mobility has not grown at a fast pace to curb the increasing co2 emission, and carbon footprint issues the world is experiencing at an alarming rate (I. Verna, E. Verna & Khan, 2020). According to Moeletsi (2021), SA has struggled to adopt electric vehicles compared to other emerging countries, and many contributed to the non-conducive environment for electric vehicles. Bloomberg New Energy Finance (2017b) estimated that more electric vehicles would occur beyond 2020.

Auto car manufacturers require action to accelerate the market readiness to invest in research and development to produce electric vehicles the market wants to buy. This includes marketing EVs in South Africa. The government needs to incentivise auto car manufacturers through taxes and grants to make the incentives more viable and popular in the market like South Africa. External factors like electricity providers to fulfil the electricity demand and organisations to promote low carbon emissions and their environmental effects. Charging port providers to increase the infrastructure available for the market, including charging stations accessible and convenient for consumers in the electric vehicle market.

Globally major Original Equipment Manufacturers (OEMs) have committed to investing in producing and developing electric vehicles in the future (Amsterdam round table 2014). The major OEMs like BMW, Renaults, and VW, to name a few, are investing huge billions in technology to produce electric vehicles by going fully fledge to electric vehicles by 2030 (Lombardi et al. 2018,7). The Global EV Outlook (2020) estimated that the global EV market is valued at around R1,6 trillion (USD 118.9 billion). There were about 783 000 units of electric passenger vehicles sold globally in 2018/2019. The report believes that the private transport sector segment accounts for the largest portion of the global market with electric vehicles. The Department of Trade and Industry in South Africa proposed a road map in 2013 with proposed incentives for vehicle manufacturers to start looking into manufacturing locally produced electric vehicles in South Africa, and there was a cash-back incentive investment that DTI put in place of about 35% with the condition that manufacturers needed to produce a minimum of 5000 electric vehicles annually to qualify for the 35% cash back in investment initiative to promote the acceleration of electric vehicles in South Africa (Electric Vehicle Market Intelligence Report, 2020).

Zhang et al. (2013) examined the government's impact and investigated government policies' results on EV acceptability by assessing four key variables. The decisions made by consumers are

influenced by their willingness to buy, the time spent shopping, environmental awareness, and psychological health rational demands. According to these authors, performance characteristics and the most crucial factor to consider is not money gains but sway a consumer's choice to buy an electric vehicle. These authors contend that the government initiative has had a negligible impact on the buying intent time and price.

2.9 Evolution of Technology Acceptance Models

UTAUT is a collection of interconnected technology acceptance theories or models (Venkatesh et al., 2003). Many researchers have applied the UTAUT theory to the adoption of electric vehicles. The main reason that different researchers have used UTAUT is that electric vehicle adoption is limited. Several researchers extended the UTAUT model to investigate factors influencing consumer behaviour toward sustainable vehicles. In another study, Khazei (2020) extended the UTAUT model with personal innovativeness and the price or cost to examine consumer intention to use electric vehicles. Another study, Sovacool (2017), integrated UTAUT into a conceptual framework for electrical vehicle adoption and discovered that it effectively encouraged consumers to adopt electric vehicles. The UTAUT uses four determinants.

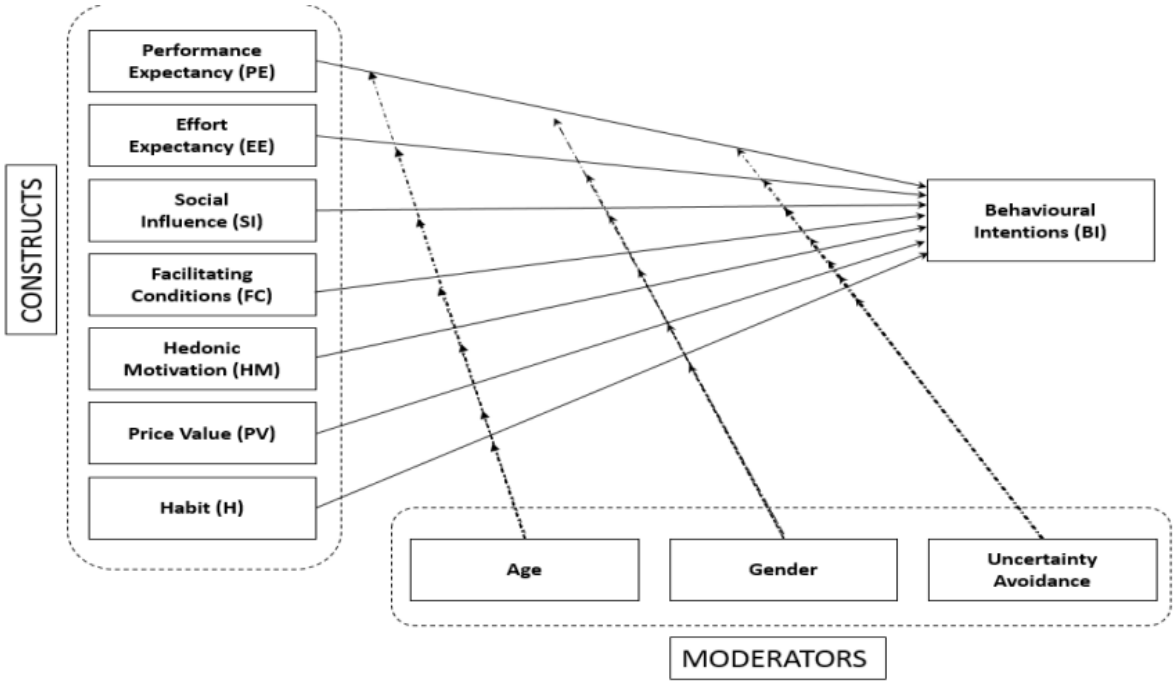

Figure 4: UTAUT four determinants
Source: Researcher (Adapted from Venkatesh et al. (2012)'s UTAUT model)

This framework observes acceptance of latest technology in different contexts, such as population and culture, as one of three types that can improve outcome ratio of technology acceptance (Venkatesh, 2012). The second type is when the framework considers different concepts to the models to broaden the scope of UTAUT's theoretic relationship. The third type is when the framework considers a new predictor of variables into UTAUT, and despite the integrated model addition, Venkatesh et al. (2012) emphasizes the importance of including the salient predictor variable that can be used within a user technology use context. UTAUT has investigated various issues, including software acceptance, smart mobile device adoption, and self-service technology. The purpose of this study of electric vehicles market readiness in SA UTAUT is used as the primary origin of the study as the results of its comprehensiveness and interpretations in comparison to other theories of technology access. This study adopts UTAUT as a theoretical framework for the market readiness of electric vehicles in South Africa.

Table 1: Theoretical Approaches to Electrical Vehicles: An Overview

Theory/Concept	Discipline	Unit of key analysis	Key concepts
Automobility	Sociology, political geography, and mobility studies	Motion or the practice of mobility	Socio material complexes, social identification, and cultural symbols
Actor-Network Theory	Science & technology studies, sociology, and scientific knowledge	Science and technology	Network assemblage, translation, enrolment actants and lieutenants
Unified Theory of Acceptance and Use of Technology	Innovation studies, information systems, computing, management science	Individuals	Performance expectancy, effort expectancy, social influence, facilitating conditions, price value, experience, and habit

The above table summarizes the theoretical framework approaches electric vehicles. The term "automobility" was coined by John C. Burnham (Frink, 1975) as part of a broader "mobilities" (Urry 2007; Sheller and Urry 2006; Hannaam et al.2006) investigation into "large scale movements of people, objects, capital, and information across the world as well as local processes of daily transportation, movement through public space, and travel material things within everyday life" (Urry, 2000:4). According to Kirsch, automobility is a "complex of cultural values, infrastructure networks, historic patterns of circulation and exchange, and technological artefacts" (Kirsch, 2000:6). Automobility refers to private transportation that includes not only electric vehicles but also other modes and preferences; automobility encompasses numerous technical, sociopolitical, and cultural dimensions; and thus, automobility deemphasizes the importance of the single mode of transportation. The other preferred approach in the above table is Actor-Network Theory (ANT), which seeks to explain how scientific or technological objects become integrated into society (Latour and Woolgar 1979; Callon 1986; Callon and Latour 1986; Law 1999), and this theory suggests that artefacts are not things in the usual sense, as Feenberg(2001:p 114) says "nodes in a network that contains both people and devices in interlocking roles.". According to Schwanen (2016), nothing is coincidental regarding the environment of automobiles, and the vehicle is the most single-engineered space routinely occupied by humanity.

2.10 Framework(s) for interpreting research findings for a market readiness for electric vehicles in South Africa

The market readiness for electric vehicles in South Africa is being addressed by the department of trade and transport sector and auto car manufacturers, and there is much-needed education for

consumers about climate action and the danger of fossil fuel vehicles in our communities. The market readiness of electric vehicles is a joint effort from the government and auto car manufacturers in which there is a need to create a conducive environment in accelerating the market readiness by ensuring that the cost of manufacturing and importing electric vehicles is being investigated to ensure that there is an incentive and cash back for auto manufacturers that are willing to import electric vehicles in South Africa. In partnership with auto car manufacturers, the government needs to create an infrastructure for charging stations for electric vehicles. Energy supply is another factor that needs government intervention for the consumers to be willing to shift their minds toward electric vehicles. The electric vehicle intelligence report 2020 indicates that buses and the mini taxi have the highest number of commuters in South Africa, even by looking at the biggest cities like Johannesburg, Cape Town, and Durban to enhance the readiness for the government to partner with the OEMs for buses and mini taxis in transition to electric vehicles and incentives such effort to reduce the emissions in our cities and communities.

2.11. Chapter Summary

The literature review on the problem statement analysis the environmental damage and air pollution that is caused by the fossil fuel and CO2 emission issues in our society and South Africa at large, and as a result, the alternative for the motor sector is to transition to electric vehicles which will reduce the air pollution and emissions and pressure from civil society for vehicle manufacturers. This chapter explored the theories supporting electric vehicles: automobility, Actor-Network Theory and the UTAUT theory. The UTAUT theory is the most used by authors in electric vehicle literature and the most relevant theory the researcher adopted for the market readiness for electrical vehicles in South Africa. As part of the objectives, this chapter looked at the recommendation and strategies to enhance the market readiness of electric vehicles in South Africa.

CHAPTER 3: RESEARCH METHODOLOGY

3.1 Introduction

This chapter outlined and described the research approach, design, procedure, and methods and guide in terms of choices for techniques to use for the study. This chapter essentially described

and identified the research approach, design, procedures, and methods employed in this research. This research was to collect and analyse qualitative data for empirical evidence. The research study had the objectives for research approach, research design, data collection methods, population sample, research instrument, the procedure for data collection, the validity or trustworthiness and ethical consideration.

3.2 Research Approach

The research approach outlines and indicates the course of action for a study. Authors such as Nayak and Singh (2015), Wagner et al. (2012), Bryman (2012) and Rabbie (2014) have highlighted the research approach as an activity that involves regulations and procedures, which includes methods to adhere to when conducting research. Nayak and Singh (2015:1) indicated that the strategy research approach "translates ontological and epistemological principles into guidelines that show how research should be conducted and principles, procedures and practices that govern research". In the meantime, Bryman (2012, p78) alluded that the research approach is a "general orientation to the conduct of social research". The two distinctive research approach includes quantitative and qualitative (Bryman (2012). The hybrid is a mixed strategy that combines qualitative and quantitative (Nayak & Singh, 2015; Wagner et al., 2012; Bryman, 2012).

The quantitative research approach can generalize and replicate results and findings (Bryman, 2012). This approach uses measurements to describe and explain social phenomena and test the significance of the phenomena to be sure about the conclusion collected from the numerical data collected. To ensure the results, an emphasis on the large data sample size represents the entire population free of biases and sampling error (Wagner et al., 2012). This research investigates the market readiness of electric vehicles in South Africa. An electric vehicle with the total cost of ownership of an electric vehicle. The infrastructure readiness and government, private and public sector drive towards electric vehicles. Not much research has been done in South Africa on electrical vehicles' market readiness. In a study by Moeletsi (2021), the questions concerned some of the factors being looked at; in this research, the cost price of EVs concluded that electric vehicles are negatively affected by the high price of acquiring an electric vehicle.

A quantitative method was very useful for this study, where the survey link questionnaires included questions around the aims and objective themes in examining the market readiness for electric vehicles. The survey targeted more than 250 respondents with questionnaires about electric vehicles' cost, infrastructure, benefits of owning an electric vehicle and sustainability benefits as

example questions formulated. The quantitative approach revealed the hypothesis testing for factors influencing the market readiness for electric vehicles in South Africa. The findings assisted in generalising results for private and public sectors in the Transport sector. The numerical data determined the general perception of electric vehicles for market readiness in South Africa. It allowed the testing of scales of measurements by using reliability and validity test for quality and replication of research for this study.

3.3 Methods

3.3.1 Univariate

This technique was used to simultaneously assess the dissemination of items on each variable, such as nonfiction data and realistic parts of common attitudes toward electric vehicle market readiness. Central tendency measures allow a researcher to summarize data using mean and mode to determine the central dispersion (Hair, Black, Babin, & Anderson, 2010).

3.3.2 Bivariate technique

According to Bhattacherjee (2012) and Shui et al., chi-square and cross-tabulation are used when comparing two or more constructs simultaneously (2009). This technique is generally recommended because it categorizes participants as per feedback received. It is well known for assessing the goodness of fit between detected and projected distributions (Hair, Black, Babin, and Anderson) (2010). The Chi-square test determines the statistical significance of two or more clusters' occurrence dispersion (Aaker et al., 2017).

3.3.3 Correlation Analysis

Correlation matrix techniques are interested with simultaneous occurrence of variables (Bhattacherjee, 2012). It is intended to allow information about the degree and relationship of the variables (Wiid & Diggines, 2009). Hair et al. (2010) state that the Pearson correlation coefficient measures the degree of linear association between two variables. The Pearson correlation matrix was used in this study to test the relationships between the variables.

3.3.4 Multivariate Analysis

Multivariate studies the relationships between variables and predict which variable has a contingent effect on another (Aaker et al., 2017). Multivariate analysis "refers to all statistical methods that simultaneously analyse multiple measurements of each individual or object under investigation," according to Hair et al. (2010:13). This analysis aims to create models and dimensions to

accommodate the entire population. Dependence and connectedness fixtures are intertwined, such that the captured factor is equal to or exceeds sixty per cent (60%) in the factor analysis technique and is subject to the dependence requirement. The significance of multivariate analysis in this study as a numerical method will reveal the relationship between variables. Importance of multivariate analysis in this study as a numerical method reveals relationship between variables.

3.4 Research Design

The research design usually provides an algorithm for the research. The algorithm includes the study's aim, objectives, generalization, population, sampling, and methods (Wagner et al., 2012 & Bryman, 2012). It provides the plan and direction for how the study should be researched. Bryman (2012), Nayak and Singh (2015), and Wagner et al. (2012) highlighted that the research design, a framework that suggests or imply on how the study should be taken or will be undertaken which includes the collection of data, analysis, and the approach the study should answer questions of the study. Bryman (2012, p. 88) suggested that "the research design relates to criteria' being employed when evaluating social research". Normally research design is a logical and systematic way to follow and understand the criteria for conducting social research.

Exploratory research was used in this study. **Exploratory research** commonly used to explain problematic aspects of a topic and conduct research in the early stages of an investigation when no definite evidence requires additional investigation (Babin & Zikmund, 2016). According to Sekaran and Bongie (2016), the exploratory research design is only used when little knowledge exists. This method works well when the aim is to understand the problem. It must adhere to the following settings, according to Shajahan (2009): (1) to design a problem for investigation and (2) formulate a hypothesis; (3) to determine the priorities for further research; (4) to gather data about the practical problems in researching conjectural statements; (5) to increase the analyst's interest in the research. This study's focus was consistent with the conditions listed above; an exploratory research design was formulated for this study.

3.5 Time Horizon

The research used cross-sectional, which is normally a survey research design. The cross-sectional method is usually associated with quantitative strategy as it involves research designed to determine a collection of numerical data from a sample administered using questionnaires at any given time (Nayak & Singh, 2015; Wagner et al., 2012; Bryman, 2012). The research collected data from the sampled participants for the study; the questions were structured in an order with options with a

structured approach survey questionnaire. Nayak and Singh (2015), Wagner et al. (2012), Rabbie (2014), and Bryman (2012) have suggested that in a cross-sectional design, data can be collected at a single point in time. Rabie (2014 p.101) alluded that the "design entails collecting data for more than one case at a single point in time to collect quantitative or quantifiable data". The independent and dependent variables are based on a sample used to determine the relationship (Nayak & Singh, 2015; Rabbie, 2014). This includes observations which are measured at a particular point in time.

3.6 Population and sample

3.6.1 Population size

According to Nayak and Singh (2015, p. 78), "a sample is a subgroup of a population, that is, people, objects, or items that are taken from a larger population for measurement". However, Nayak and Singh (2015, p. 37) commented that certain issues that researchers must be careful in choosing an appropriate sampling strategy in a way that it must be "closely related to the unit of analysis in a research problem". Moreover, an adequate sample size is needed to provide data and generalise to the population (Bryman, 2012). Two techniques of sampling are probability sampling and non-probability sampling (Nayak & Singh, 2015; Wagner et al., 2012; Bryman, 2012; Sarstedt & Mooi, 2019).

3.6.2 Sample Size

Many scholars have described sampling as choosing individuals, environments, activities or behaviours to observe or investigate for a study (Cohen et al.,2018). The target population for this study were individuals in the public and private sectors in major cities in South Africa, including Gauteng province, Durban, Cape Town, and Port Elizabeth and included major OEM vehicle manufacturers around electric vehicles in South Africa. The target population were individuals above the age of 18 that were interested in electric vehicles. Using the sample determinant table of 95% confidence with a marginal error of 5%, the study population was 250, and out of 152 questionnaires distributed, only 124 were collected, which.

3.6.3 Sampling method

Sampling involves the selection of individuals who are participating in the research from the targeted population, which are normally around the research and if by any event, the targeted population cannot be reached (Nayak & Singh, 2015; Wagner et al., 2012; Bryman, 2012 and Sarstedt & Mooi, 2019). Collecting data from a subset of all possible cases or elements is known as sampling, and it includes both probability and non-probability sampling (Saunders et al.,

2019:38-45). Mostly in research, there are two sampling techniques: probability and non-probability (Nayak & Singh, 2015; Wagner et al., 2012; Bryman, 2012; Sarstedt & Mooi, 2019). The study adopted nonprobability sampling, called judgemental sampling, which was used to select the participants for the study. The researcher decided on the study participants based on the researcher's judgement; therefore, a judgement sampling was used. The researcher addressed the bias in judgement sampling with purposive sampling of the sample based on the researcher's judgment and experience. The researcher also addressed the bias by ensuring that the most suitable candidates were selected based on 'fit for purpose' as well as the relevance of them fulfilling the objectives of this study of the electric vehicles market, which included the department of transport employees, OEM's and the public that uses private and public vehicles in major cities in South Africa. The sample size is the number of individuals selected and able to answer the research question on behalf of the population (Wagner et al., 2012; Bryman, 2012). The sample size is the number of sampled individuals selected from the population, and in quantitative research, it should be represented (Bryman, 2012). The sample size was based on the 95% significance level with a margin of error of 5%. A targeted sample of 152 people was interested in electric vehicles, which was a convenient approach.

3.7 Data collection methods

This section documents an actual procedure and methods for collecting research data, processing collation, and analysing empirical evidence from quantitative data collected in the research study. The research understudy was subjected to the fully structured/structured self-administered questionnaire from the two testing instruments: reliability and validity for a quantitative research study. This study or research used an online self-completion questionnaire to collect the data. Data collection is one of the most important components of any research study, and the researcher must collect data with great care (Quinlan, Babin, Carr, and Griffin,2019). It is important to emphasize that the data obtained is accurate and true, affecting the following chapters and the study's findings and results (Quinlan et al., 2019).

3.8 The research instrument

This study or research used an online self-completion questionnaire. Questionnaires were formulated as a written document with questions posed to targeted respondents to respond and provide their perceptive. 'The questionnaire can be administered as a written document that is completed by the person being surveyed; it is either an online questionnaire or a standardised face-to-face or telephone interview" (Wagner et al., 2012, p. 100). Nevertheless, according to Bryman

(2012, p. 275), the "questionnaires that respondents themselves complete are instruments for gathering data using a social survey design, along with the structured interview". An advantage of online questionnaires is retrieving information from a targeted population at a specific time (Bryman, 2012). This process is convenient and cheap and does not have much bias as the respondents must answer the survey question without assistance (Bryman, 2012).

The quantitative method entails collecting numerical data measured by regulations in how numbers are positioned or understood collectively as a measurement scale. The researcher in this study used the 5 Likert scale (1=Strongly disagree, 2=Disagree, 3=Neither agree nor disagree, 4=Agree and 5=Strongly agree). The questionnaires for this research were mainly on gender, education, city, mode of transport currently used, sector or industry, and knowledge of electric vehicles. The questionnaires for this study were developed to examine the market readiness of EVs in South Africa. Therefore, Section 1 of the questionnaire was about the demographics, and Section 2 was about the industry where the targeted respondents work. Section 3 of the questionnaires was around knowledge of electric vehicles, including the type of electric vehicles respondents were familiar with. Section 4 of the questionnaires concerned market readiness, including infrastructure development and government and auto car manufacturers' investment. Section 5 of the questionnaires was around factors influencing electric vehicle market readiness in South Africa. Section 6 of the questionnaires concerned OEMs and cost of ownership structure and incentives to accelerate the market readiness by auto car manufacturers and the government.

3.9 Data analysis and interpretation

The statistical analysis tools used in analysing the data give assurance that the tools used are reliable to measure the construct. Statistical tool IBM SPSS version 28 to test for data validity and reliability and using Cronbach's alpha other statistical data analysis tools for data interpretation.

"Data analysis is the process of dissecting massive amounts of collected data to analyse and comprehend it," says Sileyew (2019:31). According to & Vaske (2019:32), data analysis is a collection of techniques that aid in the construction of meanings, the identification of patterns, and the testing of hypotheses. The data analysis plan entailed comprehending and presenting the study's data. The researcher dissects, analyses, scrutinizes, and presents all the study details. The information in this study on the market readiness of electrical vehicles was loaded into numerical tools, tables, and diagrams to present the analysed data. The Statistical Package for Social Scientists (SPSS) version 28 was used to analyse the data collected in this study. The following section discusses the data analysis and presentation methods used in the study.

3.10 Limitations of the study

It is important to understand the limitation of the undertaken research study. Awareness of the limitation will inform the researcher to acknowledge the technical and administrative limitations and develop contingency plans for technical and administrative limitations. Technical limitation entails sample and sampling error with research design and data collection (Nayak and Singh, 2015; Wagner et al., 2012; Bryman, 2012). Administrative limitations include confidentiality issues that must be communicated to the participants (Nayak& Singh, 2015; Wagner et al., 2012; Bryman, 2012). The researcher needs to highlight the nature of the research limitations, and common limitations in most research include frames and monetary constraints (Nayak& Singh, 2015; Wagner et al., 2012; Bryman, 2012).

3.11 Validity (Quantitative)

Research validity and reliability are important for research studies as they prove evidence if the results are truthful and credible with quality (Nayak & Singh, 2015; Wagner et al., 2012; Bryman, 2012; and Sarstedt & Mooi, 2019). According to Nayak and Singh (2015, p. 24), research the "accuracy and trustworthiness of instruments, data, and research findings" is referred to as validity. Furthermore, research reliability refers to "whether or not you get the same answer by measuring something more than once with the same instrument." Collectively, Nayak and Singh (2015), Wagner et al. (2012), and Bryman (2012) have suggested that researchers need to display a high quality of the research processes, methods, and instruments for their research to be reported and the extent of consistency by utilising the reliability and validity test measures. Four main types of validating research are as follows, measurement validity, internal validity, external validity, and ecological validity for a quantitative research strategy or credibility, dependability, transferability, and conformability for a qualitative research strategy (Nayak & Singh, 2015; Wagner et al., 2012; Bryman, 2012; and Sarstedt & Mooi, 2019).

3.12 Reliability (Quantitative)

Reliability specifies the consistency of items in trying to answer the research questions. Scale measurements of the data collection instruments must be tested for reliability using statistical tests such as Pearson's and Cronbach's Alpha (Almalki, 2012). The higher value of alpha represents high levels of internal consistency. According to Wagner et al. (2012, p. 80), reliability is the "degree to which an instrument measures a construct the same way each time it is used under the same

conditions with the same respondents". Research reliability can only apply to quantitative research as it relates to scales used to measure data using structured instruments such as questionnaires (Nayak & Singh, 2015; Wagner et al., 2012; Bryman, 2012). As a result of the influence of human error, it is important to strengthen and minimise the threat of validity to your research (Nayak & Singh, 2015; Wagner et al., 2012; Bryman, 2012).

3.13 Ethical Considerations

The survey was anonymous, and the information gathered was not used for anything other than this research. A researcher abided by POPIA Act to protect information and not to share personal information. The researcher obtained ethical clearance number **WBS/BA2492664/743** from the research committee to conduct a study and declared no harm to humans or participants participating in the study or research. All necessary permission was granted to the government and auto manufacturers to participate in the survey, and data will be stored and not used in any other way except for this study. The respondents, including the government, were made aware that any data used would be treated as confidential and anonymous and not be used in any other form. The ethical principles where participant anonymity and informed consent, as defined by (Kara& Pickering,2017), is a process in which a person chooses whether to participate in a study.

3.14 Chapter Summary

This chapter presented the theoretical and conceptual framework of this study undertaken by the researcher and explored past theoretical and conceptual frameworks on past research about electrical vehicles. This chapter detailed the research methodology used in this study effectively, efficiently, and successfully. This study adopted a quantitative research method to be used in the study of electric vehicle market readiness, and the study's population and sampling method were explained in detail, which non-probability and purposive sampling method was explained in this chapter and methods used to collect data for online survey questionnaires. This study considered the exploratory research type and cross-sectional time horizon to be used, and lastly, the ethical consideration to ensure that the study has followed Wits' ethical clearance procedure and was approved by Wits School Ethics committee to conduct this research.

CHAPTER 4: PRESENTATION OF RESEARCH RESULTS

4.1 Introduction

The primary goal of this section is to elicit participant perspectives on the market readiness for electric vehicles in South Africa. Because questionnaires were used to collect data for this study, the previous chapter on research methodology proposed using (1) univariate, (2) bivariate, and (3) multivariate as the correct methodology for this study. This chapter analyses and interprets data by examining the effects of each variable on a set of data and statistical models used to evaluate

patterns in multidimensional data using multiple data variables, multi-regression analysis, and quantitative methods using SPSS version 28 software.

4.2 Univariate Analysis

The univariate analysis examines the distribution of cases on one variable at a time for descriptive purposes, and bivariate analysis assesses connection between the variables themselves in a data set, according to Hair et al. (2014); Fox and Weisberg (2011). The breakdown of a descriptive statistic begins with constructing the frequency distribution and ultimately examines sample data to assess locations, consistency, and bias in a frequency distribution. By analysing each feature inside the initial research or study, establishing distribution with midpoint inclination offers an informative recommendation of the dispersion of events and standard figures.

Exploring the relationship between variables entails looking for evidence that a difference in one variable corresponds to a difference in another variable (Hair et al., 2014). There were three reasons for using descriptive analysis in this study of market readiness for electrical vehicles in South Africa: first, to lay out preparatory perceptions of the feedback acquired as replicated in the dispersion of values for constructs; second, to provide a method for demonstrating the data in a sample and clear format with tables and diagrams, and third, it allows you to determine whether the dispersal expectation of subsequent statistical measures within bivariate and multivariate analysis is likely to be a frequency distribution.

4.3 Frequency Distribution

By typifying data schematically, frequency distribution indicates how different figures of variables are mixed in components of the review. Frequency distributions usually describe responses of a particular variable by showing or displaying the counts and percentages before and after adjustment for non-responses, and then determine the amount of non-response, if any" (Hair et al., 2014:32). These encapsulations allow the researcher to draw the important features of diverse dissemination, summarise material in distinct values, and allow for more practicable data elucidation.

4.4 Description of the research respondents

The research respondents in the electric vehicle market include car owners, auto manufacturers, government, and potential electric vehicle buyers, including private and public transport users. Therefore, this section describes the research respondents for the study.

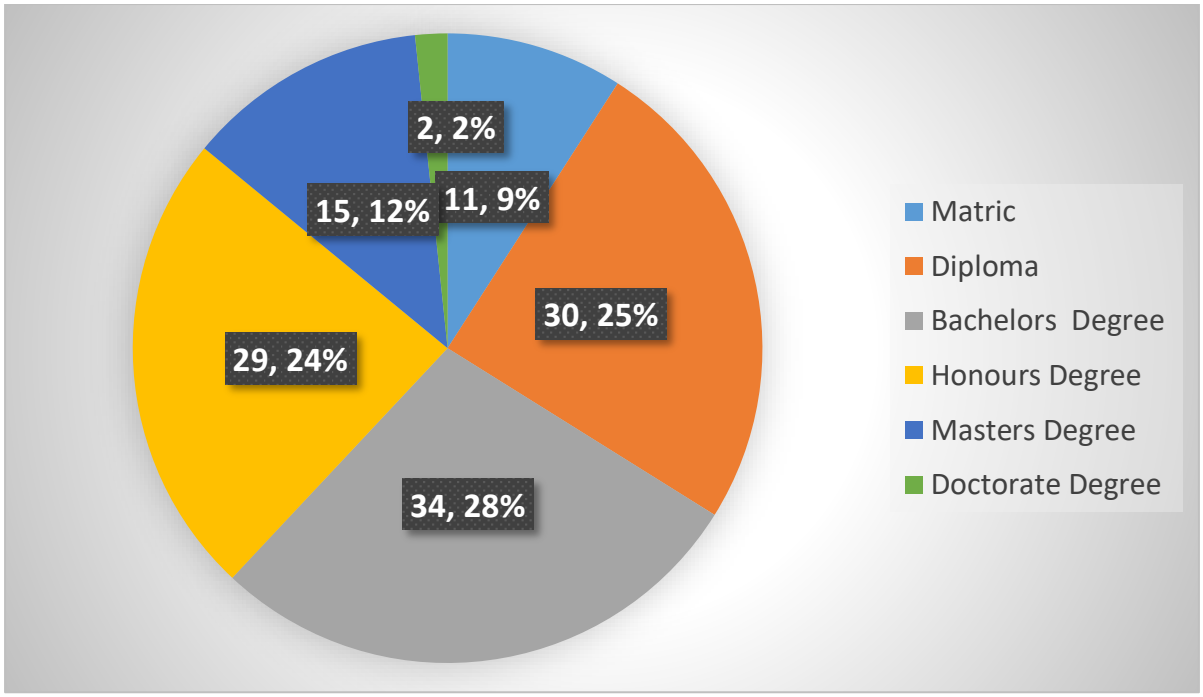

Figure 5: Level of Education of respondents

Figure 5 shows the percentage of respondents from different levels of education. The Honours level represents 24% of the study participants, and the bachelor's level represents 28%, which indicates the highest representation. Diploma represents 25% which is the second highest among the listed education level; a master's degree represents 12% of respondents; 11.9% represents respondents with matric, and 2% with a Doctorate level of education.

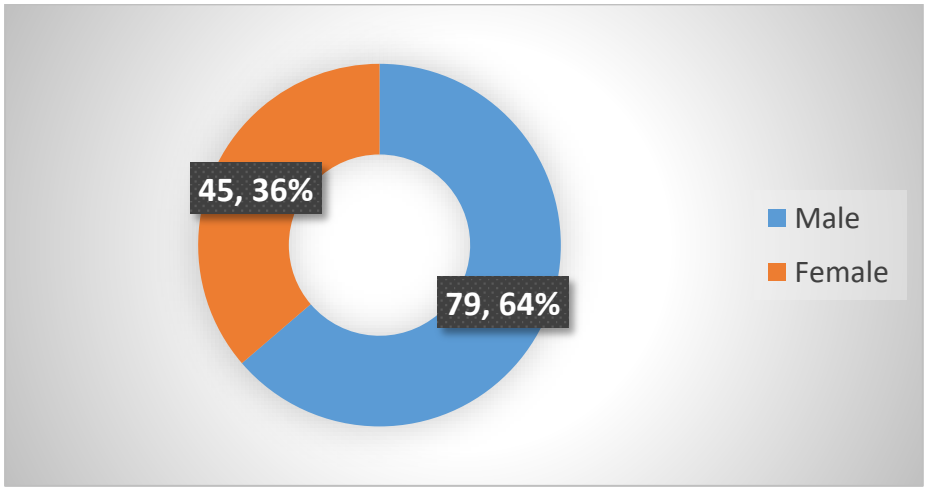

Figure 6: Gender of respondents

Figure 6 represents the gender of participants for the study between female and male respondents, and the presentation of 63.7% were males, and 36.3% were females for the study.

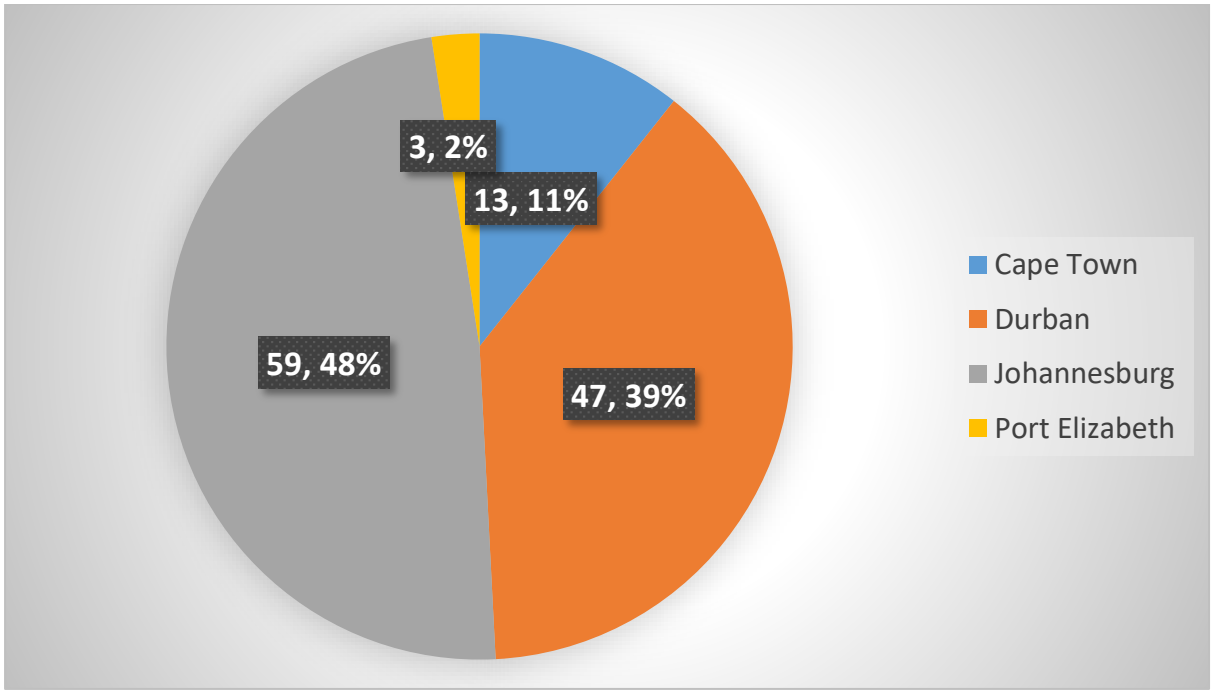

Figure 7: City where respondents reside

Figure 7 indicates where respondents resided in major cities for the study; 48.4% of respondents reside in Johannesburg city, 38.7% reside in the city of Durban, whereas 10.5% reside in Cape Town, and 2.4% of respondents reside in Port Elizabeth.

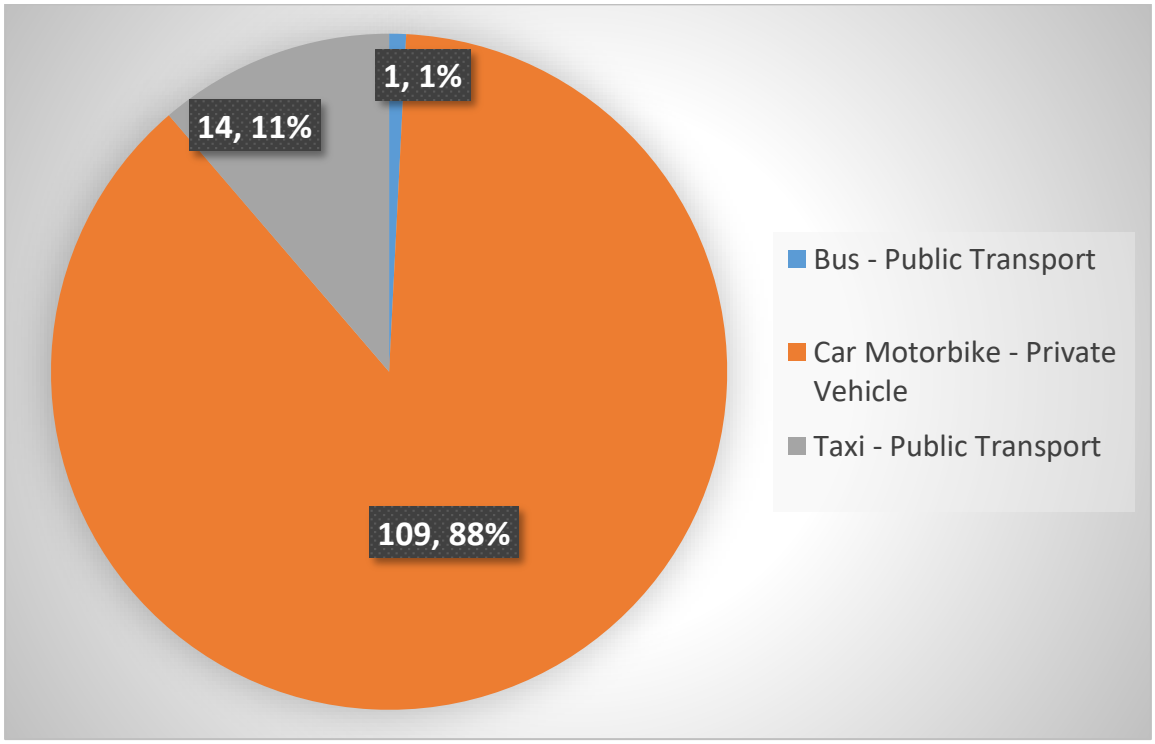

Figure 8: Mode of Transport respondents use.

Figure 8 indicates the mode of transport the respondents use, with the overwhelming 87.9 % using private cars in the cities where they live. 11.3% of respondents use Taxi public transport, and 0.8% use Bus as a form of Public Transport.

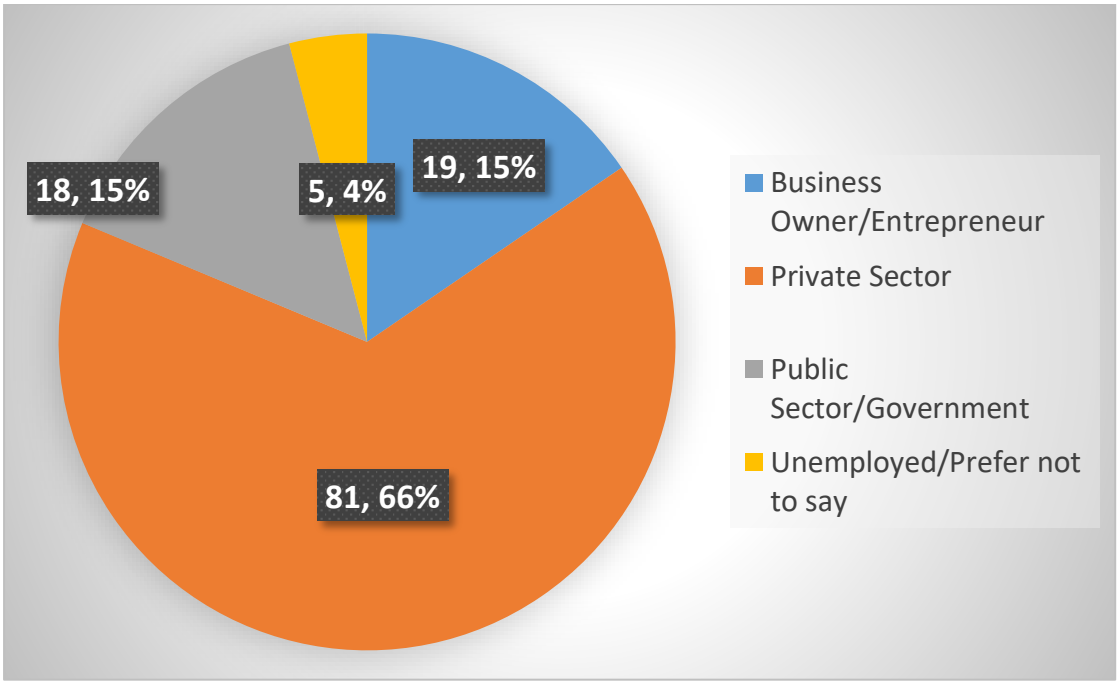

Figure 9: Industry of respondents

Figure 9 represents the industry respondents currently working, with 66.1% working in the private sector, 14.5% working for the private sector /Government, 15.3% are business owners/ Entrepreneurs, and 4% are unemployed/prefer not to say.

4.5 Knowledge of electric vehicles, including the type of electric vehicles respondents familiar with

Figure 10 below represents the frequency distribution of all respondents about their knowledge of electric vehicles, including the type of electric vehicles respondents familiar with

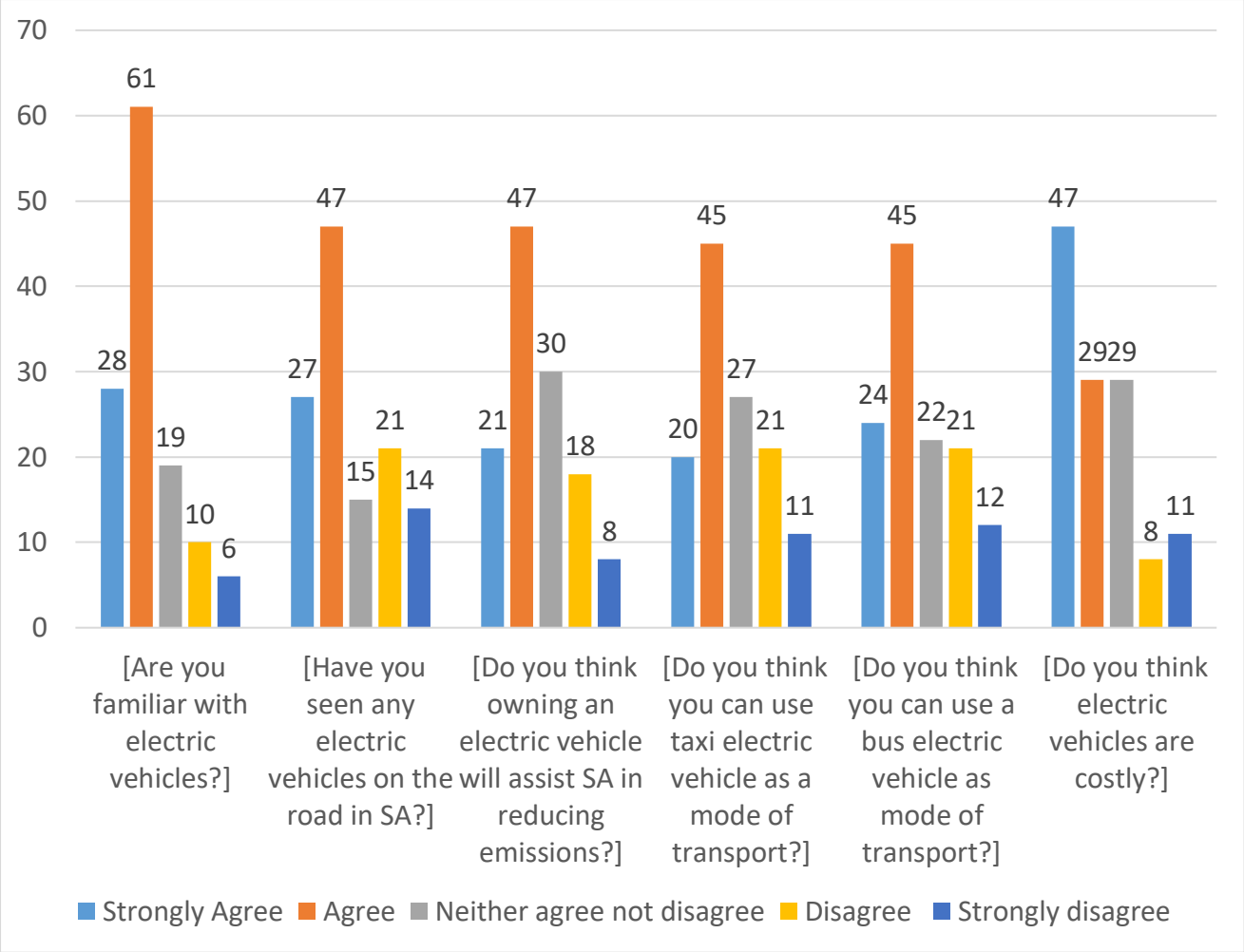

Figure 10: Knowledge of electric vehicles, including the type of electric vehicles respondents familiar with

Figure 10 shows knowledge of electric vehicles, including the types of electrical vehicles respondents are familiar with. The above indicates that 61 respondents are familiar with electric vehicles, 28 respondents strongly agree to be familiar with electrical vehicles, 19 respondents neither agree nor disagree with being familiar with electrical vehicles, ten respondents disagree with it, and six respondents strongly disagree with being familiar with electrical vehicles. Forty-seven respondents agree that they have seen an electric vehicle on the road in SA, with 27 strongly agreeing to have seen it in South Africa. Twenty-one respondents disagree with having seen electrical vehicles in SA, 14 strongly disagree with also seeing the electrical vehicle on the road in SA, and 15.

Forty-seven respondents agree that owning an electric vehicle will assist in reducing emissions in South Africa, with 21 strongly agreeing that electrical vehicles will assist in reducing emissions. Eighteen respondents disagree that owning an electric vehicle will assist SA in reducing emissions,

and eight strongly disagree that owning an electric vehicle will also assist SA in reducing emissions. Thirty respondents neither agree nor disagree that electrical vehicles will assist SA in reducing emissions. 45 Respondents agree that they can use a taxi electrical vehicle as the mode of transport in SA, while 20 respondents strongly agree that they can use a taxi electrical vehicle as a mode of transport. 21 Respondents disagree that they can use a taxi electrical vehicle as a mode of transport, while 11 strongly disagree that they can use a taxi electrical vehicle as a mode of transport, with 27 respondents neither agreeing nor disagreeing that they will use a taxi electrical vehicle as a mode of transport.

45 Respondents agree that they can use a bus electrical vehicle as the mode of transport in SA, while 24 respondents strongly agree that they can use a bus electrical vehicle as a mode of transport. 21 Respondents disagree that they can use a bus electrical vehicle as a mode of transport, while 12 strongly disagree that they can use a bus electrical vehicle as a mode of transport, with 22 respondents neither agreeing nor disagreeing that they will use a bus electrical vehicle as a mode of transport. 29 Respondents agree that electric vehicles are costly, with 47 respondents strongly agreeing that electrical vehicles are costly, eight respondents disagree that electrical vehicles are costly, and 11 strongly disagree that electrical vehicles are costly, with 29 respondents neither agreeing nor disagreeing that electrical vehicles are costly.

Table 2: Summary statistics knowledge on electric vehicles, including the type of electric vehicles respondents familiar with

	N	Minimum	Maximum	Mean		Std. Deviation	Skewness	
	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Statistic	Std. Error
[Are you familiar with electric vehicles?]	124	1	5	3.77	.094	1.045	-.995	.217
[Have you seen any electric vehicles on the road in SA?]	124	1	5	3.42	.117	1.307	-.531	.217

[Do you think owning an electric vehicle will assist SA in reducing emissions?]	124	1	5	3.44	.101	1.128	-.496	.217
[Do you think you can use a taxi electric vehicle as a mode of transport?]	124	1	5	3.34	.107	1.195	-.423	.217
[Do you think you can use an electric bus vehicle as a mode of transport?]	124	1	5	3.39	.112	1.247	-.466	.217
[Do you think electric vehicles are costly?]	124	1	5	3.75	.114	1.273	-.768	.217
Valid N (listwise)	124							

The above descriptive statistics summary by respondents on knowledge of electric vehicles indicates that respondents are familiar with electric vehicles with a Mean = 3.77 and Std. Deviation = 1.045. Respondents indicate that they have seen electric vehicles on the road with a Mean = 3.42 and Std Deviation = 1.307. Respondents think owning an electric vehicle will assist SA in reducing emissions with a Mean = 3.44 and an Std Deviation of 1.128. Respondents indicate that they can use a taxi electric vehicle as the mode of transport with Mean = 3.34 and Std Deviation 1.195. Respondents indicate that they can use an electric bus vehicle as the mode of transport with Mean = 3.39 and Std Deviation 1.247. Respondents indicate that electric vehicles are costly, with a mean of 3.75 and an Std Deviation of 1.273.

$H1_0$ The respondents have no adequate knowledge of electric vehicles.

$H1_1$ The respondents have adequate knowledge of electrical vehicles.

Table 3: Statistics hypothesis of knowledge on electric vehicles, including the type of electric vehicles respondents familiar with

Null Hypothesis	Test	Sig. a,b	Decision
The median of [Are you familiar with electric vehicles?] equals 3.	One-Sample Wilcoxon Signed Rank Test	<.001	Reject the null hypothesis.

The median of [Have you seen any electric vehicles on the road in SA?] equals 3.	One-Sample Wilcoxon Signed Rank Test	.001	Reject the null hypothesis.
The median of [Do you think owning an electric vehicle will assist SA in reducing emissions?] equals 3.	One-Sample Wilcoxon Signed Rank Test	<.001	Reject the null hypothesis.
The median of [Do you think you can use a taxi electric vehicle as a mode of transport?] equals 3.	One-Sample Wilcoxon Signed Rank Test	.004	Reject the null hypothesis.
The median of [Do you think you can use an electric bus vehicle as a mode of transport?] equals 3.	One-Sample Wilcoxon Signed Rank Test	.002	Reject the null hypothesis.
The median of [Do you think electric vehicles are costly?] equals 3.	One-Sample Wilcoxon Signed Rank Test	<.001	Reject the null hypothesis.
The median of [Government, public and private sector collaborate to accelerate market readiness] equals 3.	One-Sample Wilcoxon Signed Rank Test	<.001	Reject the null hypothesis.

Source: Author

When using - Sample Wilcoxon asking respondents if they are familiar with electric vehicles, the result was <.001 meaning it was less than a significant value of 0.05 which implies that we reject the null hypothesis and conclude that the respondents have no adequate knowledge of electrical vehicles. When respondents were asked if they had seen an electric vehicle on the road, the results were .001, meaning it was less than a significant value of 0.05 which implies that we reject the null hypothesis and conclude that the respondents have no adequate knowledge of electrical vehicles.

Regarding whether respondents think owning an electric vehicle will assist SA in reducing the emission, the results were <.001, meaning it was less than a significant value of 0.05 which implies that we reject the null hypothesis and conclude that the respondents have no adequate knowledge of electrical vehicles.

When respondents were asked if they think they could use a taxi electric vehicle as the mode of transport, the result was 004, meaning it was less than the significant value of 0.05, which implies that we reject the null hypothesis and conclude that the respondence have no adequate knowledge on electrical vehicles. When respondents were asked if they think they could use an electric bus vehicle as the mode of transport, the result was 0.02, meaning it was less than the significant value of 0.05, which implies that we reject the null hypothesis and conclude that the respondence have no adequate knowledge on electrical vehicles. When respondents were asked if they think electric vehicles are costly, the results were <.001, meaning it was less than a significant value of 0.05, implying that we reject the null hypothesis and conclude that the respondents have no adequate knowledge of electrical vehicles. When respondents were asked if they think the government, public and private sectors are collaborating to accelerate market readiness, the result was <.001 meaning it was a less significant value of 0.05, which implies that we reject the null hypothesis and conclude that the respondence have no adequate knowledge on electrical vehicles.

4.6 Internal and external factors influence the market readiness for electric vehicles in South Africa.

Figure 11 below represents the frequency distribution of all respondents to the sub-question about the influence of the market readiness for electric vehicles in South Africa by internal and external factors.

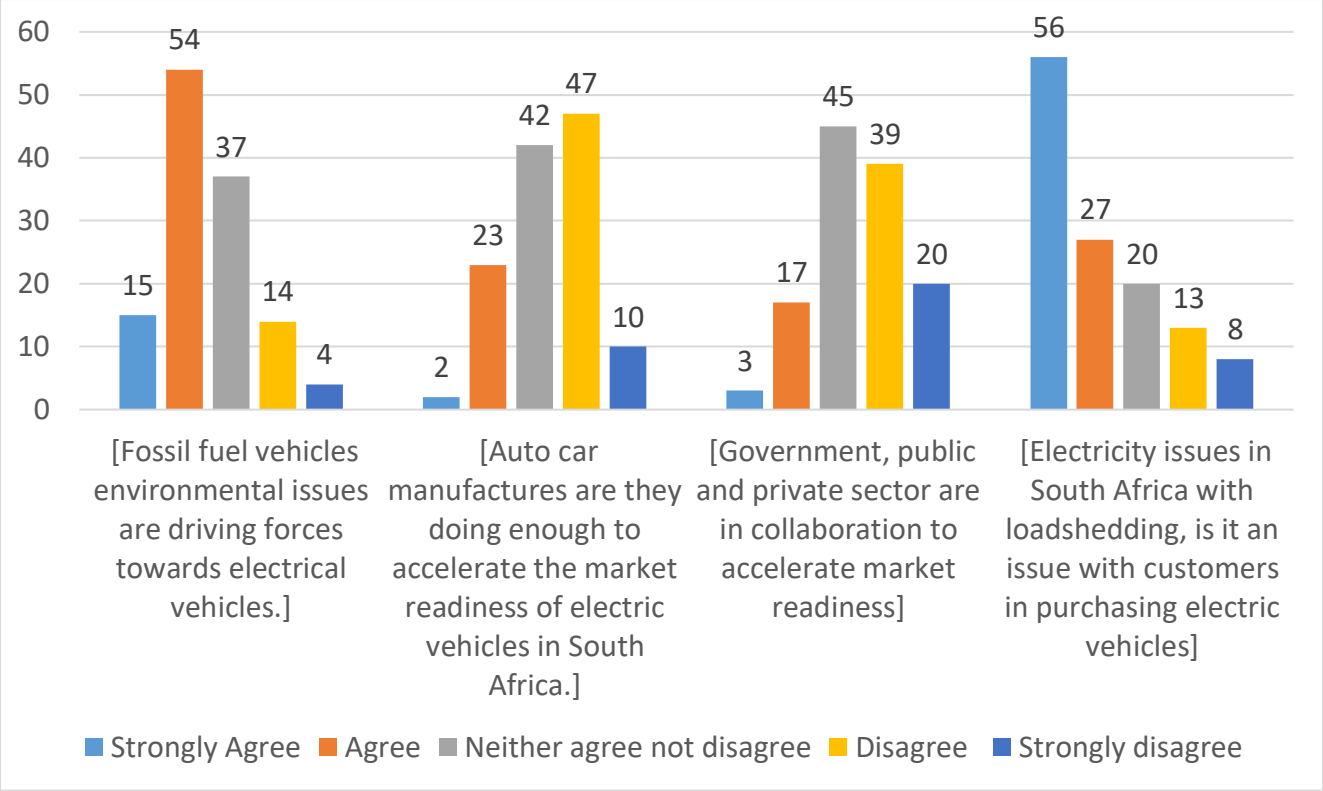

Figure 11: The factors influencing electric vehicles, are they clear and understood for the market readiness of electric vehicles in South Africa, including internal and external factors

A total of 54 respondents agree that fossil fuel vehicle environmental issues are a driving force towards electrical vehicles, while 15 strongly agree that fossil fuel vehicle environmental issues are driving towards electrical vehicles. 14 respondents disagree that fossil fuel vehicle environmental issues are a driving force towards the electrical vehicle, with 4 respondents strongly disagree that fossil fuel vehicle environmental issues are a driving force, with 37 respondents neither agreeing nor disagree that fossil fuel vehicle environmental issues are a driving force towards electrical vehicles. 23 respondents agree that auto manufacturers are doing enough to accelerate the market readiness for electrical vehicles, while 2 respondents strongly agree that auto manufacturers are doing enough to accelerate the market readiness. 47 respondents disagree that auto manufacturers are doing enough to accelerate the market readiness for electrical vehicles, 10 respondents strongly disagree that auto manufacturers are doing enough to accelerate the market readiness, and 42 respondents neither agree nor disagree that auto manufacturers are doing enough to accelerate the market readiness.

A sum of 17 respondents agrees that the government, public and private sectors are in collaboration to accelerate the market readiness of electrical vehicles in the SA market, while 3

respondents strongly agree that the government, public and private sectors are in collaboration to accelerate the market readiness. 39 respondents disagree that the government, public and private sector are in collaboration to accelerate the market readiness of electrical vehicles in the SA market, while 20 respondents strongly disagree that the government, public and private sector are in collaboration to accelerate the market readiness with 45 neither agree nor disagree that auto manufacturers are doing enough to accelerate the market readiness for electrical vehicles in South Africa. 27 respondents agree that electricity issues in South Africa with load-shedding is an issue with customers purchasing electric vehicles. In comparison, 56 respondents strongly agree that electricity issues in South Africa with load-shedding are an issue with customers purchasing electrical vehicles. 13 respondents disagree that electricity issues in South Africa with load-shedding are an issue with customers purchasing electric vehicles. In comparison, 8 respondents strongly disagree that electricity issues in South Africa with load-shedding are an issue with customers purchasing electric vehicles, with 20 respondents neither agreeing nor disagree that electricity issues in South Africa with load-shedding are an issue in purchasing electric vehicles.

Table 4: Summary statistics on factors influencing electric vehicles. Are they clear and understanding of the market readiness of electric vehicles in South Africa, including internal and external factors?

	N	Minimum	Maximum	Mean		Std. Deviation	Skewness	
	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Statistic	Std. Error
[Government involvement helps improve the readiness for the electric vehicle market.]	124	1	5	2.69	.114	1.270	.161	.217
[The government initiatives help in advancing the electric vehicle market.]	124	1	5	2.58	.110	1.224	.229	.217

[The introduction of incentives by the government in partnership with auto manufacturers will accelerate the market readiness of electric vehicles in South Africa]	124	1	5	3.25	.111	1.240	-.359	.217
Valid N (listwise)	124							

Source: Author

The above table summarises statistics on factors influencing electric vehicles where respondents indicate that government involvement helps improve the market readiness for electric vehicles with a Mean = 2.69 and Std Deviation of 1.270. Respondents indicate that government initiatives help advance the electric vehicles market with a Mean =2.58 and an Std Deviation of 1.124. Respondents indicate that government incentives with auto manufacturers will accelerate the market readiness of electric vehicles in South Africa with a Mean = 3.25 and Std Deviation of 1.240. Auto manufacturers and government initiatives accelerate the market for electric vehicles in South Africa.

$H2_0$ Auto manufacturers and government do not have initiatives to accelerate the market for electric vehicles in South Africa.
$H2_1$ Auto manufacturers and government initiatives accelerate the market for electric vehicles in South Africa.

Table 5: Statistical hypothesis of the influence of the market readiness for electric vehicles in South Africa by internal and external factors.

Null Hypothesis	Test	Sig. a,b	Decision
The median of [The government involvement helps improve the readiness for the electric vehicle market.] equals 3.	One-Sample Wilcoxon Signed Rank Test	.006	Reject the null hypothesis.

The median of [The government initiatives help advance the electric vehicle market.] equals 3.	One-Sample Wilcoxon Signed Rank Test	<.001	Reject the null hypothesis.
The median of [The introduction of incentives by the government in partnership with auto manufacturers will accelerate the market readiness of electric vehicles in South Africa] equals 3.	One-Sample Wilcoxon Signed Rank Test	.047	Reject the null hypothesis.

Source: Author

When using one- Sample, Wilcoxon asked respondents if government involvement helps improve the readiness for the electric vehicle market. The result was .006, which implies that we reject the null hypothesis and conclude that auto manufacturers and government initiatives do not accelerate the market for electric vehicles in South Africa. When respondents were asked if government involvement initiatives help in advancing the electric vehicle market, the results were <.001, meaning it was less than the significant value of 0.05 and which implies that we reject the null hypothesis that says auto manufacturers and government initiatives accelerate the market for electric vehicles in South Africa. When asking respondents if the introduction of incentives by the government in partnership with auto manufacturers will accelerate the market readiness of electric vehicles in South Africa, the result was .047, meaning it was less than the significant value of 0.05 and which implies that we reject the null hypothesis that says auto manufacturers and government initiatives accelerate the market for a vehicle in South Africa.

4.6 Auto manufacturers and government initiatives accelerate the market for electric vehicles in South Africa (Infrastructure development and investment)

Figure 12 below represents the frequency distribution of all respondents to the sub-question about auto manufacturers and government initiatives that accelerates the market for electric vehicles in South Africa. Infrastructure development and investment.

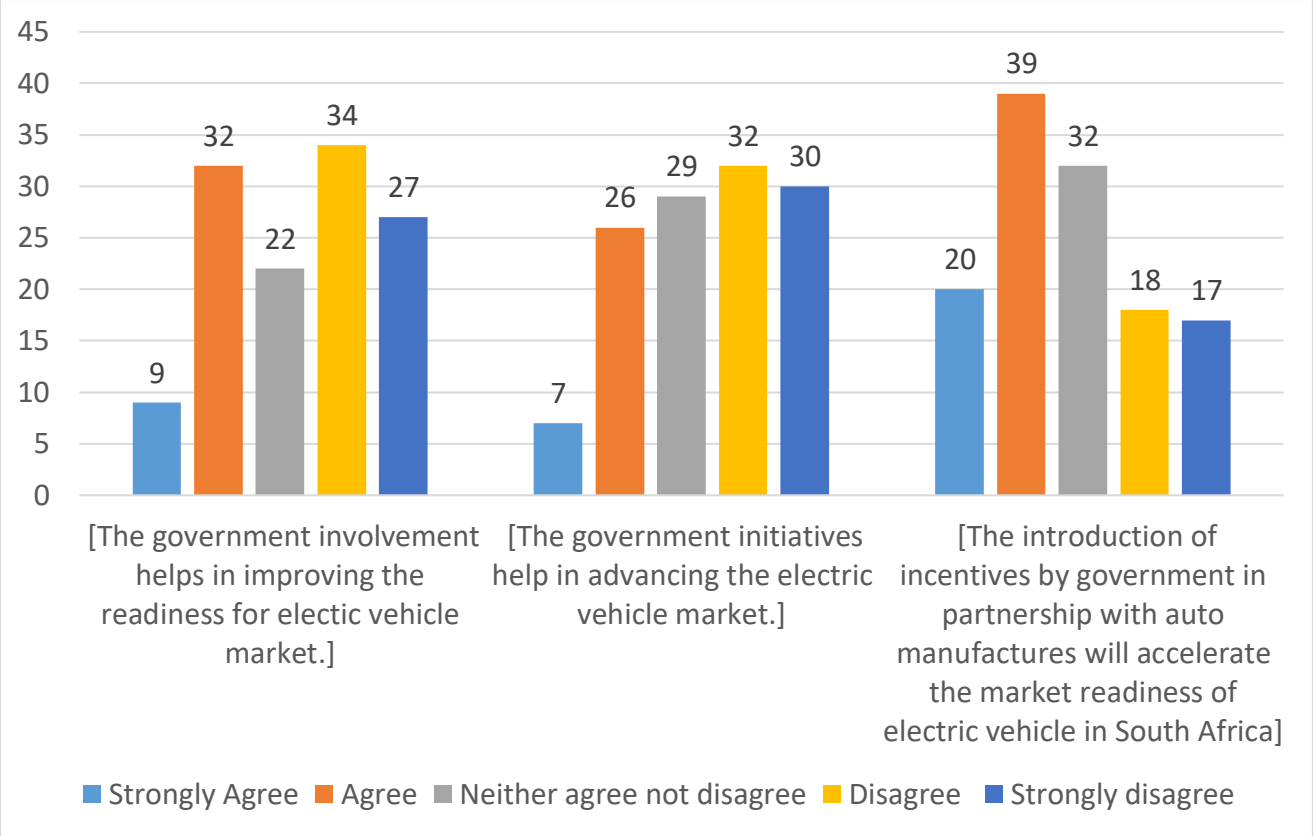

Figure 12: Auto manufacturers and government initiatives accelerate the market for electric vehicles in South Africa. Infrastructure development and investment

Figure 12 shows that 32 respondents agree that government involvement helps improve the readiness for the electrical vehicle market, while 9 respondents strongly agree that government involvement helps in improving the readiness for the electrical vehicle market. 34 Respondents disagree that government involvement helps in improving the market readiness for the electrical vehicle market, with 27 respondents strongly disagreeing that government involvement improves the readiness for the electrical vehicle market, while 22 respondents neither agree nor disagree that the government helps in improving the market readiness for electrical vehicles. 26 Respondents agree that government initiatives help in advancing the electric vehicle market, while 7 strongly agree that the government initiative help in advancing the electric market. 32 Respondents disagree that the government initiatives help in advancing the electric vehicle market, 30 respondents strongly disagree that the government initiative help in advancing the electric market, while 29 respondents neither agree nor disagree that the government initiatives help in advancing the electric vehicle market.

A sum of 39 respondents agrees that the introduction of incentives by the government in partnership with auto manufacturers will accelerate the market readiness of electrical vehicles, while 20 strongly agree that the introduction of incentives by the government in partnership with auto manufacturers will accelerate the market readiness of electrical vehicles. 18 Respondents disagree that the introduction of incentives by the government in partnership with auto manufacturers will accelerate the market readiness, with 15 strongly disagreeing that the introduction of incentives by the government in partnership with auto manufacturers will accelerate the market readiness, while 32 neither agree nor disagree.

Table 6: Summary statistics on auto manufacturers and government initiatives that accelerate the market for electric vehicles in South Africa. Infrastructure development and investment

	N	Minimum	Maximum	Mean		Std. Deviation	Skewness	
	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Statistic	Std. Error
[Fossil fuel vehicles' environmental issues are driving forces towards electrical vehicles.]	124	1	5	3.50	.086	.958	-.535	.217
[Auto car manufacturers are doing enough to accelerate the market readiness of electric vehicles in South Africa.]	124	1	5	2.68	.083	.924	.187	.217
[Government, public and private sectors are in collaboration to accelerate market readiness]	124	1	5	2.55	.090	.999	.163	.217
[Electricity issues in South Africa with load-shedding, is it an issue with customers in purchasing electric vehicles]	124	1	5	3.89	.114	1.270	-.874	.217
Valid N (listwise)	124							

Source Author

The above statistical summary on auto manufacturers and government initiatives accelerates the market for electric vehicles in South Africa. Infrastructure development and investment. Respondents, when asked If fossil fuel vehicles' environmental issues are the driving forces towards electric vehicles results, indicate a Mean = 3.50 and Std Deviation .958. When asked if auto car manufacturers are doing enough to accelerate the market readiness for electric vehicle results, respondents indicate a Mean = 2.68 and an Std Deviation of .924. Respondents, when asked if Government, Public and Private sectors are collaborating to accelerate the market readiness of electric vehicles, indicate a Mean of 2.55 and an Std Deviation of .999. Respondents, when asked if electrical issues in South Africa with Load-shedding is an issue with customers purchasing electrical vehicles, indicated a Mean of 3.89 and an Std Deviation of 1.270.

$H3_0$ Government involvement does not influence the market readiness for electric vehicles in South Africa.

$H3_1$ Government involvement influences the market readiness for electric vehicles in South Africa.

Table 7: Statistical hypothesis of auto manufacturers and government initiatives accelerates the market for electric vehicles in South Africa. Infrastructure development and investment

Null Hypothesis	Test	Sig. a,b	Decision
The median of [Fossil fuel vehicles environmental issues are driving forces towards electrical vehicles.] equals 3.	One-Sample Wilcoxon Signed Rank Test	<.001	Reject the null hypothesis.
The median of [Auto car manufacturers are doing enough to accelerate the market readiness of electric vehicles in South Africa.] equals 3.	One-Sample Wilcoxon Signed Rank Test	<.001	Reject the null hypothesis.
The median of [Government, public and private sector collaborate to accelerate market readiness] equals 3.	One-Sample Wilcoxon Signed Rank Test	<.001	Reject the null hypothesis.
The median of [Electricity issues in South Africa with load-shedding, is it an issue with customers purchasing electric vehicles] equals 3.	One-Sample Wilcoxon Signed Rank Test	<.001	Reject the null hypothesis.

Source: Author

When using one- Sample, Wilcoxon asked respondents if fossil fuel vehicles' environmental issues are driving forces towards electrical vehicles; the results were <.001, meaning it was less than a significant value of 0.05, which implies that we reject the null hypothesis that says the government

involvement influences the market readiness for electric vehicles in South Africa. When asking respondents if auto car manufacturers are doing enough to accelerate the market readiness for electric vehicles in South Africa and the result was <.001, meaning it was less than the significant value of 0.05, which implies that we reject the null hypothesis that says the government involvement influences the market readiness for electric vehicles in South Africa. When asking respondents if the government, public and private sectors are collaborating to accelerate market readiness, the results <.001 mean it was less than the significant value of 0.05, implying that we reject the null hypothesis that says government involvement influences market readiness for electrical vehicles. When asking respondents if electricity issues in South Africa with load-shedding is an issue with customers purchasing electric vehicles, the results were<.001 means it was less than a significant value of 0.05 which implies that it rejects the null hypothesis that says government involvement influences the market readiness for electrical vehicles.

4.7 Auto car manufacturers and government strategies enhance the market readiness for electric vehicles in South Africa.

Figure 13 below represents the frequency distribution of all respondents to the sub-question on auto car manufacturers and government strategies that enhances the market for electric vehicles in South Africa.

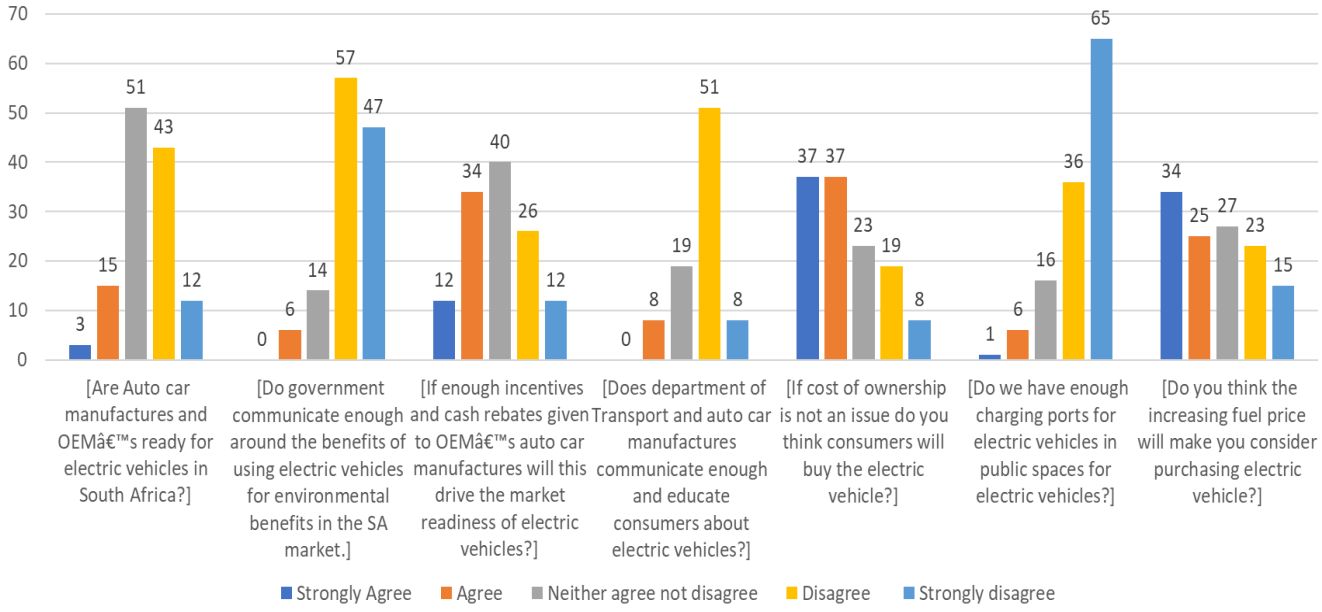

Figure 13: Are Auto manufacturers and OEMs getting support in South Africa from the government in providing incentives and rebates for producing electric vehicles in the SA market

Fifteen (15) respondents agree that auto manufacturers and OEMs are ready for electric vehicles in South Africa, while 3 respondents strongly agree that auto manufacturers and OEMs are ready for electric vehicles in South Africa. 43 respondents disagree that auto manufacturers and OEMs are ready for electric vehicles in South Africa, while 12 strongly disagree that manufacturers and OEMs are ready for electric vehicles in South Africa, with 51 respondents neither agreeing nor disagreeing that auto manufacturers and OEMs are ready for electric vehicles in South Africa. 6 respondents agree that government communicate enough around the benefits using the electrical vehicle for environmental benefits in SA market. 57 respondents disagree that government communicate enough about the benefits of using electric vehicles for environmental benefits in the SA market, while 47 respondents strongly disagree that government communicate enough about the benefits of using electric vehicles for environmental benefits in the SA market, with 14 respondents neither agree nor disagree that government communicate enough around the benefits of using electric vehicles for environmental benefits in SA market.

Thirty-four respondents agree that enough incentives and rebates given to OEMs and Auto manufacturers will drive the market readiness for an electric vehicle, while 12 respondents strongly agree that enough incentives and rebates given to OEMs and Auto manufacturers will drive the market readiness for an electric vehicle. Twenty-six respondents disagree that enough incentives and rebates given to OEMs and Auto manufacturers will drive the market readiness for EVs, with 12 respondents strongly disagreeing that enough incentives and rebates given to OEMs and Auto manufacturers will drive the market readiness for an electrical vehicle, with 40 respondents neither agree nor disagree. Eight respondents agree Department of Transport and Auto car manufacturers communicate enough and educate consumers about electric vehicles in South Africa. In comparison, 51 respondents disagree that the Department of Transport and Auto car manufacturers communicate enough and educate consumers about electric vehicles, with 46 respondents strongly disagreeing that the Department of Transport and Auto car manufacturers communicate enough and educate consumers about electric vehicles. In comparison, 19 respondents neither agree nor disagree that the Department of Transport and Auto car manufacturers communicate enough to educate consumers.

Thirty-seven respondents agree that if the cost of ownership is not an issue, they will purchase an electric vehicle. Also, 37 respondents strongly agree that if the cost of ownership is not an issue, they will purchase an electric vehicle. Nineteen respondents disagree that if the cost of ownership is not an issue, they will purchase an electric vehicle, with eight strongly disagreeing that they will

purchase an electric vehicle, while 23 respondents neither agree nor disagree that if the cost of ownership is not an issue, they will purchase an electric vehicle. Six respondents agree that we have enough charging ports for electrical vehicles in South Africa, while one strongly agrees. Thirty-six respondents disagree that we have enough charging ports for electrical vehicles, while 65 respondents strongly disagree that we have enough charging ports for electrical vehicles in SA, with 16 respondents neither agreeing nor disagreeing that if the cost of ownership is not an issue, they will purchase an electrical vehicle. Twenty-five respondents agree that with the ever-increasing fuel price, they will consider purchasing electric vehicles, while 34 respondents strongly agree that with the ever-increasing fuel price, they will consider purchasing electric vehicles. Twenty-three respondents disagree that the ever-increasing fuel price they will consider purchasing an electric vehicle, while 15 respondents strongly disagree that with the ever-increasing fuel price, they will consider purchasing an electric vehicle, with 27 respondents neither agree nor disagree that with the ever-increasing fuel price, they will consider purchasing electric vehicles.

Table 8: Summary statistics on Auto manufacturers and OEMs getting support in South Africa from the government in providing incentives and rebates for producing electric vehicles in the SA market.

	N	Minimum	Maximum	Mean		Std. Deviation	Skewness	
	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Statistic	Std. Error
[Are auto manufacturers and OEMs ready for electric vehicles in South Africa?]	124	1	5	2.63	.081	.906	.207	.217
[Do government communicate enough about the benefits of using electric vehicles in the SA market for environmental benefits.]	124	1	4	1.83	.073	.814	.874	.217
[If enough incentives and cash rebates are given to OEMs auto car manufacturers, will this drive the market readiness of electric vehicles?]	124	1	5	3.06	.101	1.124	-.129	.217
[Does the Department of Transport and auto car manufacturers communicate enough and educate consumers about electric vehicles?]	124	1	4	1.91	.079	.884	.750	.217
[If the cost of ownership is not an issue, do you think consumers will buy the electric vehicle?]	124	1	5	3.61	.111	1.241	-.548	.217
[Do we have enough charging ports for electric vehicles in public spaces for electric vehicles?]	124	1	5	1.73	.083	.923	1.207	.217
[Do you think the increasing fuel price will make you consider purchasing an electric vehicle?]	124	1	5	3.32	.123	1.371	-.237	.217
Valid N (listwise)	124							

Source: Author

The above statistical summary on Auto manufacturers and OEMs is getting support in South Africa from the government in providing incentives and rebates for producing electric vehicles in the SA market. Respondents, when asked if Auto Car Manufacturers and OEMs are ready for electric vehicles in South Africa, and results indicate Mean = 2.63 with an Std Deviation .906. Respondents, when asked if the government communicates enough about the benefits of using electric vehicles for environmental benefits and results, indicate Mean = 1.83 with an Std Deviation .814. Respondents, when asked if enough rebates given to OEMs and Auto Car Manufacturers will drive the market readiness for electric vehicles results, mean = 3.06 with an Std Deviation of 1.124. When asked if the Department of Transport and Auto Car Manufacturers communicate enough and educate consumers about electric vehicles, the results indicate a Mean = 1.91 and a Std Deviation of .884. Respondents, when asked if the cost of ownership is not an issue, do they think that consumers will purchase electric vehicles, and results indicate a Mean = 3.61 with an Std Deviation 1.241. Respondents, when asked if the SA market has enough charging ports for electric vehicles in public spaces, the results indicated a Mean = 1.73 with an Std Deviation of .923. Respondents, when asked about the increasing fuel price will make them consider buying an electric vehicle, and results indicate a Mean = 3.32 with an Std Deviation of 1.371

$H4_0$ Auto car manufacturers and government strategies do not enhance the market readiness for electric vehicles in South Africa.
$H4_1$ Auto car manufacturers and government strategies enhance the market readiness for electric vehicles in South Africa.

Table 9: Statistical hypothesis Auto car manufacturers and the government strategies enhance the market readiness for electric vehicles in South Africa

Null Hypothesis	Test	Sig. a,b	Decision
The median of [Are Auto car manufacturers and OEMs ready for electric vehicles in South Africa?] equals 3.	One-Sample Wilcoxon Signed Rank Test	<.001	Reject the null hypothesis.

The median of [Do government communicate enough around the benefits of using electric vehicles for environmental benefits in the SA market.] equals 3.	One-Sample Wilcoxon Signed Rank Test	.000	Reject the null hypothesis.
The median of [If enough incentives and cash rebates are given to OEMs auto car manufacturers, will this drive the market readiness of electric vehicles?] equals 3.	One-Sample Wilcoxon Signed Rank Test	.567	Retain the null hypothesis.
The median of [Does the Department of Transport and auto car manufacturers communicate enough and educate consumers about electric vehicles?] equals 3.	One-Sample Wilcoxon Signed Rank Test	.000	Reject the null hypothesis.
The median of [If the cost of ownership is not an issue, do you think consumers will buy the electric vehicle?] equals 3.	One-Sample Wilcoxon Signed Rank Test	<.001	Reject the null hypothesis.
The median of [Do we have enough charging ports for electric vehicles in public spaces for electric vehicles?] equals 3.	One-Sample Wilcoxon Signed Rank Test	.000	Reject the null hypothesis.
The median of [Do you think the increasing fuel price will make you consider purchasing an electric vehicle?] equals 3.	One-Sample Wilcoxon Signed Rank Test	.008	Reject the null hypothesis.

Source: author

When asking respondents if enough incentives and cash rebates given to OEMs auto car manufacturers will drive the market readiness of electrical vehicles, the results were <.001, which is less than 0.05, which implies that we reject the null hypothesis that auto car manufacturers and the government strategies enhance the market readiness for electric vehicles in South Africa. When asking respondents if do government communicate enough about the benefits of using electric vehicles for environmental benefits in the SA market and the result was .000, which is less than 0.05, which implies that we reject the null hypothesis that auto car manufacturers and governments strategies enhance the market readiness for electric vehicles in South Africa. When asking respondents if enough rebates and cash incentives given to OEMs auto car manufacturers will drive this drive market readiness and the result was .567, which is greater than 0.05, and this implies that we accept the null hypothesis that says auto car manufacturers and the government strategies enhances the market readiness for electric vehicles in South Africa. When asking respondents whether the department of transport and auto car manufacturers communicate enough and educate consumers about electric vehicles, the result was .000. This implies that we reject the hypothesis that says auto car manufacturers. Government strategies enhance the market readiness for electric vehicles in South Africa.

When asking respondents whether the department of transport and auto car Manufacturers communicate enough and educate consumers about electric vehicles, the result was .000, which is less than 0.05 and implies that we reject the hypothesis that says auto car manufacturers and government strategies enhance the market readiness. When asking respondents if the cost of ownership is not an issue, do they think consumers will buy electric vehicles? The result was <.001, less than 0.05, implying that we reject the hypothesis that auto car manufacturers and government strategies enhance market readiness. When asking respondents if we have enough charging ports for electric vehicles in public spaces, the results were .000, less than 0.05, implying that we reject the hypothesis that auto manufacturers and government strategies enhance market readiness. When asking respondents if they think the increasing fuel price will make them consider purchasing electric vehicles, the result was .008, which is less than 0.05, implying that we reject the hypothesis that auto manufacturers and government strategies enhance market readiness.

4.8 Comparing results with other similar studies of electric vehicles

The study by Mtogwane and Moeletsi (2021) found that the cost of electric vehicles and charging infrastructure availability, and electricity load-shedding in South Africa were the main constraints for the electrical vehicle market in agreement with this study where respondents indicated that

electricity issues in South Africa with load-shedding is an issue with customers in purchasing electric vehicles with a Mean of 3.89 which is a constraint for SA market when it comes to electric vehicles. Respondents in this study also agree that we do not have enough charging ports for electric vehicles for market readiness with electric vehicles.

A study by Skerlos and Winebrake (2010) found that developed countries allocated funding and stimulus to promote the adoption of electric vehicles, and this study also indicated that the introduction of incentives by the government in partnership with auto manufacturers would accelerate the market readiness for electrical vehicles in South Africa with statistical evidence means of 3.25 which respondents agree that SA market will need incentives from the government to accelerate the market for electrical vehicles. According to a study by Matulka (2014), electrical vehicles are popular in urban residences and are perfect for short trips around towns and cities. In this study, respondents from Johannesburg, Durban, Cape Town, and Port Elizabeth were familiar with electric vehicles and had seen electrical vehicles in major cities of South Africa.

In a study by Kwame (2019) titled unpacking the technical and perception barriers to electric vehicle uptake in South Africa, findings were that purchasing electric vehicles was accelerating globally, with China, Europe, and the United States among the highest growth with the purchase of electric vehicles. In this study, respondents were asked if auto manufacturers and OEMs are ready for electric vehicles, with a Mean of 2.63, meaning that auto manufacturers and OEMs are not ready to accelerate the electric vehicle market in South Africa. The article by Auto Trader CEO Mienie (2021) indicated that consumer education would play an important role in the adoption and perception towards electric vehicles and market readiness, which is in agreement with the respondents in this study where a Mean of 1.83 that the government are not communicating around the benefits of using electric vehicles for environmental benefits in the SA market, this study also found a mean 1.91 with respondents indicating Department of Transport and auto manufacturers are not communicating enough to educate consumers about electric vehicles.

4.9 Chapter Summary

In conclusion, the above analysis indicated that respondents are familiar with electric vehicles, and there is statistical evidence of a Mean = 3.77 when respondents were asked if they were familiar with electric vehicles, which shows most of the respondents agreed. Respondents also indicated having seen an electric vehicle on the road in South Africa with statistical evidence of a Mean = 3.42, which they agreed to have seen electric vehicles in SA on the road. In our analysis, respondents also think owning an electric vehicle will assist SA in reducing emissions, with a Mean

= 3.44, which positively agrees with the statement. Most respondents agree that they can use a taxi electric vehicle as a mode of transport, with a Mean = 3.44 and indicated they could use an electric bus vehicle, with a Mean = 3.39. Respondents indicated that electric vehicles are costly, with statistical evidence of Mean = 3.75. Respondents indicated that the introduction of incentives by the government in partnership with auto manufacturers would accelerate the market readiness for electric vehicles, with statistical evidence Mean of 3.25, but respondents indicated that the government are not doing enough to improve the market readiness for electric vehicles with statistical evidence Mean of 2.69 and government initiatives are not helping in advancing electric vehicle market with statistical evidence of a Mean of 2.58

CHAPTER 5: DISCUSSION OF RESULTS

5.1 Introduction

In this chapter, we unpack the data analysis and respondents in which the statistical package for social scientists (SPSS) was applied to analyse the data collected.

5.2 Demographic factors

The first part of the questionnaires was created to gather the characteristics of the research participants and ascertain the degree to which respondents understand the electric vehicle market in terms of market readiness for electric vehicles in South Africa. One hundred twenty-four respondents, 63.7 % males and 36.3% females, participated in the study. The respondents were in different levels of education, with the Honours level representing 23.4% Bachelor's level representing 28.2% which indicated the highest-level representation. The diploma represents 24.2 which was the second highest-level representation. The Master's level represents 13.7% of respondents, respondents with Matric represent 8.9%, and 1.6% represent Doctorate level in this research.

The study indicated that respondents were concentrated between Johannesburg and Durban, with 48.4% residing in Johannesburg and 38.7% residing in Durban. 10.5% of respondents reside in Cape Town, and 2.4% are in Port Elizabeth. Respondents indicated the mode of transport they were currently using during the study, with an overwhelming 87.9 % of respondents using private cars in the major cities they reside. 11.3 % of respondents confirmed to be using public taxi transport, and 0.8% of respondents used Bus as a form of transport; interesting, for this study, none were using a Train. In this study, 66.1 % of respondents work in the private sector, with 14.5% working in government, 15.3% being entrepreneurs/ business owners, and 4% are unemployed/prefer not to say.

5.3 Descriptive Statistical Analysis

The results of the statistical analysis on the below themes

5.3.1 Objective one of this study

Knowledge of electric vehicles, including the type of electric vehicles respondents, are familiar with. Respondents indicated that they are familiar with electric vehicles with a (Mean = 3.77),

which is a positive response. Respondents indicated that they had seen an electric vehicle on the road in South Africa with a (Mean = 3.42), which is a positive response. Respondents indicated that owning an electric vehicle will assist SA in reducing emissions with a (Mean = 3.44), which is a positive response. Respondents indicated that they could use a taxi electric vehicle as a mode of transport with a Mean of 3.34, which is a positive response. Respondents indicated that they could use an electric bus vehicle as a mode of transport with a (Mean = 3.39), which is a positive response. Respondents agree that electric vehicles are costly (Mean =3.75). Assessing the above theme on knowledge of electric vehicles indicates that respondents are aware of electric vehicles and understand that electric vehicles can assist in reducing emissions in South Africa. They can use different types of electric vehicles in South Africa and think electric vehicles are costly for the readiness of the electric vehicles market in South Africa.

5.3.2 Objective two of this study

Internal and external factors influence the market readiness for electric vehicles in South Africa. Respondents indicated that government involvement helps improve the readiness for the electric vehicle market with a (Mean = 2.69), which is not in agreement that government involvement will help improve electric vehicle market readiness. Respondents indicated that the government initiatives help in advancing the electric vehicle market with a (Mean = 2.58), while respondents are not in agreement that government initiatives help in advancing the electric vehicle market. Respondents indicated that the introduction of incentives by the government in partnership with auto manufacturers would accelerate the market readiness of electric vehicles in South Africa with a (Mean = 3.25), which is a positive response meaning the respondents agree with the introduction of incentives by government in partnership will accelerate the market readiness of electric vehicles.

5.3.3 Objective three of this study

Auto manufacturers and government initiatives accelerate the market for electric vehicles in South Africa, Infrastructure development and investment. Respondents indicate that fossil fuel vehicles' environmental issues are the driving forces towards electrical vehicles with Mean = 3.50, which is a positive response that respondents agree that fossil fuel vehicle environmental issues are the driving forces towards electrical vehicles. Respondents indicate that Auto Car Manufacturers are doing enough to accelerate the market readiness of electric vehicles in South Africa with a (Mean = 2.68), which means respondents do not agree that auto car manufacturers are doing enough to accelerate the market readiness of electric vehicles in South Africa. Respondents indicated that the

government, public and private sectors are collaborating to accelerate market readiness with a (Mean= 2.55), while respondents do not agree that the government, public sector, and private sector are collaborating to accelerate market readiness of electric vehicles in South Africa. Respondents indicated that electricity issues in South Africa with load-shedding is an issue with customers in purchasing electric vehicles with a (Mean= 3.89) which respondents positively agree that electricity in South Africa with load-shedding is an issue with customers in purchasing electric vehicles

5.3.4 Objective four of this study

Are Auto manufacturers and OEMs getting support in South Africa from the government in providing incentives and rebates for producing electric vehicles in the SA market? Respondents indicate that Auto car manufacturers and OEMs market readiness for electric vehicles in South Africa with a (Mean= 2.63), which respondents are not agreement that Auto manufacturers and OEMs are ready for electric vehicles in South Africa. Respondents indicated that government do not communicate enough about the benefits of using electric vehicles for environmental benefits in the SA market with a (Mean = 1.83), which means respondents are not in agreement that government communicate enough about the benefits of using electric vehicles for environmental benefits in the SA market. Respondents indicate that enough incentives and cash rebates given to OEMs auto car manufacturers will drive the market readiness of electric vehicles with a (Mean = 3.06) which respondents agree that enough incentives and cash rebates given to OEMs auto car manufacturers will drive the market readiness of electric vehicles. Respondents indicate that the Department of Transport and Auto Car Manufacturers communicate enough and educate consumers about electric vehicles with a (Mean = 1.91), while respondents do not agree that the department of transport and auto car Manufacturers communicates enough and educates consumers about electric vehicles. Respondents indicate the cost of ownership is not an issue, do. Do they think consumers will buy electric vehicles with a (Mean = 3.61)? Respondents agree that if ownership costs are not an issue, consumers will buy electric vehicles in South Africa. Respondents indicate if we have enough charging ports for electric vehicles in public spaces with a (Mean = 1.73), which respondents agree that we don't have enough charging ports for electric vehicles in public spaces for electric vehicles in South Africa. Respondents indicate that the increasing fuel price will make them consider purchasing electric vehicles with a (Mean = 3.32). Respondents agree that increasing fuel prices in South Africa will make them consider purchasing electric vehicles.

5.4 Discussing the results of the study objectives.

5.4.1 To establish factors influencing the market readiness of electric vehicles in South Africa

Carbon footprint and CO2 emission in which the transport sector is perceived as one of the main contributors to CO2 emission and carbon footprint, which is growing at an alarming rate, and electric vehicle mobility has not grown at a fast pace to curb the increasing CO2 mission and has established in the study that fossil fuel vehicles environmental issues are the driving forces towards the electrical vehicles with a(Mean =3.50) which is in agreement that transport sector is perceived as one of the main contributors of CO2 emission which is the same sentiments that respondents lean towards. Financial factors and other factors influencing the market readiness with environmental benefits, with financial incentives and other factors which consist of charging ports and the cost of electric vehicles, our analysis established that these factors were the introduction of incentives by the government in partnership with auto manufacturers will accelerate the market readiness of electric vehicles with a (Mean =3.25)which indicates financial incentives is a factor which influences market readiness. Respondents also indicated that if enough incentives and cash rebates are given to OEMs, auto car manufacturers will drive the market readiness of electric vehicles with a (Mean= 3.06). Respondents in another factor influencing market readiness factor about charging ports with a (Mean= 1.73) that we do not have enough charging ports for electric vehicles in public spaces for electric vehicles. Market drivers for macro-economic factors with the fuel price increasing which respondents indicated with a (Mean =3.32) in agreement that fuel prices will make respondents consider purchasing electric vehicles and the cost of ownership if it was not an issue respondents will buy electric vehicles and the (Mean =3.61) which is strongly suggesting that cost of the electric vehicle is a cost factor.

5.4.2 Examining market readiness of electric vehicles with auto manufacturers and government initiatives to accelerate the market for electric vehicles in South Africa

The department of public transport needs to demonstrate the business case for the electric vehicles in; which the study indicated that respondents would consider owning an electric vehicle in assisting South Africa in reducing emissions with a (Mean =3.44), which is a positive response for SA market readiness when it comes to addressing the emission problem in South Africa. Respondents indicated that they could use a taxi electric vehicle as the mode of transport with a

(Mean =3.34), which is a positive response that respondents can commute using a taxi electric vehicle in South Africa. Respondents indicated that they could use an electric bus vehicle as the mode of transport with a (Mean = 3.39), which is a positive response that respondents can commute using bus electric vehicles in South Africa, where the department of transport need to do a business case with OEMs and Auto car manufacturers to manufacture electric taxis and business to accelerate market considering infrastructure development and investment to enable the acceleration of this initiatives. Global EV outlook (2020) the global EV market was estimated valued around R1.6 trillion (USD 118.9 billion). The EV reports suggested that private transport sector segments account for the largest portion of the global market with electric vehicles. Department of Trade and Industry in South Africa in 2013 proposed a road map with proposed incentives for manufacturers to locally produce electric vehicles and cashback incentives be put in place to produce a minimum of 5000 units of electric vehicles annually to qualify for 35% cash back investment initiative to promote the acceleration of electric vehicles in South Africa (Electric vehicle market intelligence report)

5.4.3 Establishing the readiness of auto manufacturers and government in South Africa for electric vehicles.

In this study, the respondents indicated that Auto manufacturers and OEMs are not ready for electric vehicles which respondents indicated a (Mean = 2.63) about the readiness of auto manufacturers and the government, and respondents indicated that the department of transport and auto car manufacturers do not communicate enough to educate consumers about electric vehicles with a (Mean = 1.9). Respondents indicated that auto manufacturers are not doing enough to accelerate the market readiness for electric vehicles with a (Mean = 2 .68), with government, public and private sectors not in collaboration to accelerate the market with a (Mean of 2.55)

5.4.4 Strategies to enhance the market readiness of electric vehicles with auto car manufacturers and government playing a critical role.

To effectively recommend strategies to enhance the market readiness for electric vehicles in the SA market, start with educating consumers about electric vehicles and the benefits of adopting electric vehicles in South Africa in collaboration with auto car manufacturers and the government. In this study, respondents indicated that government do not communicate enough about the benefits of using electric vehicles for the environmental benefits of the SA market with a(Mean =

1.83), and the Department of Transport and auto car manufacturers do not communicate enough to educate consumers about electric vehicles with a(Mean =1.91) which suggests that there is need for a drive to inform and communicate the public about the benefits of using electric vehicles which will increase the benefits to meet the emission reduction targets. The government needs to develop a communication framework roadmap to educate South Africans about the benefits of electric vehicles and develop a strategy for infrastructure development to accelerate market readiness, including auto car manufacturers and OEMs. The government should invest more in EV charging infrastructure in major cities of South Africa, namely, Johannesburg, Durban, Cape Town, and Port Elizabeth. This will enable market readiness for private use and public transport, electric buses and taxis in all major cities in South Africa. EV charging infrastructure could be an issue if the electricity issue in South Africa is not resolved in the near term future considering the load-shedding and EV charging ports will add load in the form of EV charging ports infrastructure upliftment in public areas in South Africa (Collett, Hirmer, Dalkamann, Crozier, Mulugetta & McCulloch, 2021). Independent power producers will provide a solution to infrastructure development in major cities with charging ports connected to independent power producers to accelerate the market readiness for electric vehicles. In this study, respondents indicated that electricity is an issue in South Africa with load-shedding, which will be an issue for customers purchasing electric vehicles with a (Mean of 3.89), which suggests that electricity issues will affect the market readiness for electrical vehicles in South Africa. Respondents also indicated that we do not have enough charging ports for electric vehicles in public spaces, with a (Mean of 1.73)

5.5 Conclusion

The above analysis applied by the researcher to get findings of the study of market readiness for electric vehicles in South Africa was the finding based on the analysis of all the data collected specifically for this study. The study aimed to achieve objectives which were outlined in chapter one; the researcher applied statistics analysis using SPSS, version 28, for all the data findings about the market readiness for electric vehicles, and the finding of this study matched against other preceding studies to ascertain if this study will reveal other unique findings. The study recommendation aligns with the South African context around market readiness for electric vehicles, but other markets like South Africa may share similar characteristics.

CHAPTER 6: SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

6.1 Introduction

This study sought to understand the market readiness in South Africa in major cities Johannesburg, Durban, Cape Town, and Port Elizabeth. This study explored the research which intended to establish factors influencing the market readiness of electric vehicles, examine the market readiness of electric vehicles with auto car manufacturers and government initiatives to accelerate the market, establish the readiness of auto car manufacturers and government in South Africa for electric vehicles and to recommend strategies to enhance the market readiness of electric vehicles with auto car manufacturers and government playing a critical role.

6.3 Conclusions

6.3.1 Factors influencing the market readiness of electric vehicles in South Africa

The study concludes that the market readiness for electric vehicles in South Africa in influenced by several factors, including environmentalism, government involvement and initiatives, and incentives. Respondents agree that fossil fuel environmental issues are the driving force towards electrical vehicles. In summary statistics, it was clear on the question that asked if government involvement helps improve the readiness for electric vehicle market the (Mean=2.69) indicates that respondents do not agree that government involvement helps improve market readiness for electric vehicles. When respondents were asked if government initiatives help in advancing the electric vehicle market, the (Mean=2.58) indicated that respondents do not agree that government initiatives help in advancing the electric vehicle market. When respondents were asked if the introduction of incentives by the government in partnership with auto manufacturers would accelerate the market readiness for electric vehicles indicated that respondents agreed (Mean= 3.25).

6.3.2 Auto manufacturers and government initiatives accelerate the market vehicles in South Africa

The study concludes that auto manufacturers disagree that government initiatives accelerate the market of vehicles in South Africa. In a summary statistic, when respondents were asked if fossil

fuel vehicles' environmental issues are the driving forces towards electrical vehicles, respondents agreed with a (Mean =3.50), and this indicated that respondents agree with fossil fuel vehicles causing environmental issues. When respondents were asked if auto car manufacturers are doing enough to accelerate the market readiness of electric vehicles and respondents indicated not in agreement with a (Mean =2.68). When respondents were asked if the government, public and private sectors are collaborating to accelerate the market readiness, this indicated that respondents do not agree with a (Mean =2.55); when respondents were asked if electricity issues in South Africa with load-shedding is an issue with customers in purchasing electric vehicles and respondents indicated that they agree with a (Mean= 3.89).

6.3.3 Auto manufacturers and OEMs getting government support

The study concludes that auto manufacturers and OEMs do not obtain support in South Africa by government in providing incentives and rebates in producing electric vehicles in SA market. In the above objective respondents, when asked if auto car manufacturers and OEMs are ready for electric vehicles in South Africa, the respondents do not agree with a (Mean=2.63). When respondents were asked whether do government communicate enough about the benefits of using electric vehicles for environmental benefits in SA and respondents were not in agreement with a Mean =1.83) When respondents were asked if enough incentives and cash rebates were given to OEMs auto car manufacturers if this will drive the market readiness for electric vehicles and respondents agree with a (Mean=3.06) When respondents asked if department of transport and auto car manufacturers communicate enough and educate consumers about electric vehicles and agree disagree with a (Mean=1.91) indicating that department of transport and auto car manufacturers do not communicate and educate consumers about electric vehicles in South Africa. When respondents were asked if the cost of ownership is not an issue they think consumers will buy electric vehicles, respondents agreed with a (Mean=3.61). When respondents were asked if we have enough charging ports for electric vehicles in public spaces for electric vehicles and respondents were not in agreement with a (Mean=1.73). When respondents were asked if they think increasing fuel prices will make them consider purchasing electric vehicles and respondents agreed with a (Mean= 3.32)

6.4 Recommendations of this Study

There is a need to educate consumers about electric vehicles and the benefits of electric vehicles, including the environmental benefits of transitioning from internal combustion engines to electric vehicles. The government is to collaborate with auto manufacturers and OMEs to create a market

readiness for electric vehicles in the public and private sectors. A clear road map for electric vehicle infrastructure and investment in major cities. Cash incentives and rebates attract customers to purchase electric vehicles. Government auto manufacturers work with independent power producers to scale up the acceleration of charging ports in public spaces for electric vehicles.

This study has managed to answer certain partial answers to the research questions objectives and from the literature review, and findings emerged from the scientific part of this study. The following recommended findings are based on the electric vehicles market readiness in South Africa based on the results analysis of this study.

- Factors influencing electric vehicles are clear and understood for the market readiness of electric vehicles, and fossil fuel issues will still be a driving force towards environmental issues, and government and stakeholders need to play a role in educating consumers about environmental issues and emissions, which will influence the market to understand the benefits of moving towards electric vehicles vs the internal combustion engine vehicles.
- There is more that needs to be done by auto manufacturers to accelerate the market readiness, including infrastructure development with the government for charging ports in public spaces to accelerate the market towards electric vehicles. Auto manufacturers must work closely with independent power producers to fast-track the charging port infrastructure.
- The government's resolve of the electricity issues in South Africa will enable the market to consider purchasing electric vehicles. If the electricity load-shedding is not resolved, this will delay the market readiness of electric vehicles.
- The government is to work with auto manufacturers and OEMs and provide incentives and rebates for consumers looking to purchase electric vehicles, enabling market readiness. The OEMs and Auto manufacturers should look at the ownership structure cost for incentives and rebates for consumers interested in purchasing electric vehicles.

6.5 Proposal for future research

The contribution of this study to broader discipline research can be broadened and enhanced by other future research studies on electric vehicles in South Africa by looking at the major dimensional findings, and the results will contribute to the body of knowledge in auto manufacturing, OEMs, department of transport within the government public space and private individuals interested with electric vehicles. The study explored theoretical models, the extant electric vehicles-oriented literature survey, and the research questions to understand the market

readiness of electric vehicles in South Africa despite certain limitations. This study explored insights into this new trend of electrical vehicle adoption around the globe and focussed on the South African market perspective. Based on the results, it will be interesting to find out how this knowledge and information will be shared with stakeholders to support the market readiness of electrical vehicles. Future research should consider addressing infrastructure development issues for electrical vehicles and energy issues in South Africa, considering that South Africa hasn't resolved the load-shedding issue for the past 15 years and how this will affect the transition towards electric vehicles.

6.6 Conclusion of the study

This study found certain differences in factors that affect the market readiness of electric vehicles in South Africa and literature that supported research findings in this study and recommendations. This study found that respondents are familiar with electric vehicles and have seen an electric vehicle on the road in South Africa, and they positively agree that owning an electric vehicle will reduce emissions. Most respondents agree that they can use taxi or bus electric vehicles as the mode of transport and agree that electric vehicles are costly and infrastructure and investment are needed for the electric vehicles market in South Africa. Respondents agree that load-shedding is an issue with customers looking to purchase electric vehicles. When testing the hypothesis, the null hypothesis was less than 0.05, meaning that we should reject the hypothesis for most of the hypotheses tested. This means that even though the respondents are familiar with electric vehicles, the market is not yet ready for electrical vehicles in South Africa, so there is a need for consumer education about the benefits of using electric vehicles needs to be done by the government and auto manufacturers. There is still an infrastructure development for charging ports that the government need to invest in for this market to be ready for electrical vehicles in South Africa, and there is a need for auto manufacturers to provide incentives and assist consumers in purchasing electric vehicles. The government need to work with auto car manufacturers and OEMs to accelerate the market readiness for the electric vehicles market in South Africa.

REFERENCES

Bryła, P., Chatterjee, S., & Ciabiada-Bryła, B. (2023). Consumer Adoption of Electric Vehicles: A Systematic Literature Review. *Energies*, *16*(1), 205-212.

Bryman, A. (2012) Social Research Methods. Oxford University press.

Bessenbach, N., & Wallrapp, S. (2013). *Why do Consumers resist buying Electric Vehicles?* Retrieved May 29, 2022, from https://research.cbs.dk/files/58427925/nadine_bessenbach_og_sebastian_wallrapp.pdf

Carbon Brief. (2022). *Emissions from fossil fuels hit a record high.* Retrieved November 26, 2022, from https://www.carbonbrief.org/analysis-global-co2-emissions-from-fossil-fuels-hit-record-highin-2022/

Hair, J. F., Black, W. C., Babin, B. J., Anderson, R. E., & Tatham, R. L. (2012). *Multivariate data analysis*. New Delhi: Pearson Education Inc. Publisher.

Hair, J.F., Black, W.C., Babin, B.J. and Anderson, R.E. (2014). *Multivariate data analysis* (7th ed.). Edinburgh Gate: Pearson

Ghasri, M., Ardeshiri, A., & Rashidi, T. (2019). Perception towards electric vehicles and the impact on consumers' preference. *Transportation Research Part D: Transport and Environment, 77*(1), 271-291. doi: 10.1016/j.trd.2019.11.003

Global EV. (2022). *Outlook 2021 – Analysis - IEA.* Retrieved June 17, 2022, from https://www.iea.org/reports/global-ev-outlook-2021

Jaiswal, D., Kaushal, V., Kant, R., & Singh, P. K. (2021). Consumer adoption intention for electric vehicles: Insights and evidence from Indian sustainable transportation. *Technological Forecasting and Social Change*, *173*(1), 121089.

Kumar, R. R., Chakraborty, A., & Mandal, P. (2021). Promoting electric vehicle adoption: Who should invest in charging infrastructure? *Transportation Research Part E: Logistics and Transportation Review*, *149*(1), 102295.

Matulka, R. (2014). The history of electrical vehicles. Retrieved June 2022
The History of the Electric Car | Department of Energy

Malinga, S. (2022). *More South Africans see the merits of electric vehicles*. Retrieved June 10 2022, from https://www.itweb.co.za/content/G98YdMLYmgwqX2PD

Meisel, S., & Merfeld, T. (2018). Economic incentives for the adoption of electric vehicles: A classification and review of e-vehicle services. *Transportation Research Part D: Transport and Environment*, *65*(1), 264-287.

Moeletsi, M. (2021). Future Policy and Technological Advancement Recommendations for Enhanced Adoption of Electric Vehicles in South Africa: A Survey and Review. *Sustainability, 13*(22), 12535. doi: 10.3390/su132212535

Miles, D.A. & Scott, L. (2017). Workshop: Confessions of a Dissertation Chair Part 1: *The Six Mistakes Doctoral Students Make with the Dissertation*. Presented at the 5th Annual 2017 Black Doctoral Network Conference in Atlanta, GA, on October 26-29.2017.

Moeletsi, M. (2021). Socio-Economic Barriers to Adoption of Electric Vehicles in South Africa: Case Study of the Gauteng Province. *World Electric Vehicle Journal, 12*(4), 167-174. doi: 10.3390/wevj1204016

Nayak, J. K., & Singh, P. (2021). *Fundamentals of research methodology problems and prospects*. Dehli: SSDN Publishers & Distributors.

New Energy Outlook 2021 | Bloomberg NEF. (2022). *New Energy Outlook 2022*. Retrieved May 29 2022, from https://about.bnef.com/new-energy-outlook/

Mou, X., Zhang, Y., Jiang, J., & Sun, H. (2019). Achieving Low Carbon Emission for Dynamically Charging Electric Vehicles Through Renewable Energy Integration. *IEEE Access, 7*(1), 118876-118888. Doi: 10.1109/access.2019.2936935

Ouyang, D., Zhang, Q., & Ou, X. (2018). Review of market surveys on consumer behaviour of purchasing and using electric vehicle in China. *Energy Procedia*, *152*(1), 612-617.

Rabbie, E. (2014). *The practice of social research.* London: Sage.

Ruoso, A. C., & Ribeiro, J. L. D. (2022). The influence of countries' socioeconomic characteristics on the adoption of electric vehicles. *Energy for Sustainable Development*, *71*(1), 251-262.

Sileyew, J.K. (2020). Research Design and Methodology. Semantic Scholar, Cyberspace. http://doi.org/10.5772/intechopen.85731

Singh, V., Singh, V., & Vaibhav, S. (2020). A review and simple meta-analysis of factors influencing adoption of electric vehicles. *Transportation Research Part D: Transport and Environment*, *86*(1), 102436.

Savier, J., & Rahul Charles, C. (2022). An overview on hybrid energy storage systems for electric vehicles. *International Journal of Electric and Hybrid Vehicles, 14*(1/2), 56. doi: 10.1504/ijehv.2022.10050105

Sarstedt, M., & Mooi, E. (2014). *A concise guide to market research*. Switzerland: Springer Nature.

Michael, K. V, S. J. L., Hungund, S., & Fernandes, M. (2022). Factors influencing adoption of electric vehicles – A case in India. *Cogent Engineering, 9*(1). doi: 10.1080/23311916.2022.2085375

Sparkman, R., Hair, J., Anderson, R., Tatham, R., & Grablowsky, B. (1979). Multivariate Data Analysis with Readings. *Journal Of Marketing Research, 16*(3), 437. doi: 10.2307/3150726

Thiel, C., Perujo, A and Mercier, A, "Cost and C02 Aspects of Future Vehicle Options in Europe under New Energy Policy," Energy Policy, Vol.38, No.11, 2010, pp.7142-7151. http://dx.doi.org/10.1016/j.enpol.2010.07.034

Tongwane, M., & Moeletsi, M. (2022). *Status of electric vehicles in South Africa and their carbon mitigation potential.* Retrieved May 30, 2022, from https://www.energy.gov/articles/history-electric-car

Tongwane, M., & Moeletsi, M. (2021). Status of electric vehicles in South Africa and their carbon mitigation potential. *Scientific African, 14*(1), e00999. doi: 10.1016/j.sciaf. 2021.e00999

Vaske, J. J. (2019). *Survey Research and Analysis* (2nd ed.). Sagamore: Urbana

Will, C., Lehmann, N., Baumgartner, N., Feurer, S., Jochem, P., & Fichtner, W. (2022). Consumer understanding and evaluation of carbon-neutral electric vehicle charging services. *Applied Energy*, *313*(1), 118799.

U. S. Department of Energy. (2022). *Where the Energy Goes: Electric Cars.* Retrieved June 17 2022, from https://fueleconomy.gov/feg/atv-ev.shtml

Zhao, X., Ma, Y., Shao, S., & Ma, T. (2022). What determines consumers' acceptance of electric vehicles: A survey in Shanghai, China. *Energy Economics*, *108*(1), 105805.

APPENDICES

Appendix 1: Research Instrument /Interview Questionnaires

Consent:

Do you provide consent to participate in the study?

Yes	☐
No	☐

SECTION 1: DEMOGRAPHICS

This information is for analysis purposes only and will not be used to identify you.

Please click in the appropriate box to indicate your response.

To which gender identity do you most identify with?

Female	☐
Male	☐
Prefer not to answer	☐

What is your highest level of education completed?

Less Than Matric	☐
Matric	☐
Diploma	☐
Bachelors degree	☐
Honours degree	☐
Masters degree	☐

Doctorate	☐

Please indicate the city where you currently reside

CAPE TOWN	☐
JOHANNESBURG	☐
DURBAN	☐
PORT ELIZABETH	☐

Please indicate the mode of transport you are currently using

CAR or Motorbike – Private Vehicle	☐
Taxi – Public Transport	☐
Bus – Public Transport	☐
Train- Public Transport	☐

In which Industry are you currently working

Private Sector /	☐
Public Sector /Government	☐
Business Owner/ Entrepreneur	☐
Unemployed /Prefer not to say	☐

Section 2: knowledge on electric vehicles including type of electric vehicles respondents are familiar with.

Please click in the appropriate box to indicate your response to the following statements where: 1 = strongly disagree, 2 = disagree, 3 = neither agree nor disagree, 4 = agree, 5 = strongly agree.

	1	2	3	4	5
Are you familiar with electric vehicles?	☐	☐	☐	☐	☐
Have you seen any electric vehicles on the road in SA?	☐	☐	☐	☐	☐
Do you think owning an electric vehicle will assist SA in reducing emissions?	☐	☐	☐	☐	☐

Do you think you can use a taxi electric vehicle as a mode of transport?	☐	☐	☐	☐	☐
Do you think you can use an electric bus vehicle as a mode of transport?	☐	☐	☐	☐	☐
Do you think electric vehicles are costly?	☐	☐	☐	☐	☐

SECTION 3: Is the South African market ready for Electric vehicles? Infrastructure development and investment.

Please click in the appropriate box to indicate your response to the following statements where: 1 = strongly disagree, 2 = disagree, 3 = neither agree nor disagree, 4 = agree, 5 = strongly agree.

	1	2	3	4	5
Government involvement helps in improving the readiness for the electric vehicle market.	☐	☐	☐	☐	☐
The government initiatives help in advancing the electric vehicle market.	☐	☐	☐	☐	☐
The introduction of incentives by the government in partnership with auto manufacturers will accelerate the market readiness of electric vehicles in South Africa.	☐	☐	☐	☐	☐

SECTION 4: The factors influencing electric vehicles are clear and understood for the market readiness of electric vehicles in South Africa.

Please click in the appropriate box to indicate your response to the following statements where: 1 = strongly disagree, 2 = disagree, 3 = neither agree nor disagree, 4 = agree, 5 = strongly agree.

	1	2	3	4	5
Fossil fuel vehicles' environmental issues are driving forces towards electrical vehicles.	☐	☐	☐	☐	☐
Auto car manufacturers are doing enough to accelerate the market readiness of electric vehicles in South Africa.	☐	☐	☐	☐	☐

Government, public and private sectors are in collaboration to accelerate market readiness	☐	☐	☐	☐	☐
Electricity issues in South Africa with load-shedding is an issue with customers purchasing electric vehicles	☐	☐	☐	☐	☐

SECTION 5: Are Auto Car Manufacturers and OEMs getting support in South Africa by Government in providing incentives and rebates in producing electric vehicles for the electric vehicle market in South Africa?

Please click in the appropriate box to indicate your response to the following statements where: 1 = strongly disagree, 2 = disagree, 3 = neither agree nor disagree, 4 = agree, 5 = strongly agree.

	1	2	3	4	5
14. Are Auto car manufacturers and OEMs ready for electric vehicles in South Africa?	☐	☐	☐	☐	☐
15. Do government communicate enough about the benefits of using electric vehicles in the SA market for environmental benefits?	☐	☐	☐	☐	☐
16. If enough incentives and cash rebates are given to OEM's auto car manufacturers, will this drive the market readiness of electric vehicles?	☐	☐	☐	☐	☐
17. Does the department of Transport and auto car manufacturers communicate enough and educate consumers about electric vehicles?	☐	☐	☐	☐	☐
18. If the cost of ownership is not an issue, do you think consumers will buy the electric vehicle?	☐	☐	☐	☐	☐
19. Do we have enough charging ports for electric vehicles in public spaces for electric vehicles?	☐	☐	☐	☐	☐
20. Will the increasing fuel price make you consider purchasing electric vehicles?	☐	☐	☐	☐	☐

Appendix 2: Ethics Clearance



Ethics clearance - Siyabonga Msomi.pd

Appendix 3: Language Editing Memorandum

EDITING CONFIRMATION

To whom it may concern:

This memo serves to confirm that the manuscript/research project detailed below has been language-edited and/or proof-read.

Regards,

-SM001-

S. Mpunz *(Cert. Lang. Ed.)*
Language Editor

****

Manuscript Title:

THE MARKET READINESS FOR ELECTRIC VEHICLES IN SOUTH AFRICA

Author:

Siyabonga Msomi

Issued on:

28/02/2023

Disclaimer:
The editor/proofreader makes no claim as to the accuracy of the manuscript contents nor the objectives of the author. While all possible efforts have been made to ensure the text as edited is readable and grammatically correct, the author(s) have the option to accept or reject suggestions and trackable changes made to the document before submission.

*** Professional Editors ***

sarchcot@gmail.com