Gordon Institute of Business Science
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Exploring consumer perceptions, experiences, and adoption factors of electric vehicles in South Africa's mixed-energy mobility market

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ABSTRACT

The transport industry plays a significant role in contributing to high carbon emissions due to their complete dependency on fossil fuels. This has led to the automotive industry becoming one of the key focus areas for driving sustainability at a global level. Despite the initiatives and policies introduced by various governments to promote electric vehicles (EVs), they still make up a small percentage of vehicles on the roads, especially in African countries. This can be attributed to macroeconomic factors such as the decline in household income and daily load-shedding or reduction in many parts of South Africa (PwC, 2023). However, with more variants in the market and more accessible models, there is a slight improvement and a general optimistic projection for future mobility.

This study aimed to explore consumer perceptions, experiences, and factors influencing the adoption of EVs within South Africa's mixed-energy mobility landscape. As South Africa seeks to transition towards more sustainable energy solutions and reduce carbon emissions, it faces unique challenges and opportunities in EV adoption. The problem focused on identifying the key drivers and barriers that impacted EV adoption, particularly emphasising economic, technological, social, and psychological factors shaping consumer decisions.

To address this problem, a qualitative research approach was employed, utilising in-depth interviews with diverse stakeholders, including consumers, industry experts, and policymakers. Thematic analysis was conducted on the data collected, which provided detailed insights into how perceptions of cost, infrastructure limitations, environmental benefits, and government policy influenced consumer willingness to adopt EVs in South Africa.

The findings revealed that although environmental awareness among consumers was increasing, several barriers deterred EV adoption. These included high initial costs, inadequate charging infrastructure, and frequent power outages, which compounded concerns around EV viability. Additionally, insufficient government incentives and support were perceived as a further obstacle to widespread adoption. The implications of these findings suggest that strategic interventions are necessary to promote EV adoption in South Africa. The study recommended policy initiatives that could make EVs more accessible and affordable, alongside significant investment in charging infrastructure and public education campaigns to enhance awareness and acceptance. The study contributed to the broader body of knowledge on sustainable transportation by addressing the unique challenges faced in developing regions and providing actionable insights for policymakers and industry stakeholders interested in accelerating the EV transition within South Africa.

KEYWORDS

Electric Vehicles (EVs): Vehicles powered by electric motors are central to understanding adoption factors within South Africa's mobility landscape.

Mixed-Energy Mobility: Refers to transportation systems using various energy sources, emphasising the exploration of alternatives to fossil fuels in South Africa.

Consumer Perceptions: Key to understanding how potential users view electric vehicles, which influences adoption trends.

Sustainable Transportation: Reflects the environmental focus on greener energy solutions within the transportation sector.

Adoption Barriers: Identifies factors that hinder electric vehicle adoption in South Africa, which is important for comprehending market challenges.

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ABBREVIATIONS

EV	Electric Vehicle
NEV	New Energy Vehicle
BEV	Battery Electric Vehicles
HEV	Hybrid Electric Vehicles
PHEV	Plug-in Hybrid Electric Vehicles
ICEV	Internal Combustion Engine Vehicles
OEM	Original Equipment Manufacturer
TCO	Total Cost of Ownership
naamsa	National Association of Automobile Manufacturers of South Africa. The Automotive Business Council
UN SDGs	United Nations Sustainable Development Goals

PLAGIARISM DECLARATION

I declare that this research project is my own work. It is submitted in partial fulfilment of the requirements for the degree of Master of Business Administration at the Gordon Institute of Business Science, University of Pretoria. It has not been submitted before for any degree or examination in any other University. I further declare that I have obtained the necessary authorisation and consent to carry out this research.

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CHAPTER 1:

INTRODUCTION TO THE RESEARCH PROBLEM

1.1 Background to the research problem

South Africa has an energy-intensive mining industry and mainly depends on coal-generated electricity, making it one of the countries with high carbon emissions. In addition, most of the new cars in the country are imported, and this heavy reliance on imported cars exposes it to economic fluctuations and environmental impact from fossil fuel imports. According to the Department of Transport (2018), 10.8% of the Greenhouse Gas (GHG) Emissions comes from the transport sector and 41% of the total road emissions emanating from private vehicles. Overall, passenger vehicles contribute 90% of these emissions (Moeletsi, 2021). Road transport is crucial for economic activity in South Africa; thus, moving to more sustainable vehicles is essential to ensure that this sector reduces its environmental impact.

International OEMs have invested significantly in transitioning to EVs and phasing out petrol and diesel cars (Lawson, 2023). Volkswagen, prominent in South Africa, is aiming for 80% of EV sales in Europe and 55% in North America by 2030 (Kumar et al., 2023). South Africa must now align with these strategies for a sustainable vehicle supply (ADT Staff, 2023). However, there is still limited research and literature related to Electric Vehicles (EVs), and it is even more limited when it comes to economies comparable to South Africa. Tongwane and Moeletsi (2021) argue that the cost to purchase EVs, inadequate charging infrastructure and electricity challenges, also known as load shedding, are the three main factors that impact EV adoption in the country.

Load shedding is a challenge that is mostly prevalent in developing countries, thus limiting the applicability of studies from developed countries. Malima and Moyo (2023) posit that the total cost of ownership of electric vehicles was found to be comparatively higher than that of internal combustion vehicles in Tanzania, leading to calls to review electric vehicle import duties downward by up to 40%. The reliance on importing vehicles also hinders job creation, technology independence, and electric vehicle infrastructure transition and poses supply chain risks. These are some of the issues that further strain the adoption of EVs, and the reason why exploring consumer perceptions, experiences, and adoption factors for mixed-energy mobility solutions in South Africa is essential.

In developed economies, green mobility innovation has taken centre stage, with governments giving financial incentives to encourage the adoption of electric vehicles. Many European Union (EU) countries offer financial incentives to lower the cost of acquiring electric vehicles and promote the decarbonisation of urban freight transportation (Gil Ribeiro & Silveira, 2024). Martins et al. (2024) reiterate that the provision of financial incentives towards the acquisition of electric vehicles contributed to a rise in new registrations of electric vehicles in European nations. The availability of financial incentives in the UK was also lined with a phenomenal increase in new electric vehicle registrations between 2009 and 2019 (Alali et al., 2022). These incentives are great motivators and can offset the high cost of the acquisition of EVs, which in turn influences the decision to purchase an EV in countries with incentives. As a result of South Africa not having such incentives currently, it is important to engage consumers to understand what will motivate them to adopt EVs to inform policymakers.

Despite these benefits of the acquisition of electric vehicles, the other dimension towards the adoption of electric vehicles relates to their operating costs. A study in Arizona confirmed that consumers with electric vehicles use relatively higher electricity consumption at 0.4 kWh more as compared to users without electric vehicles (Liang et al., 2022). Electricity consumption was drastically cut by 1.1 kWh when the use of electric vehicles was combined with the installation of photovoltaic solar energy for powering electric vehicles. However, the study did not factor in the cost of acquiring the solar-powered system into the cost of ownership of electric vehicles.

Concern over the purchase prices of electric vehicles featured prominently in the Spanish vehicle market, where the purchase prices were singled out as a key determinant of their uptake (Rosales-Tristancho et al., 2022). A Vietnamese study confirmed that infrastructure gaps and financial barriers militate against the adoption of electric two-wheelers (E2W) (Trung & Urmee, 2024). The research focused on the British Columbia province of Canada confirmed that the cost of electric vehicles, their limited range, and the scarcity of charging infrastructure were the main barriers to adopting electric vehicles (Axsen & Pickrell-Barr, 2024). The prohibitive costs also relate to the adoption of electric vehicles in sub-Saharan Africa. The works of Malima and Moyo (2023) specified that the total cost of ownership of electric vehicles was found to be comparatively higher than that of internal combustion vehicles in Tanzania, leading to calls to review electric vehicle import duties downward by up to 40%.

1.2 Research Problem

There is a common theme that has prominently featured in research whenever the issue of adopting electric vehicles has been raised. It primarily relates to their acquisition costs. Other studies have highlighted that the ownership of electric vehicles was directly proportional to the rise in electricity cost for purchasing electric vehicles. Research has established that the need for proper infrastructure and charging ports also limits the consumer adoption of electric vehicles in developed and developing nations. It remains to be seen how electric vehicles will be received in the South African market given the extended periods of electricity load shedding in addition to their relatively high cost.

In line with the worldwide push for decarbonisation, the South African government has set a goal of reducing carbon emissions by converting to electric vehicles (EVs) by 2035 (Maluleke, 2024). According to the green paper, South Africa aims to have new energy vehicles (NEVs) accounting for 60% of the market by 2035, with 10% Hybrid Electric Vehicles (HEVs), 20% Plug-in Hybrid Electric Vehicles (PHEVs), and 30% Battery Electric Vehicles (BEVs) (Barnes et al., 2022). NEVs made up 1.45% of total new car sales in 2023 in South Africa, and EVs accounted for only 12% of those total NEV sales (naamsa, 2024). For the 60% NEV market share to be possible by 2035, a compound annual growth rate (CAGR) of around 40.3% will be required each year from 2024 over the 11-year period. Based on poor vehicle market performance in recent years due to economic conditions, it is unlikely that such a growth rate can be achieved in such a short period. The cost of EVs was estimated to be 52% higher than Internal Combustion Engine Vehicles (ICEV), 43% for PHEV and 12% for HEVs (Barnes, et.al, 2021).

While research has established the essence of providing financial incentives towards their acquisition as they relate mainly to the EU market (Correia Sinézio Martins et al., 2024; Gil Ribeiro & Silveira, 2024), other developed nations are yet to support the acquisition of electric vehicles such as Spain (Rosales-Tristancho et al., 2022) and Canada where purchase costs have been raised (Axsen & Pickrell-Barr, 2024). There is limited research on consumer insights around adoption factors unique to South Africa, such as energy challenges and lack of incentives, resulting in the high cost of acquisition influencing their preferences. A study by Hull (2024) found that risk perceptions, cost perceptions and environmental perceptions influence EV adoption intention. In addition, the study's results proved that the most effective strategies to improve EV adoption intention in this market would need to highlight the safety benefits and business advantages of EVs. However, Haider, Zuang, and Ali (2019) contradict this sentiment by arguing

that intent and concern about the social and environmental impacts of a product do not translate into the sale of the product.

This means that there is still a gap in studies that measure and examine the actual adoption of mixed-energy mobility solutions in South Africa. This research challenge examines and answers several key questions: What are the consumer perceptions and experiences of mixed-energy mobility solutions in South Africa? What factors influence consumers' preferences (Li et al., 2020)? How do social, economic, and environmental issues influence the adoption of mixed-energy mobility solutions?

1.3 Significance of the Research Problem

South Africa imports most of its new cars, and this heavy reliance on imported cars exposes it to economic fluctuations and environmental impact from fossil fuel imports. This reliance also hinders job creation, technology independence, and electric vehicle infrastructure transition and poses supply chain risks. Addressing these challenges is crucial for the automotive sector's resilience. This study explores consumer perceptions, experiences, and adoption factors for mixed-energy mobility solutions in the country.

There is a commitment from governments globally to decrease carbon emissions by moving towards electric vehicles. This is the result of the major impact on water quality, air quality, land resources and biodiversity (DOT). All these factors negatively impact human health and biodiversity, which will, in turn, burden the healthcare system and increase socio-economic challenges, thus slowing down economic growth even further. If there are no interventions through the promotion of the adoption of EVs, carbon emissions will increase by 1 – 5% by 2030 at current economic growth and an increase of carbon emissions by 35 – 41% by 2030 in a high economic growth scenario (Moeletsi & Tongwane, 2020).

The South African government is in the process of developing incentive programmes for investors in EVs; therefore, this study will assist policymakers and businesses in developing strategies to match the demand in the market. Furthermore, the insights from the findings and recommendations can be used to assist in consumer education and product positioning of EVs to decrease new technology anxiety and increase adoption.

1.4 Relevance to Real-World Challenges

The study addresses pressing real-world issues relating to energy, sustainability and transportation. South Africa, like many other countries, faces challenges such as energy security,

air pollution (Maluleke, 2024), and reliance on fossil fuels, notably in the transportation sector. From an environmental perspective, numerous studies highlight the benefits of transitioning to mixed-energy mobility solutions, including significant reductions in greenhouse gas emissions and air pollution. Adopting EVs could substantially decrease carbon emissions and enhance air quality in urban areas (Su et al., 2021). It also improves energy security by diversifying transportation fuel sources and utilising local renewable energy resources.

In the context of South Africa's ongoing load shedding and electricity challenges, exploring consumer perceptions, preferences, and adoption factors for EVs is particularly pertinent. A study by Hull et al., (2024) which focused on the ease of adopting electric vehicles in Cape Town, South Africa, emphasised that the perceived acquisition, servicing, and charging costs associated with the use of electric vehicles were the most prominent determinants of their adoption. Hull et al., (2024b) also touched on the challenges relating to extended load shedding and power outages as the key concerns arising from the proposed adoption of electric vehicles. However, these studies were undertaken in relatively wealthy vehicle markets in South Africa, particularly in Cape Town, which leaves a practical gap in the applicability of these sentiments to the generality of the South African vehicle market. Frequent power outages not only affect citizens' daily lives but also pose a significant barrier to the adoption of EVs, which depend on a reliable electricity supply. By exploring how these energy challenges impact consumer preferences, this research aims to provide insights that can inform strategies to mitigate these issues. This is crucial for promoting sustainable mobility solutions (Huang et al., 2021) that align with the United Nations Sustainable Development Goals (SDGs) (*THE 17 GOALS | Sustainable Development,* n.d.).

This research is firmly in line with several United Nations Sustainable Development Goals (UN SDGs), highlighting its relevance to real-world challenges. By promoting the adoption of EVs, this study supports SDG 7: Affordable and Clean Energy, since it tackles the pressing need to use more renewable energy sources and less fossil fuels, helping to create a cleaner and more sustainable energy future. Additionally, the research is pertinent to SDG 11: Sustainable Cities and Communities, as it provides insights into creating sustainable urban transportation systems that can lessen air pollution, ease traffic congestion, and improve city life in South Africa.

Furthermore, the study aligns with SDG 13: Climate Action by identifying strategies to lower greenhouse gas emissions through the widespread adoption of EVs, thus playing a pivotal role in combating climate change. The integration of these SDGs underscores the significance of this research in addressing pressing issues such as air pollution, energy security, and economic opportunities in the green mobility sector. By focusing on these global goals, the study not only

adds to academic knowledge but also provides actionable insights for stakeholders striving to achieve sustainable development and environmental resilience in South Africa.

1.5 Academic and Practical Justification

Considering that South Africa is a late adopter and needs to expedite the deployment of EVs, this research aims to guide urban planners and policymakers in developing effective regulations and policies that promote sustainable transportation practices (RMI, 2023). Mixed-energy mobility solutions contribute to economic growth by facilitating job creation, investment, and development within renewable energy sectors and infrastructure. This presents the possibility of establishing a domestic electric vehicle manufacturing industry, ultimately decreasing reliance on imported fossil fuels (Brand et al., 2020) and the cost of these EVs due to lower import taxes. However, difficulties such as battery technology and the availability of charging infrastructure remain significant barriers to widespread adoption (Singh et al., 2020). This research strives to fill this gap by offering a concise yet comprehensive summary of existing research while highlighting emerging areas within the field.

Moreover, increased awareness plays a critical role in this context. Through increased awareness and strategic planning, South Africa can enhance its energy infrastructure, making EV adoption more feasible and contributing to a sustainable future. This research aims to raise awareness of the need to shift towards EVs and mixed-energy solutions, highlighting the importance of sustainable practices for the South African populace. Awareness is a crucial social factor that could significantly impact the adoption of sustainable mobility solutions, making it an integral part of the research focus. It is essential for driving behavioural change and adoption among consumers, and this research could catalyse increasing public awareness by emphasising the environmental and economic benefits of sustainable mobility solutions. By examining the level of awareness and its impact on consumer preferences, this study enhances academic knowledge with insights that can help develop targeted awareness campaigns and educational initiatives, further promoting sustainable development and environmental resilience in South Africa.

1.6 Business and Theoretical Needs

The business needs for this study are evident in the necessity for market alignment, economic growth, and industry changes driven by global trends and local commitments to environmental goals. Numerous OEMs, including Ford, Stellantis, Volvo, and Nissan (Lawson, 2023), have stated their ambitions to offer only fully electric vehicles by 2030 (Baghel et al., 2016) and attain

climate neutrality by 2040. In his Annual Budget Speech of 2024, the Minister of Finance announced a forward-looking plan to promote EV manufacturing locally, aligning with the global transition towards sustainable mobility solutions. The Automotive Business Council welcomed this initiative, emphasising the need for a strategic and investment-driven plan. A R964 million incentive was announced, which aims to facilitate the automotive industry's transition towards producing EVs. Under this plan, producers can claim 150% of qualifying investment spending on electric and hydrogen-powered vehicles in the first year (naamsa, 2024).

The theoretical need is supported by the requirement to understand consumer behaviour and preferences in adopting new technologies. The implementation of mixed-energy mobility solutions also impacts inclusivity and social equity. A study by Litman (2016) noted the importance of ensuring that low-income communities have access to reliable transportation and affordable options. Public transportation systems utilising mixed-energy sources could enhance accessibility and mobility for underserved populations, promoting social cohesion and reducing inequality. (Litman, 2016) .

The shift to mixed-energy mobility solutions, especially in the transportation sector, has attracted considerable global interest because of its potential to tackle social, environmental and economic issues (Higueras-Castillo et al., 2021). As noted by Sovacool et al., (2022) in South Africa's context, the intersection of challenges such as economic development, energy security, and air pollution highlights the crucial need to understand and adopt mixed-energy mobility solutions (Sovacool et al., 2022). Recent incentives announced by the South African Finance Minister for EV investments further highlight the government's commitment to this transition (naamsa, 2024). Ultimately, embracing mixed-energy solutions helps social equity by improving accessibility to sustainable transportation options, contributing to a more inclusive and resilient society. With its comprehensive approach, this research strives to establish a sustainable and resilient transportation system that serves current and future generations.

1.7 Purpose Statement

This study aims to explore and deepen the understanding of consumer perceptions, experiences, and adoption factors related to electric vehicles within South Africa's mixed-energy mobility market. The general aim of the study is to analyse the factors influencing consumer choices between EVs and traditional vehicles, as well as the unique challenges and opportunities for EV adoption in the South African context.

Specific Research Objectives:

1. To identify and evaluate the key factors influencing consumer choices between EVs and internal combustion engine (ICE) vehicles, including economic considerations, environmental awareness, and convenience.
2. To investigate the barriers impeding EV adoption in South Africa, focusing on issues such as infrastructure limitations, high purchase costs, and technological constraints.
3. To examine the role of government policies, incentives, and regulatory frameworks in shaping consumer adoption of EVs.
4. To analyse the impact of technological advancements in EVs on consumer perceptions and their readiness to transition from ICE vehicles.
5. To assess how the evolving energy landscape in South Africa influences consumer attitudes towards EVs and their potential to contribute to sustainable mobility.

Contribution to the Broader Body of Knowledge: This study contributes to the understanding of EV adoption within developing countries by providing insights specific to South Africa's unique mixed-energy mobility market. By examining consumer perceptions and identifying key adoption factors, this research highlights the economic, social, and technological challenges that differentiate the South African market from more developed contexts. Additionally, the study provides actionable recommendations for policymakers and industry stakeholders to support the shift towards sustainable transportation. This research fills a critical gap in the literature on EV adoption in emerging markets and offers a basis for future studies on sustainable mobility solutions tailored to the needs of developing regions.

CHAPTER 2:

LITERATURE REVIEW

2.1 Introduction

The scope of this literature review is to discuss the converging and contradictory views focused on consumer perceptions relating to the adoption of electric vehicles. The literature review is guided by several technology adoption theories, including the Technology Acceptance Model, the Diffusion of Innovations Theory, the Environmental Psychology Theory, the Social Exchange Theory, The Sustainability Theory, the Theory of Planned Behaviour and behavioural economics. This literature review positions the research within the broader context of existing academic literature, highlighting established and unexplored facets of the topic to demonstrate the imperative for conducting this study. It aims to refine the research problem or question to strengthen the argument and actively engage with ongoing debates within the field.

2.2 What is Known and What is Not Known?

Table 2.1 compares what is currently known about the adoption of electric vehicles and what is yet to be discovered.

What is Known	What is Not Known
Global Trends: There is a growing global trend towards the adoption of EVs as part of initiatives aimed at decreasing reliance on fossil fuels and diminishing greenhouse gas emissions (Illahi et al., 2024). **Environmental Benefits**: EVs offer significant environmental benefits, including lower emissions of pollutants and greenhouse gases compared to traditional vehicles (Choudhari et al., 2024). **Policy Initiatives**: Many countries have implemented plans to incentivise EV adoption, such as tax incentives, subsidies, and infrastructure development (Correia Sinézio Martins et al., 2024; Gil Ribeiro & Silveira, 2024). **Technological Advancements**: Advances in EV technology, particularly in charging infrastructure and battery technology, have	**Local Context**: The specific factors influencing EV demand and customer preferences in South Africa are not fully understood (Hull et al., 2024a). **Barriers to Adoption**: The barriers to widespread EV adoption in South Africa, such as infrastructure limitations, affordability concerns, and range anxiety, require further exploration (Hull et al., 2024b). **Consumer Behaviour**: There is a gap in understanding the nuanced factors shaping consumer behaviour and preferences regarding EVs in South Africa, including socio-economic factors, cultural influences, and perceptions of EVs (Msosa, 2023). **Policy Effectiveness**: The efficacy of current policies and incentives in encouraging the uptake of EVs in South Africa and the need for additional policy measures require empirical analysis (Moeletsi, 2021).

improved EV performance and affordability (Flores, 2024). **Consumer Interest**: There is increasing consumer interest in EVs driven by environmental consciousness, fuel cost savings, and technological appeal (Axsen & Pickrell-Barr, 2024)	**Integration Challenges**: The challenges and opportunities associated with integrating EVs into South Africa's existing energy and transportation infrastructure, particularly in mixed-energy mobility solutions, are not fully understood (Hull et al., 2024b).

Table 2.1: What is known and not known about the topic?

Research on EVs has been gaining traction globally owing to their capacity to lessen reliance on fossil fuels and mitigate greenhouse gas emissions (Choudhari et al., 2024). South Africa, with its unique socio-economic landscape, presents both challenges and opportunities for the adoption of EVs and mixed-energy mobility solutions (Hull et al., 2024b). This literature review synthesises existing research on consumer perceptions, experiences, and adoption factors related to electric vehicles (EVs) and mixed-energy mobility solutions in South Africa, as well as the drivers and barriers influencing consumer preferences and adoption rates. Its objective is to shed light on prevailing trends, obstacles, and prospects within the South African setting. This examination endeavours to enrich scholarly understanding and furnish valuable perspectives on the environmental (Challa et al., 2022), economic, and social aspects linked with the shift towards sustainable transportation systems. The purpose is to contextualise the need for further research by highlighting what is known and unknown about the topic and to situate the study within the relevant academic literature.

The decision to switch to EVs is influenced by a variety of factors, including social interactions, consumer demographics, and infrastructure development (Axsen & Pickrell-Barr, 2024). Zhao et al., (2022) highlighted the significant impact of peer effects on the diffusion of EVs in Shanghai, demonstrating that social interactions and consumer influence play a crucial role in purchase decisions. Similarly, in South Africa, leveraging peer effects could enhance EV adoption by fostering positive word-of-mouth and community acceptance (Msosa, 2023).

Zhao et al., (2022) further revealed that younger, high-income, and well-educated urban residents are more inclined to purchase EVs. This demographic trend suggests that targeting similar consumer groups in South Africa could be effective (Malima & Moyo, 2023a). Additionally, potential EV buyers in Shanghai were primarily concerned about vehicle performance, whereas existing EV owners prioritised charging infrastructure and supportive government policies. These insights underscore the need to address performance concerns and improve charging facilities to boost EV adoption in South Africa.

Furthermore, the availability and accessibility of charging stations significantly impact consumer acceptance of EVs (Illahi et al., 2024). Developing a comprehensive charging infrastructure akin to the approach in Shanghai is essential for promoting EV usage in South Africa. Life attitudes, such as environmental awareness and fashion consciousness, also influence EV acceptance (Gil Ribeiro & Silveira, 2024). Promoting the benefits to the environment and the modern appeal of EVs can attract environmentally conscious and trend-focused consumers (Choudhari et al., 2024).

Lastly, recognising the heterogeneity of consumer preferences is vital for effective marketing. Tailored marketing strategies that address the diverse needs and concerns of different consumer segments can enhance the efficiency of EV promotion efforts in South Africa. By considering these factors, policymakers and industry stakeholders can develop informed strategies to foster a sustainable transition to mixed-energy mobility solutions.

2.3 Theoretical Underpinnings

Exploring consumer perceptions, experiences, and adoption factors of EVs in South Africa's mixed-energy mobility market requires a theoretical framework rooted in several interdisciplinary areas. These include behavioural economics, consumer behaviour, innovation diffusion, technology acceptance models, environmental psychology, and sociocultural factors specific to South Africa. Several key theories can be applied to provide a robust theoretical framework and provide insightful information on the decision-making processes and external factors shaping this market. Below are key theoretical underpinnings that can guide such an exploration:

2.3.1 Technology Acceptance Model (TAM) and Rational Choice Theory

Both TAM (Davis,1989) and Rational Choice Theory (Coleman, 1990; Becker, 1976) provide insights into how consumers evaluate EV adoption. TAM is central to understanding consumer adoption of new technologies (Granić & Marangunić, 2019), including EVs. It focuses on perceived usefulness (PU) and perceived ease of use (PEOU) as critical determinants in the adoption of new technologies. In South Africa, this could mean considering long-term cost savings (especially amid rising fuel prices - fuel savings, reduced maintenance) and ease of accessing charging infrastructure. Additionally,

- Existing research has raised concern over load shedding (energy shortages) along with the accessibility of charging ports that may potentially impact perceptions of EV reliability in South Africa (Hull et al., 2024b)

- Environmental benefits

Factors such as the availability of charging stations, ease of charging, and the simplicity of operating an EV will influence consumer adoption (Hull et al., 2024a). In the South African context, where infrastructure is still developing, hybrid vehicles might be perceived as easier to use, thus influencing preference (Msosa, 2023).

2.3.2 Rational Choice Theory

This theory argues that consumers adopt EVs based on a cost-benefit analysis. For example, consumers might compare the higher upfront cost of EVs with the potential long-term financial savings (Liang et al., 2022). This economic theory posits that individuals make decisions by evaluating costs and benefits to maximise utility. In the context of EV adoption in South Africa, Rational Choice Theory suggests that consumers will weigh factors such as:

- Upfront Costs vs. Long-Term Savings: EVs generally have higher initial costs compared to traditional vehicles but lower operational costs (e.g., fuel and maintenance). Consumers may rationally choose EVs if they perceive long-term savings driven by rising fuel prices and lower maintenance requirements.
- Government Incentives: Policies like tax rebates, subsidies, or incentives for using renewable energy may make EVs more appealing by reducing the perceived financial burden.
- Charging Infrastructure: The limited availability of charging stations in South Africa may be perceived as a cost, which could deter adoption unless offset by the availability of home charging or extended range capabilities in EVs (Danielis et al., 2020).

Rational Choice Theory emphasises that consumers will adopt EVs if they perceive a favourable balance of benefits (environmental impact, lower long-term costs) over costs (initial investment, infrastructure limitations).

2.3.3 Diffusion of Innovations Theory and Institutional Theory

Developed by Everett Rogers (1962), the Diffusion of Innovations Theory explains the stages of adoption, from innovators to the early majority. It clarifies how, why, and how quickly new concepts and innovations proliferate in a community. In South Africa, innovators and early adopters may be drawn to EVs for their sustainability and technology appeal, while the early majority might require

institutional support through government incentives like tax rebates. The adoption of EVs follows the typical pattern of innovation diffusion:

- Innovators and early adopters are likely to be environmentally conscious and technologically savvy consumers who prioritise sustainability. This could typically be higher-income consumers who are more open to new technologies (Curtale et al., 2021).
- Early majority and late majority adopters will rely on social proof, such as observing the experiences of early adopters, market incentives, and government policies. As infrastructure improves and prices decrease, the early and late majority are likely to adopt EVs, leading to broader market penetration.
- Observability and Trialability: The visibility of EVs in urban centres and the ability to test-drive them can enhance the diffusion process. The hybrid vehicle market might act as a bridge, easing the transition to fully electric vehicles (Farzin et al., 2021).

Locally, the success of EV diffusion may also depend on market readiness, availability of affordable models, and government incentives such as tax breaks or subsidies for EV buyers (Dua et al., 2024). Institutional Theory expands on this, stressing the need for favourable regulations and infrastructure development (charging stations) to drive market adoption and alleviate concerns about load shedding.

Institutional Theory focuses on the role of formal and informal institutions—such as regulations, policies, and societal norms—in shaping behaviour. For EV adoption in South Africa, institutional theory highlights how:

- Regulatory Frameworks: Government policies, such as those regulating emissions standards or offering subsidies for EV buyers, play an important part in shaping consumer behaviour (Rosales-Tristancho et al., 2024). In South Africa, the development of favourable regulations for clean energy vehicles will significantly influence EV adoption rates.
- Market Norms: Established norms in the automotive industry and among consumers also impact the transition to EVs. For instance, South Africa's long history with fossil fuel-based transportation creates path dependency, where institutional support for traditional vehicle technologies may slow the shift toward EVs.
- Institutional Support for Infrastructure: Institutional theory emphasises the importance of infrastructure development, such as the expansion of charging stations and renewable

energy sources, which is crucial for EV adoption (Gil Ribeiro & Silveira, 2024). The lack of institutional investment in these areas can create barriers to EV market growth.

Institutional theory suggests that both government and private institutions must actively promote and support the EV market through favourable policies, infrastructure investment, and public awareness campaigns.

2.3.4 Behavioural Economics and Environmental Psychology

Behavioural economics delves into the cognitive biases affecting consumer choices, such as loss aversion (fear of losing out on the benefits of traditional vehicles) (Nastjuk et al., 2020). In contrast, Environmental Psychology explores how environmental consciousness can push consumers toward EVs as they align with green energy goals and societal environmental norms. In South Africa, public awareness of air pollution and climate change may influence consumer preferences, even if there are perceived infrastructure gaps (Hull et al., 2024b).

Behavioural economics, particularly the concept of bounded rationality, is relevant in studying how South African consumers make decisions about EV adoption. Issues such as:

- The perceived high upfront cost of EVs relative to ICE vehicles (Malima & Moyo, 2023a).
- Range anxiety—the fear that an EV will run out of charge before reaching its destination might deter consumers (Farinloye et al., 2024).
- Cognitive biases such as loss aversion and status quo bias, which favour the current state, can also play significant roles in slowing adoption.

Understanding these biases can help shape marketing strategies that promote long-term savings, environmental benefits, and charging infrastructure solutions. This discipline studies the interaction between individuals and their environment, focusing on how environmental factors influence behaviour. Key aspects relevant to EV adoption in South Africa include:

- Environmental Awareness: Customers with greater environmental consciousness may be more likely to purchase EVs as worries about pollution and climate change increase. EVs are seen as a direct way to reduce carbon footprints and air pollution (Nastjuk et al., 2020).
- Perception of Green Technologies: In South Africa, public perceptions of green technologies can shape EV adoption. For instance, positive perceptions of the environmental benefits of EVs can foster a sense of environmental responsibility, while

concerns about energy reliability (due to load shedding) may hinder this perception (Electric Vehicle White Paper, 2023; Hull et al., 2024a).

- Social Identity and Norms: Environmental psychology also explores how collective identity and social norms influence behaviours. If adopting EVs becomes a symbol of social status or aligns with societal values about sustainability, it can accelerate consumer adoption.

Cultural values and environmental attitudes also heavily influence consumer behaviour. In South Africa, consumer decisions around EVs may be impacted by:

- Collective environmental consciousness: The growing awareness of climate change and pollution may push consumers toward adopting greener mobility solutions.
- Social status: Cars are often status symbols, and EVs may be perceived either as cutting-edge or as a luxury for the wealthy, affecting mass-market appeal.

The role of traditional energy sources: South Africa has a history of reliance on fossil fuels, and there may be cultural resistance to moving toward greener, electric alternatives (Electric Vehicle White Paper, 2023).

2.3.5 Value-Belief-Norm (VBN) Theory and Resource-Based View (RBV)

The VBN Theory emphasises how personal values, particularly regarding environmental sustainability, can drive consumer choices in favour of EVs. Individuals who hold strong beliefs about reducing their carbon footprint may overlook the inconveniences of limited charging stations. According to this theory of environmental behaviour, individual values impact beliefs, which in turn shape behaviours and norms. For EV adoption, individuals who value environmental sustainability may:

- View EVs as aligning with their personal norms of reducing carbon footprints.
- Be more willing to navigate inconveniences (e.g., limited charging points) in favour of environmental benefits.

In South Africa, environmental awareness could become an important motivator as concerns about air pollution and energy consumption rise. On the firm side, the Resource-Based View (RBV) highlights how automotive companies can leverage sustainability as a resource by developing affordable EV models that cater to local conditions, such as accounting for energy reliability in South Africa. The Resource-Based View (RBV) is a strategic management theory that

explains how firms achieve competitive advantage by leveraging their unique resources and capabilities (Barney, 2018). Considering the EV industry in South Africa:

- Firms' Capabilities: Automotive manufacturers and energy companies operating in South Africa can achieve an advantage over competitors by utilising exclusive competencies in clean technology, battery production, and renewable energy integration. Companies that can offer affordable EV models and solutions for energy storage (e.g., home charging solutions) will differentiate themselves in the market (Bonges & Lusk, 2016).
- Sustainability as a Strategic Resource: Companies that invest in sustainable practices, such as developing energy-efficient vehicles or creating eco-friendly supply chains, can appeal to environmentally conscious consumers. Sustainability itself becomes a key resource that enhances the firm's reputation and consumer trust (Illahi et al., 2024).
- Local Adaptation: Firms that adapt to the specific needs of South African consumers, such as accounting for load shedding or the availability of renewable energy sources, will be better positioned to capture the market.

RBV highlights the importance of firm-specific resources in driving innovation and competitiveness in the EV market. Companies that invest in unique, sustainable solutions will likely lead in South Africa's mixed-energy mobility market.

2.3.6 Social Exchange Theory and Social Identity/Norms (Environmental Psychology)

Social Exchange Theory suggests that consumers will evaluate the economic benefits (fuel savings, reduced maintenance) against the initial costs (EV price, charging availability) (Wang et al., 2023). If South African consumers perceive more significant long-term benefits, this could enhance EV adoption. This ties in with Environmental Psychology's perspective on social norms, where EVs could become associated with social status or sustainability, accelerating adoption as it becomes a cultural expectation. Consumers weigh the perceived costs and benefits before adopting new technologies. In the context of EVs, South African consumers will consider:

- Economic benefits such as fuel savings, reduced maintenance, and potential subsidies.
- Costs, including initial purchase price, access to infrastructure for charging, and the durability of the EV battery.

This cost-benefit analysis will directly impact adoption rates, with positive consumer experiences driving higher acceptance.

2.3.7 Sustainability Transition Theory and Institutional Theory

Both theories explain how systems, such as the shift from fossil fuel vehicles to EVs, evolve. In South Africa, the Sustainability Transition Theory posits that institutional changes, such as government regulations promoting clean energy, are essential (Zhao et al., 2024). This framework explains how societies transition from one dominant system to another, such as the shift from fossil fuel-based vehicles to EVs (Sugihara et al., 2024). The transition in South Africa's case may be gradual, influenced by:

- Government regulations and incentives promoting clean energy.
- The role of private companies and innovators in building an EV-friendly ecosystem, including charging stations, battery recycling, and renewable energy integration.

Institutional Theory aligns with this by stressing that support for renewable energy sources and building a robust EV infrastructure will determine how successfully the country transitions toward electric mobility.

2.3.8 Theory of Planned Behaviour (TPB) and Sociocultural Factors

The TPB focuses on perceived behavioural control, attitudes and subjective norms. In South Africa, consumer attitudes towards EVs will be shaped by media and peers, while the perceived ease of access to EV models and charging points will influence their adoption behaviour. The TPB developed by Icek Ajzen (2020) emphasises how attitudes, perceived behavioural control, and subjective norms all play a significant role in determining consumer intentions. South African consumers' attitudes towards EVs, influenced by media, peers, and government endorsements, will determine adoption. Perceived ease of access to charging infrastructure and affordable EV models will also influence the level of behavioural control consumers feel.

- Attitudes: South African consumers' attitudes towards EVs can be shaped by their perceptions of environmental benefits, cost savings, and technological appeal.
- Subjective Norms: Social influences, including the desire to project a status of eco-friendliness or innovation, can affect the adoption of EVs. In South Africa, where vehicle

ownership often carries social significance, subjective norms have the potential to significantly influence demand.

- Perceived Behavioural Control: The availability of charging infrastructure and the perceived ease of use of EVs influence perceived behavioural control. Range anxiety and concerns about infrastructure might reduce perceived control, thus affecting demand.

Sociocultural factors, such as the status associated with owning an EV, also contribute to the development of attitudes and norms, particularly if EVs are seen as symbols of innovation or wealth.

2.4 Conclusion

Exploring the adoption of electric vehicles in South Africa's mixed-energy mobility market requires an interdisciplinary approach. This integrated theoretical framework, blending TAM, Rational Choice Theory, Diffusion of Innovations Theory, Behavioural Economics, Institutional Theory, and other relevant models, provides a comprehensive lens through which to explore consumer perceptions, experiences, and adoption drivers for EVs in South Africa's mixed-energy mobility market. By addressing both economic and sociocultural factors, businesses and policymakers can better understand and influence EV adoption. This multi-disciplinary approach not only accounts for consumer behaviour but also highlights the institutional support and firm-level strategies that are crucial for fostering a sustainable EV ecosystem in South Africa. Together, these theories provide a comprehensive framework and a holistic approach for analysing the factors which will shape the expansion of the emerging EV market in South Africa. By understanding how technological acceptance, cultural attitudes, and economic incentives interplay with policy and infrastructure developments, businesses and policymakers can better predict market behaviour, craft strategies that address consumer concerns, improve infrastructure and foster an atmosphere that encourages broad adoption of electric vehicles.

2.5 Current and Projected Demand for Local Mixed-energy Mobility Solutions

The uptake of EVs in South Africa has been comparatively sluggish in comparison to global leaders, but there is growing interest driven by environmental concerns and potential economic benefits. Research indicates that the current demand for EVs is influenced by factors including limited charging infrastructure, high initial costs, and lack of government incentives (Energy Agency, 2021). Despite the global push towards EVs, South Africa's market remains modest, primarily due to economic constraints and infrastructure challenges.

Malima & Moyo (2023)’s study on the economic viability of EVs in sub-Saharan Africa, including South Africa, indicates that while the total cost of ownership (TCO) for EVs is currently higher than (Philip et al., 2023a) for internal combustion engine vehicles (ICEVs), this gap is expected to narrow as battery technology improves and economies of scale are achieved (Malima & Moyo, 2023a) According to a recent study conducted by Exeter University's Economics of Energy Innovation and System Transition (EEIST) project, a substantial change in consumer purchasing patterns is forecasted to occur once EVs become more economical than traditional fossil-fuel vehicles. This pivotal moment, where EVs become more affordable to purchase, is projected to happen as soon as 2024 in Europe, 2025 in China, 2026 in the US, and 2027 in India for medium-sized cars, and even earlier for smaller vehicles. In China, the lifetime costs of compact EVs already undercut those of their fossil-fuelled counterparts. (RMI, 2023). Moreover, when factoring in both operational and acquisition expenses, EVs are already more financially advantageous to own than petrol or diesel cars in the EU and China, with the US expected to follow suit within the next one or two years (RMI, 2023).

Sensitivity analysis suggests that significant reductions in EV costs or increases in fuel prices are necessary to reach TCO parity between EVs and ICEVs. EVs offer lower operating costs, which could make them economically viable in the long term. Furthermore, the co-adoption of EVs and solar panel systems has shown positive effects on electricity demand and consumer behaviour, with households reducing their dependence on the grid during peak hours by leveraging solar energy for EV charging.

In the future, there is an anticipation of increased demand for EVs in South Africa, driven by advancements in technology, policy interventions, and increasing environmental awareness. The International Energy Agency (IEA) projects a gradual increase in global EV market share, and similar growth is anticipated in South Africa if supportive measures are implemented. The potential for integrating renewable energy with EVs is significant, as it could reduce greenhouse gas emissions and promote energy independence. However, realising this potential requires substantial investment in both EV infrastructure and renewable energy sources.

2.6 Factors Influencing Consumer Preferences and Adoption Rates

Consumer preferences for EVs are formed by a mixture of technological, social, economic, and psychological factors. (Beak et al., 2020). High purchase prices, limited driving range, and inadequate charging infrastructure are some of the major obstacles to adoption.

2.6.1 Economic Factors

Substantial purchase prices and restricted driving range present notable obstacles to the widespread adoption of electric vehicles. Research from resource-rich contexts such as in the EU and the US indicates that financial incentives, such as tax credits or subsidies, and improvements in charging infrastructure are critical to increasing adoption rates (Alali et al., 2022; Correia Sinézio Martins et al., 2024; Gil Ribeiro & Silveira, 2024). However, the works of Llopis-Albert et al., (2021) dispute this position and state that neither financial incentives nor improvements in the charging infrastructure are likely to improve the adoption rates for electric vehicles in the near future. Economic determinants have also featured prominently in research from other regions, such as in the state of Arizona, where it was confirmed that comparatively, consumers with electric vehicles use relatively higher electricity consumption at 0.4 kWh more as compared to users without electric vehicles (Liang et al., 2022). The TCO is a key determinant of the economic analysis towards the uptake of EVs. Research in Tanzania underscored that the poor adoption of electric vehicles in Sub-Saharan Africa is impacted by the relatively higher TCO for EVs relative to ICEVs (Malima & Moyo, 2023a). Similar sentiments were featured in a Nigerian study where it was realised that affordability and cost advantages over the long run are key determinants of the uptake of EVs in developing nations (Farinloye et al., 2024).

2.6.2 Technological Factors

Technological advancements are crucial in shaping consumer preferences for EVs. Improvements in battery technology (Beak et al., 2020; Ingeborgrud & Ryghaug, 2019)., resulting in longer driving ranges and shorter charging times, which are vital to overcoming consumer reluctance. The current low acceptance of EVs in South Korea, for example, is attributed to high prices and inadequate battery charging technology. Related sentiments were expressed by Rosales-Tristancho et al., (2024) who stressed the failure to extend the range for battery electric vehicles in a shorter charge time as contributing to their poor uptake. Farinloye et al., (2024) cited scarce charging ports as a stumbling block to the adoption of electric vehicles in Nigeria. Research in the USA confirmed that existing EVs are unwilling to compromise on the recharge time, travel range, battery replacement costs and the availability of home recharging when they decide to purchase new electric vehicles (Dua et al., 2024).

Similar challenges are faced in South Africa, where enhancing battery performance and expanding charging infrastructure are essential to boosting EV adoption (Hull et al., 2024b). Studies from other regions provide insights into factors that could influence South African

consumers. For example, in China and South Korea, consumers showed a higher willingness to pay for EVs with advanced features like fast charging and extended range. These features enhance the perceived value of EVs, enhancing their appeal to possible purchasers. Consumers are inclined to consider EVs if they offer comparable or superior performance to ICEVs in these areas. Moreover, environmental awareness and the desire to reduce greenhouse gas emissions are significant motivators for adopting EVs in these markets (Jena, 2020). However, Cruz-Jesus et al., (2023) argue that electric vehicles have a task-technology misfit when it comes to their capabilities to respond to some unique driver needs

2.7 Social and Environmental Factors

Environmental awareness is a significant motivator for adopting EVs. Consumers with higher environmental consciousness are more likely to choose EVs due to their lower environmental impact. Research in South Korea confirmed that consumers demonstrate a higher willingness to pay for carbon dioxide reduction linked with electric vehicles in comparison to consumers from other nations (Beak et al., 2020). A Taiwanese study highlights that social pressure is a key determinant of the uptake of EVs (Eccarius & Chen, 2024). The study underscored that social pressure builds trust, which eventually motivates the need to acquire EVs. The works of Curtale et al., (2021) confirmed that social influence was a key driver towards the adoption of electric car-sharing services in the Netherlands. Environmental policy was found to be a key electric vehicle adopter determinant in Sweden and Denmark (Bas et al., 2021). Relatedly, Nastjuk et al., (2020) specified that ecological awareness was essential in promoting the migration to electric vehicles.

In South Africa, promoting the environmental benefits of EVs, such as their ability to mitigate greenhouse gas emissions and enhance air quality, can significantly influence the increase in their adoption. Additionally, the incorporation of EVs with renewable energy sources, such as panels, can further enhance their environmental appeal. The simultaneous adoption of EVs and solar panels not only diminishes carbon emissions but also offers economic benefits, such as lower electricity costs and reduced reliance on fossil fuels (Liang et al., 2022).

2.7.1 Psychological Factors

As noted by Ye et al., (2021), psychological factors, such as environmental consciousness and social status also influence consumer decisions. The works of Huang et al., (2021) concurred that Chinese consumers in smaller cities perceived greater psychological advantages like prestige associated with electric vehicles. Additionally, owning an EV can be perceived as a status symbol,

particularly among younger consumers and those in higher socio-economic brackets (Buhmann & Criado, 2023a; Ye et al., 2021).

2.7.2 Infrastructure and Policy Support

The availability of reliable and accessible charging infrastructure is an important element affecting consumer adoption of EVs. In South Africa, the lack of widespread charging stations is a major barrier. Research by Zhao et al., (2022) indicates that increasing the density of charging stations and ensuring their accessibility can significantly boost consumer confidence and willingness to purchase EVs. In addition to infrastructure, policy interventions play a vital role in shaping the EV market and accelerating the transition to electric mobility (Zhao et al., 2022). Government policies that support the development of charging infrastructure (Visaria et al., 2022), along with providing financial incentives, can make EVs more affordable and attractive to consumers (Salari, 2022).

The government's role as a participator, regulator and facilitator was found to be instrumental in the adoption of autonomous vehicle innovations in the U.K. and Australia (Schepis et al., 2023). Furthermore, policies that promote the use of renewable energy for EV charging can enhance the environmental benefits of EVs and encourage their adoption. Hernández-Tamurejo et al., (2024) believed uncertainty in government policy affects the purchase decision for new vehicles leading to the postponement of the decision while aggravating the risk of air pollution. In South Africa, the government’s dedication to curbing carbon emissions and advancing sustainable energy solutions will be key to the success of EV adoption initiatives.

Research in South Africa focusing on a typical electric vehicle consumer in Gauteng province suggested the provision of a government policy shift towards tax rebates and purchase subsidies as ideal for promoting the uptake of electric vehicles (Moeletsi, 2021). An early study indicated that there is uncertainty relating to the policy framework regarding access to charging ports, charging fees, and knowledge of etiquette cards (Bonges & Lusk, 2016). A policy gap exists in the Chinese market since there is an absence of a policy governing the adoption of leased electric vehicles (Huang & Qian, 2021). Philip et al., (2023b) stressed that government policy directives on the adoption of electric vehicles such as regulations on emissions are key determinants of market targeting strategies by electric vehicle manufacturers. Danielis et al., (2020) raised the essence of policy mechanisms relating to the provision of financial incentives, raising awareness on the benefits of the transition towards electric vehicles and the provision of charging infrastructure as key determinants of the electric vehicles adoption.

2.8 Gaps in the Literature and Need for Further Research

While there is considerable knowledge about global trends and the environmental benefits of EVs, gaps remain in understanding the specific dynamics of EV demand and customer preferences domestically and the broader implications for mixed-energy mobility solutions. Most studies focus on developed markets, with limited research specific to South Africa and other developing regions. Existing literature primarily addresses the barriers to EV adoption, such as high costs and inadequate infrastructure, but there is limited detailed investigation of the socio-cultural issues specific to South Africa that might influence consumer preferences. Understanding the unique economic, social, and infrastructural challenges in South Africa is essential for formulating successful strategies to encourage EV uptake.

Additionally, more empirical research is needed on consumer behaviour and preferences within the context of South Africa. Research investigating the specific reasons influencing South African consumers' decisions to adopt EVs, such as financial considerations, environmental awareness, and technological preferences, can offer valuable perspectives for industry stakeholders and policymakers.

Furthermore, the possibility of mixed-energy mobility solutions and the impact of integrating renewable energy sources, such as solar panels, with EVs requires further exploration. While studies from other regions indicate positive effects, more investigation is required to understand how this integration can be optimised in South Africa’s unique energy landscape to meet the needs of South African consumers.

2.9 Conclusion

The literature review highlights the complex interplay of factors influencing consumer preferences and the adoption of EVs in South Africa. It underscores the potential for significant growth in the adoption of EVs and mixed-energy mobility solutions in South Africa. However, realising this potential requires addressing economic barriers, improving infrastructure, and implementing supportive policies. Targeted efforts to educate consumers about the benefits of EVs, along with financial incentives and the establishment of a strong infrastructure for charging, are essential to accelerating the transition to sustainable mobility.

By synthesising current research and identifying gaps, this review underscores the need for more localised research and the importance of a comprehensive approach that includes economic incentives, infrastructure development, and consumer education to foster the adoption of EVs and

mixed-energy mobility solutions in South Africa. Further studies tailored to the South African context will provide critical insights for developing effective strategies to promote sustainable transportation and reduce carbon emissions. This research is essential to inform policymaking and investment decisions aimed at advancing sustainable transportation solutions in South Africa. Additionally, further investigation is necessary to explore the efficacy of accelerating the adoption of these solutions in the country.

CHAPTER 3

RESEARCH QUESTIONS.

3.1 Introduction

The precise purpose of the research is defined through the formulation of specific research questions. Given that the topic of EVs within mixed-energy mobility solutions in South Africa is relatively new and under-researched, research questions are used to guide the investigation. These questions are supported by relevant literature to ensure a robust scholarly foundation and to create an expectation that subsequent chapters will provide empirical evidence exploring these dimensions. Each research question is numbered and presented with supporting literature.

3.2 Research Question 1

How do South African consumers' perceptions and experiences of mixed-energy mobility solutions, particularly electric vehicles, influence their decision-making in adopting these technologies? (Jensen et al., 2021a; Maluleke, 2024).

This research question explores the relationship between consumer perceptions and experiences and how these impact the decision-making process regarding the adoption of EVs and mixed-energy mobility solutions. It delves into:

1. **Consumer Perceptions**: Understanding how South African consumers view EVs in terms of performance, sustainability, reliability, and cost-efficiency. Studies such as by Msosa, (2023) show that perceptions can strongly influence whether individuals embrace new technologies.
2. **Experiences with Mixed-Energy Vehicles**: Investigating how prior experiences with traditional and mixed-energy vehicles, such as hybrids or EVs, shape the willingness to adopt EVs. According to Dua et al., (2024)., prior consumer experiences play a pivotal role in determining future behaviour and adoption rates.
3. **Decision-Making in Technology Adoption**: Analysing how these perceptions and experiences inform and drive consumers' choices in adopting EVs over traditional vehicles. Malima & Moyo (2023) emphasise that a positive consumer experience with EVs, particularly concerning ease of use, cost-effectiveness, and environmental benefits, can significantly encourage adoption.

This question aims to contribute to understanding the behavioural and psychological factors that guide consumer choices, specifically focusing on the South African context, where economic conditions, infrastructure, and cultural attitudes may uniquely influence adoption trends.

3.3 Research Question 2

What factors influence consumer preferences and adoption rates for mixed-energy vehicles in South Africa? (Baghel et al., 2016; Hawkins, 2024; Liao et al., 2019; Ye et al., 2021)

The demand for EVs is influenced by various factors, including consumer preferences, market trends, and environmental concerns (Featherman et al., 2021). According to Maluleke, (2022), there is a growing interest in EVs due to increasing awareness of environmental issues and the push for sustainable transportation solutions. The role of market trends and government initiatives in shaping the adoption of EVs has also been highlighted by (Malima & Moyo, 2023). This research question delves into the specific determinants that shape consumer choices and preferences for mixed-energy vehicles. Consumer preferences and adoption rates for mixed-energy vehicles, including EVs, are influenced by factors such as cost, environmental concerns, and infrastructure availability (Armenio et al., 2022). Baghel et al., (2015) emphasises the significance of cost as a determinant of consumer behaviour, suggesting that financial incentives and lower operating costs can drive adoption. Hawkins (2024) discusses the impact of environmental concerns and the availability of infrastructure, such as charging stations, on consumer preferences (Baghel et al., 2015). The focus of this research question is to identify and analyse the specific issues that shape consumer choices in the South African market.

3.4 Research Focus

The research examines how perceptions of risk and uncertainty influence consumer investment choices in South Africa's EV sector within mixed-energy mobility solutions. It also investigates the potential economic, social, and environmental benefits of scaling up EVs compared to fossil fuel-based transport. This dual approach ensures a comprehensive understanding of demand dynamics and adoption drivers for EVs. Moreover, it will critically assess how consumer perceptions, experiences with mixed-energy vehicles, and external factors like cost, infrastructure, and sustainability concerns shape decision-making in adopting EV technologies. Supported by relevant literature, this analysis will address key questions surrounding consumer preferences and broader impacts on South Africa’s mobility ecosystem.

3.5 Conclusion

This section articulated the guiding research questions, which are informed by prior studies. By articulating these research questions, the study stands to be systematically directed toward understanding the demand dynamics and the factors influencing consumer preferences and adoption of electric vehicles within South Africa's mixed-energy mobility market. Each research question is grounded in supporting literature, which provides a solid scholarly framework, ensuring that the research is informed by contemporary debates, empirical findings, and relevant theories. This method not only enhances the investigation’s rigour but also positions the study to contribute meaningfully to the under-researched field of EV adoption in South Africa, addressing both consumer decision-making and broader market impacts. The oncoming section articulates the research methodological foundation, which determines the approach used to collect and analyse data.

CHAPTER 4:

RESEARCH METHODOLOGY

4.1 Introduction

The selection of the research design intends to offer an all-encompassing comprehension of the perceptions, experiences, and adoption factors related to EVs within the context of South Africa's mixed-energy mobility market. It pertains to the blueprint detailing how the research will be executed to address the research questions and achieve the research objectives. The chosen research design for this investigation aligns with the exploratory nature of the study (Creswell et al., 2007).

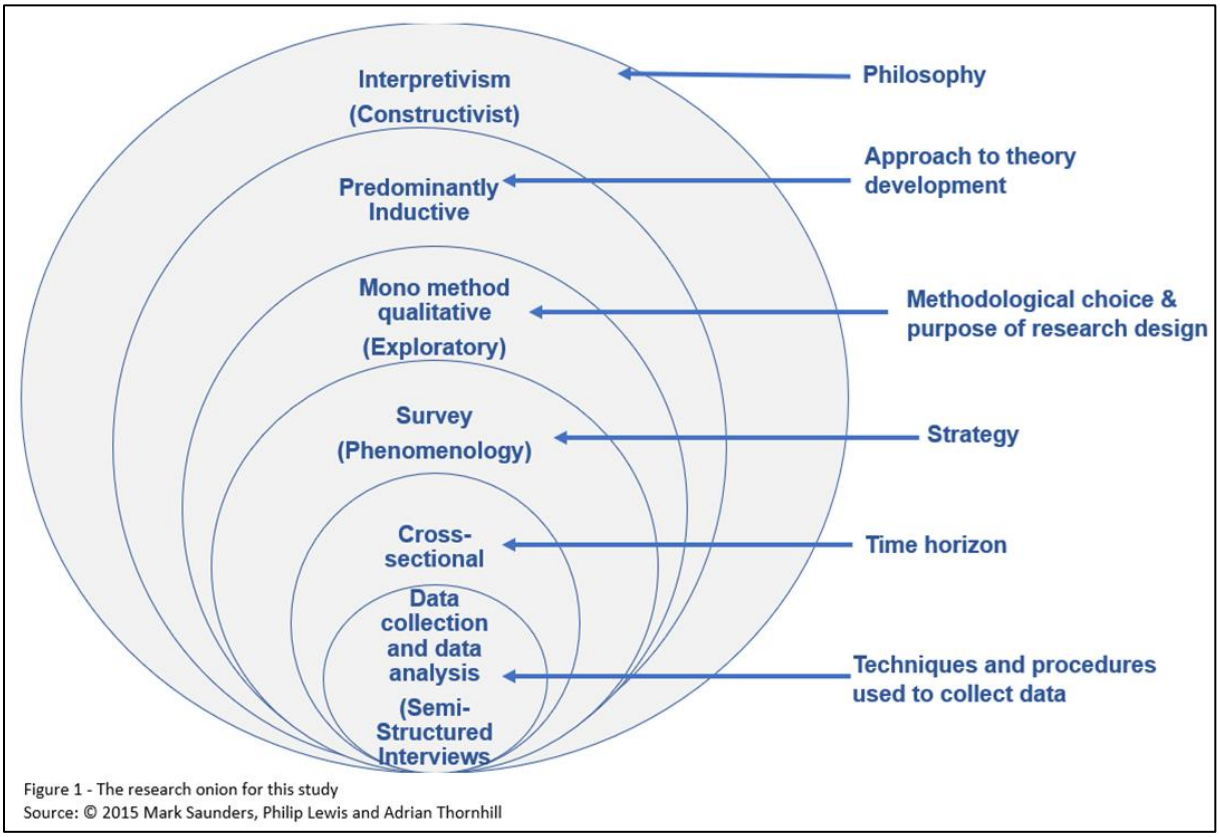

Figure 4.1: The research onion for this study

4.2 Purpose of Research Design

The purpose of this research design is to comprehensively understand and achieve two primary objectives:

Examine Consumer Perceptions and Experiences: To investigate how South African consumers perceive and experience mixed-energy mobility solutions, particularly EVs. The research aims to understand the factors that shape these perceptions and experiences and how they, in turn, influence consumers' decision-making processes when considering the adoption of EVs.

Identify Influential Factors in Adoption: To identify and analyse the key factors that influence consumer preferences and adoption rates for mixed-energy vehicles, including EVs. This involves exploring economic, technological, environmental, and infrastructural factors that either encourage or hinder the adoption of these technologies in the South African context.

The approach was chosen because it allows for flexibility in addressing real-world issues while also emphasising practical solutions. In designing this research, careful consideration was given to methodological choices, strategy, and time horizon to effectively address the research objectives. The research design is intended to systematically organise and structure an investigation effectively targeting research objectives. Its goal is to tackle the research problem and accomplish the goals drawn in the purpose statement. This entails making choices regarding methodology, data gathering, sampling, and analysis to bolster the validity and credibility of the findings. A meticulously planned study furnishes a coherent roadmap, anticipates obstacles, and contributes to generating dependable knowledge within a particular field (Saunders et al., 2019).

4.2 Philosophy

There are several philosophical foundations including positivism, realism, interpretivism and pragmatism (Saunders et al., 2019). The choice behind the selection of a particular research philosophy is largely determined by the nature of the objectives of a study. Given the qualitative foundations of this study, an interpretivist research philosophy was selected. Interpretivism is instrumental in understanding the meanings and motivations behind the domestic transition to EV adoption. It follows the constructivist paradigm, underscoring the subjective essence of reality and the significance of grasping participants' viewpoints and interpretations (Saunders et al., 2019). This philosophy belongs to the wider domain of interpretivism, which recognises that knowledge is socially constructed and contingent upon context.

By adopting an interpretive perspective, the research aims to uncover the complexities and nuances inherent in this transition process. With an emphasis on examining perceptions, behaviours, and socio-economic factors that shape the demand and preferences for mixed-energy mobility solutions, employing a constructivist approach enables thorough exploration and interpretation of qualitative data. This approach highlights subjective behaviour, experiences and

beliefs, providing valuable insights into the underlying dynamics of the transition to EV adoption in South Africa.

4.3 Approach to theory development

The study predominantly utilised a qualitative methodology, centering on semi-structured interviews as the primary means of gathering data. Interview guides and schedules will be employed to maintain consistency and structure throughout the interviews (Schindler, 2022). Qualitative data was gathered via interviews to explore participants' subjective experiences, beliefs, perceptions, and behaviours regarding mixed-energy mobility solutions. The qualitative approach was inductive, and it collected and analysed specific observations or data to formulate broader generalisations or theories.

4.4 Methodological Choices

Methodologically, a qualitative research approach was deemed most suitable for this paper as these methods, such as interviews, enable in-depth exploration of stakeholders' perspectives and contextual factors (Barczak, 2015). This approach aligned with the research objective of gaining insights into the motivations, challenges, and opportunities associated with the transition to EV demand and customer preferences. Qualitative methods are suitable for capturing rich, contextualised data that would provide deeper insights into the complexities of the automotive industry.

Furthermore, qualitative research enabled the exploration of emergent themes and the generation of new hypotheses, contributing to the development of theory and understanding within the field (McCracken, 2011). Through the utilisation of a qualitative approach, this research sought to uncover the underlying dynamics of the transition to EV production in South Africa and provide practical recommendations for fostering sustainable mobility solutions. The methodological selection comprised the use of semi-structured interviews, which facilitated a detailed exploration of participants' perceptions and experiences (Saunders et al., 2019). Interviews with consumers and industry experts from relevant organisations such as the OEMs, dealers and The Automotive Business Council (naamsa) yielded valuable qualitative insights on regulatory frameworks, financing mechanisms, and market dynamics.

4.5 Strategy

The research strategy involved conducting in-depth interviews with key stakeholders. To ensure a broad range of perspectives, inclusion from various stakeholders within the automotive sector, such as OEMs, dealerships, and industry associations like naamsa, were sought. Phenomenology was employed in investigating the subjective experiences, perceptions, and behaviours of individuals engaged in the adoption of mixed-energy mobility solutions (Saunders et al., 2019). Exploratory approaches were utilised in delving into the intricacies of demand through qualitative data collection methods (Creswell, 2007)

4.6 Time Horizon

A *cross-sectional time frame* was implemented owing to the exploratory character of the research and the necessity to capture a snapshot of current demand and preferences in the swiftly evolving EV market in South Africa at a specific juncture (Rindfleisch et al., 2008). This approach facilitated gathering data from diverse stakeholders within a predetermined timeframe to evaluate prevailing trends and dynamics in the market at a specific point in time. The cross-sectional time frame is also fitting, considering the time constraints and the data collection's focus on respondents' viewpoints and perceptions (Saunders et al., 2019)

4.7 Proposed Research Methodology and Design

4.7.1 Target Population

The population for this research comprised individuals aged 18 and older who were associated with or impacted by mixed-energy mobility solutions in South Africa. This encompassed consumers and industry experts from pertinent organisations such as The Automotive Council - naamsa. The population of interest in this research included key stakeholders involved in the transition to EV adoption in South Africa.

4.7.2 Unit of Analysis

This research analysed individual-level units and the target population consisted of a varied range of participants, such as consumers, industry experts, and representatives from organisations such as OEMs and dealerships. By examining the perspectives and actions of these stakeholders, the research aimed to understand the broader dynamics shaping the transition process. In a qualitative study, an appropriate target population size was necessary to facilitate a thorough exploration and comprehensive data collection. As per recommendations from (Guest et al., 2006)

and (Saunders et al., 2019), a sample size ranging from 12 to 18 participants, each participating in interviews lasting 45 minutes or more, is deemed sufficient for a qualitative study. Additionally, Hennink & Kaiser (2022) suggest that this sample size enables adequate data saturation, ensuring thorough exploration and analysis of emerging themes and patterns.

4.7.3 Sampling Method and Size

Sampling is categorised into probability and non-probability methods for quantitative and qualitative studies, respectively (Bougie & Sekaran, 2019). In line with its qualitative foundations, the study used purposive sampling to enable the selection of participants based on their relevance to the research questions (Ames et al., 2019), while stratified sampling ensured representation across various demographic or stakeholder groups. This sampling method was employed to select participants who have relevant knowledge and expertise related to EVs. Key participants were identified through leveraging existing networks and contacts within the industry. By employing a purposive sampling method and ensuring data saturation, the objective of this research was to encompass a broad spectrum of viewpoints and experiences, thereby augmenting the validity and applicability of the findings.

Purposive sampling is ideal for qualitative interviews when the goal is to gain in-depth insights into specific customer experiences, attitudes, and preferences (Schindler, 2022). This method was effective in selecting participants who have significant experience or knowledge about EVs and mixed-energy mobility solutions. By targeting individuals with relevant expertise, purposive sampling helped ensure that the data collected was rich and detailed, reflecting the perspectives of those who are most knowledgeable about the subject. The primary benefits of purposive sampling included obtaining in-depth insights and contextual understanding. It provided detailed qualitative data from individuals who possess unique perspectives, such as early adopters of EVs, industry experts, or automotive stakeholders. This approach allowed the researcher to delve into the reasons behind customer preferences and the factors influencing their decisions, offering a deeper comprehension of the topic. Purposive sampling involved selecting participants who are known to be early adopters of EVs, industry experts, or representatives from automotive companies. Conducting detailed interviews with these individuals yielded valuable information about their experiences and attitudes, enriching the research on consumer perceptions, experiences, and adoption factors of EVs.

The determination of the sample size was influenced by factors such as the research objectives, available resources, and the desired level of confidence and accuracy in the findings. Additionally,

it was guided by the principle of data saturation, which entails assessing emerging patterns and themes as data collection progresses. Data saturation was achieved after approximately 12 interactions (Guest et al., 2006). A diverse range of stakeholders from different sectors and perspectives will be included in the study to ensure a comprehensive understanding of the issues under investigation. The participants selected provided a clear representation of the population and met the sample criteria. Selection was guided by the criteria detailed below, in alignment with the research questions.

*Consumers***:** To ensure demographic diversity was pivotal, target individuals included those from various demographic backgrounds encompassing age, gender, income level, education, and geographic location to capture a wide array of perspectives. Moreover, consumers with diverse transportation usage patterns were included, such as daily commuters, occasional drivers, and long-distance travellers. The selection prioritised both current owners of mixed-energy mobility solutions and potential future adopters who are aware of these solutions and express interest in their adoption**.** Additionally, the sample encompassed consumers with varying degrees of experience with EVs or other mixed-energy mobility solutions.

Industry Experts: Individuals occupying key positions within OEMs, dealerships, and at naamsa were chosen. This entailed executives, managers, or analysts with expertise in the development, marketing, or sales of mixed-energy mobility solutions. Preference was given to experts possessing substantial experience and knowledge of the automotive industry, particularly within the South African context. The sample included those directly engaged in decision-making processes related to the adoption, manufacturing, distribution, or regulation of mixed-energy mobility solutions.

By adhering to these criteria, the sample was constructed to mirror the diversity of consumers and industry experts pertinent to the exploration of consumer perceptions, experiences, and adoption factors of EVs in South Africa's mixed-energy mobility market.

*Access to the sample***:** In this study, participants were selected using purposive sampling due to their specific relevance and expertise in the field of EVs and mixed-energy mobility solutions. To access individuals who possess significant experience and knowledge in these areas, the author leveraged existing professional networks in the automotive space, which is the industry in which he is currently working. This targeted approach ensured that the selected participants could provide in-depth and meaningful insights into the research topic. The author’s direct access to these individuals was facilitated through established professional connections within the

automotive and energy sectors. This network includes industry experts, early adopters of EVs, and key stakeholders in mixed-energy mobility solutions. These connections were instrumental in identifying and recruiting participants who met the study's criteria, thereby enhancing the depth and relevance of the data collected.

4.7.4 Measurement Instrument

The measurement instrument refers to the tools or methods utilised to gather participant data (Lê & Schmid, 2022). For qualitative data, this encompasses interview guides. The interview guide was developed based on the research objectives and literature review. Semi-structured interviews were used, and these represent a data collection technique where the interviewer explores a set of themes through a series of questions, affording flexibility in how the topics are addressed and their sequence (Saunders et al., 2019). The development of the interview guide for this research followed a structured and methodical approach to ensure its effectiveness in addressing research objectives and generating insightful responses. This process entailed several key steps:

Firstly, a thorough literature review and conceptual framework analysis were conducted to identify relevant themes, concepts, and variables on mixed-energy mobility solutions, consumer preferences, experiences, and adoption factors. By synthesising findings from existing studies, the interview guide was grounded in current academic knowledge and debates. Subsequently, research questions and objectives were formulated to align with the primary research questions outlined in the study, guiding the design of questions in the interview guide to directly address the research problem and objectives.

A draft of the questions was created using the identified themes and objectives, with a focus on creating open-ended questions that encourage participants to share their thoughts and experiences freely. This method made it possible to conduct a deeper investigation of the topics, as participants could provide detailed and nuanced responses. The open-ended nature of the questions was intended to elicit rich, qualitative data that reflected the diverse perspectives and experiences of the participants, aligning with the study's goals. Questions were grouped into sections focusing on different aspects of the research, such as consumer preferences and market trends. To enhance the depth of data collected, probing techniques, including clarification, elaboration, contrast, and follow-up probes, were incorporated into the interview guide, ensuring a comprehensive exploration of participant responses.

The development of the interview guide was a thorough and iterative process aimed at creating a tool that would yield rich, meaningful data to inform the study's analysis and conclusions. This

careful design ensured that the collected data would provide valuable insights into the customer preferences for mixed-energy mobility solutions in South Africa. The draft interview guide underwent expert review by specialists in mixed-energy mobility and qualitative research methodology, followed by pilot testing with a small participant sample to identify any ambiguities or issues with the questions. Considering the expert review's input and pilot testing, the interview guide was finalised, incorporating a mix of broad exploratory questions and specific targeted questions to cover all aspects of the research comprehensively and encourage open dialogue with participants. Each section of the guide was carefully structured to facilitate rapport-building and encourage honest responses (McCracken, 2011)

4.7.5 Data Gathering Process

The data collection process outlines how data was gathered from participants using the selected measurement tools. Clear protocols were established for each data collection method to ensure uniformity and trustworthiness in the data. Semi-structured interviews were suitable for this study as they necessitated further exploration to gain deeper insights into the phenomenon and adequately addressed the research questions. Semi-structured interviews combined the flexibility of unstructured interviews with the consistency of structured interviews. These interviews were characterised by their adaptable and flexible format, facilitating reciprocal interaction between the respondents and the researcher (Lester et al., 2020). This dynamic allowed the researcher to pose follow-up questions, thereby augmenting the understanding of the respondent's responses. In a semi-structured interview, the interviewer uses a predefined set of open-ended questions or topics to guide the conversation but allows for deviations and follow-up questions based on the interviewee's responses. These interviews required a certain level of familiarity with the research subject, as questions were shaped by prior knowledge and prepared beforehand using an interview guide (Saunders et al., 2019). While the guide furnished a structured framework for the interview, the order of topics was not strictly adhered to, allowing for spontaneity and adaptation to the participant's response (Saunders et al., 2019).

The interview methodology for this study was flexible, incorporating both in-person and virtual interviews to accommodate geographical challenges in South Africa. Microsoft Teams and Zoom were used for virtual interviews, and flexible scheduling and communication platforms were employed to arrange interviews across various regions, guaranteeing the representation of diverse viewpoints. The interviews followed the seven-stage interview process, emphasising rapport building, attentive listening, and comprehensive questioning. Interview requests were sent via email and at industry associations to reach potential interviewees, with formal invites being

sent later. By starting with known contacts who fit the study criteria, the author initiated the snowball sampling process, where the author requested that these initial participants then refer other individuals within the same networks who also met the study's requirements. This approach not only taps into the author's existing connections but also helps in expanding the sample by reaching participants who might otherwise be difficult to identify. Overall, the process prioritised inclusivity, professionalism, and collecting high-quality data to inform the study's objectives.

Appropriate methods were used to ensure that all research data was securely stored in an accessible format for a minimum period of 10 years. Digital data has been stored in a password-protected and encrypted repository, with regular backups to a secure, encrypted external drive. Physical data, such as printed transcripts or notes, will be securely stored in a locked filing cabinet. Access to the data will be restricted to authorised personnel, with measures in place to prevent unauthorised access. Participants were informed of their right to access their own data, and upon request, they may review or withdraw their contributions in accordance with ethical guidelines. After the 10-year retention period, all data will be securely deleted or shredded.

4.7.6 Analysis Approach

This section details the analysis of the gathered data, illustrating how it was managed and interpreted to tackle the research questions and objectives. For qualitative data, this iterative process encompassed thematic analysis to discern trends, recurring themes and relationships in the data (Saunders et al., 2019). To identify and scrutinise themes extracted from interview transcripts, a thematic study was conducted using Atlas.ti. This thematic analysis is recommended for this research as it enabled the researcher to interpret the collective, shared meanings and experiences, aligning with the phenomenological approach of this study (Braun & Clarke, 2012).

Data analysis for this research employed thematic analysis, a qualitative method to identify and analyse patterns or themes within the data. The process involved several steps: familiarisation with the data through repeated reading, systematic generation of initial codes to identify key concepts, development of broader themes and sub-themes based on similarities, review and refinement of themes through team discussions, and interpretation and reporting of findings about the research objectives and theoretical framework. Through thematic analysis, qualitative data collected from diverse sources, such as interviews, was meticulously scrutinised to discern recurring themes and patterns (Lester et al., 2020). These themes included a range of perspectives, challenges, and opportunities associated with the adoption of EVs (Asadi et al., 2021). By systematically coding and categorising the data, overarching themes emerged,

illuminating key factors that influence customer preferences and adoption factors (Braun & Clarke, 2012). Ultimately, the insights derived from thematic analysis guided evidence-based recommendations and strategies aimed at fostering sustainable and accessible energy mobility solutions in South Africa.

The combination of semi-structured interviews and thematic analysis enriched the research process by gathering diverse perspectives from participants and methodically interpreting the collected data. Semi-structured interviews elicited contextual information directly from participants, while thematic analysis aided in identifying recurring themes and patterns within the collected data. This integrated approach facilitated a deeper comprehension of the research topic, revealing nuanced insights and developing comprehensive analyses that guide decision-making in the realm of energy mobility solutions. Given the qualitative nature of the study, the interview guide served as the measurement instrument, with interview questions formulated from the research questions (McCracken, 2011)

4.7.7 Quality Controls

Quality controls were essential measures incorporated into the research process to maintain the reliability, validity, and integrity of the study outcomes. These controls encompassed several aspects, including establishing a clear research design aligned with objectives, conducting pilot tests to evaluate data collection instruments, implementing standardised data collection procedures, performing regular quality assurance checks, conducting comprehensive data validation and cleaning, soliciting peer review feedback, and ensuring transparent interpretation and reporting of results. By adhering to these quality controls, the credibility and robustness of the research findings were bolstered, thereby contributing to the advancement of knowledge in the field.

Additionally, several strategies were employed to ensure the quality and rigour of the data analysis. Data triangulation compared findings from different sources for validity and reliability; member checking entailed presenting participants with preliminary findings to validate responses; peer debriefing included regular discussions and reviews among the research team to challenge interpretations; reflexivity was maintained by acknowledging the researcher's biases and assumptions, ensuring transparency and minimising bias. Triangulation of data sources was applied to improve the validity and reliability of the findings by corroborating evidence and identifying common themes across different sources. Employing thematic analysis and these quality control techniques—triangulation, member checking, peer debriefing, audit trails,

reflexivity, detailed descriptions, and prolonged engagement—were essential for the reliability, credibility and validity of the data collected in this qualitative study. By rigorously applying these methods, the research yielded robust and trustworthy findings that accurately reflected the perspectives of the participants.

4.7.8 Limitations

The investigation into consumer perceptions, experiences, and adoption factors of EVs encounters various constraints that could impact the accuracy and generalisability of its findings (Cui et al., 2021). Potential biases within self-reported data and the limited duration of the study, inhibiting the ability to monitor changes over time, restricted the depth of analysis and hindered a thorough exploration of long-term trends and consequences (Price & Murnan, 2004). Access to policymakers and governmental bodies could have enriched the research. Furthermore, the study did not fully grasp stakeholders' perspectives on the risks and uncertainties linked with investing in mixed-energy mobility solutions (Price & Murnan, 2004).

While the chosen methodology offered valuable insights, several limitations should be acknowledged. To begin with, the qualitative aspect of the research constrains the applicability of the findings. The viewpoints and experiences gathered via interviews may not represent the entire population of all stakeholders involved. Therefore, caution should be exercised when extrapolating the findings to broader contexts. Secondly, the reliance on self-reported data from interviews introduces the potential for social desirability bias and respondent bias. It is possible that participants gave answers they believed to be socially acceptable or that aligned with their interests or agendas, affecting the accuracy and validity of the data collected.

Additionally, while efforts were made to ensure data saturation through purposive sampling and iterative data collection, some perspectives or themes may not be fully explored or represented in the analysis. This limitation underscored the need for continued research and ongoing engagement with stakeholders to comprehensively understand the dynamics of EV adoption and customer preferences. Despite these limitations, the research findings provided valuable insights into the motivations, opportunities and challenges in mixed-energy mobility solutions in South Africa. By acknowledging these limitations, future research can build upon the findings of this study and address gaps in knowledge to inform policy and practice effectively.

4.7.9 Generalisability Challenges

The issues regarding generalisability arise from the challenges in generalising findings from qualitative data due to the smaller sample size. Additionally, the South African market's diversity, marked by regional discrepancies, socioeconomic disparities, and cultural distinctions, poses challenges to generalisability. Consequently, findings from the research may not readily apply to or represent the entire country. Additionally, external factors like changes in government policies, economic circumstances, and technological advancements may exacerbate the complexity of generalising the research findings over time. Despite these hurdles, endeavours to mitigate bias and ensure diverse representation in the sample population bolstered the reliability and relevance of the research outcomes to a wider context.

4.7.10 Constraints and Subjectivity

Limitations and subjectivity present significant hurdles, such as budgetary constraints, time limitations, and data accessibility issues. These factors restricted the scope and depth of the research, potentially impacting the thoroughness of the findings. Moreover, subjectivity introduces biases originating from researchers' perspectives, experiences, and interpretations, which can influence data collection, analysis, and conclusions. Overcoming these challenges necessitates transparency in research methodologies, rigorous validation of data sources, and acknowledgement of potential biases in the research process. By employing robust methodologies, triangulating data sources, and incorporating diverse viewpoints, researchers can mitigate constraints and subjectivity to bolster the credibility and reliability of the research outcomes.

4.7.11 Research Ethics

Strict adherence to robust ethical standards is essential. All potential participants were approached with an official invitation to take part in the research. Informed consent was obtained, confirming that participants understood the goal of the study, their role, and the confidentiality measures in place. Crucial considerations included guaranteeing anonymity, honouring the autonomy and dignity of participants, and mitigating potential harm. Participants' identities and the data collected were anonymised to ensure confidentiality and protect their privacy throughout the study.

The methodology was designed to ensure that the recruitment process is transparent, voluntary, and respectful of participants' privacy. Transparency, integrity, and cultural sensitivity were also

crucial, along with adherence to pertinent regulations and institutional policies. Upholding these ethical principles, this research upheld the trust and collaboration of participants, safeguarding their rights and welfare and responsibly contributing to knowledge advancement in the domain of mixed-energy mobility solutions.

4.8 Conclusion

By employing a qualitative research approach, the design allowed for a thorough investigation of consumer attitudes and behaviours. The insights gained from this study are intended to provide valuable information to stakeholders, including automotive manufacturers, policymakers, and marketers, who are involved in the development and promotion of EVs and mixed-energy vehicles in South Africa. The goal is to contribute to the broader understanding of how these emerging technologies can be more effectively integrated into the South African market, thus supporting the transition to sustainable mobility solutions.

CHAPTER 5

FINDINGS

5.1 Introduction

This chapter presents the findings from interviews conducted with various experts involved in the operationalisation and adoption of EVs in South Africa. The insights shared here reflect the perspectives of individuals from multiple sectors of the economy, each contributing knowledge amassed over years of experience regarding the evolving role of EVs within South Africa. Reference is also made to South Africa's EV White Paper, which outlines government-proposed incentives to encourage the adoption and increased use of EVs.

Data in this chapter were analysed through thematic analysis, facilitated by the processing of extensive interview transcripts using the Atlas.ti software package. The chapter begins with an overview of the interviewees' demographics, including their professional designations, types of vehicles owned, and likelihood of transitioning to EVs. This contextual foundation is followed by an in-depth examination of the research-specific findings.

5.2 Personal demographics of interviewees

This section presents the demographic profiles of the interviewees, which were deemed essential for understanding the backgrounds and expertise of the study participants regarding electric vehicle usage in South Africa. Profiling these individuals provided context to their perspectives and the depth of knowledge they bring to the topic.

5.2.1 Designation

The participants in this research held a wide range of professional designations across various economic sectors and cities. However, most demonstrated substantial knowledge of electric vehicles, informed by the roles they occupy within their respective industries. Figure 5.1 illustrates the designations and experience levels of the interviewees, providing further insight into their expertise.

Table 5.1: Designation and experience of interviewees

Participant number	Time of interview	Date of interview	Occupation
Participant 1	9.30 - 10.30	Wednesday 2 October 2024	A business development manager for a vehicle finance department
Participant 2	12.30 - 1.30		Motor enthusiast, previously business development manager at an EV OEM and now at a bank
Participant 3	1.30 - 2.30		Commercial asset finance and renewables expert
Participant 4	3.00 - 4.00		An executive at Absa – Sales Origination
Participant 5	11.30 - 12.30	Thursday 3 October 2024	Business Analyst and lifestyle farmer in Muldersdrift
Participant 6	12.30 - 1.30		A background in banking and HR at Standard Bank, Nedbank, MFC and Absa
Participant 7	2.00 - 3.00		National Manager for Credit Lending – finances EVs
Participant 8	4.00 - 5.00		Senior Sales Manager in East London
Participant 9	6.00 - 7.00	Friday 4 October 2024	Relationship Manager in the financial sector for 20 years. Ex Partnership Manager responsible for big dealer groups
Participant 10	2.00 - 3.00	Monday 7 October 2024	Vehicle Finance and Renewable energy expert. Ex Strategy Manager
Participant 11	8.00 - 9.00	Tuesday 8 October 2024	Franchise Director at a Dealer Group. Ex-GM at an EV OEM
Participant 12	10.00 - 11.00		Engineer with a good understanding of electric vehicles. Currently a Product Manager responsible for EV propositions
Participant 13	10.00 - 11.00	Wednesday 23 October 2024	Senior Energy Adviser for South Africa Just Energy Transition. British High Commission

Participants in this research represented various sectors of the economy, with most holding senior managerial roles, including positions as business development managers in vehicle finance, commercial asset management, and renewable energy specialists. The study also included

insights from an engineer with substantial expertise in electric vehicles, as well as a Senior Energy Adviser from the British High Commission, who focuses on South Africa's Just Energy Transition.

This research's inclusion of diverse perspectives from various economic sectors enabled a comprehensive understanding of the broad implications associated with the adoption of electric and mixed-energy vehicles within South Africa's automotive market. The participants' professional designations suggest that they could offer credible insights, drawing on both their authoritative roles and their direct or indirect exposure to electric and mixed-energy vehicle usage and adoption in South Africa.

Given their positions of authority, participants were well-equipped to articulate the influence of government policies, as well as the broader economic and social context, on shaping consumer perceptions regarding the adoption of electric and mixed-energy vehicles in South Africa.

5.2.2 Vehicle ownership

Vehicle ownership was utilised as a criterion to gauge participants' familiarity with the automotive environment. Research findings revealed that none of the 13 participants in this study owned an electric vehicle, which is concerning. Despite their extensive knowledge of electric vehicles, their lack of ownership raises important questions. This situation provides valuable insights into their perceptions, feelings, and motivations for not owning an electric vehicle, even when they demonstrate a strong understanding of the technology. The research participants all own various internal combustion engine vehicles, specifically petrol or diesel-powered cars, with none having transitioned to electric vehicles yet.

For instance, Participant 1 reported owning a Mini Cooper with an internal combustion engine (ICE) and expressed a willingness to transition to an electric vehicle, contingent upon the availability of more charging infrastructure and a decrease in electricity costs in South Africa. Participant 3, who owns a petrol-powered Toyota Corolla, is familiar with electric vehicles and looks forward to owning one in the future. Participant 4 drives a petrol Mercedes-Benz sports coupe, while Participant 5 currently owns three fossil fuel vehicles but is contemplating a switch to electric vehicles. Their primary concerns include charging infrastructure, pricing, and the travel range achievable from a full charge. Participant 6 has owned a petrol SUV for the past two years, having replaced a diesel vehicle that had been in use for 11 years. Lastly, Participant 7 drives an ICE SUV and has yet to own an electric or hybrid vehicle but is considering such a purchase in the future.

Participant 8 has owned a petrol-driven VW Polo since 2020. Participant 9 possesses a gasoline sedan and has expressed concerns regarding the reliability of electric vehicles and the adequacy of charging infrastructure in South Africa. Participant 10 is actively contemplating a transition to a hybrid or electric vehicle, driven by environmental concerns, but cites cost and range anxiety as significant barriers to adoption. Similarly, Participant 11 is considering the purchase of a hybrid vehicle. Participant 12, who owns a Mercedes bakkie, is interested in electric vehicles but finds their pricing to be prohibitively high. Lastly, Participant 13 currently drives a diesel SUV and notes that affordability challenges are a significant impediment to the widespread adoption of electric vehicles in South Africa.

5.2.3 Generic Word Cloud created from conversations with interviewees

The generic word cloud presented in Figure 5.1 illustrates the most prominent terms used by participants in response to interview questions generated using Atlas.ti. The size of the words in the figure reflects their frequency of use within the interview transcripts. Notably, the most frequently mentioned words are related to personal feelings and perceptions, including terms such as "think" and "know." Additionally, other commonly used terms include "vehicle," "electric," and "hybrid," highlighting the participants' focus on the concept of electric vehicles and their associated experiences.

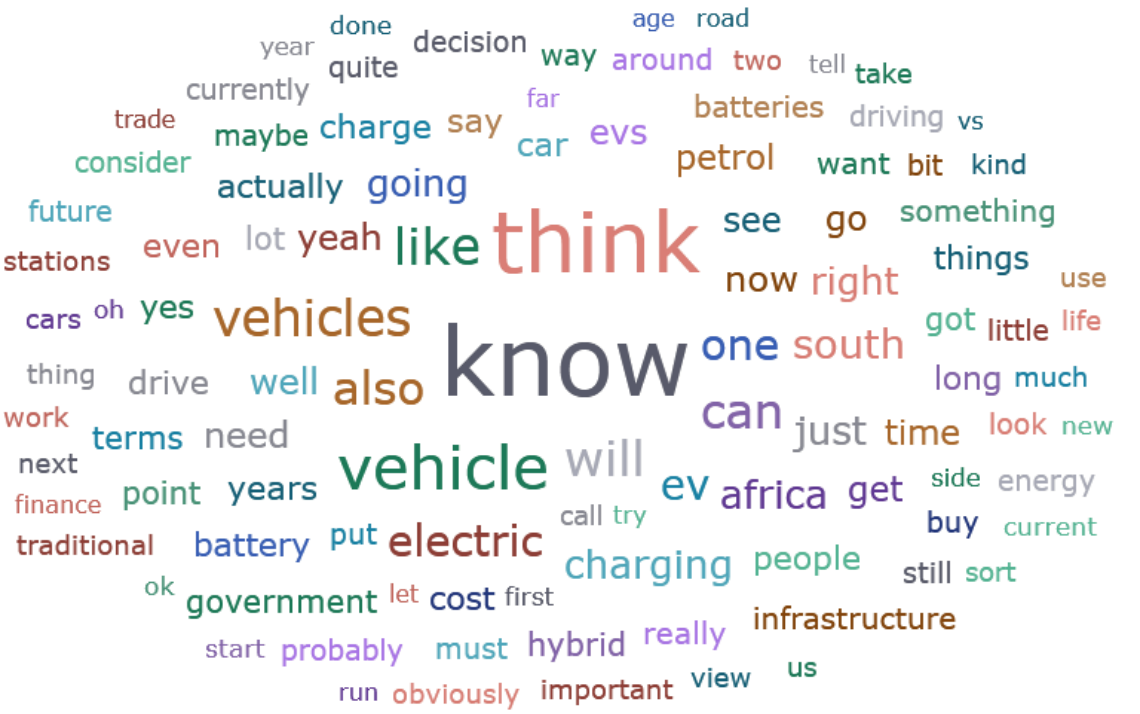

Figure 5.1: Generic word cloud created from conversations with interviewees

5.2.4 Saturation point

The saturation point diagram is illustrated in Figure 5.1.

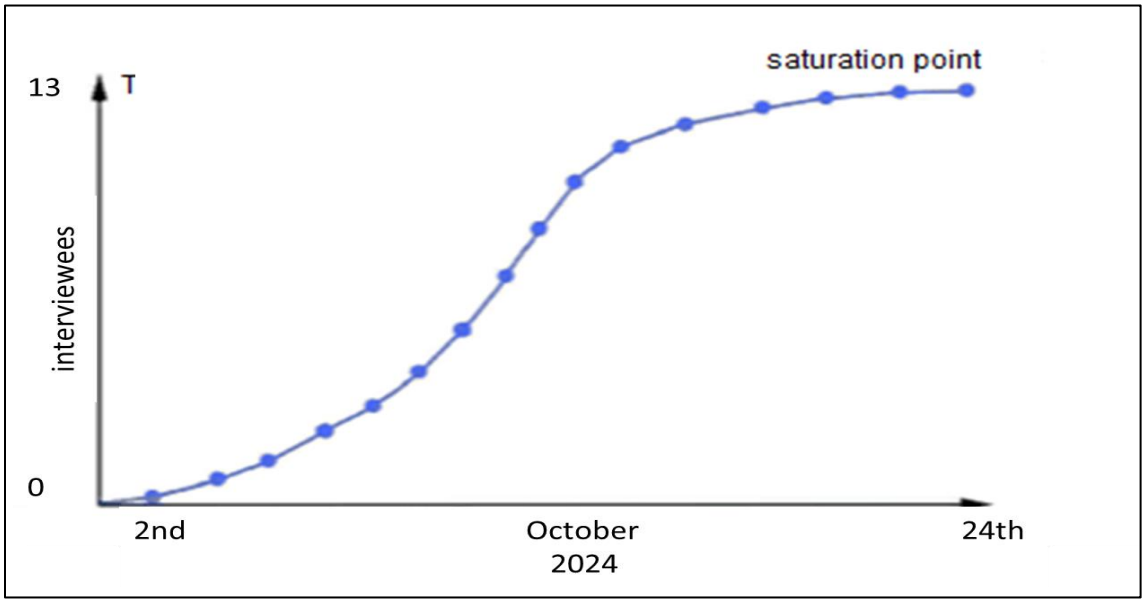

Figure 5.2: Saturation point graph

The interviews started on the 2nd of October 2024 and were conducted until the saturation point was reached on the 24th of October 2024, when the 13th interview was held. All these interviews lasted close to an hour and were recorded with the permission of the interviewees. The saturation point was adjudicated the moment no new insights emerged from the discussions.

5.3 Findings

This section presents research findings derived from transcripts of interviews conducted with 13 participants. It begins by outlining the results in relation to the research objectives, followed by an exploration of key themes that emerged from the interviews. These themes were identified through coding extracted from the interview transcripts. Additionally, verbatim quotations from participants are included to illustrate their authentic views and opinions regarding the phenomenon under discussion. The analysis subsequently synthesises all the presented themes, views, and opinions, aiming to provide a comprehensive understanding of the key aspects and discussions surrounding the adoption of electric vehicles in South Africa.

5.3.1 Themes

Table 5.2 shows the main themes.

Table 5.2: Main themes

Research question 1	Research question 2
Cost	Cost of ownership and discounts
Distance range and performance	Operating costs
Charging infrastructure	Charging time and infrastructure
Unfamiliarity with Mixed-Energy Vehicles	Travelling range of electric vehicles
Expected features	Durability and disposal of electric vehicles
Drawbacks to electric vehicle adoption	Environmental Security
	Infrastructure and Policy Support

The above themes are analysed in this chapter.

5.4 Research Question 1:

How do South African consumers' perceptions and experiences of mixed-energy mobility solutions, particularly electric vehicles, influence their decision-making in adopting these technologies?

The first research objective focused on exploring the relationship between consumer perceptions and experiences, examining how these factors shape decision-making processes related to the use of mixed-energy mobility solutions and electric vehicles.

5.4.1 Consumer Perceptions:

The first part of this objective involved examining the responses regarding consumer perceptions, which were categorised into three primary themes that emerged concerning the use and adoption of mixed energy mobility solutions and electric vehicles in South Africa.

5.4.1.1 Theme 1: Cost

All participants in this study consistently identified the cost of electric vehicles as a significant determinant influencing the uptake of electric vehicles in the South African market. Participants expressed that the potentially high costs associated with owning these advanced vehicles represent a major barrier to adoption, particularly considering the country’s economic conditions. In relation to the cost of electric vehicles, participants emphasised the necessity for government intervention, as outlined in the White Paper, to facilitate the reduction of acquisition costs for electric vehicles. They suggested the implementation of various incentives targeted at both

electric vehicle manufacturers in South Africa and end users who are considering the transition to electric vehicles and mixed-energy mobility solutions.

Specific insights shared by participants believed that "*the positioning of electric vehicles within the market is still very luxury based"* Participant 4. Others stated that electric vehicle prices are "*a little bit too high for us at the moment*" Participant 5. Others cast doubts on the contribution that electric vehicles make towards environment protection and global warming by stipulating that "*I don't think changing to an electric vehicle would necessarily assist".* Participant 4. Other participants thought that *"I still find that the cost of petrol or cost of diesel in a fuel efficient cars too low enough to offset the electric and driving experience"* Participant 2

5.4.1.2 Theme 2: Distance range and performance

The limited distance range of electric vehicles was considered a key factor in the uptake of electric vehicles in South Africa, with participants expressing reservations concerning the ability of electric vehicles to enable them to "*take a long distance trip in South Africa*" Participant 4; Another participant believed that, *"you get 300 kilometres"* from a single charge Participant 7. While another believed that *the* "*distances that they can drive have much improved over time"* Participant 6. Others considered owning both the ICEVs and EVs to cater for long-haul trips. "*we keep fuel vehicle in the garage for, you know, the longer trips,"* Participant 6. There was a concern over the reliability and safety of electric vehicles with one participant asking, "*How reliable are they?"* Participant 7.

The performance of electric vehicles was also highlighted by participants expressing, "*They do put out an immense amount of power when you put your foot down"* Participant 6. However, that was associated with a heightened pace of battery draining and lowering the distance range one can travel on an electric vehicle. The performance perceptions of electric cars were rather speculative as most participants did not have first-hand experience with them "*I've never driven one, but I know It's purely battery-based; there's no traditional engine Participant 1. "People are scared that they might find themselves desperate in terms of when they find themselves with a car that's discharged… in the middle of nowhere… It's unlike petrol, where you know, after 50 kilometres, you're going to find a petrol station not with EVs" Participant 12*

Participants expressed concerns regarding the relatively limited distance range of electric vehicles compared to internal combustion engine vehicles. Additionally, they highlighted the inadequate infrastructure and the scarcity of charging stations as significant obstacles. These factors were identified as key deterrents that diminish individuals' willingness to transition to electric vehicles.

5.4.1.3 Theme 3: Charging infrastructure

One of the participants acknowledged that "*in South Africa, we don't have enough infrastructure in terms of charging"* Participant 1. The lack of adequate infrastructure is quite concerning, especially at the height of load shedding in South Africa. Participants indicated awareness of electric vehicles by stating that they required one to *"plug them, you know, onto electricity* Participant 3 which becomes a challenge, especially when electricity is scarce" *with the unreliability that we had with Eskom"* Participant 3

Regarding consumer perceptions of electric vehicle adoption, participants demonstrated a strong familiarity with the technology and articulated various benefits and costs associated with their environmental impact. They identified limited charging infrastructure as a significant barrier to the widespread adoption of electric vehicles, particularly the anxiety around running out of charge, especially in remote areas. The vast road network in South Africa necessitates longer travel distances between provinces, which contributes to reservations about fully adopting electric vehicles, given their range limitations—typically up to 500 km on a single charge.

Some participants expressed hesitations about exclusively owning electric vehicles. They suggested a mixed approach, proposing the ownership of electric vehicles for short trips while relying on internal combustion engine vehicles for longer journeys. This preference is largely influenced by the greater availability of petrol and diesel service stations compared to the relatively sparse network of charging ports across the country.

Concerns were also raised regarding the durability of EV batteries, their disposal, and the potential for financial incentives as key factors influencing the adoption of electric vehicles in South Africa. Participants emphasised the environmental benefits of EVs, particularly their role in reducing carbon emissions, contributing positively to global warming mitigation, and alleviating negative externalities such as air and noise pollution. However, a prevailing perception exists that electric vehicles remain largely inaccessible to the mass market, as they are often positioned as luxury items catering to niche markets.

5.4.2 Experiences with Mixed-Energy Vehicles

This study sought to understand and appreciate participants' experiences with mixed-energy vehicles. These vehicles do not rely solely on electric power but utilise a combination of energy sources to operate, rather than depending exclusively on traditional fossil fuels. The findings indicate that several participants possess both personal and shared experiences regarding the

effectiveness of operating mixed-energy vehicles compared to exclusively using pure electric or internal combustion vehicles. Key insights that emerged from discussions with participants are detailed below.

5.4.2.1 Theme 1: Unfamiliarity with Mixed-Energy Vehicles

Several participants expressed a notable unfamiliarity with mixed-energy vehicles. This lack of familiarity is not entirely surprising, considering that all participants in this study reported owning internal combustion vehicles powered by either petrol or diesel fuel.

Participant 1 expressed unfamiliarity with the use of mixed-energy vehicles since there are *"too many uncertainties and limited battery life."* Another participant has yet to be exposed to mixed-energy vehicles. *I haven't had a chance to use a hybrid vehicle, a plug-in hybrid vehicle now, but it's something that I would consider"* Participant 3. Others did not view the mixed energy vehicles positively as they assumed that the "*batteries are damaged"* when the car is delivered to a client Participant 6 though there is no evidence to justify this claim.

Some of the views and opinions regarding mixed-energy vehicles stem from participants who have either driven such vehicles or shared experiences with colleagues in their social circles. Nevertheless, while the general responses concerning perceptions of mixed-energy vehicles—especially hybrids—were favourable, there remains a notable level of unfamiliarity with these vehicles compared to traditional internal combustion vehicles.

5.4.2.2 Theme 2: Expected features

Discussions with participants revealed that they expect mixed-energy vehicles to possess features comparable to those found in traditional internal combustion vehicles, such as car audio systems, air conditioning, and other electronic attributes. However, participants expressed reservations about whether the inclusion of additional features might limit the vehicle's range, resulting in faster battery depletion. This concern highlights the importance of balancing technological advancements with the practical considerations of battery life and vehicle performance.

Most participants expected to get "*all the standardised features that come with a petrol vehicle would need to be in the electric vehicle"* Participant 4. While others expected to make investments "*a bit more in batteries*" Participant 5 that could increase the distance range of mixed-energy vehicles. Speed was also identified as a key attribute, "*They are very quiet, great acceleration"*

Participant 5. Prolonged battery life was also highlighted by several participants, "*Battery life and charging rates are continually improving"* Participant 5.

The key insights derived from these discussions indicated a distinct preference among participants for pure electric vehicles over hybrids. Participants expressed that mixed-energy vehicles should be equipped with accurate range projection capabilities to facilitate effective travel planning. While it was acknowledged that mixed-energy vehicles could offer extended travel ranges, there remained uncertainty regarding the reliability and utility of electric vehicles in the context of load shedding in South Africa.

The SA Electric Vehicle White Paper (2023:3) acknowledges the disruptions posed by load shedding by stating, "*Firstly, the country currently has an energy shortage, and power availability has led to load shedding. This will impact domestic adoption of EVs in the short-term due to the need to avoid a sharp rise in energy demand on the grid from EVs whilst the grid capacity is rebuilt".* This highlights the importance of addressing energy infrastructure issues to foster consumer confidence and facilitate the adoption of electric vehicles in the current economic climate.

Another group of participants expressed a preference for plug-in hybrids, citing their dual power sources as a significant advantage. They noted that these vehicles are generally more cost-effective, reliable, and user-friendly compared to pure electric vehicles. Some participants were optimistic about technological advancements that could eventually reduce the costs of electric vehicles, highlighting developments in lithium battery technology that have enabled electric vehicles in China to achieve ranges of up to 1,000 km on a single charge. However, in the South African context, there is a consensus that hybrid vehicles are likely to remain more popular than pure electric vehicles for the foreseeable future. This preference reflects concerns about the current limitations of electric vehicles, particularly regarding charging infrastructure and the overall cost of ownership.

5.4.3 Decision-Making in Technology Adoption:

Respondents were invited to share their perspectives on the likelihood of adopting mixed-energy vehicles or electric vehicles in the future. Their insights revealed a range of attitudes and considerations that influence their decision-making processes. Many participants indicated a cautious optimism toward adopting electric vehicles, primarily driven by environmental concerns and a desire to contribute to sustainable mobility. However, they also acknowledged significant barriers, such as the current limitations of charging infrastructure, range anxiety, and the upfront

costs associated with electric vehicles. For some, these factors tempered their enthusiasm for immediate adoption.

Conversely, several respondents expressed a more favourable view of mixed-energy vehicles, particularly plug-in hybrids. They appreciated the flexibility offered by having both electric and internal combustion power sources, which they believed mitigated concerns related to range and charging availability. Participants highlighted that mixed-energy vehicles would enable them to travel longer distances without the anxiety of finding a charging station, especially in areas with limited infrastructure.

Overall, while there was a recognition of the potential benefits of electric vehicles, practical considerations around cost, convenience, and infrastructure significantly influenced respondents' likelihood of adopting either mixed-energy or purely electric vehicles in the future. Below are some of their key insights.

5.4.3.1 Theme 1: Drawbacks to electric vehicles adoption

Participants expressed significant disadvantages associated with the transition to electric vehicles, particularly regarding *"Charging infrastructure* is necessary …t*here is a long queue on that charger, or the charger's not working"* Participant 1. It was also highlighted that South Africa is still developing when it comes to the mass rollout of electric vehicles since the country has relatively *"Fewer stations where you can stop and plug your vehicle and recharge"* Participant 3. It appears that issues related to charging infrastructure are of paramount importance and represent a key drawback to the adoption of electric vehicles in South Africa.

Despite these drawbacks, other participants believed that *"There is an improvement when you think of the lithium batteries and the life span of those batteries"* Participant 3. Another participant concurred that "*Fewer stations where you can stop and plug your vehicle and recharge* Participant 3. However, there is an anticipation that in the future the situation in respect to the adoption of electric vehicles in South Africa will improve, *"In 15 to 20 years you will start seeing more EVs"* Participant 6. Other participants were already speculating that the situation for the adoption of electric vehicles is better since *"There is an improvement when you think of the lithium batteries and the life span of those batteries*" Participant 3

The key insights from the discussions revealed significant drawbacks to the adoption of electric vehicles in South Africa. These challenges include the availability of charging ports, the overall charging infrastructure, and the price and cost of ownership compared to internal combustion

engines. However, participants expressed a strong belief that providing financial incentives to citizens could positively influence their decision to purchase electric vehicles in the future.

Participants emphasised the importance of government support and policies, particularly the current white paper advocating for the adoption of electric vehicles in South Africa. Key suggestions included the provision of financial incentives and tax rebates, which could encourage many individuals to transition to electric vehicles. Others expressed the belief that technological advancements, such as the development of lithium batteries, are likely to enhance the performance of electric vehicles in terms of distance range in the future.

5.5 Conclusions on Research Question 1

Participants expressed concerns regarding the relatively limited distance range of electric vehicles compared to internal combustion engine vehicles. Issues related to inadequate charging were identified as key deterrents to the transition to electric vehicles. Other key issues relate to the durability of EV batteries, their disposal, and the potential for receiving financial incentives and tax rebates, which could encourage many individuals to transition to electric vehicles. Participants emphasised the environmental benefits of EVs in reducing carbon emissions and lowering negative externalities like air and noise pollution. There is a notable level of unfamiliarity with these vehicles compared to ICEVs. Some participants were optimistic about advancements in lithium battery technology that could eventually reduce the costs of electric vehicles and achieve distance ranges of up to 1,000 km on a single charge. However, hybrid vehicles are likely to remain more popular than pure electric vehicles for the foreseeable future.

5.6 Research Question 2

What factors influence consumer preferences and adoption rates for mixed-energy vehicles in South Africa?

The focus of the second research objective was on the consumer preferences and adoption rates for mixed energy vehicles with particular emphasis on the economic, technological and environmental factors.

5.6.1 Economic Factors

The scope of economic factors included considerations such as the cost of owning electric vehicles, the availability of financial incentives, and government support measures outlined in South Africa's white paper on electric vehicle adoption.

5.6.1.1 Theme 1: Cost of ownership and discounts

The primary insights shared by participants regarding economic factors indicate an expectation that the "*government needs to be able to provide some form of subsidy."* Participant 4. Other participants indicated that *"the government reduce the taxation"* Participant 5. The issue of incentives was also highlighted *"If someone buys an EV, probably the government is willing to contribute some kind of subsidy of some sort"* Participant 3. The need for financial support to bridge the affordability gap and make EVs a viable option for a broader segment of the population was raised. "*If I could afford one now, I'll buy one. But then now in terms of pricing, they're still very expensive* " Participant 12. Other participants expected to receive a *"discount"* Participant 1 as a reward for purchasing an EV. This expectation reflects a broader sentiment that incentives could play a crucial role in encouraging adoption despite existing challenges.

Given this scenario, participants emphasised the need for mechanisms such as *"incentives on purchases of these vehicles."* As one participant noted, *"I think it's going to be a very long road before we actually see the sales increase on these vehicles."* Participant 8. Transparency was seen as essential to help potential buyers make informed decisions and to promote understanding of the long-term advantages of electric vehicle adoption. "*To make sure that the cost of ownership is fully the customers are fully aware of that, so that that you build confidence in that way, but."* Participant 11.

Other participants expressed a different view that the provision of incentives may not be sustainable, as it could lead to dependency on government support rather than fostering a self-sustaining electric vehicle market. They argued that a more robust market for electric vehicles should be developed through technological advancements and competition, which could ultimately reduce costs without the need for ongoing subsidies. "*I have actually heard that a lot of the countries are starting to pull out of it because they have spent a lot of money on incentives",* Participant 8.

Regarding the issue of incentives, the SA Electric Vehicle White Paper (2023) highlights that the Department of Trade and Industry (DTI) aims to enhance investment funds dedicated to the transition to electric vehicles (EVs) and batteries. The DTI plans to issue guidelines for the modifications of the Automotive Investment Scheme (AIS), ensuring cost-effectiveness while facilitating localisation, employment, and value chain development. Additionally, a review will be conducted after five years to assess the necessity of continued funding, considering government

allocations, industry investments, and the responsiveness of Original Equipment Manufacturers (OEMs).

5.6.1.2 Theme 2: Operating costs

Participants stressed that they do not exclusively rely on electric vehicles, noting that many consumers use them as secondary vehicles within their households. As Participant 8 stated, "*I have heard from customers that they actually use EVs as a second vehicle, so they'll have their day-to-day vehicle, and then they'll have this EV basically for the run-around."* This suggests a trend where electric vehicles serve a supplementary role, complementing traditional vehicles for everyday use.

Concerns were also raised regarding the lack of home charging options for electric vehicles. As one participant expressed, *"If I were to own one, I would need to invest in a home charger. But then the challenge is that charging stations across the country are not yet distributed evenly."* Participant 12. This highlights a significant barrier to the widespread adoption of electric vehicles, as the availability of charging infrastructure remains uneven and poses challenges for potential owners. Other issues related to the exponentially high cost of maintenance of EVs given that, "*I need to buy a 10K battery*" Participant 7. Similar sentiments expressed that "*I think it would be a lot more expensive to replace components in these vehicles should anything go wrong."* Participant 8. Relatedly it was also highlighted that *"The battery is extremely expensive to replace, and the way of the disposal of that battery actually frightens me"* Participant 8.

Key economic considerations include the cost of ownership and the perceived higher insurance premiums associated with electric vehicles compared to internal combustion engine vehicles. Additionally, the issue of government subsidies and financial incentives emerges as a crucial determinant influencing the adoption of electric vehicles within the mixed-energy mobility market in South Africa. These factors collectively shape consumer perceptions and can significantly impact the decision-making process regarding the transition to electric mobility solutions.

5.6.2 Technological Factors:

The study also gathered data concerning the significance of technological factors, particularly focusing on the battery life of electric vehicles and the availability and accessibility of charging infrastructure in South Africa. These elements are crucial in shaping consumer perceptions and play a significant role in the likelihood of adopting electric vehicles in the future. Understanding

these technological considerations provides insights into the barriers and facilitators affecting the transition to electric mobility solutions in the South African context.

5.6.2.1 Theme 1: Charging time and infrastructure

Regarding charging time, the participants understood the limitations that electric vehicles have. They pointed out that the time taken to charge an electric vehicle can be a strong detractor, bearing in mind the much shorter refuelling time for traditional vehicles. It was highlighted that *"it takes you like 5 minutes max to fill up your tank and if you're going to charge an EV max, fastest charge I think it will take 30 minutes to the full right"* Participant 12. "*Now, if you've got an electric vehicle and you know you need to charge it, and again you are faced with bad weather and there is load shedding, then what do we do?"* Participant 9. It was specified that "*I wouldn't necessarily be a fan of having to stop somewhere for an hour or two to charge it"* Participant 2 Since there are not enough charging ports in South Africa *"Now the recharging points; you know they are not as much"* Participant 3. Anxiety over the ownership of electric vehicles was evident in expressions like "*I'm supposed to be using to move from point A to point B that I can't use (an EV) because now I'm unable to charge it"* Participant 9.

These insights highlight the importance of not only the availability of charging stations but also the efficiency and speed of charging technology. Participants emphasised that for electric vehicles to become more appealing, advancements in charging technology must be made to reduce charging times, thereby enhancing the overall user experience and encouraging broader adoption: *"I thought we charged that (an EV) … from 11% to 100% in 42 minutes or something* Participant 13. Another participant indicated, *"I think there are like 300 or 400 or 450 something (charging ports) in South Africa"* Participant 1.

Others expected the price of electric vehicle batteries to fall drastically following the lithium battery technology "*as battery prices come down. Hopefully, the price of EVs also start to come down,"* Participant 10. Comparisons were made between the South African infrastructure to that of developed nations *"They are standardising on the Tesla plug because in the States there's a lot of Tesla charging stations"* Participant 5. It was noted that in South Africa, "*charging infrastructure in our country might be an issue"* Participant 2, given that *"there are only two charging stations that we have in East London"* Participant 8

5.6.2.2 Theme 2: Travelling range of electric vehicles

The reported limited range of electric vehicles even on a full charge is a significant barrier to their widespread adoption in South Africa, alongside concerns regarding their cost. This limitation represents a critical design and technology challenge that requires urgent attention. Participants highlighted that the current range of electric vehicles may not meet the long-distance travel needs of many consumers, particularly in a country where journeys between provinces can be lengthy. Addressing this issue through advancements in battery technology and vehicle design is essential for enhancing consumer confidence and promoting the transition to electric mobility in South Africa.

Participant 8. expressed that "*I've even heard of vehicles in China now that have gone up to 1000 kilometres in regards to their range"* The limited travelling range led another participant to indicate that *"There is still a market for the traditional vehicles"*. Participant 3. Some participants expressed concerns linked to 'range anxiety', which refers to the distance that an electric vehicle can travel. "*A vehicle that has like a 400 kilometres range might give me a little bit of range anxiety if I'm going to travel down to Cape Town"* Participant 10. Such anxiety arises from the question of whether an electric vehicle could travel the needed distances without depleting its battery charge. Such people may be discouraged from buying such EVs for fear of being stranded or not being able to finish their trips, especially in areas with few charging points. Addressing range anxiety through improving battery technology, increasing the number of charging station locations available, and better consumer education about how electric vehicles work are necessary steps in combating range fear in order to increase the use and adoption of electric vehicles in South Africa.

5.6.2.3 Theme 3: Durability and disposal of electric vehicles

One participant expressed concern about the durability, disposal and resale value of electric vehicles compared to ICEVs. She stated *"I think that if they had to change the processes of how they were mining for minerals, what materials they were using and if they came up with a better solution for the disposal of these batteries*" Participant 8. The lifetime of electric vehicles was raised by one participant who indicated that *"So the average (life) of a car (EV) in the UK might be …(a) minimum (of) 8 years… and the length of time life of a car (EV) is 12 years"* Participant 13. Others speculated that durability could be guaranteed if a local assembly is actioned, *"if they bring parts into the country and we assemble it from here, the price might be much better, and people might be able to afford them*" Participant 12.

Ultimately, participants expressed mixed feelings with respect to the charging time of electric vehicles, which they expect to be lower so as not to disrupt the travelling time and enjoyment that comes with their usage. It appears that the travelling public is willing to adopt electric vehicles if we hold the price factor constant. However, they are not prepared to endure the inconvenience of disrupting their travel itinerary on the long haul through a limited travel range. The situation is made more complicated by the scarcity of charging stations in South Africa, which others perceived are not "evenly" distributed. It was indicated that preference is to use ICEV for long journeys while electric vehicles are for short runs. With such anxiety, the adoption of electric vehicles in South Africa has a long way to go. Another key issue is related to the durability of electric vehicles; this is quite concerning given that South Africa has a vibrant used car market.

5.6.3 Environmental Factors:

Several participants pointed out some of the benefits of EVs when it comes to environmental conservation. They argued that EVs help in lessening the emission of greenhouse gas which in return assists in mitigating the impact of climate change and ensuring quality of air. Additionally, many participants mentioned the fact that EVs are less noisy than internal combustion engines, which leads to an enhanced quality for the community. Such an approach to environmental sustainability is not only consistent with the international efforts to prevent global warming but also shows a greater number of consumers becoming conscious of the ecological impact of their means of transport.

5.6.3.1 Theme 1: Environmental Security

Participant 8 shared *"I've heard of an EV that caught fire overseas and it burned for seven hours, and it was highly toxic.*" Other participants were of the opinion that the use of electric vehicles is likely to counter challenges associated with *"Climate change.*" Participant 7 And *"global warming* Participant 3. The use of electric vehicles was ultimately associated with the ability to generate *"Clean energy, but the batteries—they're all chemical."* Participant 1. Relatedly, it was highlighted that electric vehicles are also associated with the ability to *"significantly reduce the carbon footprint and that will contribute to cleaner air and a healthier planet, and that's what we all are looking for*" Participant 9.

One participant expressed the opinion that South Africa remains lenient in imposing carbon taxes aimed at mitigating environmental degradation. "*South Africa has a carbon tax, but it's so small it's not deterring people from buying a polluting diesel* Participant 13. They argued that more

stringent measures could incentivise the transition to cleaner technologies and discourage reliance on fossil fuels. A comparison was made between the South African legislative environment to that of the UK, "*We did it in two ways, increasing the carbon tax on them. The second one about the road tax we hacked up and the other one was starting at low emission zones, is a charge. If you're over a barrier"* Participant 13. This perspective underscores the need for stronger governmental policies to drive environmental sustainability and support the adoption of electric vehicles as part of a broader strategy to combat climate change.

While EVs instead of fossil fuels seem like a relatively better option regarding environmental considerations, a few participants voiced concerns about some limitations. They highlighted that the production and disposal of EV batteries can result in considerable environmental impacts, including resource extraction and waste management issues. In addition, people were also concerned about the carbon footprint generated during the manufacturing process of electric vehicles, which could undermine their perceived environmental advantages. These insights suggest that while the transition to electric mobility is generally viewed favourably, a more nuanced understanding of its environmental implications is necessary to address potential drawbacks and promote sustainable practices within the industry.

5.6.3.2 Theme 2: Infrastructure and Policy Support

Infrastructural and government policy issues featured prominently in the discussions. It was highlighted that *"On charging infrastructure and the incentive policy I will consider changing if both infrastructure and incentives are in place."* Participant 1. Others including " Participant 4 simply emphasised the essence of *"infrastructure*… and *sufficient charging stations"* as key determinants of their transition towards the adoption of electric vehicles in the mixed-energy mobility market in South Africa. Other participants indicated awareness of government policy on electric vehicles by stating that, *"The government is the custodian of policymaking"* Participant 3, while others stated that *"I think the OEMs already get some kind of incentive from the government for just being operational in South Africa* Participant 3.

The presence of a supportive electric vehicle adoption policy initiative was expected to promote the growth in the adoption of electric vehicles since *"South African consumers, they're quite adaptable, so they're willing to try new things,"* Participant 1. Positive sentiments were expressed in favour of the adoption of electric vehicles "*When the budget allows it and there's infrastructure, I'd really like to own an electric vehicle because (of) the performance …*" Participant 11.

Nonetheless, several prerequisites must be fulfilled before South Africa takes up EVs in a wholesale manner. *"the first one is the infrastructure, the second one would be the cost, and then the third one is the cost of charging*" Participant 1. A cost-effective charging infrastructure that guarantees a widespread availability of charging points in both urban and rural centres is among the requirements. It was also specified that *"Currently I think hybrids are still the best solutions for now until the infrastructure is well patted down."* Participant 12. *"…maybe 1000% more EVs on the road than we have now"* Participant 13.

The influential role of government policy in reducing the consumption of ICEs and promoting the transition to EVs was particularly evident in the UK automotive market. One participant highlighted how the UK government has implemented a range of supportive measures, such as tax incentives, grants for EV purchases, and investment in charging infrastructure. These initiatives not only encouraged consumers to choose electric vehicles over traditional ones but also contributed to a broader strategy aimed at achieving net-zero emissions by a specified target year.

5.7 Conclusions on Research Question 2

Participants emphasised that such support would be essential in making electric vehicles more accessible and affordable for South African consumers, especially given the higher initial costs associated with EVs compared to traditional vehicles. Participants highlighted that the high cost of electric vehicles is a central barrier to adoption, especially as current price increases make EVs unaffordable for many. This sentiment highlights the perceived necessity of supportive policies to accelerate the adoption of electric vehicles in South Africa. Participants highlighted the importance of making information readily available regarding the ownership costs and benefits associated with electric vehicles.

5.7.1 Insights from the White Paper on electric vehicles in South African

The South African government has formulated a formal response to promote the adoption of electric vehicles in the mixed-energy mobility market in South Africa through the White Paper on EVs. Key takeaways of the White Paper include localising new capabilities and technologies, enhancing investment funding for the manufacturing of EV components, and facilitating access to export markets for South African EV and ICE components. Projections indicate an expected R80 billion in component investments by 2035. Furthermore, Broad-Based Black Economic Empowerment (B-BBEE) stipulations will be gradually implemented to support essential

component manufacturing, thus enhancing domestic production. These initiatives outlined in the White Paper will also promote the participation of small companies in the value chain, fostering a more inclusive automotive industry. (Electric Vehicle White Paper, 2023)

The SA Electric Vehicle White Paper (2023) outlines six core principles, including duty-free export market access, R&D tax incentives, green hydrogen production, energy reforms, rail line refurbishment, and EV certification programs. Stakeholders, including DFIs, private capital, and industry, are essential in financing these policy actions.

South Africa has a complex challenge in changing its automotive industry and production capabilities to include EVs while fulfilling the objectives laid out in the South African Automotive Masterplan (SAAM). The paper sets out a comprehensive electric vehicle policy and regulatory mechanisms for the automotive sector that seeks to move away from manufacturing internal combustion engine vehicles to incorporating electric vehicles into the production and consumption paradigm by 2035.

The change corresponds with the SAAM's aims, evolving export market demand, and South Africa's dedication to mitigating greenhouse gas emissions. The document outlines a synchronised strategy emphasising the domestic manufacturing of electric vehicles and promoting the development of local industries. The transition represents a strategy that promotes growth and investment, accompanied by a commitment to public initiatives and fiscal support. All stakeholders must collaborate to navigate this change and convert it into an opportunity for growth, sustainability, and economic vibrancy. (Electric Vehicle White Paper, 2023)

5.8 Summary of Outcomes

The introduction of electric vehicles in South Africa has faced challenges which are not common with diesel or petrol vehicles. A major area of interest of the study was to evaluate the effect of financial incentives on potential electric vehicle owners. Other economic variables were found to have a stronger conceptual appeal in influencing consumer choices and adoption rates for electric vehicles in the country. The key proposed economic considerations include the provision of subsidies for acquiring electric vehicles as well as tax reductions. Some respondents believed that the provision of these incentives was unsustainable since the government should focus on assisting electronic vehicle manufacturers in South Africa rather than the importance of completed electronic vehicles.

This study explored consumer attitudes and experiences regarding mixed-energy mobility solutions, with a specific focus on electric vehicles in South Africa. The research was structured around three key themes, including the total cost of ownership of electric vehicles. The aim was to highlight the significant factors that influence the adoption of electric vehicles in the South African context. The research further revealed that the factors that the limited range and performance of electric vehicles are key variables that influence their adoption. The infrastructural constraints pose huge challenges and are among the main factors responsible for the adoption of electric vehicles in South Africa. Furthermore, the study showed that most of the surveyed participants are in favour of mixed-energy vehicles, which include hybrids, primarily for their cost, reliability, and ease of use.

Key takeaways from the White Paper on electric vehicles in South Africa highlight the effort of the government to improve the investment capital base to speed up the transition towards electric vehicles. This view is seen as a cost-effective method to ensure employment creation in the country and enhance the local value chain. However, operating costs are expected, especially concerning technological constraints such as the range of electric cars. The study also addresses the adoption of electric vehicles, highlighting concerns related to their durability and functionality, including range, residual value, and utility. Environmental considerations focus primarily on apprehensions regarding the potential ecological impact of electric vehicles, especially in terms of battery disposal.

5.9 Conclusion

The research investigates the determinants of EV adoption in South Africa and points out three main categories: cost, range, and charging infrastructure. The high cost of electric and hybrid vehicles significantly hinders adoption, with many stakeholders arguing that the market is disproportionately geared towards luxury models. In addition, the limited range and performance of EVs and the insufficient charging infrastructure are some of the challenges that are defined as key obstacles to mass acceptance. Hybrid vehicles, integrating electric and internal combustion engines, are favoured for their cost-effectiveness, dependability, and user-friendliness. The South African Department of Trade and Industry aims to increase investment funds to facilitate the transition to electric vehicles; however, challenges related to operational costs, technological limitations, and range persist. The study highlights the necessity of addressing insurance-related issues and underscores the role of influential advocates in promoting the adoption of EVs in South Africa.

CHAPTER 6

DISCUSSION OF RESULTS

6.1 Introduction

This chapter contributes by offering a comprehensive discussion of the research findings in relation to each objective of the study. The goal is to identify areas where current results align with existing empirical literature and to highlight key divergences between the study's findings and established insights in the literature.

6.2 Summary of Key Results

The following summary outlines the findings of each research objective.

6.3 Research Question 1

How do South African consumers' perceptions and experiences of mixed-energy mobility solutions, particularly electric vehicles, influence their decision-making in adopting these technologies?

Consumer perceptions strongly influence attitudes toward EV adoption. Out of 13 participants, only one had direct experience with an EV, while the remainder continued using ICE vehicles, reflecting significant hesitance about full EV adoption. Government initiatives, such as incentives, have the potential to encourage greater EV use, but concerns about EV range limitations make them less appealing for long-distance travel. Participants noted that ICE vehicles offer greater convenience for long trips, avoiding the need for frequent recharging and overcoming the scarcity of charging ports in South Africa. While participants expressed reservations about fully transitioning to EVs, they showed an openness to hybrid vehicles, which combine ICE technology with battery power to provide a balanced alternative.

Table 6.1: (naamsa, 2024)

	Year 2019	Year 2020	Year 2021	Year 2022	Year 2023	Q2:2023	Q2:2024
Plug-in hybrid	72	77	51	122	336	91	160
Traditional hybrid	181	155	627	4,070	6,518	1,167	3,543
Electric	154	92	218	502	929	270	419
Total NEVs	407	324	896	4,694	7,783	1,528	4,122

The above table shows the diversity of drivetrain sales in the South African NEV landscape from 2019 through to 2023 Q4

6.4 Research Question 2

What factors influence consumer preferences and adoption rates for mixed-energy vehicles in South Africa?

Key insights expressed for the second research objective indicate multiple factors that influence consumer preferences and adoption rates for mixed-energy vehicles in South Africa. These factors encompass a variety of operational expenses, economic concerns, technological advancements such as reduced charging times, the availability of charging infrastructure, and environmental impact considerations. Participants also highlighted economic issues related to the government's provision of subsidies and tax incentives to promote the adoption of electric vehicles. It was also highlighted that there are anticipated high operational expenses associated with electric vehicles, especially concerning the procurement of batteries and their servicing, as well as estimated high insurance premiums for EVs.

Technological issues linked to the use of EVs, particularly the limited travelling range on a full charge, have sparked anxiety among participants. Environmental issues were also tackled in the study regarding the positive contributions associated with the reduction of the carbon footprint, the reduction of negative externalities, and the contribution to a cleaner and pristine environment. However, the study did not prioritise them as key factors that determine the adoption of EVs in South Africa. It was highlighted that environmental gains were not absolute since the use of EVs depends on the availability of charging infrastructure, which is predominantly powered by fossil fuels like coal, whose usage also contributes to global warming. Until the county has fully embraced the application of renewable energy sources, like wind, solar, and biomass energy, the charging of EVs will depend on the use of non-renewable energy sources that are a threat to the

environment. Moreover, the disposal of lithium batteries after the lapse of their useful economic life has raised concerns as they could potentially affect environmental security.

6.5 Discussions

Considering the above findings, the following discussions are proposed

6.5.1 Research Question 1

How do South African consumers' perceptions and experiences of mixed-energy mobility solutions, particularly electric vehicles, influence their decision-making in adopting these technologies?

This study highlighted that the procurement cost of electric vehicles is a major deterrent to their adoption and usage in South Africa, given the prevailing economic conditions. This has resulted in people preferring internal combustion engine vehicles or, at best, hybrid vehicles, which are mixed energy vehicles that combine both internal combustion engines and batteries. These research results resonate with similar insights that were expressed in a Tanzanian study where it was highlighted that the poor adoption of electric vehicles was influenced by the relatively higher total cost of ownership (Malima & Moyo, 2023). This implies that South Africans are late adopters when it comes to the diffusion of electric vehicles, and since they look forward to others initiating the adoption of EVs, they follow suit. These views support the existing literature that highlights the influence of social pressure as a key determinant of the uptake of EVs (Eccarius & Chen, 2024). Related insights were also raised by Curtale et al., (2021) where it was stressed that social influence was a determinant for the adoption of electric vehicles in the Netherlands.

Research results highlighted that the current position of electric vehicles in South Africa is for the luxury market. These research findings corroborate similar findings from the works of Buhmann & Criado, (2023) who specified that reputation-driven consumers prefer electric vehicles when their prices are higher than those of other vehicles.

This research highlighted that the uptake of electric vehicles in South Africa is largely determined by their distance range, with reservations being expressed regarding their inability to travel longer distances. These research results echo similar insights that were expressed in a study by Rosales-Tristancho et al. (2024), where it was emphasised that the limited battery range for electric vehicles contributes to their poor uptake. The works of Danielis et al., (2020) in Italy also

underscore the influence of the driving range of electric vehicles as a determinant of the uptake of EVs in addition to purchase price and fuel economy.

It stands to reason that technological developments that will culminate in longer driving ranges and shorter charging times are vital to overcoming consumer reluctance towards the adoption of electric vehicles. These findings support similar outcomes, which suggest that the current low acceptance of EVs in South Korea is attributed to high prices and inadequate battery charging technology. Related sentiments were expressed by Axsen & Pickrell-Barr (2024), who stressed the failure to extend the range for battery electric vehicles in a shorter charge time as contributing to their poor uptake in the British Columbia Province of Canada. Current research results also support views from Farinloye et al., (2024), who cited scarce charging ports as a stumbling block to the adoption of electric vehicles in Nigeria. The present research findings are also in alignment with research in the USA, where it was confirmed that existing EV users are unwilling to compromise on the recharge time, travel range, battery replacement costs, and the availability of home recharging when they decide to purchase new electric vehicles (Dua et al., 2024).

This study's findings revealed that the lack of charging infrastructure significantly hinders the adoption of electric vehicles in South Africa. These findings correlate with the prevailing load shedding in the country, which reduces the conceptual appeal of adopting pure electric vehicles. Similar insights were expressed in studies done in the European Union, where improvements in charging infrastructure were identified as critical determinants in the adoption of electric vehicles (Alali et al., 2022; Gil Ribeiro & Silveira, 2024).

The research results also indicated that some participants are quite unfamiliar with the use of electric vehicles since they project more uncertainties regarding their usage, which has resulted in preference being placed on hybrid vehicles. These research results support existing literature, which indicates that technological development and battery technology are important in shaping customer preferences for electric vehicles (Beak et al., 2020). Relatedly, a Norwegian study confirmed that advanced battery technology is expected to enhance the uptake of electric vehicles in the future (Ingeborgrud & Ryghaug, 2019).

The research findings also suggest that the expected features in electric vehicles show that the travelling public expects to enjoy the same features provided by traditional combustion engine vehicles, like the car audio system and air conditioner. But they also expect to enjoy these without impairing or draining the battery life so much as to reduce the driving range. These research

results confirm the outcomes of a South African study by Hull et al., (2024b) which highlighted that enhanced battery performance can boost the adoption of electric vehicles.

6.5.2 Decision-Making in Technology Adoption:

Study results concerning decision-making in technology indicate that there are significant drawbacks concerning charging infrastructure, battery life, and the travelling range that are affecting the adoption of electric vehicles in South Africa. There have been positive sentiments expressed on technological developments that have resulted in some electric vehicles travelling as far as 1,000 km, with developments in lithium battery technology being expected to be diffused in the South African market. However, these sentiments relate to the future adoption of electric vehicles, possibly within the next 15 to 20 years, not in the present.

These research results back up existing literature from a South Korean study by Kim et al., (2020) where it was emphasised that research and development initiatives to expand the per-charge distance range of electric vehicles could influence their adoption. Results from the works of Salari (2022) confirmed that the decision towards the consumption of electric vehicles is largely influenced by persuasive marketing communications and supportive government policies. On the other hand, sentiments expressed by Philip et al., (2023) stress that advancements in electric vehicle battery technology are likely to result in a fall in TCO in the future leading to an improved uptake of EVs.

6.5.3 Conclusions on Research Question 1

Insights from the research suggest that electric vehicle adoption in South Africa remains limited. Concern was raised regarding the functionality of EVs in terms of driving range, charging infrastructure, and charging time. This confirms similar issues that have been raised in other contexts where the adoption of EVs was raised. These reservations shape consumer perceptions and opinions concerning their desire to buy an electric vehicle. Results also indicate that preference now is being given to the purchase of hybrid vehicles as opposed to pure electric vehicles, with a greater majority still expressing their preference towards the use of ICEVs.

6.5.4 Research Question 2

What factors influence consumer preferences and adoption rates for mixed-energy vehicles in South Africa?

The focus of the second research objective was on the consumer preferences and adoption rates for mixed energy vehicles with particular emphasis on the economic, technological and environmental factors.

6.5.5 Economic factors

The research findings on economic factors primarily focused on the incentives offered by the government to encourage the use of electric vehicles in South Africa. Outcomes emphasised the need to expand these subsidies and incentives. These research results support existing literature by Illahi et al., (2024) who highlight that TCO inhibits the EVs purchase decisions. Related sentiments were expressed by the works of Jensen et al., (2021) who reiterated that TCO as composed of the purchase price, yearly service and maintenance costs determined the ease of migrating towards electric vehicles. On the other hand, Choudhari et al., (2024) proposed that adopting a car-sharing shift in the use of electric vehicles significantly reduces the TCO leading to improved adoption of electric vehicles.

The research findings also suggest that perceived high insurance premiums, total cost of ownership, and operating costs moderate the adoption of electric vehicles in South Africa. These results correlate with similar insights from the works of Philip et al. (2023a), which show that the total cost of ownership for EVs is currently higher than for internal combustion engine vehicles. Similarly, Curtale et al., (2021) highlight that insurance-related issues are a key determinant when it comes to the adoption of electric vehicle car sharing approaches.

6.5.6 Technological Factors

Research results on technological factors indicated that improving South Africa's charging infrastructure is critical, as current limitations create anxiety and reduce South Africans' willingness to adopt electric vehicles. This suggests that improvements in the ease of accessing charging infrastructure are likely to influence the wider adoption of electric vehicles in the country, views which are in support of existing literature by Jauhar et al., (2024) showing that improving the electric vehicle ecosystems that incorporate scalable charging infrastructure encouraged the growing acceptance and production of electric vehicles.

However, current research results are distinguished from the results from research by Llopis-Albert et al., (2021) which suggested that neither charging infrastructure nor the provision of financial incentives were effective in promoting the adoption of electric vehicles. Similarly, Cruz-Jesus et al., (2023) raised concern over the capability of EVs to respond to unique driver needs, they further specified the lack of versatility of electric vehicles concerning the ease of accessing charging infrastructure compared to ICEVs. Nevertheless, existing research still emphasises the importance of charging infrastructure as a key determinant for the adoption of electric vehicles (Jensen et al., 2021; Trung & Urmee, 2024).

Additionally, current research results resonate with the works of Rosales-Tristancho et al. (2024), where it was established that extending the distance range of electric vehicles and developing fast charges will increase the uptake of electric vehicles. Other results are in support of findings from research by Curtale et al., (2021) who underscored that drivers have uncertainty over the driving range of electric vehicles over long distances. American research by Dua et al., (2024) specified that the perceived functional barriers of electric vehicles particularly the driving range affect the repurchase probability of current electric vehicle owners. The intensity of the driving range of electric vehicles is critical when a family depend on one car (Cruz-Jesus et al., 2023).

Research findings indicate that there are key issues concerning the durability of electric vehicle batteries, the disposal of batteries, and the economic value of used electric vehicles. These research results align with existing literature, which confirms that consumers in Arizona, United States of America, experienced a marginal rise in their electricity consumption when they made a transition to electric vehicles (Liang et al., 2022). Current research results research in support of related sentiments expressed in a research by Llopis-Albert et al., (2021) were policy initiatives towards increasing the reliability and durability of batteries aimed at promoting the shift towards the use of efficient means of transport.

6.5.7 Environmental Factors

This research highlighted that there are mixed opinions with respect to the environmental benefits associated with the adoption of electric vehicles since the electricity that is used to charge the batteries is mainly generated from fossil fuels like coal. In effect, environmental factors were not perceived as the key driver of consumer preference towards the use of electric vehicles in the South African market. However, some sections of respondents indicated that there are positive environmental benefits in terms of reducing global warming. These results corroborate related insights shared by Nastjuk et al., (2020) who specified that ecological awareness influenced the

perceived usefulness of using electric vehicles. Related sentiments were expressed in a study by Bas et al., (2021) which showed that environment-oriented policies were instrumental in shaping consumer attitudes towards the use of electric vehicles in Sweden and Denmark.

Current research results are distinguished from the literature, which indicates that environmentally conscious consumers are inclined towards car-sharing to reduce traffic congestion and lower their carbon footprint in the atmosphere (Eccarius & Chen, 2024). The works of Kim et al., (2020) add that the driving ecosystem of electric vehicles determines their fuel efficiency.

6.5.8 Infrastructure and Policy Support

Key outcomes on infrastructure and policy support in South Africa indicate the need to develop more charging infrastructure, which enhances the convenience of the travelling public, who might be willing to adopt electric vehicles. Current research results indicate that enforcing a stringent government policy, such as increasing carbon tax on ICEVs, could potentially influence the adoption of electric vehicles. Research results support existing literature from the works of Hernández-Tamurejo et al. (2024), which highlighted that government policy can influence positive decisions in support of electric vehicles. Current research results also agree with research results by Llopis-Albert et al., (2021) highlighting that uncertainty on the possibility of receiving government financial incentives lowered consumer preference towards purchasing electric vehicles.

6.6 Conclusions on Research Question 2

The adoption of electric vehicles in South Africa is influenced by a complex interplay of economic, environmental, and infrastructure support factors. Research findings highlighted the significant impact of economic factors, particularly the total cost of ownership of electric vehicles, which remains prohibitively high and hinders widespread adoption in the South African market. This is notwithstanding the government's policy to provide incentives to both manufacturers and consumers, which is aimed at enhancing the production and consumption of electric vehicles in the country. Other key considerations highlighted from a technological perspective related to the limited distance range of electric vehicles. The comparatively lower distance range for EVs reduces the conceptual appeal of relying on them to travel long distances across provinces in South Africa. Additionally, the study identified insufficient charging infrastructure, a key technological issue that affects the convenience of using EVs for travelling. In the South African vehicle ecosystem, economic and technological factors related to the functional attributes of EVs,

specifically the charging infrastructure, charge time, and driving range, take precedence over the environmental benefits of adopting electric vehicles.

6.7 Conclusions

Results of this study indicate that the pace of adopting electric vehicles in South Africa is anticipated to remain subdued over the foreseeable future due to concerns raised concerning the functionality of electric vehicles, which is slightly different from that of traditional internal combustion engine vehicles. The issues raised in this study, especially the distance range of electric vehicles and the total cost of ownership of electric vehicles, along with the inadequate charging infrastructure, were also highlighted in previous studies in both developing and developed economies. The key takeaway is that South African consumers' opinions and perceptions of electric vehicles are aligned with market realities, especially when viewed against international best practices for EV adoption. Nevertheless, the South African government's demonstrated commitment to electric vehicle adoption is evident in the publication of the White Paper on electric vehicles in November 2023.

CHAPTER 7

CONCLUSIONS AND RECOMMENDATIONS

7.1 Introduction

To recap, **Chapter 1: Introduction to Research Problem** - This chapter established the need to research the adoption of electric vehicles (EVs) in South Africa, particularly in light of the country's unique challenges and opportunities within a mixed-energy mobility landscape. It discussed the global shift towards sustainable transport, the impact of fossil fuel reliance, and the potential role of EVs in reducing carbon emissions. The research problem was defined as understanding the factors influencing South African consumer adoption of EVs.

Chapter 2: Literature Review - The literature review provided a theoretical foundation for understanding EV adoption by examining various models and theories, including the Technology Acceptance Model, Rational Choice Theory, and Diffusion of Innovations Theory. It identified knowledge gaps, such as the economic, technological, and infrastructural challenges specific to South Africa. The review also highlighted factors like environmental awareness and infrastructure availability as critical to influencing consumer adoption rates.

Chapter 3: Research Questions - This chapter outlined the specific research questions that guided the study. It focused on how South African consumers perceived EVs and their experiences with mixed-energy mobility solutions. Additionally, it explored the factors shaping consumer preferences, with particular attention to economic, social, and technological influences.

Chapter 4: Research Methodology - This chapter described the chosen research design, which aligned with the exploratory nature of the study. A qualitative methodology was used, involving semi-structured interviews with industry experts and consumers. This section covered sampling methods, data collection tools, and thematic analysis techniques to ensure comprehensive insights into consumer behaviour and perceptions related to EVs in South Africa.

Chapter 5: Findings - This chapter presented the primary data collected through interviews, offering insights into consumer perceptions, challenges, and barriers to EV adoption. Key findings revealed that high upfront costs, limited charging infrastructure, and frequent power outages were major deterrents. Participants noted that while environmental awareness was increasing, practical

issues often outweighed ecological considerations in decision-making.

Chapter 6: Discussion of Results - The discussion in this chapter integrated the findings with the literature reviewed in Chapter 2. It highlighted the alignment and divergence between South African consumers' perspectives and global trends in EV adoption. Economic, technological, and infrastructural challenges appeared more pronounced in the South African context. The chapter emphasised the need for local policy interventions, subsidies, and educational efforts to address these barriers and foster EV adoption.

Chapter 7 will synthesise the key findings and provide actionable recommendations for stakeholders, including industry participants and policymakers. It will highlight practical implications, such as policy changes, incentives, and infrastructure investments needed to support EV adoption in South Africa. Additionally, this chapter will discuss the study's contributions to existing literature, limitations, and suggestions for future research, guiding the way forward for advancing EV integration in South Africa's mixed-energy mobility market.

The contribution of this chapter is to provide answers to research questions and to specify the contribution that this study made towards theory development and practice. The chapter also articulates the extent to which this study has resolved objectives. The primary focus of the study was to explore consumer perceptions and experiences and the factors influencing the adoption of electric vehicles in South Africa's mixed-energy mobility market. This chapter highlights the experiences of experts from diverse sectors with interests in the automotive market. It presents the main findings of the research, synthesising the results with the existing literature to form cohesive conclusions that address the research questions. It offers recommendations for stakeholders, including practical managerial implications drawn directly from the findings. Additionally, the chapter outlines the limitations of the study and provides suggestions for future research avenues.

1. What did I study, and why does this matter?

This study focused on exploring consumer perceptions, experiences, and the factors influencing the adoption of electric vehicles within South Africa's mixed-energy mobility market. Given the global shift towards sustainability and clean energy, understanding what drives or hinders EV adoption is essential to fostering a successful EV market in South Africa. As the country faces

significant challenges in reducing carbon emissions and improving energy efficiency, EVs offer a potential solution. Understanding consumer attitudes will help businesses and policymakers make informed decisions to promote EV adoption and contribute to environmental sustainability.

2. What was the research context, and why does it matter?

The study was conducted within the context of South Africa's evolving automotive industry, energy crisis, and environmental challenges. South Africa is grappling with mixed-energy solutions due to its reliance on fossil fuels and the push toward cleaner energy sources. This context is significant because the adoption of EVs is not only a technological transition but also one deeply tied to socioeconomic, infrastructural, and policy considerations. Consumer behaviour in this setting is shaped by various factors, such as the availability of charging infrastructure, government incentives, and economic conditions, making this research highly relevant to local businesses and policymakers.

3. What did we already know/not know?

Previous research has shown that factors such as price sensitivity, technological familiarity, environmental awareness, and infrastructure availability influence EV adoption globally. However, there was limited understanding of how these factors apply specifically to South Africa, a country with its unique set of challenges, including energy shortages, economic inequality, and limited EV infrastructure. This study fills that gap by examining how South African consumers perceive and experience EVs and what drives their adoption decisions.

4. What specific questions did I answer?

The research aimed to answer the following questions:

- How do South African consumers perceive electric vehicles?
- What are their experiences with mixed-energy mobility solutions?
- What factors influence their decision to adopt or reject EVs?
- How do perceptions of infrastructure, government policy, and cost affect these decisions?

5. How did I answer these questions – i.e., research methodology?

A qualitative approach was used, combining qualitative interviews with discussions with industry experts to explore both subjective experiences and general trends in EV adoption. The qualitative component provided insights into personal perceptions and attitudes, and the data were analysed using thematic analysis and relevant coding frameworks, which identified recurring themes related to consumer preferences, infrastructure concerns, and economic factors.

7.2 Principal conclusions

The value of this research was based on gathering qualitative insights from experts with in-depth knowledge about electric vehicles. The choice behind undertaking a qualitative study was not to generalise research results to the diversity of the South African vehicle market but to get quality insights from experts who were able to share rich insights regarding trends in the mixed-energy mobility solutions sector in South Africa. Their lived experiences can help shape policy, especially when we consider that in South Africa, we have an electric vehicle White Paper that articulates measures that the government of South Africa will take to promote the manufacture and consumption of electric vehicles in the country.

The conclusions were that:

1. **Consumer Awareness and Education**: Many South African consumers still lack sufficient knowledge about electric vehicles, particularly regarding their environmental benefits, cost savings over time, and how mixed-energy mobility solutions can reduce reliance on fossil fuels. Misinformation or limited awareness contributes to reluctance to adopt EVs.
2. **Price Sensitivity and Financial Barriers**: EVs' high upfront costs are a significant barrier to adoption, even though long-term savings on fuel and maintenance could offset the initial investment. Without accessible financing solutions, government incentives, or reduced import duties, the general market for EVs remains limited to a niche of higher-income consumers.
3. **Infrastructure Challenges**: The lack of a well-developed charging infrastructure is a critical factor limiting EV adoption. Range anxiety, or the fear of running out of charge due to limited charging stations, is prevalent among potential buyers. This issue is exacerbated in rural areas, where infrastructure is even scarcer.
4. **Environmental Motivations**: Environmental consciousness is growing in South Africa, particularly among younger urban populations. However, the environmental benefits of

EVs alone are not enough to drive large-scale adoption. For most consumers, the financial and practical aspects still outweigh environmental considerations.

5. **Government and Policy Support**: There is a clear need for stronger government policies to support the EV market, such as tax incentives, subsidies, and more aggressive urban planning for EV infrastructure. Without active institutional involvement, the transition to mixed-energy mobility will remain slow.
6. **Cultural and Social Perceptions**: EVs are still considered a “luxury” or status symbol in many circles, with limited appeal to middle-class or price-conscious consumers. Moreover, perceptions of EVs as “foreign” technology rather than locally adapted solutions further hinder adoption.

7.3 Research Question 1

How do South African consumers’ perceptions and experiences of mixed-energy mobility solutions, particularly electric vehicles, influence their decision-making in adopting these technologies?

On the first research question, the study highlighted that the prevailing consumer perceptions and experiences, as presented by experts in the automotive industry in South Africa, do not project an exponential rise in the usage of electric vehicles in the near future. Several instances express this observation. To start with, respondents who participated in this study do not own any electric vehicles themselves, which in itself is a glaring gap when it comes to the uptake of electric vehicles in South Africa. While several reasons were proffered, among them the high prices of electric vehicles that raise the total cost of ownership, technological shortcomings of EVs in comparison to ICEVs also took centre stage as key determinants of adopting EVs in South Africa.
Consumer perceptions and experiences about the use of EVs are shaped by the reported scarcity of charging infrastructure in South Africa, which is thought to be unevenly distributed. Concern over charge infrastructure was prominently featured in extant literature (Gil Ribeiro & Silveira, 2024; Illahi et al., 2024; Sugihara et al., 2024; Zhao et al., 2024).

These views come from people who are enjoying convenient access to fuel stations with minimal disruptions to their travel itineraries. Participants also expressed concern over the distance range of travelling on a single full charge using electric vehicles. The limited range of travel lowers the utility value of using EVs in comparison to ICEVs. The technical shortcomings of EVs, such as scarce charging infrastructure, charging time, and range of travel, are key determinants when

planning long journeys across the country. Preference was given to the continued ICEVs for longer journeys, with the EVs filling the gaps for shorter daily runs. Similar concerns on the distance range were raised in literature (Cruz-Jesus et al., 2023; Curtale et al., 2021; Dua et al., 2024)

Resultantly, it was established that consumer preferences are aligned towards the adoption of mixed-energy mobility solutions, particularly the use of hybrid vehicles. Concern was also raised regarding the safety of electric vehicles, especially when they are involved in a road accident. It was highlighted that electric vehicles are likely to explode and endanger the safety of the driver and passengers as opposed to ICEVs. Electric vehicles are more toxic and negatively affect the environment in the event they are involved in an accident. The disposal of electric vehicle batteries was also a cause for consumer concern. These issues relate to the disposal and the aftermarket value of electric vehicles, considering that electric vehicles have an estimated economic lifespan of batteries ranging between 8 and 12 years. The works Choudhari et al., (2024) echoed similar sentiments that lithium-ion batteries used in electric vehicles have an expected lifespan between 5 and 10 years.

Given these considerations, research results indicate that there is a greater proclivity towards the adoption of mixed mobility energy solutions in the form of hybrid vehicles as opposed to a paradigm shift towards electric vehicles. This comes out of the realisation that hybrid vehicles can charge themselves, and they are also cost-effective in terms of reducing the petrol bill while providing the convenience of a higher travel distance. It was specified that South Africa has witnessed a phenomenal rise in the number of hybrid vehicles as opposed to pure electric vehicles.

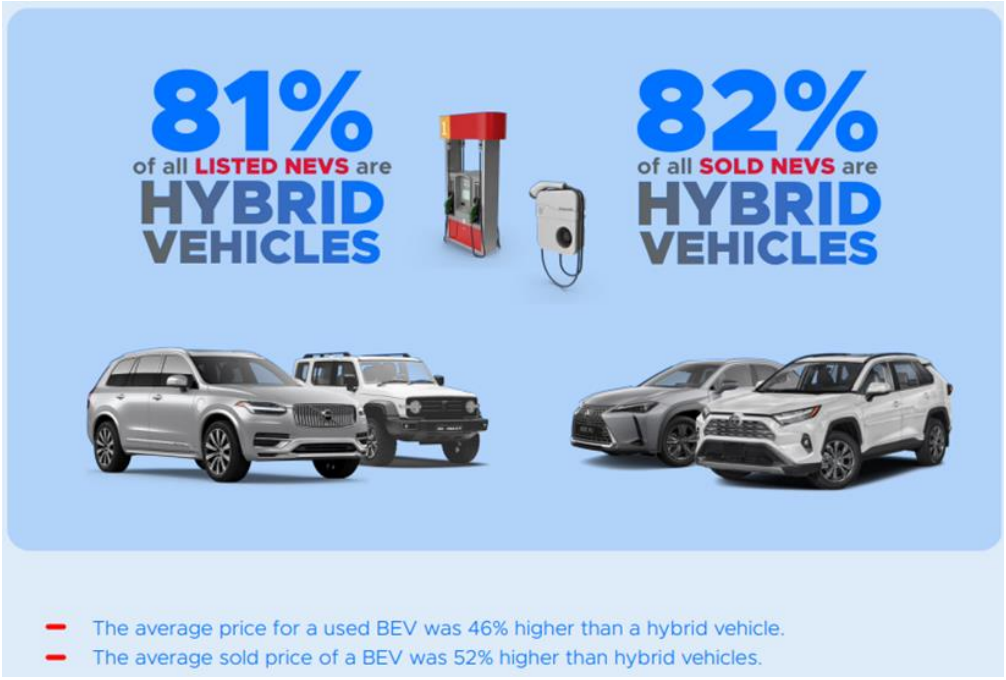

Figure 7.1: 2024 Mid-Year Car Industry Report: *(AutoTrader, 2024)*

Despite the positive sentiments expressed for the adoption of hybrid vehicles, reservations were especially expressed regarding their prohibitive prices. Ultimately, it was highlighted that the market for electric vehicles in South Africa is a small luxury segment composed of innovators as opposed to the mass market for ICEVs. Indications were that the full adoption of electric vehicles in South Africa could be promoted by the government departments adopting the use of electric vehicles in their fleet as a strategy of demonstrating the commitment of the government in promoting the transition towards EV usage in the South African market. In addition, consumer perceptions were expressed about the suitability of electric vehicles in the passenger and goods traffic sector, such as taxis, buses, and trucks, considering the scarcity of charging ports and the range for electric vehicles.

7.4 Research Question 2

What factors influence consumer preferences and adoption rates for mixed-energy vehicles in South Africa?

The main outcomes that emerged from this study concerning the second research question indicated that the consumer preferences and adoption rates for mixed energy vehicles in South Africa are largely determined by the complex mixture of economic, environmental, and technological considerations. From these three determinants, it was highlighted in the study that

economic issues regarding the total cost of ownership of electric vehicles are the single most prominent determinant of the proclivity with which consumer preferences are shaped towards the adoption of mixed energy mobility solutions in South Africa. Related insights on the inhibited TOC of electric vehicles were also raised in prior studies (Gil Ribeiro & Silveira, 2024; Illahi et al., 2024; Malima & Moyo, 2023).

The government is being urged to increase its efforts in offering incentives to encourage the adoption of electric vehicles in the nation. The provision of financial incentives promoted an exponential rise in the migration towards electric vehicles in the European Union nations (Correia Sinézio Martins et al., 2024; Gil Ribeiro & Silveira, 2024) and in the UK (Alali et al., 2022). These calls support existing government initiatives that culminated in the publication of the White Paper outlining the mechanisms to support the adoption of electric vehicles in South Africa. Other participants indicated awareness of the EVs White Paper and the proposed support that the government pledges to provide to both manufacturers and consumers as a way of improving the adoption and usage of electric vehicles in the country. Apart from financial incentives, other key economic issues that were highlighted relate to the operating costs of electric vehicles, especially the replacement costs of batteries that are very prohibitive, and issues related to the disposal value of electric vehicles. An Irish study underscored that the increasing costs of degrading batteries over time discourage electric vehicle usage (Illahi et al., 2024).

The second research question's outcomes revealed that participants placed less emphasis and value on the expected environmental benefits associated with the shift to electric vehicles. This is inconsistent with outcomes from a study by Nastjuk et al., (2020) where environmental awareness influenced the perceived value of electric vehicle adoption. Despite participants highlighting environmental sustainability issues related to global warming and the reduction of negative externalities such as noise and air pollution, emissions, and the reduction of the carbon footprint, the study failed to identify these factors as key drivers that could influence consumer preferences towards the adoption of electric vehicles. Research results indicate that environmental factors were not singled out as the key drivers that could influence favourable consumer preferences regarding the adoption of electric vehicles in South Africa.

Perhaps the second most prominent issue after the Total Cost of Ownership (TCO) of electric vehicles is technological considerations. These issues were raised concerning the need to improve the functionality of electric vehicles, such as expanding the range of travel to as much as

1,000 km on a full charge, as opposed to the current range of electric vehicles of between 250 km and 500 km. Positive sentiments were expressed for technological developments that have culminated in the use of lithium batteries that have a greater lifespan.

These developments are expected to improve the uptake of electric vehicles in the country. Other key technical issues that were emphasised include the availability of charging infrastructure and the charging time for electric vehicles.

The study revealed several key findings:

- **Perceptions and Attitudes:** The general view among South African consumers towards electric vehicles is positive, particularly for their environmental impact. However, concerns about the high cost of EVs, the absence of adequate charging infrastructure, and their reliability during blackouts (due to load shedding) were some of the critical barriers.
- **Economic Considerations:** The price and the total cost of ownership emerged as significant factors in the adoption of these vehicles. Hybrid models appeared to the consumers as a transitional technology, and this is what they preferred.
- **Government Policy and Incentives:** While consumers knew of the existence of the policies that support EVs, they still thought that wider adoption would require better incentives than those available, such as tax breaks and rebates.

These findings suggest that while there is interest in EVs, substantial barriers, particularly economic and infrastructural, remain. Interpretations focused on how these barriers could be addressed through targeted business strategies and policy interventions.

7.5 Theoretical contributions

How does this add to the current scholarly debate, i.e., relevance/contributions?

This study contributes to the ongoing scholarly debate on EV adoption by providing insights into a developing economy's unique challenges and consumer behaviours. It highlights how traditional adoption models may not fully apply in contexts where infrastructure is underdeveloped and energy security is an issue. It also adds to discussions on mixed-energy mobility and transitional technologies, suggesting that hybrid vehicles may serve as a more practical interim solution in South Africa.

Additionally, the outcomes of this study have an influential contribution to existing technology

adoption theories, such as the Technology Acceptance Model and the Diffusion of Innovations Model. The usage of electric vehicles in South Africa is in its infancy stages for both consumer and industrial markets. Research results validate the TAM regarding the efficacy of the perceived usefulness and the perceived benefits linked with the use of electric vehicles. Results indicate that people go through a rational decision-making process when considering including electric vehicles as part of their fleet based on the anticipated costs and benefits. These findings resonate with the tenets of TAM, the Diffusion of Innovations Theory, and the Rational Choice Theory.

This study also underscored the essence of the Theory of Reasoned Action, demonstrating that individuals can occasionally behave in ways that deviate from their subjective norms. The realisation that the participants in this study, despite their in-depth knowledge of the benefits associated with the use of electric vehicles, are not expected to be innovators or leaders in the adoption of electric vehicles serves as evidence of this. Their continued use of internal combustion engine vehicles does not inspire confidence toward the full adoption of EVs in the country. Ultimately, research results confirmed the relevance of existing technology adoption and consumer behavioural theory when it comes to the adoption of electric vehicles in the South African mixed energy mobility solutions environment.

7.6 Managerial implications

What is the practical/business relevance of the study findings?

People in positions of authority are considered innovators and adopters when it comes to the use of EVs in South Africa, and they should act as brand ambassadors to popularise the essence of migrating towards the use of electric vehicles to the rest of the population. This is instrumental as a first-mover advantage to demonstrate the benefits associated with the use of EVs. Such initiatives prepare a platform for the wider adoption of EVs to the generality of other adopter categories, such as early adopters, early majority, and late majority.

The automotive industry in South Africa should take advantage of the existence of the White Paper published by the government of South Africa to develop strategic plans that will communicate that the transition towards the manufacturing of electric vehicles is a first process, starting with the increased manufacturing of hybrid vehicles. This is expected to lead to the eventual full-scale production of EVs in the country.

It is recommended that smart partnerships be entered with EV manufacturers in China so that they can do their assembly in South Africa. The local EV market stands to benefit from significant reductions in the total cost of ownership of such vehicles, which can act as a key incentive to support the adoption of EVs in the country. Moreover, combined research and development initiatives that the government funds can go a long way, especially when they are focused on technological ways of improving the functionality of electric vehicles, such as expanding the range of travel to as much as 1,000 km as well as making sure that they are improving charging infrastructure across all provinces in the country. These initiatives can prove invaluable in improving the ease with which people are prepared to adopt and use electric vehicles.

Education and public sensitisation programs are of paramount importance in raising awareness of the benefits of migrating to EVs in South Africa. The starting point might be for government departments to start using EVs in their fleet as a way of demonstrating the government's commitment to sustainability issues. The findings offer several managerial implications:

- **For Automakers, the original equipment manufacturers**: Addressing concerns that consumers have regarding the price, infrastructure, and range will assist in targeting product offerings, for instance, cheaper hybrid cars or EVs with longer battery ranges. Partnering with the government or the private sector to build charging facilities might also alleviate consumers' concerns.
- **For Policymakers**: The study reveals that further government-supported incentives must be improved to drive EV adoption. Policies aimed at easing the cost of owning an EV, such as making available tax incentives or subsidies and the provision of more charging stations, will be necessary for expansion.
- **For Energy and Utility Companies – e.g., Eskom**: It is necessary to overcome the existing energy crisis, specifically load shedding, as it negatively impacts consumer perceptions of EVs. Energy producers should partner with the motor industry to integrate solutions such as solar charging EVs.

7.7 Recommendations

1. **Increase Consumer Education and Awareness Campaigns**: It is paramount that private firms, as well as the government, fund outreach campaigns to make consumers understand the economic and environmental advantages of EVs. Such campaigns should

also seek to correct the common misconceptions related to the range of EVs, maintenance costs, and affordability.

2. **Introduce Financial Incentives**: To enhance the adoption of EVs, the current financial incentives offered must be enhanced. This could be done through lowering taxes on EV imports, providing government subsidies when purchasing EVs, and favourable loan or payment conditions, e.g., low interest rates or extended payment periods.

3. **Expand Charging Infrastructure**: Investment in charging infrastructure is essential, especially in rural and underserved regions. The government and private sector must establish ventures that will aid in creating a wide and efficient network of charging stations to lessen people's fears about owning an EV.

4. **Foster Local Manufacturing and Assembly**: South Africa would stand a better chance of expanding the current EV market by increasing local manufacturing of EVs or assembling them. This would cut down the costs of the vehicles and create employment opportunities. Furthermore, this would enable the EV technology to fit with the local conditions and infrastructure, thus increasing the appeal to South African consumers.

5. **Strengthen Government Policy and Incentives**: Both state and local governments should implement more stringent measures regarding emission-free vehicles. This includes, among other things, establishing incentives, subsidies, or even penalties for emissions-based use of vehicles or grants for businesses investing in EVs.

6. **Cultural Shift and Market Positioning**: Companies should work to reposition EVs as mainstream, cost-effective alternatives rather than luxury items. Marketing efforts should emphasise the practical benefits of EV ownership, such as lower maintenance costs and long-term fuel savings, while also appealing to environmentally conscious consumers.

7. **Leverage Renewable Energy Sources for EV Charging**: The integration of South Africa's abundant renewable sources of energy, such as solar, into the EV charging global infrastructure makes the transition a lot smoother and more sustainable. Promoting renewable-powered charging stations would not only make EVs more attractive but also create synergies between different clean technologies.

By addressing these factors, South Africa can foster greater adoption of electric vehicles and ensure the development of a robust mixed-energy mobility market that balances economic growth with environmental sustainability.

7.8 Limitations of the research

The greatest limitation of this study is its methodological choices. The study was qualitative as it was focused on collecting the personal lived experiences of people who are believed to have in-depth knowledge of the usage and application of EVs in South Africa. In that regard, the scope of this research was limited to the views and opinions of 13 participants from diverse sectors of the South African economy who have an interface with EVs.

The main limitation comes from the realisation that not all the participants own an EV themselves. Some of the views and opinions expressed and shared in this research are a result of the experience and exposure gained from the encounters with people who own EVs at a professional and social level. Nevertheless, the transcripts were quite insightful, as they demonstrated an in-depth appreciation of the EVs ecosystem as well as the existence of the White Paper on the adoption of EVs in South Africa.

7.9 Suggestions for future research

For future studies, researchers should opt to take a pragmatic stance whereby they incorporate both qualitative and quantitative research so that a well-rounded view and balanced understanding of electric vehicles' use is achieved. Such an approach would encompass expert opinions with specific EV technology knowledge, actual electric vehicle users, and government representatives in charge of EV policy. The quantitative aspect of the study, using a set of EV owner surveys, would provide a more in-depth understanding of the appeal of EVs. Additionally, this mixed-methods approach would also increase the external validity of the results across the entire South African automotive industry, providing a more comprehensive view of factors influencing EV adoption.

1. **Longitudinal Studies on EV Adoption**: Further research is needed to examine EV uptake trends in South Africa with a view to mapping out changes in consumer habits, market evolution, and infrastructure growth. Longitudinal studies can be useful in answering how long these adoptions are augmented by government policies, technological advancements and even changes in public perception.
2. **Comparative Studies of Urban vs. Rural Adoption**: Exploring the differences between urban and rural consumer attitudes and experiences with EVs would be valuable. South Africa's diverse geography and socio-economic landscape mean that rural consumers

may face unique challenges, such as limited infrastructure and higher costs, which urban-centric studies may overlook.

3. **Behavioural and Psychological Drivers**: Future studies should take a closer look into the emotional, behavioural and attitudinal factors that impede or enable consumers to adopt EVs, for instance, the level of risk a consumer associates with the new technology, trust in the technology and emotions towards sustainability initiatives. It may also be helpful to enhance some of the marketing campaigns and consumer education strategies.
4. **Impact of Mixed-Energy Mobility Solutions**: Further research is needed to explore the broader implications of mixed-energy mobility solutions such as hybrid vehicles and renewable energy charging stations in South Africa. It will be critical to understand how the end users engage with these blended technologies and to what extent, as that will inform future mobility strategies.
5. **Effectiveness of Government Incentives**: More research should be conducted to evaluate the effectiveness of various government incentives for EV adoption. Comparative studies between South Africa and other countries with successful EV markets could provide insights into which policy frameworks are most impactful in increasing adoption rates.
6. **Environmental and Economic Impact of EV Adoption**: Studies quantifying the environmental and economic benefits of widespread EV adoption in South Africa would help policymakers and businesses make informed decisions. This could include analysing reductions in carbon emissions, fuel cost savings, and job creation in the renewable energy and EV sectors.
7. **Role of Local Manufacturing**: Research on the feasibility and impact of establishing local EV manufacturing or assembly plants could help determine the economic and market benefits for South Africa. This could also include exploring how localising production might reduce costs and increase accessibility for consumers.
8. **Consumer Segmentation and Personalisation**: Further studies could examine how different demographic groups in South Africa (e.g., age, income, region, and social class) perceive and interact with EVs. Understanding these differences could help businesses develop more targeted marketing and product offerings that cater to diverse consumer needs.

In investigating and addressing these areas, future research will not only deepen the understanding of the complexities involved in promoting EV adoption in South Africa's mixed-energy mobility market but can provide a clearer and more nuanced understanding of the factors that influence the adoption of electric vehicles in South Africa and contribute to more effective strategies for promoting the growth of the EV market.

Reference List.

Ajzen, I. (2020). The theory of planned behaviour: Frequently asked questions. *Human Behavior and Emerging Technologies*, *2*(4), 314–324. https://doi.org/10.1002/hbe2.195

Alali, L., Niesten, E., & Gagliardi, D. (2022). The impact of UK financial incentives on the adoption of electric fleets: The moderation effect of GDP change. *Transportation Research Part A: Policy and Practice*, *161*(May 2021), 200–220. https://doi.org/10.1016/j.tra.2022.04.011

Ames, H., Glenton, C., & Lewin, S. (2019). Purposive sampling in a qualitative evidence synthesis: A worked example from a synthesis on parental perceptions of vaccination communication. *BMC Medical Research Methodology*, *19*(1), 26. https://doi.org/10.1186/s12874-019-0665-4

Armenio, S., Bergantino, A. S., Intini, M., & Morone, A. (2022). Cheaper or eco-friendly cars: What do consumers prefer? An experimental study on individual and social preferences. *Ecological Economics*, *193*(December 2021), 107323. https://doi.org/10.1016/j.ecolecon.2021.107323

Asadi, S., Nilashi, M., Samad, S., Abdullah, R., Mahmoud, M., Alkinani, M. H., & Yadegaridehkordi, E. (2021). Factors impacting consumers' intention toward adoption of electric vehicles in Malaysia. *Journal of Cleaner Production*, *282*. https://doi.org/10.1016/j.jclepro.2020.124474

AutoTrader. (2024). *2024 Mid-Year Car Industry Report.* AutoTrader South Africa. Retrieved from [https://www.autotrader.co.za/car-industry-report/2024-autotrader-mid-year-car-industry-report/6]

Axsen, J., & Pickrell-Barr, J. (2024). What drives fleets? Organisations' perceived barriers and motivators for alternative-fuel vehicles. *Transportation Research Part D: Transport and Environment*, *132*(March), 104220. https://doi.org/10.1016/j.trd.2024.104220

Baghel, A. K., Kumar, P., & Kumar, P. (2016). Scenario of electric and hybrid electric vehicles by 2030. *2015 IEEE International Transportation Electrification Conference, ITEC-India 2015*, 1–7. https://doi.org/10.1109/ITEC-India.2015.7386914

Barczak, G. (2015). Publishing Qualitative versus Quantitative Research. *Journal of Product Innovation Management*, *32*(5), 658. https://doi.org/10.1111/jpim.12277

Barnes, J., Analysts, B., Montmasson-Clair, G., Moshikaro, L., & Ndlovu, M. (2022).

Recommendations to advance South Africa's new energy vehicle market and domestic supply chain. Compiled by the New Energy Vehicle Project Team. www.tips.org.za

Barney, J. (2018). Why resource-based theory's model of profit appropriation must incorporate a stakeholder perspective. *Strategic Management Journal*, *39*, 3305–3325.

Bas, J., Cirillo, C., & Cherchi, E. (2021). Classification of potential electric vehicle purchasers: A machine learning approach. *Technological Forecasting and Social Change*, *168*, 120759. https://doi.org/10.1016/j.techfore.2021.120759

Beak, Y., Kim, K., Maeng, K., & Cho, Y. (2020). Is the environment-friendly factor attractive to customers when purchasing electric vehicles? Evidence from South Korea. *Business Strategy and the Environment*, *29*(3), 996–1006. https://doi.org/10.1002/bse.2412

Bonges, H. A., & Lusk, A. C. (2016). Addressing electric vehicle (EV) sales and range anxiety through parking layout, policy and regulation. *Transportation Research Part A: Policy and Practice*, *83*, 63–73. https://doi.org/10.1016/j.tra.2015.09.011

Bougie, R., & Sekaran, U. (2019). *Research methods for business: A skill building approach* (Fifth). John Wiley & Sons.

Brand, C., Anable, J., Ketsopoulou, I., & Watson, J. (2020). Road to zero or road to nowhere? Disrupting transport and energy in a zero carbon world. *Energy Policy*, *139*, 111334. https://doi.org/10.1016/j.enpol.2020.111334

Braun, V., & Clarke, V. (2012). Thematic analysis. *APA Handbook of Research Methods in Psychology, Vol 2: Research Designs: Quantitative, Qualitative, Neuropsychological, and Biological.*, *2*, 57–71. https://doi.org/10.1037/13620-004

Buhmann, K. M., & Criado, J. R. (2023a). Consumers' preferences for electric vehicles: The role of status and reputation. *Transportation Research Part D: Transport and Environment*, *114*(April 2022), 103530. https://doi.org/10.1016/j.trd.2022.103530

Buhmann, K. M., & Criado, J. R. (2023b). Consumers' preferences for electric vehicles: The role of status and reputation. *Transportation Research Part D: Transport and Environment*, *114*. https://doi.org/10.1016/j.trd.2022.103530

Challa, R., Kamath, D., & Anctil, A. (2022). Well-to-wheel greenhouse gas emissions of electric versus combustion vehicles from 2018 to 2030 in the US. *Journal of Environmental Management*, *308*, 114592. https://doi.org/10.1016/j.jenvman.2022.114592

Choudhari, T. P., Illahi, U., Al-Hosni, M., Caulfield, B., & O'Mahony, M. (2024). Decarbonising shared mobility: The potential of shared electric vehicles. *Transportation Research Part D: Transport and Environment*, *133*(July), 104313. https://doi.org/10.1016/j.trd.2024.104313

Correia Sinézio Martins, E., Lépine, J., & Corbett, J. (2024). Assessing the effectiveness of financial incentives on electric vehicle adoption in Europe: Multi-period difference-in-difference approach. *Transportation Research Part A: Policy and Practice*, *189*(August). https://doi.org/10.1016/j.tra.2024.104217

Creswell, J. W. (2007). *Qualitative inquiry and Research Design: Choosing among five approaches* (2nd ed.). Sage Publications.

Cruz-Jesus, F., Figueira-Alves, H., Tam, C., Pinto, D. C., Oliveira, T., & Venkatesh, V. (2023). Pragmatic and idealistic reasons: What drives electric vehicle drivers' satisfaction and continuance intention? *Transportation Research Part A: Policy and Practice*, *170*(March 2020), 103626. https://doi.org/10.1016/j.tra.2023.103626

Cui, L., Wang, Y., Chen, W., Wen, W., & Han, M. S. (2021). Predicting determinants of consumers' purchase motivation for electric vehicles: An application of Maslow's hierarchy of needs model. *Energy Policy*, *151*. https://doi.org/10.1016/j.enpol.2021.112167

Curtale, R., Liao, F., & van der Waerden, P. (2021). User acceptance of electric car-sharing services: The case of the Netherlands. *Transportation Research Part A: Policy and Practice*, *149*(May), 266–282. https://doi.org/10.1016/j.tra.2021.05.006

Danielis, R., Rotaris, L., Giansoldati, M., & Scorrano, M. (2020). Drivers' preferences for electric cars in Italy. Evidence from a country with limited but growing electric car uptake. *Transportation Research Part A: Policy and Practice*, *137*(April), 79–94. https://doi.org/10.1016/j.tra.2020.04.004

Dua, R., Edwards, A., Anand, U., & Bansal, P. (2024). Are American electric vehicle owners quitting? *Transportation Research Part D: Transport and Environment*, *133*(February 2024), 104272. https://doi.org/10.1016/j.trd.2024.104272

Department of Trade, Industry and Competition (2023). *Electric Vehicle White Paper*. https://www.thedtic.gov.za/wp-content/uploads/EV-White-Paper.pdf

Department of Transport. (2018). *Green transport strategy for South Africa (2018–2050)*. https://www.changing-transport.org/wp-content/uploads/I_K_Green-Transport-

Strategy_South-Africa_2018_EN.pdf

Eccarius, T., & Chen, C. F. (2024). Examining trust as a critical factor for the adoption of electric vehicle sharing via necessary condition analysis. *Technological Forecasting and Social Change*, *208*(August), 123681. https://doi.org/10.1016/j.techfore.2024.123681

Electric Vehicle White Paper. (2023). *Electric Vehicle White Paper*. https://www.thedtic.gov.za/wp-content/uploads/EV-White-Paper.pdf

Farinloye, T., Oluwatobi, O., Ugboma, O., Dickson, O. F., Uzondu, C., & Mogaji, E. (2024). Driving the electric vehicle agenda in Nigeria: The challenges, prospects and opportunities. *Transportation Research Part D: Transport and Environment*, *130*(March), 104182. https://doi.org/10.1016/j.trd.2024.104182

Farzin, M., Sadeghi, M., Yahyayi Kharkeshi, F., Ruholahpur, H., & Fattahi, M. (2021). Extending UTAUT2 in M-banking adoption and actual use behavior: Does WOM communication matter? *Asian Journal of Economics and Banking*, *5*(2), 136–157. https://doi.org/10.1108/ajeb-10-2020-0085

Flores, P. J. (2024). What motivates consumers to adopt controversial green mobility innovations? The case of shared e-bikes and e-scooters. *Technological Forecasting and Social Change*, *208*(August), 123694. https://doi.org/10.1016/j.techfore.2024.123694

Gil Ribeiro, C., & Silveira, S. (2024). The impact of financial incentives on the total cost of ownership of electric light commercial vehicles in EU countries. *Transportation Research Part A: Policy and Practice*, *179*(October 2023), 103936. https://doi.org/10.1016/j.tra.2023.103936

Granić, A., & Marangunić, N. (2019). Technology acceptance model in educational context: A systematic literature review. *British Journal of Educational Technology*, *50*(5), 2572–2593. https://doi.org/10.1111/bjet.12864

Guest, G., Bunce, A., & Johnson, L. (2006). How many interviews are enough? An experiment with data saturation and validity'. *Field Methods*, *18*(1), 59–82.

Haider, S. W., Zhuang, G., & Ali, S. (2019). Identifying and bridging the attitude behavior gap in sustainable transportation adoption. *Journal of Ambient Intelligence and Humanized Computing, 10*(10), 3723–3738. https://doi.org/10.1007/s12652-019-01405-z

Hawkins, A. (2024). Mercedes-Benz backs off plan to only sell EVs by 2030 - The Verge. In *The Verge*. The Verge. https://www.theverge.com/2024/2/22/24080220/mercedes-benz-ev-only-sales-2030-back-off

Hennink, M., & Kaiser, B. N. (2022). Sample sizes for saturation in qualitative research: A systematic review of empirical tests. *Social Science and Medicine*, *292*, 114523. https://doi.org/10.1016/j.socscimed.2021.114523

Hernández-Tamurejo, Á., Saiz-Sepúlveda, Á., & Lacárcel, F. J. S. (2024). Are urban mobility policies favoring the purchase of new vehicles? *Technological Forecasting and Social Change*, *198*(October 2023). https://doi.org/10.1016/j.techfore.2023.122976

Higueras-Castillo, E., Guillén, A., Herrera, L. J., & Liébana-Cabanillas, F. (2021). Adoption of electric vehicles: Which factors are really important? *International Journal of Sustainable Transportation*, *15*(10), 799–813. https://doi.org/10.1080/15568318.2020.1818330

Huang, Y., & Qian, L. (2021). Consumer adoption of electric vehicles in alternative business models. *Energy Policy*, *155*(May), 112338. https://doi.org/10.1016/j.enpol.2021.112338

Huang, Y., Qian, L., Tyfield, D., & Soopramanien, D. (2021). On the heterogeneity in consumer preferences for electric vehicles across generations and cities in China. *Technological Forecasting and Social Change*, *167*(February), 120687. https://doi.org/10.1016/j.techfore.2021.120687

Hull, C., Giliomee, J. H., Visser, M., & Booysen, M. J. (2024a). Electric vehicle adoption intention among paratransit owners and drivers in South Africa. *Transport Policy*, *146*(October 2023), 137–149. https://doi.org/10.1016/j.tranpol.2023.11.015

Hull, C., Giliomee, J. H., Visser, M., & Booysen, M. J. (Thinus. (2024b). Survey data on the socio-economic characteristics and electric vehicle perceptions of paratransit owners and drivers in and around the Cape Town Metropole of South Africa. *Data in Brief*, *53*, 110126. https://doi.org/10.1016/j.dib.2024.110126

Illahi, U., Pramod Choudhari, T., Charly, A., O'Mahony, M., & Caulfield, B. (2024). Driving green change: Commercial sector adopting electric vehicles in Ireland. *Transportation Research Part D: Transport and Environment*, *135*(August), 104398. https://doi.org/10.1016/j.trd.2024.104398

Ingeborgrud, L., & Ryghaug, M. (2019). The role of practical, cognitive and symbolic factors in the

successful implementation of battery electric vehicles in Norway. *Transportation Research Part A: Policy and Practice*, *130*(January), 507–516. https://doi.org/10.1016/j.tra.2019.09.045

Jauhar, S. K., Sethi, S., Kamble, S. S., Mathew, S., & Belhadi, A. (2024). Artificial intelligence and machine learning-based decision support system for forecasting electric vehicles' power requirement. *Technological Forecasting and Social Change*, *204*(March), 123396. https://doi.org/10.1016/j.techfore.2024.123396

Jena, R. (2020). An empirical case study on Indian consumers' sentiment towards electric vehicles: A big data analytics approach. *Industrial Marketing Management*, *90*(January), 605–616. https://doi.org/10.1016/j.indmarman.2019.12.012

Jensen, A. F., Thorhauge, M., Mabit, S. E., & Rich, J. (2021a). Demand for plug-in electric vehicles across segments in the future vehicle market. *Transportation Research Part D: Transport and Environment*, *98*(July), 102976. https://doi.org/10.1016/j.trd.2021.102976

Jensen, A. F., Thorhauge, M., Mabit, S. E., & Rich, J. (2021b). Demand for plug-in electric vehicles across segments in the future vehicle market. *Transportation Research Part D: Transport and Environment*, *98*. https://doi.org/10.1016/j.trd.2021.102976

Kim, J., Seung, H., Lee, J., & Ahn, J. (2020). Asymmetric preference and loss aversion for electric vehicles: The reference-dependent choice model capturing different preference directions. *Energy Economics*, *86*, 104666. https://doi.org/10.1016/j.eneco.2020.104666

Kumar, A., Kanunjna, G., & Shetty, A. (2023). Volkswagen's New Electric Targets for 2030. In *Frost & Sullivan*. https://www.frost.com/frost-perspectives/volkswagen-takes-its-electric-ambitions-up-another-notch-with-new-targets-for-2030/

Lawson, A. (2023). Nissan vows to go all-electric by 2030 despite Sunak delay on petrol ban | Nissan | The Guardian. In *The Guardian*. The Guardian. https://www.theguardian.com/business/2023/sep/25/nissan-all-electric-by-2030-rishi-sunak-petrol-ban-europe

Lê, J. K., & Schmid, T. (2022). The Practice of Innovating Research Methods. *Organizational Research Methods*, *25*(2), 308–336. (ABS Raking 4*)

Lester, J. N., Cho, Y., & Lochmiller, C. R. (2020). Learning to Do Qualitative Data Analysis: A Starting Point. *Human Resource Development Review*, *19*(1), 94–106.

https://doi.org/10.1177/1534484320903890

Li, L., Wang, Z., Chen, L., & Wang, Z. (2020). Consumer preferences for battery electric vehicles: A choice experimental survey in China. *Transportation Research Part D: Transport and Environment*, *78*. https://doi.org/10.1016/j.trd.2019.11.014

Liang, J., Qiu, Y. (Lucy), & Xing, B. (2022). Impacts of the co-adoption of electric vehicles and solar panel systems: Empirical evidence of changes in electricity demand and consumer behaviors from household smart meter data. *Energy Economics*, *112*(May 2021), 106170. https://doi.org/10.1016/j.eneco.2022.106170

Liao, F., Molin, E., Timmermans, H., & van Wee, B. (2019). Consumer preferences for business models in electric vehicle adoption. *Transport Policy*, *73*, 12–24. https://doi.org/10.1016/j.tranpol.2018.10.006

Litman, T. (2016). Transportation affordability: evaluation and improvement strategies. In *Transportation* (Vol. 250, Issue September, pp. 360–1560). https://www.researchgate.net/publication/37183850

Llopis-Albert, C., Palacios-Marqués, D., & Simón-Moya, V. (2021). Fuzzy set qualitative comparative analysis (fsQCA) applied to the adaptation of the automobile industry to meet the emission standards of climate change policies via the deployment of electric vehicles (EVs). *Technological Forecasting and Social Change*, *169*. https://doi.org/10.1016/j.techfore.2021.120843

Malima, G. C., & Moyo, F. (2023a). Are electric vehicles economically viable in sub-Saharan Africa? The total cost of ownership of internal combustion engine and electric vehicles in Tanzania. *Transport Policy*, *141*(July), 14–26. https://doi.org/10.1016/j.tranpol.2023.07.014

Malima, G. C., & Moyo, F. (2023b). Are electric vehicles economically viable in sub-Saharan Africa? The total cost of ownership of internal combustion engine and electric vehicles in Tanzania. *Transport Policy*, *141*, 14–26. https://doi.org/10.1016/j.tranpol.2023.07.014

Maluleke, V. (2024). Is South Africa ready for electric vehicles? In *The Citizen*. The Citizen. https://www.citizen.co.za/business/is-south-africa-ready-for-electric-vehicles/

McCracken, G. (2011). The Long Interview. In *The Long Interview*. SAGE Publications. https://doi.org/10.4135/9781412986229

Moeletsi, M. E. (2021). Future policy and technological advancement recommendations for

enhanced adoption of electric vehicles in south africa: A survey and review. *Sustainability (Switzerland)*, *13*(22). https://doi.org/10.3390/su132212535

Moeletsi, T., & Tongwane, M. I. (2020). Projected direct carbon dioxide emission reductions as a result of the adoption of electric vehicles in Gauteng Province of South Africa. *Atmosphere, 11*(6), 591. https://doi.org/10.3390/atmos11060591

Msosa, S. K. (2023). Demystifying Customer Perception of Electric Vehicle Adoption in South Africa Using the Technology Acceptance Model. *The Problems of Economy*, *4*(58), 32–40. https://doi.org/10.32983/2222-0712-2023-4-32-40

naamsa. (2024). *Industry support and critical considerations*. www.naamsa.co.za.

NAAMSA. (2024). *Quarterly review of business conditions: new motor vehicle manufacturing industry / automotive sector – 2nd quarter 2024.* NAAMSA, The Automotive Business Council.

Nastjuk, I., Herrenkind, B., Marrone, M., Brendel, A. B., & Kolbe, L. M. (2020). What drives the acceptance of autonomous driving? An investigation of acceptance factors from an end-user's perspective. *Technological Forecasting and Social Change*, *161*(September), 120319. https://doi.org/10.1016/j.techfore.2020.120319

Philip, T., Whitehead, J., & Prato, C. G. (2023a). Adoption of electric vehicles in a laggard, car-dependent nation: Investigating the potential influence of V2G and broader energy benefits on adoption. *Transportation Research Part A: Policy and Practice*, *167*. https://doi.org/10.1016/j.tra.2022.11.015

Philip, T., Whitehead, J., & Prato, C. G. (2023b). Adoption of electric vehicles in a laggard, car-dependent nation: Investigating the potential influence of V2G and broader energy benefits on adoption. *Transportation Research Part A: Policy and Practice*, *167*(December 2021), 103555. https://doi.org/10.1016/j.tra.2022.11.015

Price, J. H., & Murnan, J. (2004). Research Limitations and the Necessity of Reporting Them. *American Journal of Health Education*, *35*(2), 66–67. https://doi.org/10.1080/19325037.2004.10603611

Rindfleisch, A., Malter, A. J., Ganesan, S., & Moorman, C. (2008). Cross-sectional versus longitudinal survey research: Concepts, findings, and guidelines. *Journal of Marketing Research*, *45*(3), 261–279. https://doi.org/10.1509/jmkr.45.3.261

Rogers, E. (1962). *Diffusion of Innovations*. Free Press.

Rosales-Tristancho, A., Brey, R., Carazo, A. F., & Brey, J. J. (2022). Analysis of the barriers to the adoption of zero-emission vehicles in Spain. *Transportation Research Part A: Policy and Practice*, *158*(April 2021), 19–43. https://doi.org/10.1016/j.tra.2022.01.016

Rosales-Tristancho, A., Carazo, A. F., Brey, R., & Lindhjem, H. (2024). Meta-analysis of consumers' trade-offs between range and charging infrastructure for electric vehicles. *Transportation Research Part D: Transport and Environment*, *134*(July). https://doi.org/10.1016/j.trd.2024.104342

Salari, N. (2022). Electric vehicles adoption behaviour: Synthesising the technology readiness index with environmentalism values and instrumental attributes. *Transportation Research Part A: Policy and Practice*, *164*(April 2020), 60–81. https://doi.org/10.1016/j.tra.2022.07.009

Saunders, M., Lewis, P., & Thornhill, A. (2019). *Research Methods for Business Students* (8th Editio). Pearson Education Limited.

Schepis, D., Purchase, S., Olaru, D., Smith, B., & Ellis, N. (2023). How governments influence autonomous vehicle (AV) innovation. *Transportation Research Part A: Policy and Practice*, *178*(October), 103874. https://doi.org/10.1016/j.tra.2023.103874

Schindler, S. (2022). *Business research methods*. McGraw Hill.

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*. https://doi.org/10.1016/j.trd.2020.102436

Sovacool, B. K., Daniels, C., & AbdulRafiu, A. (2022). Transitioning to electrified, automated and shared mobility in an African context: A comparative review of Johannesburg, Kigali, Lagos and Nairobi. *Journal of Transport Geography*, *98*. https://doi.org/10.1016/j.jtrangeo.2021.103256

Su, C. W., Yuan, X., Tao, R., & Umar, M. (2021). Can new energy vehicles help to achieve carbon neutrality targets? *Journal of Environmental Management*, *297*. https://doi.org/10.1016/j.jenvman.2021.113348

Sugihara, C., Hardman, S., & Kurani, K. (2024). Who decides which trucks to buy? Implications for electrifying freight fleets. *Transportation Research Part D: Transport and Environment*, *126*(December 2023), 104015. https://doi.org/10.1016/j.trd.2023.104015

Tongwane, M. I., & Moeletsi, M. E. (2021). Status of electric vehicles in South Africa and their

carbon mitigation potential. *Scientific African, 14*, e00999. https://doi.org/10.1016/j.sciaf.2021.e00999

Trung, N. T., & Urmee, T. (2024). Electrifying Vietnam's streets: Identifying the determinants of electric two-wheelers uptake. *Transportation Research Part D: Transport and Environment*, *129*(October 2023), 104116. https://doi.org/10.1016/j.trd.2024.104116

Visaria, A. A., Jensen, A. F., Thorhauge, M., & Mabit, S. E. (2022). User preferences for EV charging, pricing schemes, and charging infrastructure. *Transportation Research Part A: Policy and Practice*, *165*, 120–143. https://doi.org/10.1016/j.tra.2022.08.013

Wang, Y., Liu, B., Chan, H. K., & Zhang, T. (2023). Who pays buyers for not disclosing supplier lists? Unlocking the relationship between supply chain transparency and trade credit. *Journal of Business Research*, *155*(Part B). https://doi.org/10.1016/j.jbusres.2022.113404

Ye, F., Kang, W., Li, L., & Wang, Z. (2021). Why do consumers choose to buy electric vehicles? A paired data analysis of purchase intention configurations. *Transportation Research Part A: Policy and Practice*, *147*, 14–27. https://doi.org/10.1016/j.tra.2021.02.014

Zhao, X., Li, X., Zhao, Z., & Luo, T. (2024). Media attention and electric vehicle adoption : Evidence from 275 cities in China. *Transportation Research Part A*, *September*, 104269. https://doi.org/10.1016/j.tra.2024.104269

Zhao, X., Ma, Y., Shao, S., & Ma, T. (2022). What determines consumers' acceptance of electric vehicles: A survey in Shanghai, China. *Energy Economics*, *108*. https://doi.org/10.1016/j.eneco.2021.105805.

Appendix A: Journals Ranking Table

Journal Name	**AJG 2023**	**ABDC**	**Recency of article**	**Publisher**	**Field**
Journal of Product Innovation Management	4	A*	2020		
Organisational Research Methods	4	A*	2022	SAGE	Organisational Behaviour
Social science & medicine	4	N/A	2022	Elsevier	Social Sciences
Transportation Research Part A: Policy and Practice	3	A*	2016, 2020, 2021, 2022, 2023 & 2024	Elsevier	Transportation
Energy Economics	3	A*	2020, 2021 & 2022	Elsevier	Energy

Industrial Marketing Management	3	A*	2020	Elsevier	Marketing
Ecological Economics	3	A	2022	Elsevier	Economics
Business Strategy & the Environment	3	A	2020	Wiley Online Library	Environment
Technological Forecasting and Social Change	3	A	2020 & 2021	Elsevier	Innovation
Transportation Research Part D: Transport and Environment	3	A	2021, 2023 & 2024	Elsevier	Transportation
Journal of Environmental Management	3	A	2021	Elsevier	Social Sciences
Sustainability (Switzerland	*SJR: Q1, VHB: C		2021	MDPI	N/A
Applied Energy	N/A - *SJR: Q1	A		Elsevier	Energy
Energy Policy	2	A	2021	Elsevier	Energy
Journal of Cleaner Production	2	A	2021	Elsevier	Operations
Transport Policy	2	A	2023 & 2024	Elsevier	Transportation
Journal of Transport Geography	2	A	2022	Elsevier	Transportation
International Journal of Sustainable Transportation	*N/A – SJR: Q1	B	2021	Taylor & Francis Online	N/A

Appendix B: Consistency Matrix

Title: Exploring Consumer Perceptions, Experiences, and Adoption Factors of Electric Vehicles in South Africa's Mixed-Energy Mobility Market.

Research Questions	Literature Review	Data Collection Tool	Analysis
1. How do South African consumers' perceptions and experiences of mixed-energy mobility solutions, particularly	(Featherman et al., 2021). (Malima & Moyo, 2023)	An interview guide will be developed to conduct semi-structured interviews to	Thematic analysis will be conducted using Atlas.ti to identify and determine

electric vehicles, influence their decision-making in adopting these technologies	(Jensen et al., 2021; Maluleke, 2024)	address Research Question 1.	themes. Supplemented by manual analysis coding by hand
2. What factors influence consumer preferences and adoption rates for mixed-energy vehicles in South Africa?	(Baghel et al., 2015; Hawkins, 2024; Liao et al., 2019; Ye et al., 2021)	An interview guide will be developed to conduct semi-structured interviews to address Research Question 2.	Thematic analysis will be conducted using Atlas.ti to identify and determine themes. Supplemented by manual analysis coding by hand

Appendix C: Ethical Clearance Approval

Gordon Institute of Business Science
University of Pretoria

Ethical Clearance Approved

Dear Baltazer Mahove,

Please be advised that your application for Ethical Clearance has been approved.
You are therefore allowed to continue collecting your data.
We wish you everything of the best for the rest of the project.

Ethical Clearance Form

Kind Regards

GIBS ETHICAL CLEARANCE APPLICATION FORM 2024/25

G. APPROVALS FOR/OF THIS APPLICATION

When the applicant is a student of GIBS, the applicant must please ensure that the supervisor and co-supervisor (where relevant) has signed the form before submission

STUDENT RESEARCHER/APPLICANT:

29. I affirm that all relevant information has been provided in this form and its attachments and that all statements made are correct.

Student Researcher's Name in capital letters:	BALTAZER MAHOVE
Date:	18 Aug 2024
Supervisor Name in capital letters:	NGWAKO SEFOKO
Date:	18 Aug 2024
Co-supervisor Name in capital letters:	
Date:	18 Aug 2024

Note: GIBS shall do everything in its power to protect the personal information supplied herein, in accordance to its company privacy policies as well the Protection of Personal Information Act, 2013. Access to all of the above provided personal information is restricted, only employees who need the information to perform a specific job are granted access to this information.

Decision:

Approved

REC comments:

Approved

Date: 22 Aug 2024

Appendix D: Informed Consent

Gordon Institute of Business Science
University of Pretoria

Informed consent letter

I am currently a student at the University of Pretoria's Gordon Institute of Business Science and completing my research in partial fulfilment of an MBA.

I am conducting research on electric vehicles and am trying to find out more about consumer perceptions, experiences, and adoption factors of electric vehicles in South Africa's mixed-energy mobility market. Your participation is voluntary, and you can withdraw at any time without penalty.

All data will be reported without identifiers.

If you have any concerns, please get in touch with my supervisor or me.

Our details are provided below.

Researcher name	Baltazer Mahove	**Research Supervisor Name**	Dr. Ngwako Sefoko
Email	baltazer@gmail.com	**Email**	nsefoko@gmail.com
Phone	0663013607	**Phone**	0723684415

Signature of participant: _____

Date: _____

Signature of researcher: _____

Date: _____

Appendix E: Interview Guide

Interview Guide: Exploring Consumer Perceptions, Experiences, and Adoption Factors of Electric Vehicles in South Africa's Mixed-Energy Mobility Market

NB **Mixed-energy mobility solutions** - transportation systems that use a mixture of several energy sources to power vehicles, rather than relying solely on traditional fossil fuels. These solutions aim to decrease the reliance on oil, reduce greenhouse gas emissions, and enhance energy security by integrating various types of energy.

Total Estimated Time: 45 minutes to 60 minutes

SECTION A

1. Welcome and Introduction (5 minutes)

- **Purpose of the Interview:** “Thank you for participating. We are researching consumer perceptions, experiences, and adoption factors regarding electric vehicles (EVs) and mixed-energy mobility solutions in South Africa. Your insights will help us understand consumer attitudes and decision-making processes.”
- **Confidentiality and Consent:** “Please be assured that your responses will be kept confidential and used solely for the purpose of this research. We will ensure that your name is not linked to your answers. Is it okay if I record this interview for accuracy?”
- "Before we begin, do you have any questions? Are you comfortable with proceeding?"

SECTION B

2. Background Information (5 minutes)

Directly Responds to Both Research Questions

- **Personal Demographics:** “Can you tell me a little about yourself? Your age, occupation, and where you live?”
- **General Background and Involvement:** “What is your level of involvement or interest in electric vehicles and mixed-energy mobility solutions?”

- **Vehicle Ownership and Experience:** “Do you currently own a vehicle? If so, what type of vehicle do you drive? (e.g., sedan, SUV, hybrid, EV)” “How long have you owned your current vehicle, and what influenced your decision to purchase it?”

SECTION C

3. Awareness and Perception of Electric Vehicles (10 minutes)

Directly Responds to Research Question 1

- **General Awareness:** “How familiar are you with electric vehicles? What do you know about them?” “Have you ever considered purchasing an electric vehicle? Why or why not?”
- **Perceived Benefits:** “What do you see as the main benefits of owning an electric vehicle? (e.g., environmental impact, cost savings, technology)”
- **Concerns and Barriers:** “What concerns do you have about electric vehicles? (e.g., range anxiety, charging infrastructure, cost, performance)” “What do you think are the biggest challenges for someone considering an EV in South Africa?”

SECTION D

4. Experiences with Mixed-Energy Mobility Solutions (10 minutes)

Directly Responds to Research Question 1

- **Experience with Mixed-Energy Vehicles:** “Have you used or considered using a hybrid or plug-in hybrid vehicle? What was your experience?” “What factors influenced your decision to use or not use a mixed-energy vehicle?”
- **Preferences:** “What features are important to you in a mixed-energy vehicle? (e.g., fuel efficiency, technology, cost)”

SECTION E

5. Factors Influencing Adoption (15 minutes)

Directly Responds to Research Question 2

- **Economic Factors:** “How do you perceive the cost of electric vehicles compared to traditional vehicles? Do you think they are worth the investment?” “Would financial incentives or subsidies influence your decision to purchase an EV? What kind of incentives would be most appealing?”
- **Technological Factors:** “How do you view the technology behind EVs, including battery life and charging infrastructure?” “What technological advancements would increase your likelihood of adopting an EV?”
- **Environmental Factors:** “How important is the environmental impact of your vehicle choice to you?” “Do you see EVs as a viable solution to reducing environmental harm in South Africa?”

SECTION F

6. Infrastructure and Policy Support (5 minutes)

Indirectly Responds to Both Research Questions

- **Charging Infrastructure:** “What are your thoughts on the current availability of charging stations for EVs in South Africa?” “How would the convenience of charging impact your decision to purchase an EV?”
- **Government and Industry Support:** “What role do you think the government and automotive industry should play in promoting EV adoption?” “Are there specific policies or support mechanisms that you think would make EVs more appealing?”

SECTION G

7. Outlook (5 minutes)

Indirectly Responds to Both Research Questions

- **Adoption Timeline:** “Do you see yourself switching to an electric or hybrid vehicle in the next 5-10 years? Why or why not?” “What changes would need to occur for you to consider an EV in the future? (e.g., cost reduction, improved technology, better infrastructure)”

- **Vision for Mobility:** “How do you envision the future of mobility in South Africa? Do you think electric and mixed-energy vehicles will become more common?” “What factors do you think will drive or hinder the adoption of EVs in South Africa?”

SECTION H

8. Closing (5 minutes)

- **Final Thoughts:** “Is there anything else you would like to add or any other experiences you’d like to share that we haven’t covered?”
- **Thank You:** “Thank you very much for your time and valuable insights. Your input is greatly appreciated and will contribute to our understanding of this important topic. If you have any further questions or thoughts, feel free to contact me.”

Appendix F: Manual Thematic Analysis

for a study on electric vehicles in South Africa's mixed-energy mobility market.

Herewith a comprehensive picture of the landscape, a structured way of organising some common themes and the codes they might fall under and categorising insights from interviews and conversations with various stakeholders delving into the multiple factors influencing EV adoption in South Africa's mobility market. This includes expert insights from naamsa latest SA Autoweek held from 15 – 18 October 2024 in Cape Town.

Theme	Codes	Theme	Codes
Barriers to EV Adoption - This theme captures challenges and concerns that inhibit EV adoption.	High upfront costs	**Cultural and Social Perceptions** - This theme explores how societal attitudes and perceptions impact EV adoption.	Status symbol of owning an EV
	Lack of charging infrastructure		Social influence on buying decisions
	Range anxiety		Peer attitudes towards sustainability
	Limited EV models available		Consumer trust in new technology
	High maintenance costs		Influence of media and marketing on perceptions
	Perceived complexity in technology		Perceived "coolness" or trendiness of EVs
	Skepticism about EV reliability		Local community influence on green technology adoption
	Concerns about resale value		Influence of cultural norms on car ownership
Environmental and Social Benefits - This theme focuses on the positive environmental and social impacts of EVs	Reduction in carbon emissions	**Government and Institutional Support** - This theme looks at how policies and regulations influence the EV market.	Government policies supporting EV adoption
	Less reliance on fossil fuels		Role of public infrastructure development
	Improved air quality		Urban planning for electric mobility
	Alignment with global climate change goals		Public-private partnerships in EV charging stations
	Social responsibility		Role of state utilities in EV charging
	Cleaner urban environments		Import duties or tariffs on EVs
	Government incentives for eco-friendly cars		Government campaigns promoting clean energy
	Lower long-term environmental costs		Role of institutions in market development
Economic Factors - This theme centers around financial incentives and barriers.	Government subsidies	**Consumer Decision-Making Process** - This theme focuses on how individuals make decisions regarding EVs.	Risk-benefit analysis
	Tax incentives for EV buyers		Decision influenced by family or peer pressure
	Long-term savings on fuel		Perceived value for money
	Cost of electricity vs. fuel		Comparison with hybrid vehicles
	Insurance costs for EVs		Long-term ownership goals
	Depreciation rates compared to traditional vehicles		Interest in leasing vs. buying
	Cost of EV batteries		Perceived ease of transitioning to an EV
	Availability of financing options		Influence of advertisements and media on buying choices
Technological Advancements - This theme addresses innovations and technological developments in the EV industry.	Battery technology advancements	**Infrastructure and Ecosystem Development** -This theme explores the development of infrastructure around EVs.	Availability of home charging options
	Improvements in charging speeds		Proliferation of public charging stations
	Smart charging stations		Charging infrastructure in rural vs. urban areas
	Integration of renewable energy in EV charging		Maintenance and repair facilities for EVs
	Autonomous driving features		Integration of renewable energy with charging networks
	Internet of Things (IoT) integration in EVs		Role of local businesses in supporting EV growth
	Software updates and upgrades		Partnerships between automakers and energy companies
	Energy efficiency improvements		Expansion of charging networks in commercial areas

Appendix G: Copyright Form

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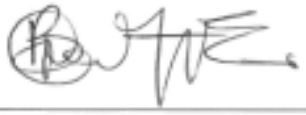
Signature: BD Mahove 	Date: 03/11/24
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