Gordon Institute of Business Science
University of Pretoria

Consumer behaviour in green energy: the impact of green energy availability and prosocial behaviour on the technology adoption of electric vehicles in South Africa.

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Abstract

The global concern regarding climate change and its impact on the environment has intensified as more of its harmful effects are registered all over the world. South Africa, and many other countries, have acknowledged the urgent need to address climate change through commitments towards reducing greenhouse gas emissions and lowering carbon footprints. One innovation, the electric vehicle or EV, has emerged as a sustainable solution that could play a crucial role in contributing to reducing carbon emissions through large-scale adoption. South Africa currently has a slow adoption rate of EVs, and this study set out to explore the adoption barriers, considering the unique context of the country's energy crisis. The study measured consumer behaviour towards EV adoption through its relationship with green energy, prosocial behaviour, and perceived innovation characteristics and consumer innovativeness as defined through the diffusion of innovation theory. The results revealed that Relative Advantage and Trialability are important drivers towards creating a positive perception of EVs with consumers. The study acknowledges the importance of private sector and government involvement to accelerate the adoption of EVs and concludes with strategy recommendations for achieving the goals set for reducing carbon emissions within the South African transportation sector.

Keywords

Consumer Innovativeness, Diffusion of Innovation, Electric Vehicle, Green Energy, Prosocial Behaviour.

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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CFA: Confirmatory Factor Analysis

CI: Consumer Innovativeness

COMPAT: Compatibility

COMPLEX: Complexity

DIO: Diffusion of Innovation

EFA: Exploratory Factor Analysis

EV: Electric Vehicle

GHG: Greenhouse gas

GTSSA: Green Transport Strategy for South Africa 2018-2050

ICE: Internal combustion engine

IEP: Integrated Energy Plan

KMO: Kaiser-Meyer-Olkin Test of Sampling Adequacy

MR: Multiple Regression

Naamsa: National Association of Automobile Manufacturers of South Africa

NDP: National Development Plan

OBS: Observability

PCA: Principal Component Analysis

PIC: Perceived Innovation Characteristics

P-P: Predicted Probability

RA: Relative Advantage

SDG: Sustainable Development Goal

SLR: Simple Linear Regression

TRIA: Trialability

VIR: Variance Inflation Factor

CHAPTER 1: Introduction to Research Problem and Purpose

1.1 Introduction

This chapter introduces the study on consumer behaviour in green energy, exploring the impact of green energy availability, prosocial actions, and consumer innovation characteristics on the technology adoption of electric vehicles within the South African context (Caprara et al., 2005; Rogers, 2003). The research problem and purpose definition can be defined as the starting point of the research process that enables the identification of knowledge gaps on a topic and helps set the research objectives (Fourie, 2023; Myres, 2023; Saunders & Lewis, 2017).

There is an urgent need for sustainable and environmentally responsible transportation practices as the worldwide concern is escalating regarding climate change and its adverse effects on our planet (Gao & Souza, 2022; He et al., 2021). As nations around the world consider the consequences of global warming, individuals, communities, and governments are realising their shared responsibility to reduce their carbon footprints and transition to cleaner and more sustainable transportation practices (Gao & Souza, 2022; He et al., 2021). South Africa, like many other nations, has committed to efforts aimed at mitigating climate change and reducing carbon emissions (South African Department of Transport, n.d.; United Nations, n.d.). These commitments include participation in the Paris Agreement, and the formulation of the ambitious national Green Transport Strategy for South Africa 2018-2050 (GTSSA) (South African Department of Transport, n.d.; United Nations, n.d.). The GTSSA report highlights the substantial contribution of the South African transport sector to greenhouse gas (GHG) emissions in the country (South African Department of Transport, n.d.). To achieve the ambitious carbon emission reduction targets set in the GTSSA, it is imperative to accelerate the adoption of innovative and sustainable transportation technologies (Broadbent et al., 2019; Moeletsi & Tongwane, 2020; Rietmann et al., 2020). One innovation identified, the electric vehicle (EV), has emerged as a solution that could play a crucial role in contributing to reducing worldwide carbon emissions with large-scale adoption (He et al., 2017; Moeletsi & Tongwane, 2020; Rietmann et al., 2020).

Unlike traditional internal combustion engine (ICE) vehicles, EVs do not generate any environmentally harmful greenhouse gas emissions, and through widespread adoption, the EV has the potential to significantly reduce harmful emissions such as carbon dioxide (He et al., 2017; Moeletsi & Tongwane, 2020; Rietmann et al., 2020). However, despite research on environmental advantages, South Africa has seen a relatively slow adoption of EVs (Naamsa, 2022; Rietmann et al., 2020).

The slow adoption rate of EVs can be attributed to numerous barriers, including economic considerations towards the high upfront cost, the limited charging infrastructure, and concerns about the driving range on a single charge (Adhikari et al., 2020; He et al., 2021; König et al., 2021; Moeletsi, 2021; Weiss & Helmers, 2019). Additionally, South Africa faces a unique energy crisis characterised by the state-owned electricity generator Eskom's inability to deliver electricity matching the demand of the country (Hanto et al., 2022; Laher et al., 2019). In response to this crisis, South Africa has seen a surge in rooftop solar installations, enabling consumers to generate private green energy (Baker & Phillips, 2019; Schlösser et al., 2019).

While existing academic research has explored the previously mentioned barriers to EV adoption, no study considered the availability of electricity, and the ability of private green energy generation as factors influencing consumer behaviour and adoption of EVs (Adhikari et al., 2020; Baker & Phillips, 2019; He et al., 2021; König et al., 2021; Moeletsi, 2021; Schlösser et al., 2019; Weiss & Helmers, 2019). This study explores this gap by examining these critical variables and their impact on the adoption of EV technology that is unique to South Africa.

As the world strives to transition to a more sustainable future, the role of EVs in the South African transportation sector has become increasingly significant, providing insights into the relationships between the various factors influencing the adoption of EVs (Broadbent et al., 2019; Moeletsi, 2021; Rietmann et al., 2020). This study aims to ultimately contribute to the development of sustainable and environmentally responsible transportation practices. Through exploring the impact of green energy availability, pro-social actions, consumer innovation characteristics, and government involvement, this study seeks to add to a greener and more sustainable future for South Africa.

1.2 Problem Statement

Widespread concern regarding climate change has intensified due to the adverse effects of global warming worldwide (Gao & Souza, 2022; He et al., 2017). Aligned with this concern is every country, and citizen's responsibility to work towards reducing their carbon footprint (Gao & Souza, 2022; He et al., 2017). This global drive towards a more sustainable future resulted in various international and national commitments by the South African government to reduce the country's carbon footprint (South African Department of Transport, n.d.; United Nations, n.d.). These commitments include the Paris Agreement and the GTSSA (South African Department of Transport, n.d.; United Nations, n.d.). As detailed in the GTSSA, research has shown that the South African transport sector, in particular road transport, contributes a large amount to the greenhouse gas emissions of the country (South African Department of Transport, n.d.). One of the strategies identified through the GTSSA includes the utilisation of cleaner fuels and new technologies such as alternative energy vehicles, including EVs, to work towards achieving the goals and targets of the initiative to reduce emissions (South African Department of Transport, n.d.). When compared to the ICE vehicle, the EV does not have any environmentally harmful GHG emissions, and through the large-scale adoption of EVs, within the transport sector of South Africa, the harmful effect of GHG, which includes carbon dioxide, can be reduced (He et al., 2017; Moeletsi & Tongwane, 2020; Rietmann et al., 2020).

To achieve the ambitious carbon emission reduction goals within the transport sector the large-scale adoption of EVs would need to be accelerated as South Africa has experienced a slow adoption rate where the number of EVs sold to date accounts for only a small percentage of total vehicles sales (Naamsa, 2022). Current research in the field of consumer behaviour, attitude, and the adoption of innovations has highlighted several barriers to the adoption of EVs that include economic considerations with the high cost to purchase EVs when compared to ICE vehicles, high cost to access limited charging infrastructure and networks, and technical barriers through the limited driving range of EV’s between charges (Adhikari et al., 2020; He et al., 2021; König et al., 2021; Moeletsi, 2021; Weiss & Helmers, 2019).

Further considerations regarding the barriers to the adoption of more sustainable electric transport strategies include the current energy crisis in South Africa, where poor management, bad governance, and high levels of corruption drove the state-owned energy generator, Eskom, to a state of high debt and the inability to deliver electricity to match the country’s demand (Hanto et al., 2022; Laher et al., 2019). In response to this crisis, the rapid rise in electricity cost, and the reduced public trust in Eskom’s ability to provide a reliable electricity supply, South Africa has experienced a rapid increase in rooftop-mounted solar installations, enabling private green energy generation (Baker & Phillips, 2019; Schlösser et al., 2019).

As previous research has indicated, South Africa shares similar barriers to the technology adoption of EVs, which include high cost and range anxiety, when compared to other countries, but current research does not include the availability of electricity, or the ability of private households to generate green electricity, as a consideration on the consumer behaviour and attitude towards the technology adoption of EVs (Adhikari et al., 2020; Berkeley et al., 2018; Broadbent et al., 2019; Hamilton & Terblanche-Smit, 2018; Moeletsi, 2021; Zhu, 2016). These considerations are a reality within the South African context and environment and thus require further study to gain a better understanding of their impact and effect.

1.3 Purpose Statement

As detailed in the problem statement, the need exists within the South African context to formulate more sustainable transportation practices and to accelerate the adoption of EVs as an enabler to reduce the harmful effects on the environment from ICE vehicles within the South African transportation sector (Gao & Souza, 2022; He et al., 2021; Moeletsi & Tongwane, 2020).

This research seeks to add to the current knowledge of consumer behaviour and attitudes toward the adoption of EV technology within the unique South African context.

This study investigates the impact of the current energy crisis in South Africa on consumer acceptance of innovative products such as EVs. Secondly, the study seeks to understand whether there is a relationship between the availability of private green energy, rooftop solar installations, and consumer behaviour. Thirdly, the relationship between perceptions and technology adoption of innovations is studied by considering prosocial actions, consumer innovation characteristics, and government involvement.

The outcomes of this research could be valuable in informing deliberations and policy formulation pertaining to the development and implementation of national measures aimed at accelerating the adoption of electric vehicles, promoting more sustainable transportation practices, and increasing private green energy generation capabilities. This would involve making investments in infrastructure and offering incentives for the purchase of electric vehicles and the installation of green energy systems. Such efforts align with the goals outlined in the Government Transport Strategy and the South African National Climate Change Response White Paper, as well as with the United Nations' Sustainable Development Goal 13, which focuses on promoting sustainable development and climate action (South African Department of Transport, n.d.; United Nations, n.d.).

Data gathered during the research will provide further insight for manufacturers and distributors of EVs regarding the behaviour and attitude of green consumers. As described in the study by Hamilton and Terblanche-Smit (2018), marketers need to understand the motivations and what influences green consumers to develop effective marketing strategies. Green marketing strategies and environmental advantages of products are also used by many company marketing campaigns to offer a distinct competitive advantage over competing companies and products (Akehurst et al., 2012).

1.4 Academic Relevance of Research

The proposed contribution of the study is to the existing academic discourse on consumer perceptions and behaviours about the adoption of electric vehicle innovations, particularly within the unique context of South Africa and its energy availability challenges (Hamilton & Terblanche-Smit, 2018; Hanto et al., 2022; Mandel et al., 2017; Moeletsi, 2021; Taherdoost, 2018). The study of consumer behaviour provides valuable insights into the decision-making processes of individuals and groups in relation to the purchase, use, and disposal of goods, services, and innovations (Alghizzawi, 2019; Mandel et al., 2017).

The study also intended to build on the existing literature on the barriers to the large-scale adoption of EVs, which include the factors influencing purchase decisions due to cost, range anxiety, and ease of access to charging infrastructure, through testing the relationships between variables not considered by previous studies (Adhikari et al., 2020; Hamilton & Terblanche-Smit, 2018; Moeletsi, 2021; Zhu, 2016). These relationships include considerations towards the availability of green energy, prosocial actions, and consumer innovation characteristics (Batson & Powell, 2003; Dearing & Cox, 2018; Moeletsi & Tongwane, 2020; Zhu, 2016).

There is an academic interest in consumer behaviour to understand the factors that drive consumers' acceptance or rejection of innovation and technologies, and several models and frameworks have been developed to explain the behaviour (Taherdoost, 2018). As this study considered the diffusion of innovation (DOI) theory as a base theory, it further intended to contribute to the ongoing development of the theory as applied to the specific context of EV adoption within South Africa, to add to the deeper understanding of how innovation spreads through our society (Dearing & Cox, 2018; Jung Moon, 2020; Rogers, 2003; Sahin, 2006; Vargo et al., 2020).

The academic study of prosocial behaviour is considered valuable because of the insights it provides into the psychological, social, and cultural aspects of individuals (Lay & Hoppmann, 2015; Martí-Vilar et al., 2019). Prosocial behaviour research contributes to the field of knowledge about human nature, cooperation, empathy, and the promotion of positive social interactions, and it explores the motivations, factors, and consequences of individual's actions (Lay & Hoppmann, 2015; Martí-Vilar et al., 2019). This study seeks to add to the research on consumer prosocial behaviour by contributing to the growth of knowledge regarding individuals, groups, and society, to address important societal challenges related to the South African transportation sector and a more sustainable transportation future (Alghizzawi, 2019; Mandel et al., 2017; Martí-Vilar et al., 2019).

1.5 Business Rationale of the Research

Recognising and understanding the needs, acceptance, and behaviours of consumers can be considered the first important stage of any business, and crucial for marketers and policymakers to drive the future (Mandel et al., 2017; Sefora et al., 2019; Taherdoost, 2018). The study aims to provide businesses with actionable insights that can be applied towards shaping strategies, product development, and operations to enable faster adoption of EVs as a crucial component towards achieving a more sustainable transportation future (Akehurst et al., 2012; Moeletsi, 2021; Sefora et al., 2019). In a rapidly evolving market EV manufacturers and distributors need to align themselves with consumer preferences and market dynamics to enable a higher and faster EV adoption rate (Hamilton & Terblanche-Smit, 2018; He et al., 2021; Moeletsi, 2021).

Consumer behaviour research helps businesses and marketers understand the preferences and motivations of consumers, to guide the development of effective and targeted marketing strategies that align with the target consumers (Mandel et al., 2017; Sefora et al., 2019; Taherdoost, 2018). The results of this study will provide further insight for manufacturers and distributors of EVs regarding the behaviour and attitude of green consumers, and as described in the study by Hamilton and Terblanche-Smit (2018), marketers need to understand the motivations, and what influences green consumers to develop effective marketing strategies. Green marketing strategies and environmental advantages of products are also used by many company marketing campaigns to offer a distinct competitive advantage over competing companies and products (Akehurst et al., 2012). Businesses that are better informed about market trends and consumer behaviour can position themselves more effectively in the emerging EV market and this study aims to add to this competitive advantage (Berkeley et al., 2018; Broadbent et al., 2019; Zhu, 2016).

The result of the study offers businesses valuable consumer insights to enable them to identify gaps and opportunities in the market, and through understanding consumer needs, desires, and pain points, they can develop innovative products and services that meet the changing needs and demands of consumers (Alghizzawi, 2019; Berkeley et al., 2018; Mandel et al., 2017). Understanding consumer decision-making patterns further allows businesses to optimize strategies, campaigns, and product placement to attract and retain customers (Alghizzawi, 2019; Mandel et al., 2017).

The changes in customer behaviour and thinking require new strategies as new digital technology provides consumers with an abundance of information, changing the habits and behaviours of the new generation of consumers (Alghizzawi, 2019). The study further offers businesses the opportunity to consider alternative target markets as the relationship between green energy users and the adoption of EVs is investigated (Baker & Phillips, 2019; Schlösser et al., 2019).

Consumer behaviour research also holds implications beyond business and marketing as it contributes to public policy discussions by examining consumer attitudes and behaviours towards social and environmental issues (Alghizzawi, 2019; Mandel et al., 2017). Understanding consumer behaviour in areas such as sustainability, ethical purchasing, and environmental concerns, will enable policymakers and organizations better insights to consider when promoting these areas (Alghizzawi, 2019; Mandel et al., 2017). This study also aims to contribute to national discussions and decision-making around policy development of incentive programs and investment in infrastructure for electric vehicles as an enabler for bigger and faster adoption (Broadbent et al., 2019; Moeletsi & Tongwane, 2020).

1.6 Conclusion

This research explores factors affecting EV adoption in South Africa, driven by the urgent need to address climate change and its impact on the environment (Gao & Souza, 2022; He et al., 2017; Moeletsi & Tongwane, 2020; Rietmann et al., 2020). South Africa's slow EV adoption rate prompted the study, despite the environmental benefits of EVs (Moeletsi & Tongwane, 2020; Naamsa, 2022: Rietmann et al., 2020). The study expands on previous research by examining additional factors unique to South Africa, such as the availability of electricity and private solar installations (Baker & Phillips, 2019; Schlösser et al., 2019). Previous research has identified barriers to EV adoption, including high cost, limited charging infrastructure, and range anxiety. (Adhikari et al., 2020; He et al., 2021; König et al., 2021; Moeletsi, 2021; Weiss & Helmers, 2019). The research aims to provide insights for promoting EV adoption in South Africa (Moeletsi & Tongwane, 2020; Rietmann et al., 2020).

The research applies the DOI theory to provide a framework for understanding the adoption of EVs and innovations and aims to contribute to the development of a deeper understanding of how innovations spread within society, with a particular focus on the role of pro-social actions, consumer innovation characteristics, and government involvement (Batson & Powell, 2003; Lay & Hoppmann, 2015; Rogers, 2003; Sahin, 2006; Vargo et al., 2020).

This research seeks to add to the existing literature on consumer behaviour and innovation adoption by exploring the relationships between variables not previously studied (Batson & Powell, 2003; Dearing & Cox, 2018; Moeletsi & Tongwane, 2020; Zhu, 2016). The study aims to provide new insights into how customers respond to new technologies in the market and to offer valuable insights into consumer behaviour and preferences for manufacturers and distributors of EVs (Hamilton & Terblanche-Smit, 2018; Moeletsi, 2021; Sefora et al., 2019). The study also aims to contribute to the development of policies towards the promotion of sustainable transportation initiatives and to support the transition to a more sustainable and environmentally responsible transportation sector in South Africa (Akehurst et al., 2012).

CHAPTER 2: Theory and Literature Review

2.1 Introduction

The integration of theory into research enables the formulation of hypotheses, grounded in existing knowledge and understanding, as provided by the literature review (Myres, 2023; Saunders & Lewis, 2017). This chapter details the base theories examined, including the DOI theory and consumer prosocial behaviour (Luengo Kanacri et al., 2021; Rogers, 2003). The adoption of EVs represents a significant innovation within the automotive sector, motivated by the need to address environmental issues and the transition towards more sustainable transportation practices (Carlucci et al., 2018). The DOI theory consists of several key components and explores the adoption process through various stages, taking into account the *Perceived Innovation Characteristics* of the innovation which include *relative advantage, compatibility, complexity, trialability,* and *observability* (Rogers, 2003; Sahin, 2006; Taherdoost, 2018). This chapter examines *prosocial behaviour*, as the actions that benefit others or society, as part of the greater good driven by various motivations (Ariely et al., 2007; Silvia & Krause, 2016). The chapter further serves as a literature review on the research topic and includes previous studies conducted on climate change, global warming, and the large-scale technology adoption of EVs (Al Halbusi et al., 2022; Shahbaz et al., 2020). The adoption of EVs is notably relevant in the context of global warming and environmental concerns and can contribute to reducing GHG emissions (He et al., 2017; United Nations, n.d.). The chapter concludes with a discussion of the current state of the state-owned energy utility Eskom and its impact on the rise of the private generation of green energy through rooftop solar installations in South Africa (Baker & Phillips, 2019; Hanto et al., 2022).

2.2 Diffusion of Innovation Theory

Innovations are the outcome of diligent efforts to resolve problems by introducing novel alternatives that can enhance existing products or processes and are typically motivated by external factors (Carlucci et al., 2018; Rogers, 2003). A noteworthy distinction exists between innovations and inventions, as an innovation may not necessarily be an entirely novel product, process, or idea, but rather a further advancement or refinement of an invention (Carlucci et al., 2018; Mohammadi et al., 2018). The emergence of electric vehicles (EVs) can be considered an innovation, building upon the initial invention of traditional internal combustion engine (ICE) vehicles, driven by critical external factors like environmental degradation and resource depletion, which provide numerous advantages over their predecessors (Carlucci et al., 2018; Jansson et al., 2017; Mohammadi et al., 2018; Xia et al., 2022).

Crucial considerations to enable the widespread distribution of any innovation include the consumer's attitude and acceptance of innovative products, practices, and new ideas (Jung Moon, 2020).

The *DOI theory* is applied as the base theory for this study to enable the analysis of the adoption attitude and further understanding of the diffusion, or distribution of EV innovation (Carlucci et al., 2018; Jansson et al., 2017; Mohammadi et al., 2018; Xia et al., 2022). The theory of DOI was first proposed by Everett Rogers in 1962 and is still widely used to analyse and explain how innovations are adopted and diffused within a society over time (Rogers, 2003; Sahin, 2006). The DOI is an established theory used to explain how new technologies, products, ideas, or innovations spread and are adopted by individuals or groups in a society (Mohammadi et al., 2018; Rogers, 2003). The theory aims to enable the understanding of the process of how innovations are communicated, accepted, and after some time become part of the mainstream (Mohammadi et al., 2018; Rogers, 2003).

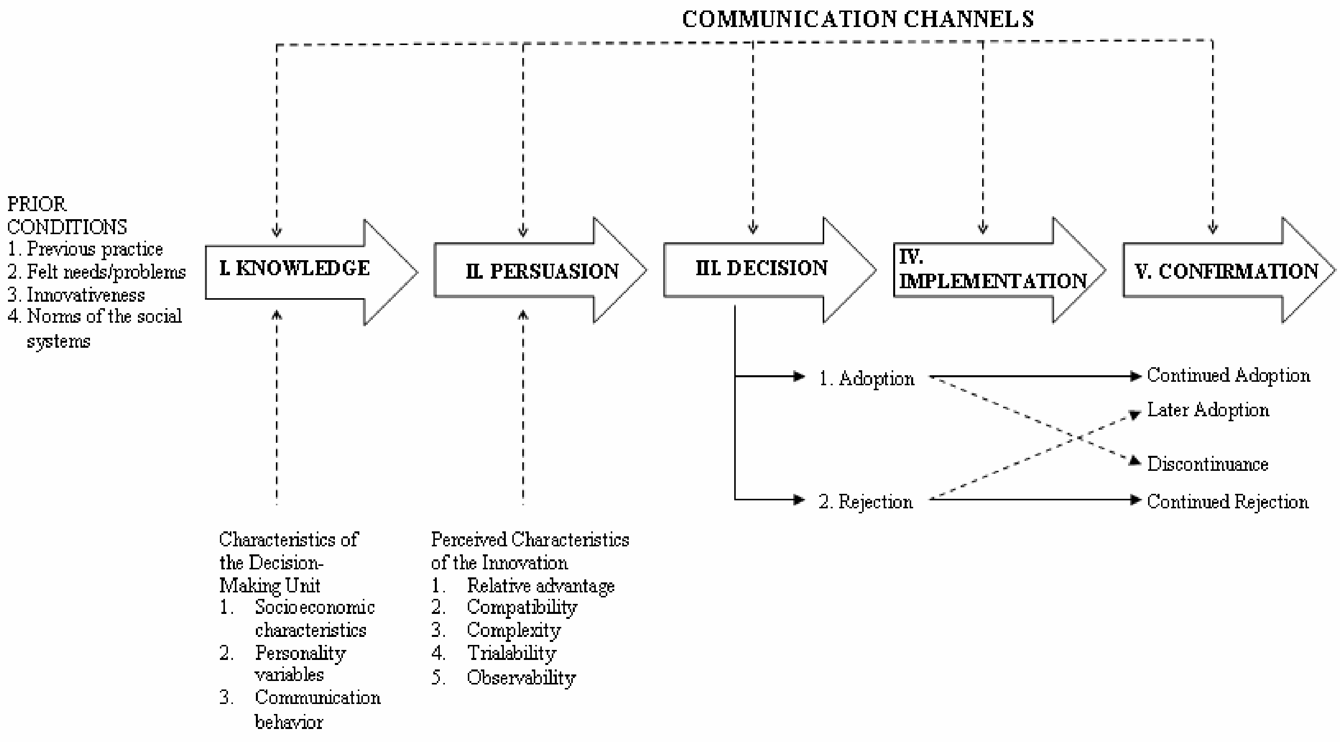

Figure 1: Model of five stages in the innovation-decision process (Source: Rogers 2003).

The DOI theory considers that innovations are adopted by society, over the lifespan of the innovation, through investigating and thereafter accepting or rejecting the innovation and describes diffusion as the process of how decisions are made about innovations within a society to adopt new products or processes to replace outdated versions (Dearing & Cox, 2018; Mohammadi et al., 2018). Important factors that influence how quickly the DOI occurs include the way these innovations are communicated to various parts of society, and the specific opinions and attitudes of the members of the society about the innovation (Dearing & Cox, 2018; Rogers, 2003; Sahin, 2006). The DOI theory can be applied to determine the adoption of technology or spread of technology, within the context of society and determine the relationship between the adoption and the Perceived Innovation Characteristics (PIC) of the innovation (Vargo et al., 2020). The DOI theory states that the innovation adoption process occurs within five distinct groups of people, over time, characterised by timing and their attitude towards the innovation (Mohammadi et al., 2018; Rogers, 2003; Sahin, 2006).

2.2.1 DOI Theory: Four Factors that Influence Diffusion

The DOI model was applied within this study to examine the range of the innovation, or EV through four factors that influence the diffusion of a new idea (Rogers, 2003; Sahin, 2006; Taherdoost, 2018). These four factors, as illustrated in Figure 2 and discussed in more detail below are *time, innovation, communication channel,* and *social system* (Rogers, 2003; Sahin, 2006; Taherdoost, 2018).

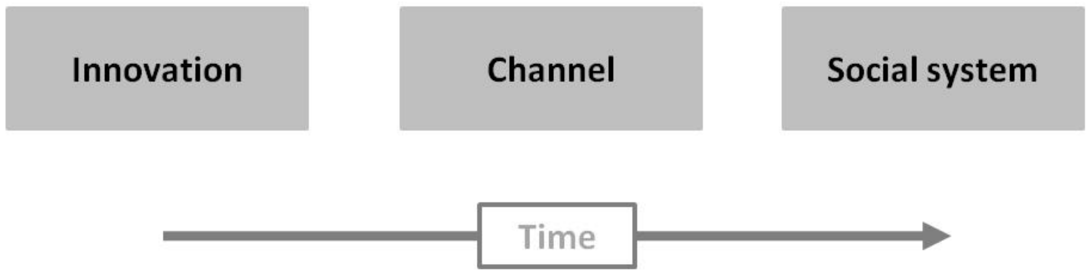

Figure 2: Four factors that influence diffusion (Source: Rogers 2003).

2.2.1.1 The Innovation

The *innovation* includes the product, process, or idea that is considered new by the consumer or adopter and is applied to this study as the EV (Rogers, 2003; Sahin, 2006; Taherdoost, 2018). Rogers (2003) defined that any *innovation* can be considered new by the consumer or adopter if they perceive the *innovation* as new, even though it might have been available for some time. Even though the EV market is more established in other countries, it is considered new by consumers in the South African market (Broadbent et al., 2019; Hamilton & Terblanche-Smit, 2018).

2.2.1.2 The Communication Channel

The *communication channel* is the means that takes the messages about the innovation from one consumer or adopter to another, spreading across society through word of mouth, mass media, and social media platforms (Mohammadi et al., 2018; Rogers, 2003; Xia et al., 2022). Mass media includes channels like television, radio, and social media while word of mouth consists of personal *communication* between two or more individuals (Rogers, 2003; Sahin, 2006). Rogers (2003) considers diffusion as a very social process that involves personal *communication* and relationships that are powerful tools to create or change the perceptions and attitudes held by individuals.

2.2.1.3 The Social System

The *social system* is the interconnected network of individuals that are joined together and include various institutions or groups within a society (Rogers, 2003; Taherdoost, 2018). Rogers (2003) defines the *social system* as "a set of interrelated units engaged in joint problem solving to accomplish a common goal". As the diffusion of an innovation occurs within a *social system* it will be influenced by the structure of that *social system* where the structure can be seen as the pattern in which the unit within the system is arranged (Rogers, 2003; Sahin, 2006). Rogers (2003) further stated that individuals' *innovativeness*, as a main construct for categorising consumers or adopters, will be influenced by the nature of the *social system*.

2.2.1.4 Time

The *time* element of the DOI theory refers to the length required for the innovation to get adopted by mainstream society, or how long is required for consumers or adopters to accept new products, processes, or ideas (Rogers, 2003; Sahin, 2006; Taherdoost, 2018). The *time* element of the DOI theory is an important factor within this study that aims to contribute to strategies for *accelerating* large-scale adoption of EVs within South Africa (Hamilton & Terblanche-Smit, 2018; Moeletsi & Tongwane, 2020; Rietmann et al., 2020). Rogers (2003) included the *time* element in the theory as the diffusion of the innovation process, the categorisation by the adopter, and the rate of adoption containing important time elements (Sahin, 2006).

2.2.2 DOI Theory: Innovation Decision Process

The theory can be applied on individual, organisational, and global levels and integrates three major components as part of the theory, the *innovation decision process*, the *characteristics of the innovation*, and the *adopter characteristics* (Rogers, 2003; Sahin, 2006).

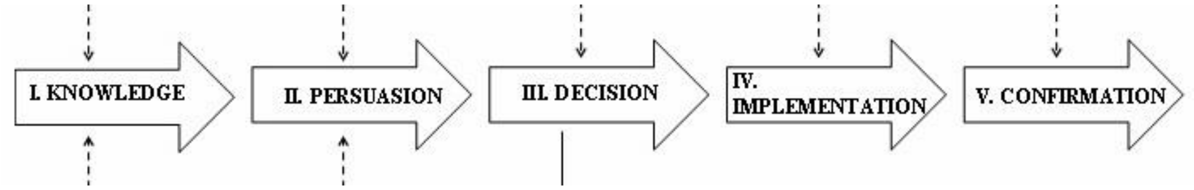

Figure 3: DOI Innovation decision process (Source: Rogers 2003).

The first major component of the theory by Rogers (2003), the innovation-decision process, suggests that there are five stages of decision-making as detailed in Figure 3 (Jung Moon, 2020; Rogers, 2003; Sahin, 2006). The first stage is the initial knowledge that society has about the innovation, the second considers the *persuasion* required to form an approving attitude to the innovation, the third involves the decision to adopt the innovation, the fourth is the implementation of the innovation, and fifth is the continuous use of the innovation and the confirmation (Jung Moon, 2020; Rogers, 2003; Sahin, 2006).

2.2.3 DOI Theory: Perceived Characteristics of the Innovation

The second component of the theory, as illustrated in Figure 4 considers the characteristics of the innovation, also referred to as the *Perceived Innovation Characteristics*, and includes five main constructs, *relative advantage, compatibility, complexity, trialability*, and *observability* (Jung Moon, 2020; Rogers, 2003; Taherdoost, 2018). The process of diffusion can be driven by various communication channels, including personal communication, mass media, and social media networks and as innovations are often communicated through these channels potential adopters gather information, assess the innovation attributes, or characteristics, and make decisions about adoption based on their perceptions (Mohammadi et al., 2018; Xia et al., 2022).

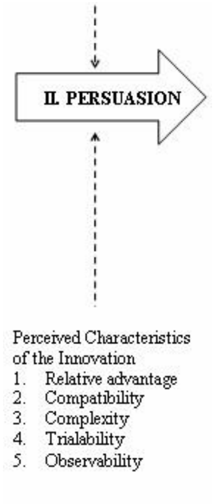

Figure 4: DOI Perceived innovation characteristics (Source: Rogers 2003).

These five key constructs, grouped as the *Perceived Innovation Characteristics* of the innovation, form part of the *persuasion* stage of the innovation-decision process and are investigated within this research to determine what factors drive the perceptions of EVs within the South African consumer (Rogers, 2003; Sahin, 2006). The five key constructs, as illustrated in Figure 5 are discussed in more detail within this section.

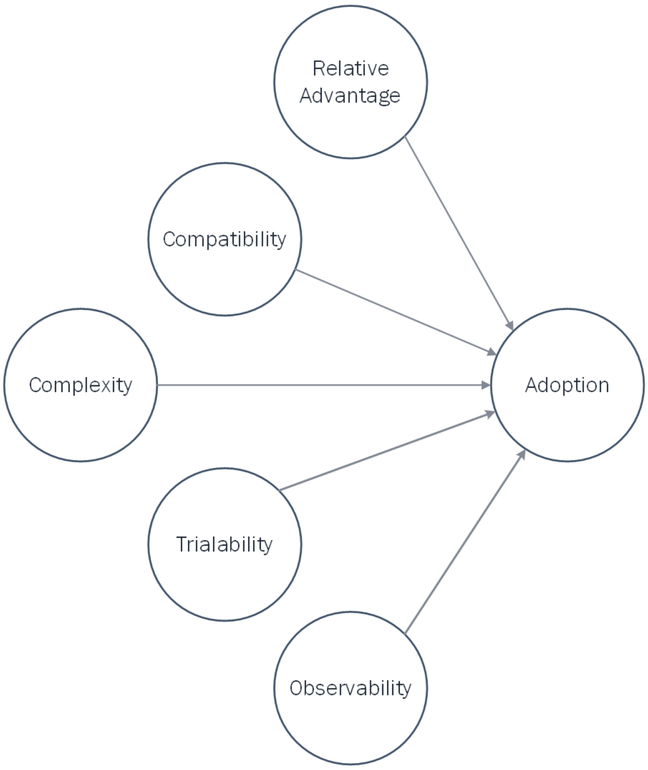

Figure 5: DOI Perceived Innovation Characteristics and Adoption (Source: Rogers 2003).

2.2.3.1 Relative Advantage

The *relative advantage* (RA) is the degree to which an innovation is perceived as better than the product, process, or idea it supersedes (Jung Moon, 2020; Rogers, 2003; Taherdoost, 2018). RA is applied to this study as the relative advantage that EVs offer over traditional ICE vehicles, as perceived by the South African consumer (Jung Moon, 2020). These advantages include environmental, social, financial, and technical considerations (Carlucci et al., 2018; Jung Moon, 2020; Xia et al., 2022).

2.2.3.2 Compatibility

Compatibility (COMPAT) is the extent to which the innovation is consistent with the values, experiences, and needs of the consumer or potential adopter (Jung Moon, 2020; Rogers, 2003; Taherdoost, 2018). The compatibility factors included in this study considered the ease of finding charging infrastructure, and the perception of how EVs would suit the lifestyles of South African consumers (Jung Moon, 2020; Xia et al., 2022).

2.2.3.3 Complexity

The *complexity* (COMPLEX) of the innovation is described as the perceived difficulty of understanding and using the innovation (Jung Moon, 2020; Rogers, 2003; Taherdoost, 2018). One of the barriers to the large-scale adoption of EVs, identified within prior research and again investigated within this study, includes the perception of consumers that EVs are difficult to drive, and require special training (Broadbent et al., 2019; Moeletsi, 2021; Zhu, 2016).

2.2.3.4 Trialability

Trialability (TRIA) considers the ability to experiment with the innovation on a limited basis before making a full commitment (Jung Moon, 2020; Rogers, 2003; Taherdoost, 2018). This construct within the context of the research relates to how important consumers consider test-driving and experimenting with EVs are when forming their perceptions within the innovation-decision process (Jung Moon, 2020; Rogers, 2003; Sahin, 2006).

2.2.3.5 Observability

Observability (OBS) is the extent to which the results or use of the innovation is visible to others and how easily it’s communicated to others within society (Jung Moon, 2020;

Rogers, 2003; Taherdoost, 2018). The study further explores the perceptions of consumers relating to their social status and environmental concerns when considering the adoption of EVs (Jung Moon, 2020; Rogers, 2003; Sahin, 2006).

The Perceived Innovation Characteristics constructs of the DOI theory are applied to this study as the theory considers that consumers or adopters form their attitudes toward the innovation in connection with their perceptions of the five Perceived Innovation Characteristics (Chou et al., 2012; Jung Moon, 2020; Rogers, 2003). As detailed in the study by Chou et al. (2012) and confirmed in the study by Jung Moon (2020) the Perceived Innovation Characteristics have a significant influence on the consumer attitude toward EV technology and innovation adoption.

2.2.4 DOI Theory: Adopter Characteristics

The third component of the DOI theory considers the adopter characteristics with five adopter characteristics steps or groups, innovators, early adopters, early majority, late majority, and laggards (Rogers, 2003). Rogers (2003) defined the adopter categories, or steps, as "the classifications of members of a social system based on innovativeness". Within each step, the individuals are categorised based on their innovativeness as a measure of how certain members of society will adopt new ideas relatively early and change habits or familiar practices sooner than others (Mohammadi et al., 2018; Rogers, 2003; Sahin, 2006). Within the theory of DOI, innovativeness is applied to enable the understanding of the primary behaviour in the innovation-decision process and allows the plotting of the consumers or adopters, based on innovativeness as illustrated by Figure 6 (Rogers, 2003; Sahin, 2006).

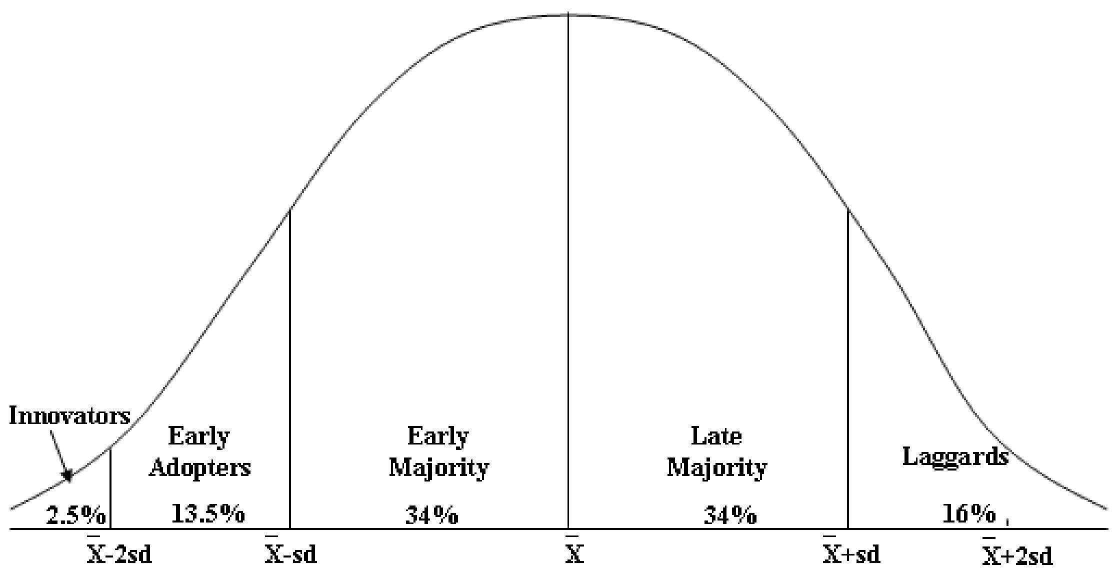

Figure 6: DOI Adopter Categorisation or groups (Source: Rogers 2003).

The curve is only applicable to successful adoption innovations and does not include incomplete and non-adoption as part of the classification (Rogers, 2003; Sahin, 2006). Within the normal distribution, each category is defined using a standardised percentage of respondents, for example, the area lying under the innovators on the left includes consumers or adopters that adopt an innovation as the first 2.5% of all the considered consumers or adopters (Rogers, 2003; Sahin, 2006).

The adopter characteristics provide valuable insights into the dynamics of innovation adoption and highlight that not all consumers or adopters, adopt the innovation at the same time but rather fall within a specific sequence of the adopter (Mohammadi et al., 2018; Sahin, 2006; Vargo et al., 2020). The five primary consumer or adoption groups include the following.

2.2.4.1 Innovators

The Innovators are considered the gatekeepers of innovation as they bring the innovation from outside of the system and are willing to test and experience new ideas (Rogers, 2003; Vargo et al., 2020). Innovators are typically a small, daring group that embraces new ideas and technologies with enthusiasm and are prepared to handle a certain level of uncertainty about the innovation (Rogers, 2003; Vargo et al., 2020). Innovators are often characterised by their risk-taking nature and good tolerance for uncertainty, which may not always be regarded highly by other members of society due to their close relationships outside the standard social system (Dearing & Cox, 2018; Sahin, 2006; Vargo et al., 2020). They are however often well connected within these social networks and function as opinion leaders who share their experiences and insights with other members, playing a pivotal role in testing and driving innovations, paving the way for other adopter groups (Carlucci et al., 2018; Dearing & Cox, 2018; Mohammadi et al., 2018; Sahin, 2006).

2.2.4.2 Early Adopters

Early Adopters will closely follow the innovators in adopting innovations and represent a more substantial portion of the population, but still only account for a relatively small segment or part of the social network (Carlucci et al., 2018; Dearing & Cox, 2018; Rogers, 2003). Early Adopters are considered influential within their social networks and are often known for their open minds and willingness to embrace new ideas within reason as they are more deliberate in their decision-making when compared to the Innovators (Carlucci et al., 2018; Dearing & Cox, 2018; Rogers, 2003). Rogers (2003) described the Early Adopters as more likely to hold leadership roles in the social system where other members will approach them for advice or information about the innovation. Rogers (2003) further stated that by adopting an innovation or idea, Early Adopters put their stamp of approval on the innovation. Early Adopters often serve as role models, inspiring others through their willingness to try innovations early and share their experiences (Dearing & Cox, 2018; Sahin, 2006).

2.2.4.3 Early Majority

The Early Majority forms a substantial segment of the adopter population and unlike the Innovators and Early Adopters, they are more cautious and measured when deciding on the adoption of innovations (Carlucci et al., 2018; Dearing & Cox, 2018; Rogers, 2003). Rogers (2003) explained that although the Early Majority often have good interactions with other members of the social system, they might not have a similar leadership position when compared to the Early Adopters, but their personal networks are still important within the innovation diffusion process. The Early Majority prefer to observe the experiences and actions of the Earlier Adopters before committing to innovation themselves (Rogers, 2003; Sahin, 2006; Vargo et al., 2020). The innovation adoption decision usually takes more time for the Early Majority, and they are deliberate in adopting innovations as they are neither the first nor the last to adopt it (Dearing & Cox, 2018; Rogers, 2003; Sahin, 2006) The Early Majority will rely on successful case studies and the endorsement of other members of the societal system to inform their decisions and their adoption tends to drive the innovation toward mainstream acceptance (Carlucci et al., 2018; Rogers, 2003; Vargo et al., 2020).

2.2.4.4 Late Majority

The Late Majority represents another substantial portion of the adopter segment, often matching the Early Majority in size (Rogers, 2003; Sahin, 2006). The Late Majority are considered more risk-averse and conservative in their adoption behaviours and even though they are sceptical about the innovation, peer pressure may lead them to adoption (Mohammadi et al., 2018; Rogers, 2003). The Late Majority will be more inclined to adopt the innovation once it has become widely adopted and well-established (Carlucci et al., 2018; Rogers, 2003). Rogers (2003) considers that the Late Majority could be influenced by peer pressure or a sense of necessity but would still require significant evidence of the benefits of an innovation before considering adoption.

2.2.4.5 Laggards

The Laggards are the last group segment to adopt innovations and do so with considerable reluctance as this group is characterised by their resistance to change and preference for traditional products and processes (Carlucci et al., 2018; Mohammadi et al., 2018; Rogers, 2003). Laggards are considered sceptical of new ideas as they hold strong and established preferences that are not easily influenced by peer pressure or trends (Mohammadi et al., 2018; Rogers, 2003). Rogers (2003) considers Laggards to not hold leadership roles as they form part of a limited social system where their personal network is mainly made up of members of the same social system. The Laggards hold a limited awareness and knowledge of innovations and would first ensure that the innovation is successfully adopted by other members of the social system before considering adoption, resulting in a relatively long innovation-decision period (Rogers, 2003).

As this study investigates the relationship between perception and the technology adoption of innovations, considering the Perceived Innovation Characteristics of EVs, it is important to align the strategies developed to accelerate large-scale adoption of EVs with the adopter groups considering each group's unique characteristics (Carlucci et al., 2018; Sahin, 2006; Sung & Wu, 2018).

2.3 Consumer Innovativeness

Consumer innovativeness (CI) forms a key part of the adoption of innovations and is also considered within the DOI theory where it refers to the characteristics of the consumer, revealing their inclination to adopt new products, processes, or ideas (Jung Moon, 2020; Persaud & Schillo, 2017; Rogers, 2003; Sahin, 2006). The Perceived Innovation Characteristics details the perceptions of consumers towards the innovative qualities of products whereas Consumer Innovativeness refers to the characteristics of the consumer (Jung Moon, 2020; Persaud & Schillo, 2017). Consumer Innovativeness plays an important role in the adoption of innovations such as EVs, influencing the rate and extent to which new products and ideas are accepted by consumers (Li et al., 2021; Persaud & Schillo, 2017). Therefore, Consumer Innovativeness forms a crucial part of this study and has key implications for accelerating large-scale adoption (Li et al., 2021; Persaud & Schillo, 2017).

2.3.1 Consumer Innovativeness Definition

Consumer Innovativeness can be defined as the extent to which an individual will adopt new products, processes, or ideas earlier than their peers within a social system (Persaud &

Schillo, 2017; Rogers, 2003). Regularly applied within research on the DOI, Consumer Innovativeness is considered a force that drives innovative consumer behaviour (Roehrich, 2004). Consumer innovativeness, also referred to as the “consumption of new things”, defines the inclination of one individual to adopt new products or ideas quicker than another (Roehrich, 2004).

2.3.2 Factors Influencing Consumer Innovativeness

As proposed by Roehrich (2004) there are four factors, or forces that influence consumer innovativeness. These forces, as detailed below, are important factors in this study because of the potential they offer to drive higher Consumer Innovativeness, enabling faster EV adoption.

2.3.2.1 Need for Stimulation

Consumer Innovativeness can be driven by a need for novel and stimulating experiences (Li et al., 2021; Roehrich, 2004). Individuals with a strong desire for novelty tend to adopt new products, like EVs quickly (Roehrich, 2004).

2.3.2.2 Seeking Novelty

Individuals who actively look for new and unique experiences are more likely to display characteristics of innovativeness within their adoption decisions (Li et al., 2021; Roehrich, 2004). As these individuals exhibit higher Consumer Innovativeness, they will also adopt EV technology quickly, playing an important role in creating awareness and accelerating the adoption toward mainstream consumers (Li et al., 2021; Persaud & Schillo, 2017).

2.3.2.3 Independence Towards the Experience of Others

Individuals who are less influenced by the experiences and opinions of others and rely more on their convictions, display more innovativeness characteristics, and will adopt innovative products like EVs based on their individual perceptions (Li et al., 2021; Roehrich, 2004).

2.3.2.4 Need for Uniqueness

The desire to stand out in your social system, and be different from others, can significantly influence Consumer Innovativeness driving the adoption of innovations like EVs (Li et al., 2021; Roehrich, 2004).

2.3.3 Consumer Innovation and Marketing Strategies

As discussed in Section 2.2, studies have concluded that consumers' perceptions of products and the innovative characteristics of these products significantly affect individuals buying behaviour (Zhang et al., 2020). The more consumers perceive a product as innovative, the more likely they are to make a purchase (Zhang et al., 2020). Consumer Innovativeness plays a further role in the adoption of new products and technologies (Kim et al., 2021; Leicht et al., 2018). Understanding the varying degrees of Consumer Innovativeness within a target segment or social network is essential for developing effective and targeted marketing strategies aimed at accelerating EV adoption (Leicht et al., 2018; Li et al., 2021). Innovators and Early Adopters tend to exhibit high levels of consumer innovativeness, making them more willing to accept and experiment with new technologies (Rogers, 2003). Early Adopters with high levels of innovativeness may respond differently to marketing messages when compared to the Late Majority consumers with lower levels of innovativeness, and custom marketing strategies for these different segments can lead to more successful innovation adoption (Kim et al., 2021; Leicht et al., 2018).

The study by Kim et al., (2021) revealed that social uniqueness had a positive effect on the overall image of innovative products, and based on this finding suggested that marketers should emphasise this social uniqueness through their marketing efforts. This will enable the adopters of these innovative products to boast about their experience, making them unique and differentiating them from others in their social network (Kim et al., 2021). Marketers can emphasise the value of social uniqueness through social networking platforms, and various other forms of media, to motivate consumers to become trendsetters when adopting innovations like EVs (Kim et al., 2021).

The DOI theory also considers that early adopters can act as a spark for the adoption and DOI (Rogers, 2003). Therefore, an understanding of the characteristics of Early Adopters is crucial for marketing efforts to turn as many consumers as possible into regular adopters and users of innovative products and services (Leicht et al., 2018).

2.4 Prosocial Behaviour

Prosocial behaviour is an element of social psychology that examines how consumers think, feel, and behave in social contexts, and provides insights into the underlying psychological processes, social norms, and situational factors that influence individuals' decision-making and willingness to help or support others (Martí-Vilar et al., 2019). The research on Prosocial Behaviour contributes to understanding human altruism, empathy, moral reasoning and is considered as part of this study because of the potential EVs offer individuals to display various elements of Prosocial Behaviour (Martí-Vilar et al., 2019).

2.4.1 Prosocial Behaviour Definitions

Prosocial behaviours can be defined in several forms as it includes various consumer behaviours and motivations.

2.4.1.1 Intent to Benefit Others or Society

Prosocial behaviour can be defined as actions or intentions with the primary aim of benefiting others or society (Lay & Hoppmann, 2015).

2.4.1.2 Conforming to Social Norms

Prosocial behaviour also includes behaviours that align with socially accepted norms, where individuals will follow certain practices considered beneficial or helpful (Batson & Powell, 2003; Lay & Hoppmann, 2015).

2.4.1.3 Practical Motivation

Prosocial actions can be motivated by practicality, such as helping someone in need due to the immediate situation or circumstance (Batson & Powell, 2003; Lay & Hoppmann, 2015).

2.4.1.4 Egotistic Motivation

Behaviours driven by egoistic motivations, including an individual's concerns about reputation or social status, are considered prosocial when the goal is to increase one's own welfare and noble appearance (Batson & Powell, 2003; Jansson et al., 2017; Lay & Hoppmann, 2015).

2.4.1.5 Aesthetics Perception

Perceptions of the aesthetics and design of products can also influence prosocial behaviour as some consumers might consider EVs unattractive, impacting their adoption and support of sustainable transportation practices (Berkeley et al., 2018).

2.4.2 Prosocial Behaviour and the Adoption of EVs

The technology adoption of EVs represents many environmental and public benefits related to reducing the world's dependency on fossil fuels, GHG emissions, and noise pollution (Ashraf Javid et al., 2021; Silvia & Krause, 2016). Unlike innovations that are primarily driven by personal or self-interest, the adoption of EVs is considered Prosocial Behaviour because of the potential benefit to the public (Silvia & Krause, 2016). Therefore, it is important to understand the motivations behind prosocial behaviour and its potential to promote EV adoption (Silvia & Krause, 2016).

Previous research on prosocial behaviour has identified three broad categories of motivations that drive the consumer adoption of innovations (Ariely et al., 2007; Silvia & Krause, 2016).

2.4.2.1 Intrinsic Motivation

Intrinsic Motivation is rooted in the personal preference of the individual to contribute to the social good, driven by altruistic concern for others, the emotional satisfaction from prosocial actions, or the need to support a positive self-identity (Silvia & Krause, 2016).

2.4.2.2 Extrinsic Motivations

The second, extrinsic motivations, consider the material rewards or benefits possible from participating in prosocial behaviour that could include incentives to reduce the relative cost of prosocial actions through tax credits, rebates, or added convenience (Silvia & Krause, 2016).

2.4.2.3 Image Motivation

The third motivation is image motivation which states that individuals naturally seek approval from their social network and are concerned about how others perceive them (Silvia & Krause, 2016). Engaging in prosocial actions that can contribute to a positive social image is particularly relevant to actions that are visible to others (Silvia & Krause, 2016).

The studies by Asadi et al., (2019) and Cai et al., (2019) both concluded that consumer's intentions to adopt environmentally friendly products, such as EVs, originate from a combination of self-interest and prosocial motives. The first approach considers that consumers action environmentally friendly behaviours for personal interests, influenced by the individual’s awareness and knowledge of the problem and environmental concern (Asadi et al., 2021). These personal interests or norms positively correlate with prosocial behaviour and intentions to adopt EVs (Ashraf Javid et al., 2021).

2.4.3 Prosocial Awareness and Environmental Responsibility

The study conducted by Asadi et al., (2021) concluded that the technology adoption of EVs is positively linked to consumers' prosocial and pro-environmental behaviour. As consumers develop a sense of awareness and responsibility regarding the negative effects of their actions, they become more inclined to adopt prosocial norms that contribute to the betterment of the urban environment, society, and the preservation of natural resources (Asadi et al., 2021; Silvia & Krause, 2016). Asadi et al., (2021) further concluded that the consumer's awareness of the economic, social, and environmental benefits achievable through the adoption of EV technology can develop positive personal norms and motivate the desire to contribute to the greater social network and environmental good.

The adoption of EV technology fosters prosocial behaviour that has the potential to benefit society and mitigate environmental concerns, therefore understanding the motivations behind this behaviour is crucial for policymakers and marketers (Ashraf Javid et al., 2021; Silvia & Krause, 2016). Increasing awareness to potential adopters through highlighting the economic, social, and environmental benefits of EV adoption can motivate consumers to choose more sustainable future transportation practices (Asadi et al., 2021).

2.5 Global Warming and Environmental Considerations

Global concerns about the environment, and the effects of global warming, have increased the urgency for consumers and companies to act towards a more sustainable future by reducing their reliance on fossil fuels (He et al., 2017; Gao & Souza, 2022).

2.5.1 Worldwide Commitments towards Mitigating Global Warming

The United Nations has defined 17 SDGs as ambitious objectives designed to work towards peace and prosperity for all people and the planet (United Nations, 2021). Included with the SDGs is the objective of SDG 13 which calls for urgent action to combat climate change and its impact on the environment (United Nations, 2021).

The worldwide concern about climate change also drove the formulation of the Paris Agreement that is currently signed by 193 States and the European Union (United Nations, n.d.). The Paris Agreement is a legally binding international treaty committing the signatories to work towards limiting global warming to below 2 degrees Celsius while pursuing the objective of limiting any increase in temperature to 1.5 degrees Celsius above the preindustrial levels (United Nations, n.d.). South Africa is one of the signatories of the Paris Agreement and the South African Government has committed to reducing the emissions of harmful greenhouse gases as detailed in the Green Transport Strategy for South Africa 2018-2050 (South African Department of Transport, n.d.; United Nations, n.d.).

2.5.2 The South African Transportation Segment

The GHG emissions from the South African transport sector are directly responsible for 10.8% of the country's total GHG emissions, with further indirect emissions resulting from the transportation, production, and refining of fossil fuels (South African Department of Transport, n.d.). Within 10.8% of the country's total GHG emissions from the transport sector, the contribution of road transport alone is 91.2% (South African Department of Transport, n.d.).

2.6 The Impact of Electric Vehicles (EVs)

Recent research has highlighted the potential EVs offer as a sustainable solution for reducing environmentally harmful GHG emissions within the transport sector, contributing to a more sustainable and green future (He et al., 2017; Moeletsi & Tongwane, 2020; Rietmann et al., 2020).

2.6.1 Greenhouse Gas Emissions (GHG)

The growing amounts of GHG emissions into the atmosphere are the result of all the human activities around the world and all main economic activities contribute to this rise in emissions in some form, adding to global warming concerns (Broadbent et al., 2019; Moeletsi, 2021). A major contributor to GHG emissions is the energy sector through the combustion of fossil fuels (Moeletsi, 2021; Rietmann et al., 2020). Another contributor is the transportation sector where GHG emissions are projected to rise when considering the current scenario and trends (Moeletsi & Tongwane, 2020; Rietmann et al., 2020).

2.6.2 The Electric Vehicle, Energy, and the Environment

In contrast to the ICE vehicle, which emits harmful greenhouse gasses like carbon dioxide (CO2) into the atmosphere, the EV does not emit any GHG and is, through large-scale adoption, a viable option to reduce air pollution and the GHG emissions that are generated through the road transport sector (He et al., 2017; Rietmann et al., 2020). This reduction in emissions further alleviates climate change by reducing the overall carbon footprint of the transportation sector (Moeletsi & Tongwane, 2020; Rietmann et al., 2020). The EV is more energy efficient when compared to the ICE vehicle, which uses a large amount of energy as heat because the EV can convert more of the electric energy from the grid into motion (König et al., 2021; Weiss & Helmers, 2019). This efficiency leads to less energy consumption and reduces the environmental impact (König et al., 2021; Weiss & Helmers, 2019).

As the EV offers a viable alternative to the ICE vehicle to reduce GHG emissions into the atmosphere, it also offers the possibility of zero-emission within the ecosystem when charged using renewable green energy sources (Sefora et al., 2019). When charged with electricity generated from renewable sources like wind or solar, the EV can be powered by green, clean, and sustainable energy to significantly reduce the environmental impact of the transportation sector, further driving the transition away from fossil fuels (Sefora et al., 2019; Zhu, 2016). The study by He et al. (2021) considered the use of EVs for urban consumers, as part of a transport-sharing network, and concluded that it serves as a more sustainable means of commuting when compared to ICE vehicles.

The biggest source of noise pollution both inside and outside of urban areas, as measured with consideration to the number of people affected, is road traffic noise from the transportation sector (Pardo-Ferreira et al., 2020). EVs run quieter than traditional ICE vehicles and the large-scale adoption would result in quieter streets and improved quality of life for all residents (Pardo-Ferreira et al., 2020).

The white paper published by the European Commission included the goal to halve the use of ICE vehicles within urban transport by 2030, followed by completely phasing out ICE vehicles from major cities by 2050 (Pardo-Ferreira et al., 2020). EVs have a crucial role to play in achieving these goals and there are strategic action plans aimed at promoting the use of EVs and increasing awareness of noise as an environmental concern (Pardo-Ferreira et al., 2020).

The environmental benefits of the large-scale adoption of EVs are aligned with SDG 13's call for action toward a sustainable future and climate action, and the South African Government's commitment to reduce GHG emissions through the GTSSA (He et al., 2017; Rietmann et al., 2020; South African Department of Transport, n.d.; United Nations, 2021).

2.6.3 Electric Vehicle Adoption in South Africa

Since the introduction of EVs into the South African market the adoption rate has been very low (Moeletsi, 2021). South Africa recorded a slight increase in EV sales in 2022 but to date still has a slow adoption rate with a low number sold when compared to the total vehicle sales in the country (Naamsa, 2022). The benefits of the large-scale adoption of EV technology in the South African context does not only include a healthier environment due to less air pollution and harmful GHG emissions, but also fewer imports of liquid fuel, and over the long run higher resource preservation due to the energy efficiency of EV's and their potential use of green energy (Naamsa, 2022).

The study by Rietmann et al. (2020) forecasted the trajectory of EV sales, using actual sales of EVs during the period between 2010 to 2018, and the consequences for worldwide carbon dioxide emissions through a logistic growth model. Rietmann et al. (2020) concluded that compared to other countries, the forecast for South Africa up to 2035 showed a slow market growth for EVs and an increase in carbon dioxide emissions because of limited green energy sources that are available in the country.

EVs still only account for a relatively small part of total vehicle sales, however, this is poised to change as the awareness of the positive impact EVs have on the environment grows together with the availability of more sustainable green energy sources (Hamilton & Terblanche-Smit, 2018). When considering the worldwide increase in GHG emission levels the EV, through large-scale adoption, presents the world with a solution toward the goals of a more sustainable future less dependent on fossil fuels (Moeletsi & Tongwane, 2020; Rietmann et al., 2020).

2.7 The Impact of the South African State-owned Energy Utility Eskom

Eskom Holdings SOC Ltd, the South African state-owned electricity utility, is the biggest actor in the South African energy sector and plays a significant role in the generation, distribution, and management of electricity in the country (Hanto et al., 2022). The utility has experienced many challenges and difficulties in recent years which has evolved to have a considerable impact on energy availability in the country (Laher et al., 2019).

2.7.1 The South African Energy Crisis

The state-owned energy utility in South Africa, Eskom, is currently a national liability and in an operational and financial crisis that requires constant state funding in the form of bailouts to repay the debt that would otherwise be unserviceable (Hanto et al., 2022). The utility is struggling with high costs to maintain aging infrastructure, delayed maintenance issues, and even more costly and long overruns on time deliverables for new coal plants (Hanto et al., 2022; Laher et al., 2019). The mismanagement and corruption associated with Eskom have resulted in a highly indebted enterprise unable to deliver electricity matching the country's demand (Hanto et al., 2022).

The most notable impact of the challenges faced by Eskom has been power generation shortages as the energy crisis resulted in the implementation of load shedding in October of 2007 (Hanto et al., 2022). Load shedding is the limitation of the electricity supply to prevent the electricity power system from a total blackout (Hanto et al., 2022; Laher et al., 2019). Frequent power outages and load shedding significantly affect the availability of electricity for businesses and households and culminated in load shedding being implemented for 10% of the year 2020 (Hanto et al., 2022).

2.7.2 The Effect on the South African Economy

The inconsistent and unreliable electricity supply has a severe economic impact on South Africa as frequent power outages disrupt manufacturing and other economic activities, leading to production losses, reduced economic growth, and increased operational costs for businesses that rely on a stable energy supply (Laher et al., 2019; Schlösser et al., 2019). Further impacts to the economy of South Africa included the sharp increases in electricity prices where increases amounting to 300% were implemented between 2003 and 2017, amid growing public concern regarding Eskom's ability to provide a reliable electricity supply in the future (Schlösser et al., 2019). These challenges and issues have a negative impact on investor confidence in South Africa, as the unreliable energy supply and doubts about Eskom's financial sustainability have made foreign and domestic investors reluctant to invest in the country impacting economic growth (Schlösser et al., 2019).

2.7.3 Green Energy in South Africa

The South African energy sector has a high reliance on coal which accounted for about 75% of the total energy supply in 2019 (Hanto et al., 2022). Energy generation through coal also contributed 80% towards SA's total GHG emissions, further emphasising that the transition towards cleaner forms of energy is important if South Africa is to achieve its National Development Plan (NDP) and the Integrated Energy Plan (IEP) goals towards a less carbon-intensive society through reducing air pollution and GHG emissions (Hanto et al., 2022).

The challenges faced by Eskom also impacted the development of new energy infrastructure, especially renewable energy projects (Hanto et al., 2022; Schlösser et al., 2019). South Africa does possess significant renewable energy potential but has struggled to realise this potential as the focus has been on addressing immediate power generation requirements over long-term sustainability projects (Nathaniel et al., 2019; Shahbaz et al., 2020). Considering the advancements in reducing the cost of constructing renewable energy sources like wind and solar, when compared to new coal power plants, and the aging coal power plants in SA, there has been a considerable shift towards newer technology and cleaner renewable energy sources available (Hanto et al., 2022).

This energy crisis introduced new technologies and actors into the energy production sector of South Africa through the private generation of green energy from roof-top solar installations (Baker & Phillips, 2019). South Africa has experienced a rapid increase in rooftop-mounted solar installations, enabling consumers to generate private green energy (Baker & Phillips, 2019).

2.8 Conclusion

The research conducted for the review did not reveal any existing research or consideration towards the availability of electricity, and the ability of private households to generate green electricity, as factors that impact consumer behaviour and attitude towards the technology adoption of EVs. The literature review highlighted the opportunity to research the impact of these factors within the South African context and environment.

This comprehensive literature review addressed various aspects of the adoption and diffusion of EVs within the South African context, considering the profound implications EVs have on the environment, natural resources, and society (Carlucci et al., 2018; Rogers, 2003; Xia et al., 2022). The DOI theory detailed that the process of adopting innovations, such as EVs, is not linear across society but occurs in distinct stages over time categorised by consumer perceptions and innovativeness (Rogers, 2003; Sahin, 2006). The DOI theory's focus on the Perceived Innovation Characteristics of innovation revealed that the relative advantage, compatibility, complexity, trialability, and observability of EVs significantly influence consumers' perceptions and decisions to adopt EV technology (Rogers, 2003; Sahin, 2006).

The literature review further discussed the impact of prosocial behaviour and highlighted that the adoption of EVs is considered a prosocial action due to its potential to benefit society and mitigate environmental concerns (Asadi et al., 2019; Ashraf Javid et al., 2021). Consumers are increasingly motivated by intrinsic and extrinsic prosocial motivations and the need to enhance their social image by adopting environmentally friendly technologies like EVs (Ashraf Javid et al., 2021; Cai et al., 2019). The rising global concern regarding global warming and the environmental impact of GHG emissions highlighted the urgency of transitioning to more sustainable transportation practices that offer a promising solution to reduce these GHG emissions, and further take advantage of their energy efficiency and potential to utilise green energy sources (Sefora et al., 2019; Zhu, 2016). Despite the challenges in South Africa's energy sector resulting from the crisis facing the state-owned utility Eskom, the large-scale adoption of EVs has the potential to address the negative impacts on the environment because of fossil fuel energy generation (Moeletsi & Tongwane, 2020; Rietmann et al., 2020; Zhu, 2016).

As the adoption of EVs in South Africa faces challenges, the potential benefits for society, the environment, and the economy are significant and through increasing awareness, the availability of sustainable green energy, and the development of more government-supportive policies, South Africa can accelerate the adoption of EVs (Alghizzawi, 2019; Luengo Kanacri et al., 2021; Rietmann et al., 2020; Silvia & Krause, 2016).

CHAPTER 3: Research Questions and Hypothesis

3.1 Introduction

The research objective is to explore consumer behaviour and attitude toward green energy and the adoption of EV technology within South Africa. The research will consider the impact of green energy availability and prosocial behaviour on the technology adoption of EVs, and what impact the current electricity crisis in South Africa has on the consumer attitude towards green energy and EVs (Batson & Powell, 2003; Caprara et al., 2005). The study explores the impact of the consumer's Perceived Innovation Characteristics and innovativeness on the forming of consumer perceptions and attitudes toward EVs (Dearing & Cox, 2018; Jung Moon, 2020; Rogers, 2003; Sahin, 2006). The study consisted of three research questions and a related hypothesis for each.

3.2 Research Model

Figure 7 below is the conceptual research model of the study, representing the relationships between the various variables considered within the research (Leicht et al., 2018; Taherdoost, 2018). The model provides a structured framework for testing the hypotheses and applying the statistical analyses to investigate the relationships studied (Leicht et al., 2018; Taherdoost, 2018).

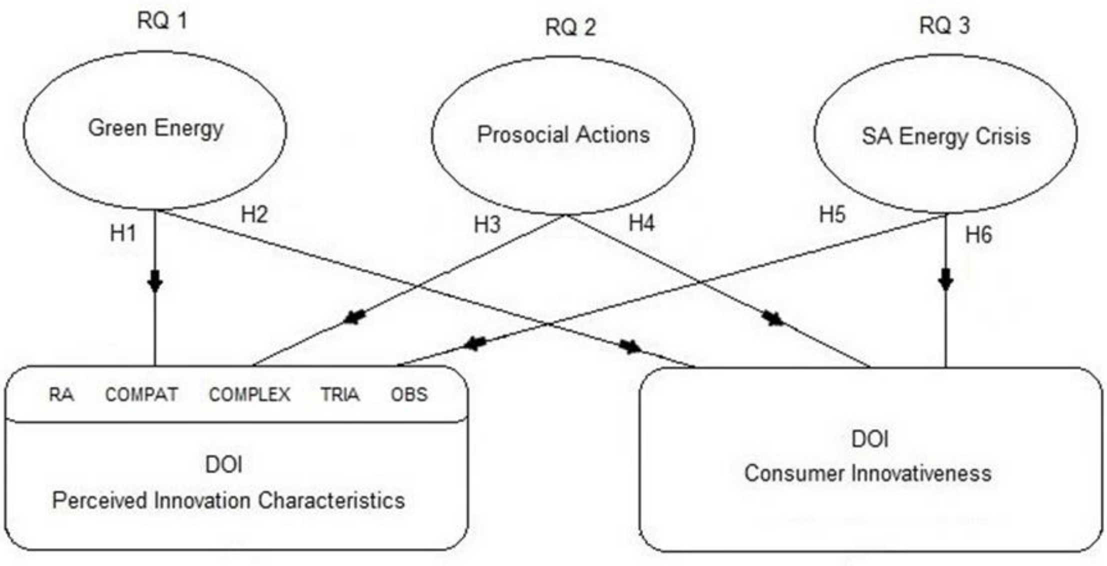

Figure 7: Research Model.

3.3 Research Question 1 and Hypothesis

Question 1: What impact does the availability of green energy have on consumer technology adoption of electric vehicles in South Africa?

The energy crisis South Africa is experiencing has introduced new technologies into the energy production sector where there has been a rapid increase in rooftop-mounted solar installations, enabling South African consumers to generate free private green energy (Baker & Phillips, 2019; Hanto et al., 2022; Laher et al., 2019).

Null Hypothesis 1 (Ho1): There is a statistically significant difference in the consumer Perceived Innovation Characteristics of electric vehicles between consumers who have access to green energy and those who do not.

Alternative Hypothesis 1 (H11): There is no statistically significant difference in the consumer Perceived Innovation Characteristics of electric vehicles between consumers who have access to green energy and those who do not.

Null Hypothesis 2 (Ho2): There is a statistically significant difference in the Consumer Innovativeness of consumers who have access to green energy and those who do not.

Alternative Hypothesis 2 (H12): There is no statistically significant difference in the Consumer Innovativeness of consumers who have access to green energy and those who do not.

3.4 Research Question 2 and Hypothesis

Question 2: What impact does consumer prosocial behaviour have on the technology adoption of electric vehicles in South Africa?

Prosocial behaviour, as a component of social psychology, examines how consumers think, feel, and behave in social contexts and situations that influence individuals' decision-making (Batson & Powell, 2003; Caprara et al., 2005; Martí-Vilar et al., 2019). Considering prosocial behaviour and the technology adoption of EVs explores the relationship of individual choices with societal and environmental impacts (Batson & Powell, 2003; Caprara et al., 2005; Martí-Vilar et al., 2019).

Null Hypothesis 3 (Ho3): There is a significant relationship between consumer prosocial behaviour and the consumer Perceived Innovation Characteristics of electric vehicles.

Alternative Hypothesis 3 (H13): There is no significant relationship between consumer prosocial behaviour and the consumer Perceived Innovation Characteristics of electric vehicles.

Null Hypothesis 4 (Ho4): There is a significant relationship between consumer prosocial behaviour and CI.

Alternative Hypothesis 4 (H14): There is no significant relationship between consumer prosocial behaviour and CI.

3.5 Research Question 3 and Hypothesis

Question 3: What impact does the current electricity crisis in South Africa have on consumer technology adoption of electric vehicles?

The state-owned energy utility, Eskom, is in an operational and financial crisis (Hanto et al., 2022). This has the utility in a state where it is struggling to deliver electricity to match the country’s demand, resulting in load shedding and growing public concern about its ability to deliver reliable electricity supply in the future (Hanto et al., 2022; Laher et al., 2019).

Null Hypothesis 5 (Ho5): There is a significant relationship between the electricity crisis in South Africa and the consumer Perceived Innovation Characteristics of electric vehicles.

Alternative Hypothesis 5 ($H_{1}5$): There is no significant relationship between the electricity crisis in South Africa and the consumer Perceived Innovation Characteristics of electric vehicles.

Null Hypothesis 6 ($H_{o}6$): There is a significant relationship between the electricity crisis in South Africa and CI.

Alternative Hypothesis 6 ($H_{1}6$): There is no significant relationship between the electricity crisis in South Africa and CI.

CHAPTER 4: Research Methodology and Design

4.1 Introduction

The utilisation of research methodology and design is of paramount importance in research, as they offer a comprehensive framework for achieving research objectives and ensuring reliable and valid results (Fourie, 2023; Myres, 2023; Saunders & Lewis, 2017). This study, focusing on consumer behaviour in the realm of green energy, investigated the influence of the availability of green energy sources, prosocial actions, and consumer innovation traits on the adoption of electric vehicles (Caprara et al., 2005; Rogers, 2003). With the aim of promoting more sustainable and environmentally responsible transportation practices, the study provides valuable insights into the factors that can facilitate the widespread adoption of electric vehicles (Broadbent et al., 2019; Moeletsi, 2021; Rietmann et al., 2020).

This research methodology was designed to answer the three research questions below:

Question 1: What impact does the availability of green energy have on consumer technology adoption of electric vehicles in South Africa?

Question 2: What impact does consumer prosocial behaviour have on the technology adoption of electric vehicles in South Africa?

Question 3: What impact does the current electricity crisis in South Africa have on consumer technology adoption of electric vehicles?

This chapter details the methodology and design of the research.

4.2 Research Design

The research employed a quantitative approach, utilizing a mono-methodological strategy of collecting data through the distribution of a digitally-based Likert-scale survey (Fourie, 2023; Myres, 2023; Saunders & Lewis, 2017). The research philosophy was positivist, with a deductive theory-testing approach, and was grounded in the diffusion of innovation theory as a foundation for understanding technology adoption (Rogers, 2003; Saunders & Lewis, 2017; Taherdoost, 2018). The research design was descriptive-explanatory in nature, employing non-probability sampling to gather data to analyse the variables that impact and influence consumer behaviour and attitude toward technology adoption (Myres, 2023; Saunders & Lewis, 2017). The time horizon of the research was cross-sectional, collecting data from various individual consumers within South Africa (Fourie, 2023; Myres, 2023). The data was collected through a self-administered survey in the form of a structured Likert-scale type survey.

4.3 Target Population

The target population for the research was consumers who reside within any of the provinces of South Africa and use their private vehicles for daily commutes. The estimated mid-year population in 2022 for South Africa is 60,6 million people (Statistics South Africa, 2022). Statistics indicate that the province of Gauteng has the largest population estimated at 16.1 million, which is a total of 26% of the total population of South Africa (Statistics South Africa, 2022). The province of Gauteng is considered the economic hub of South Africa and contributes to 34% of the total South African economy (Statistics South Africa, 2022). The second largest population is in the province of KwaZulu-Natal with 19% of the population at 11.5 million people, followed by the Western Cape with 11.9% or 7.2 million people (Statistics South Africa, 2022). The Northern Cape has the smallest share of the population with only 2,2% or 1,3 million people (Statistics South Africa, 2022).

The target population was selected as all the provinces of South Africa to ensure as many respondents as possible could be included in the study. The results from the study conducted by Pillay et al. (2019) on the affordability of battery electric vehicles based on disposable income in South Africa, concluded that the Gauteng province, along with the Western Cape and Kwazulu-Natal have households that purchase more vehicles due to higher disposable income.

4.4 Sampling Method and Size

A purposive non-probability sampling technique was used where respondents were selected based on the predefined target population within all the provinces of South Africa (Acharya et al., 2013; Saunders & Lewis, 2017). Purposive non-probability sampling is a technique whereby the researcher decides what units are required for the research because they have the appropriate characteristics for the sample (Acharya et al., 2013; Saunders & Lewis, 2017).

4.4.1 Sampling Method

The data was obtained from an online Likert-scale type survey instrument and the sampling was initiated by utilising the researcher’s personal network on social media platforms WhatsApp and LinkedIn. The initial distribution of the online questionnaire, through the researcher’s personal social media network, is a form of convenience sampling and is chosen because of the ease of access to the respondents in the network(Saunders & Lewis, 2017). The decision to initiate the data gathering through the researcher's personal WhatsApp and LinkedIn network was based on the confidence that these platforms would offer an effective method of reaching a wide range of individuals. The researcher further personally reached out to individuals to share information about the research and encouraged them to complete the questionnaire. The researcher ensured the respondents that their participation was entirely voluntary, and that no information was collected through the online questionnaire that can be used to identify any respondent personally.

The initial respondents were encouraged to forward the online questionnaire link to other possible respondents in their personal network to initiate snowball sampling. Snowball sampling is the procedure where the initial respondent is selected through a non-probability method, and then information on further respondents is provided by the initial respondents (Acharya et al., 2013; Saunders & Lewis, 2017). Limitations to this type of data collection include the bias that can be introduced as initial respondents tend to forward the survey link to other respondents that are known to them (Acharya et al., 2013; Zhu, 2016). This process could potentially dilute the quality of the analysis as all the respondents could share similar characteristics (Acharya et al., 2013; Zhu, 2016). To address the potential limitation of the snowball sampling method the online survey was also distributed through the database of the local motor dealership network of iCar Technologies. iCar Technologies has over 15 years of experience within the South African automotive sector, with five dealership brands and a large customer database (iCar Technologies, n.d.). As per one of the guidelines of the South African Protection of Personal Information Act (POPIA), the questionnaire link was only forwarded to individuals on the database who have indicated that they would like to receive electronic communication and marketing information from iCar Technologies (POPIA, n.d.). The iCar Authorisation letter was submitted with the support documentation of the research.

4.4.2 Sampling Size

The questionnaire was forwarded to the first respondents within the target population on the 15th of September 2023 and the last responses were received on the 6th of October 2023. The sample size from the online survey was 136 respondents, 14 more than the study by Zhu (2016), 60 less than the survey of Hamilton and Terblanche-Smit (2018), and 40 less than the study by Jung Moon (2020). Of the 136 respondents, 1 declined to participate in the study and selected not to complete the questionnaire, therefore the final sample size was 135 respondents. The Google Forms platform was used to host the online questionnaire and was set to only record the responses that have completed all the questions, eliminating the need to edit the data and remove any incomplete responses.

4.5 Unit of Analysis

The unit of analysis for the research was the individual consumer and the effect that private green energy, prosocial behaviour, and the energy crisis in South Africa have on consumer behaviour, perception, and attitude toward the large-scale adoption of EVs.

4.6 Measurement Instrument

Data for the research was collected through a survey instrument, in the form of a verified 5-point Likert scale-type questionnaire, where questions are put to the respondent asking them to what degree they agree or disagree with certain statements. Please see Appendix A: Survey Questionnaire.

The questionnaire was developed based on previous research dissertations where validity and reliability were established (Caprara et al., 2005; Jung Moon, 2020; Luengo Kanacri et al., 2021). These studies were conducted on technology adoption, the DOI, prosocial behaviour, and the prosocial scale (Caprara et al., 2005; Jung Moon, 2020; Luengo Kanacri et al., 2021; Roehrich, 2004). The questionnaire consisted of a total of 30 structured questions that should not have taken the respondent more than 3 minutes to complete. The survey tool Google Forms was used to host the survey questionnaire and it was divided into five sections.

4.6.1 Section 1: Demographic Profile

Section 1 of the questionnaire gathered the demographic information of the respondents. These included age, gender, geographic location, travel habits, settlement, property ownership, and access to green energy.

4.6.2 Section 2: Consumer Innovativeness

Section 2 consisted of 4 questions cantered around Consumer Innovativeness (INN). Consumer Innovativeness is an integral component of the DOI and refers to the inclination of the consumer to adopt innovative products (Jung Moon, 2020; Rogers, 2003; Sahin, 2006). The questions were closed questions requesting the respondent to indicate how strongly they agree or disagree with the statement.

4.6.3 Section 3: Perceived Innovation Characteristics

Section 3 consists of 12 questions designed to determine the respondent's Perceived Innovation Characteristics. All the questions were closed questions where respondents indicated how strongly they agreed or disagreed with a series of statements.

This section of the survey included elements of the consumer acceptance of innovative products, as it is instrumental in the DOI theory, and considers five attributes of an innovation that will influence the adoption rate (Jung Moon, 2020; Rogers, 2003; Sahin, 2006). These include:

4.6.3.1 Relative Advantage

Relative advantage (RA) of the innovation considers the perception of the innovation, is it better or worse when compared to the product or process it replaces?

4.6.3.2 Compatibility

The compatibility (COMPAT) of the innovation considers any previous understanding or past conceptions and whether the innovation will fulfil the consumer need.

4.6.3.3 Complexity

The complexity (COMPLEX) of the innovation defines how difficult the innovation is considered by the consumer.

4.6.3.4 Trialability

The trialability (TRIA), considering how accessible the innovation is for experimentation.

4.6.3.5 Observability

The observability (OBS), or unspoken peer pressure considers whether one can be seen using or not using the innovation.

4.6.4 Section 4: Prosocial Behaviour

This section is included to measure the prosocial behaviour (PS) of the respondent and used the prosocial scale (Caprara et al., 2005; Luengo Kanacri et al., 2021). The prosocial scale is a 16-item scale for assessing individual differences in adult prosocial behaviour and is a reliable and validated instrument (Caprara et al., 2005; Luengo Kanacri et al., 2021). For this questionnaire, only 3 questions were applied from the 16-item scale.

The elements of prosocial behaviours and actions can be defined in various forms, one being the intent to benefit others or society as a whole (Lay & Hoppmann, 2015). But prosocial behaviour can also be defined as conforming to socially accepted behaviours, being practicality motivated, or being egotistic including one's reputation or social status (Batson &

Powell, 2003; Jensen, 2016; Lay & Hoppmann, 2015). Egotistic behaviour is considered prosocial motivation when the ultimate goal is to increase one's own welfare and noble appearance, and the behaviour is motivated by some form of self-benefit (Batson & Powell, 2003; Jensen, 2016; Lay & Hoppmann, 2015).

4.6.5 Section 5: South African Context

Section 5 consisted of 3 questions that aimed to assess the respondent's attitude towards the current energy crisis within South Africa and if any incentives would affect their behaviour (SA).

4.7 Measurement Instrument Pre-Test

The online questionnaire was pre-tested through distribution to 10 respondents that resemble the target population. These respondents were first asked to analyse the questionnaire to determine if any spelling or grammar issues needed to be corrected. The respondents reported no spelling or grammar concerns.

The second request to the respondents was to determine the length of time required to complete the questionnaire. The average time reported by the respondents was just under 3 minutes and thus the time required to complete the questionnaire was defined as 3 minutes within the questionnaire introduction page.

The last request from the 10 pre-test respondents was to determine if any of the questions were unclear. One respondent replied that Question 20 was unclear, and it was subsequently reworded.

Original: Question 20 (COMPLEX): It is hard to lend an electric vehicle, as it is very complicated.

Reworded: Question 20 (COMPLEX): It is not easy to use someone else's electric vehicle, as it is difficult to operate.

No other issues were reported by the 10 pre-test respondents and the pre-test response data was disregarded and not included as part of the data analysed for the study.

4.8 Data Collection Process

The data was obtained from the online Likert-scale type survey instrument that was distributed digitally through social media platforms WhatsApp and LinkedIn to the identified respondents through a purposive non-probability sampling technique. The data collected from the survey was stored electronically on Google Drive and will remain stored for a minimum period of 10 years. The survey also requested the initial respondent to forward the survey link to additional respondents, matching the target population, to further create a snowball sampling approach (Acharya et al., 2013; Saunders & Lewis, 2017). To limit the possible limitation of snowball sampling the online survey was also distributed through the database of the local motor dealership network of iCar Technologies.

4.9 Data Analysis

Descriptive and inferential statistics were used to analyse the demographic interval type data gathered through the questionnaire, and frequency distribution was applied to table the data through various variables that include gender, age, location, travel distance, and access to green energy (Fourie, 2023; Myres, 2023; Saunders & Lewis, 2017; Wagner, 2020).

4.9.1 Analysis of Question 1

Question 1: What impact does the availability of green energy have on consumer technology adoption of electric vehicles in South Africa?

The collected interval data relating to Question 1 was analysed using IBM® SPSS statistics software to answer H1 and H2. Inferential statistics testing of H1, H2, H3, and H4 was performed using the ANOVA test to determine if there is a significant statistical difference between the consumers who indicated that they have access to green energy and those who do not (Breitsohl, 2019; Kim et al., 2019; Wagner, 2020). Because the interval data gathered does not fall within groups of equal size the ANOVA test was applied over the t-test (Breitsohl, 2019; Delacre et al., 2020). Assumptions of the ANOVA test include that the data is normally distributed and that variance is homogeneous (the variances between the groups are approximately equal) (Delacre et al., 2020). Another assumption of the ANOVA test is that two or more samples are independent and identically distributed (Delacre et al., 2020).

4.9.2 Analysis of Questions 2 and 3

Question 2: What impact does consumer prosocial behaviour have on the technology adoption of electric vehicles in South Africa?

Question 3: What impact does the current electricity crisis in South Africa have on consumer technology adoption of electric vehicles?

The survey interval data relating to Questions 2 and 3 was analysed using IBM® SPSS statistics software where simple linear regression (SLR) and multiple regression (MR) were applied to answer H3, H4, H5, and H6. SLR and MR analysis is a collection of mathematical and statistical techniques and was applied to the interval data to understand the relationship between a single or multiple predictor variable and one response variable (Majumder & Maity, 2018a; Olvera Astivia & Zumbo, 2019). When applying SLR and MR, the quality and type of data that is used are very important as inaccurate, incomplete, or little relevance data will result in false conclusions for correlation and causation (Gogtay & Thatte, 2017).

The SLR and MR statistical test includes certain assumptions about the interval data and its variables applied within the analysis, and should these assumptions not be met, the results of the test may not be considered reliable (Gogtay & Thatte, 2017; Olvera Astivia & Zumbo, 2019).

Three of these key assumptions for SLR and MR tested within the study include normally distributed variables, no multicollinearity, and homoscedasticity (Alita et al., 2021; Olvera Astivia & Zumbo, 2019). The data variables must be normally distributed, with a linear relationship between each variable, and must be measured without any errors (Alita et al., 2021; Gogtay & Thatte, 2017). SLR and MR further have the assumption that a constant variance at every point in the linear model exists, and if this assumption is not met, the residuals will experience heteroscedasticity and the results of the test will become unreliable (Alita et al., 2021). The last assumption has the requirement that no predictor variables be heavily correlated with each other, this is defined as multicollinearity (Alita et al., 2021; Gogtay & Thatte, 2017).

4.10 Quality Controls

The internal consistency reliability of the Likert-scale type questionnaire can be verified through various reliability values that include Cronbach's alpha which is a measure of equivalence (whether different sets of test items would give the same measurement outcomes) (Caprara et al., 2005; Jung Moon, 2020; Taber, 2018). The questionnaire used in this study was developed based on previous research instruments where the validity and reliability of the scales were reported as follows (Caprara et al., 2005; Jung Moon, 2020; Luengo Kanacri et al., 2021).

4.10.1 Reliability and Validity Measurements

The combination of the reliability values for the scale to measure the five attributes of innovation is listed in Appendix B: Reliability and Validity Measurements (Jung Moon, 2020). The reliability values indicated internal consistency and reliability except for two indicators, indicator RA1 and COMPAT2, and considering that these two deviations are only slightly lower they can still be included in the model (Jung Moon, 2020).

4.10.2 Results for Discriminant Validity

Further analysis was conducted on the discriminant validity amongst the constructs and is presented in Appendix C: Results for Discriminant Validity (Jung Moon, 2020). This analysis indicated that the correlation coefficient is smaller when compared to the square root of the average indicating discriminant validity among the constructs (Jung Moon, 2020).

4.10.3 Results for Collinearity Analysis

The results presented in Appendix D: Results for Collinearity Analysis examined the collinearity within the constructs and confirmed no collinearity concerns (Jung Moon, 2020).

4.10.4 Prosocial Scale

Conventional item and scale statistics performed for the 16-item prosocial scale are presented in Appendix E: Prosocial Scale (Caprara et al., 2005). Firstly, the means, standard deviation, skewness, and kurtosis for the prosocial scale were calculated, and then indicators of the internal consistency, including Cronbach’s alpha and mean corrected item-total correlations, were determined (Caprara et al., 2005). The mean results range from 2,96 up to 3,79 with an overall mean of 3,52 and a standard deviation of 0,64 (Caprara et al., 2005). The average skewness was -0,33 with an average kurtosis of -0,27 and the corrected item-total correlations varied from 0,47 down to 0,73, lower than 0,05 on only two indicators (Caprara et al., 2005). The Cronbach’s alpha for all the indicators was 0,91 at the scale level and the mean corrected item-total correlation was 0,59 indicating good reliability for the prosocial scale indicators (Caprara et al., 2005).

4.11 Ethical Approval for Research

Ethical clearance for the research was obtained from the GIBS Ethics Committee on the 14th of September 2023. The Ethics Approval confirmation was submitted with the support documentation of the research.

4.12 Limitations

Limitations to consider for the study would include the rate of response to the Likert-scale survey, as a high response rate would make the research more relevant in terms of the population (Sung & Wu, 2018; Taber, 2018). The sample size of 136 responses might not be representative of the population of South Africa as the sampling method applied to start the sampling was convenience sampling through the initial distribution of the questionnaire through the researcher's social media WhatsApp and LinkedIn platforms (Saunders & Lewis, 2017). Because the Likert -scale is self-completed there are no prompting and probing questions included and that can limit the information obtained from the respondent (Sung & Wu, 2018; Taber, 2018). The target population could also be extended to include more respondents from diverse backgrounds, demographics, and all the provinces that would be more representative of the population of South Africa (Taber, 2018). As a non-probability sampling technique will be used it is not always known how representative the sample will be of the population (Saunders & Lewis, 2017).

Likert scales also have the limitation of the response style that could affect the accuracy of the data as respondents might tend to select responses that are either neutral, midpoint, or extreme towards one side of the scale (Sung & Wu, 2018). Responses that follow this style might introduce a source of bias that dilutes the accuracy of respondents' genuine characteristics or traits (Sung & Wu, 2018).

CHAPTER 5: Results

5.1 Introduction

This chapter presents the results from the data collected through the research questionnaire hosted on Google Forms. It describes the results of analytical procedures and a series of statistical tests, applied using IBM® SPSS statistics software, and presents these results in a summarised format, with the complete detailed results available in Appendices J and K.

Two sections of this chapter summarise the demographic data of the respondents and detail the re-coding and data preparation that was carried out on the data set (Hair et al., 2019). Further sections of this chapter provide details of the descriptive statistics for each construct within the research and list the results of several important tests that include the assessment of the construct validity, instrument reliability, dimension reduction, and the normality of the data. The final section of this chapter describes the application of the analysis of variance (ANOVA), and linear regression models to investigate the relationships within the dataset (Breitsohl, 2019; Hair et al., 2019)

The chapter concludes with a summary of the analysis applied to each hypothesis.

5.2 Demographics and Sample Size

The questionnaire, which consisted of 30 structured questions, was first distributed to the target population on the 15th of September 2023, and the data collection phase was concluded on the 13th of October 2023. A total of 136 respondents participated in the online survey.

Of these respondents, only 1 declined the informed consent, as the first question of the survey, and this respondent was immediately redirected to the last page of the questionnaire by the logic available through Google Forms. Please see Figure 8. The last page of the questionnaire thanked the respondent for their time, recorded their response, and ended the survey. The response from the respondent who declined the informed consent was not considered for any analyses and decreased the total number of respondents from the survey down to the final total of 135.

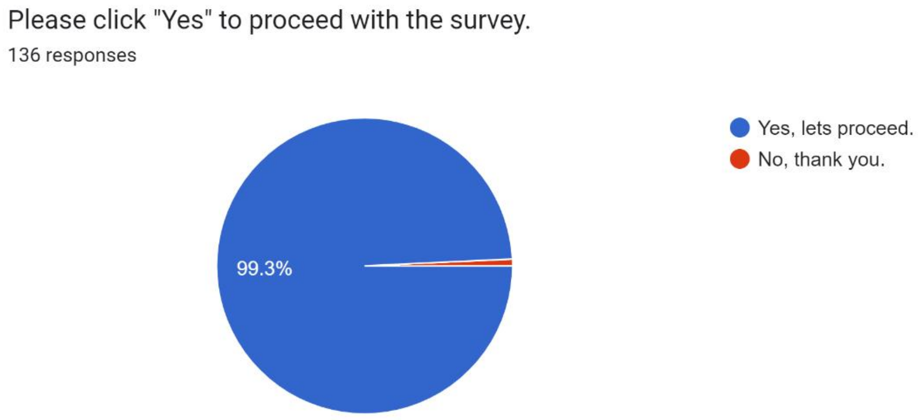

Figure 8: Survey Consent (Source: Google Forms from Research Questionnaire).

The first question within the survey asked the respondents to indicate what age group they fell within. The biggest group of respondents fell within the age group of 45 – 54 with 44 out of the 135 respondents (32.6%), and the second largest group was 35 – 44, with 43 respondents (31.9%). The third largest group was 25 – 34 years of age with 29 respondents out of the 135 (21.5%). The remaining responses were divided as 11 respondents (8.1%) within the age group of 55 – 64, 5 respondents (3.7%) of 65+ years, and only 3 respondents (2.2%) within the group of 18 – 24. Please see Figure 9.

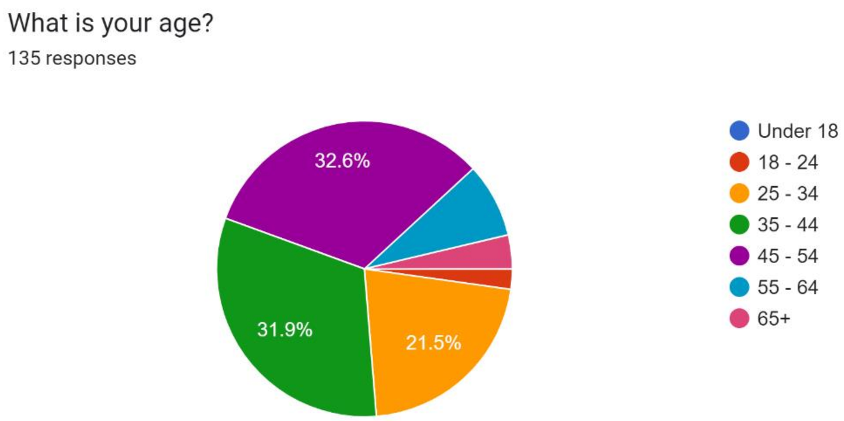

Figure 9: Age Group (Source: Google Forms from Research Questionnaire).

The respondents were also asked to indicate their gender. Most respondents were male, with 81 of the 135 (60%), followed by 54 (40%) female respondents as per Figure 10.

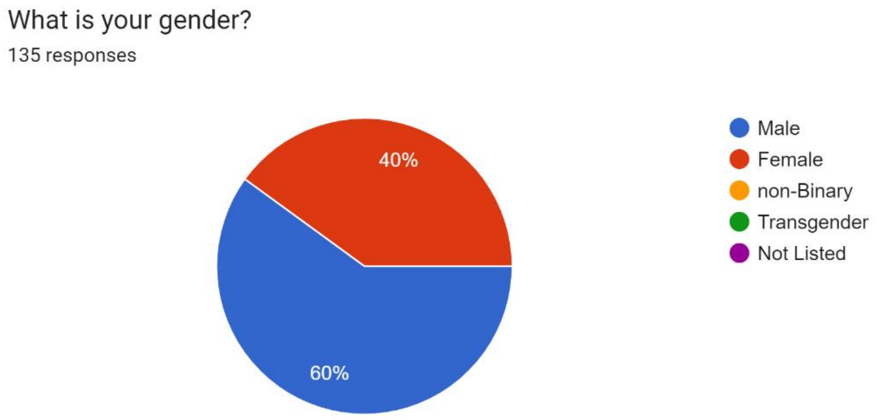

Figure 10: Gender (Source: Google Forms from Research Questionnaire).

The geographical location of the respondents, as detailed in Figure 11 below, was predominantly within the province of Gauteng with 110 (81.5%) of the responses. The second most responses came from KwaZulu-Natal with 8 responses (5.9%), followed by 6 (4.4%) from the Nort West province. There were the same number of responses from Mpumalanga and the Western Cape with 5 responses (3.7%) each. There was only 1 response from the Limpopo province (0.7%) and none from the provinces of the Eastern Cape, Free State, and Northern Cape.

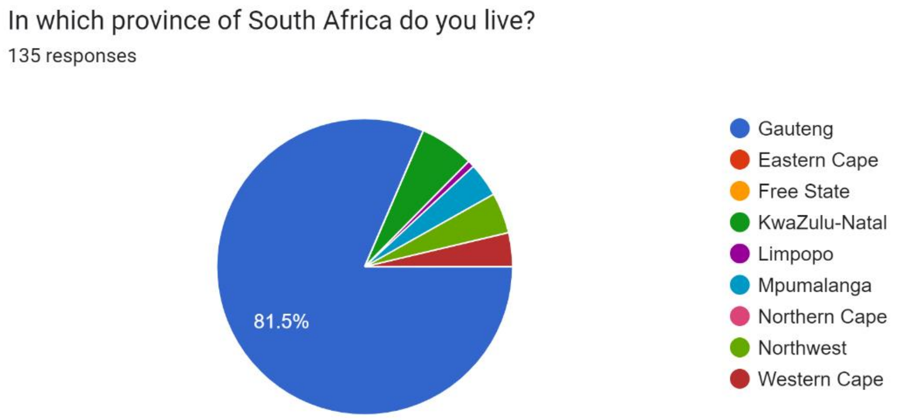

Figure 11: Province (Source: Google Forms from Research Questionnaire).

The largest portion of the respondents owned a Petrol vehicle, with 85 out of the 135 (63%), followed by diesel-powered vehicles second with 45 (33.3%). Only 4 responses were recorded for EVs (3%), and only 1 (0.7%) indicated that they own a Hybrid vehicle. Please see Figure 12.

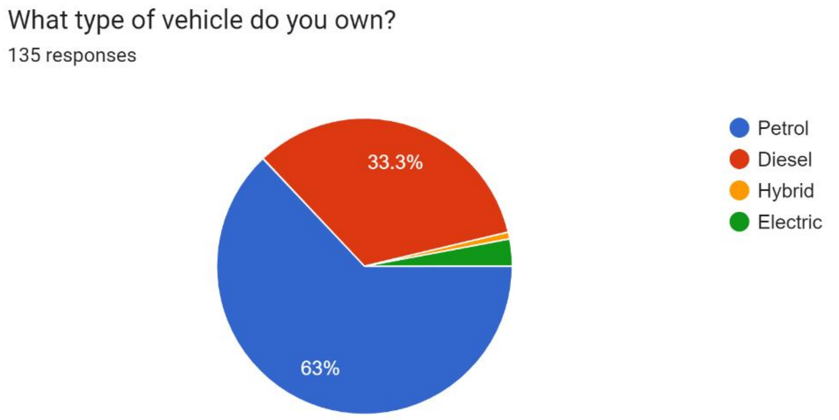

Figure 12: Vehicle (Source: Google Forms from Research Questionnaire).

The daily travel distances of all the responses varied across the different sections as detailed in Figure 13 below. Most of the respondents, 41 out of 135 (30.4%), travel between 20km and 49km per day. The second biggest group 35 (25.9%) indicated that they travel less than 20km per day, closely followed by the third group 31 (23%) who travel between 50km and 99km per day. The fourth group, consisting of 12 (8.9%) of the respondents, travel between 150km and 199km per day. The remainder of the respondents indicated that they also travel long distances daily with 10 (7.4%) traveling between 100km and 149km, 4 (3%) traveling between 200km and 249km, and only 2 (1.5%) respondents traveling more than 250km per day.

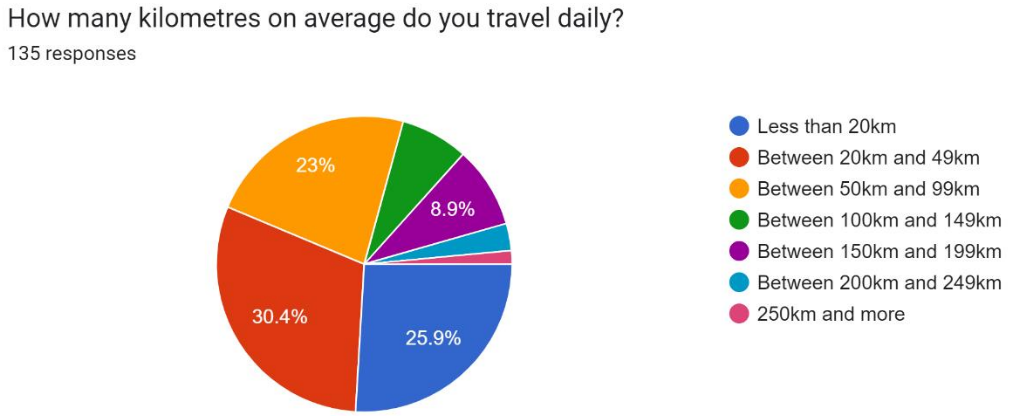

Figure 13: Daily Travel Distance (Source: Google Forms from Research Questionnaire).

The most responses were received from individuals who reside within a suburban area as 131 (97%) of the 135 respondents completed the questionnaire. As illustrated in Figure 14, only 2 (1.5%) responses were received from individuals that reside within a township, and another 2 (1.5%) from a rural area.

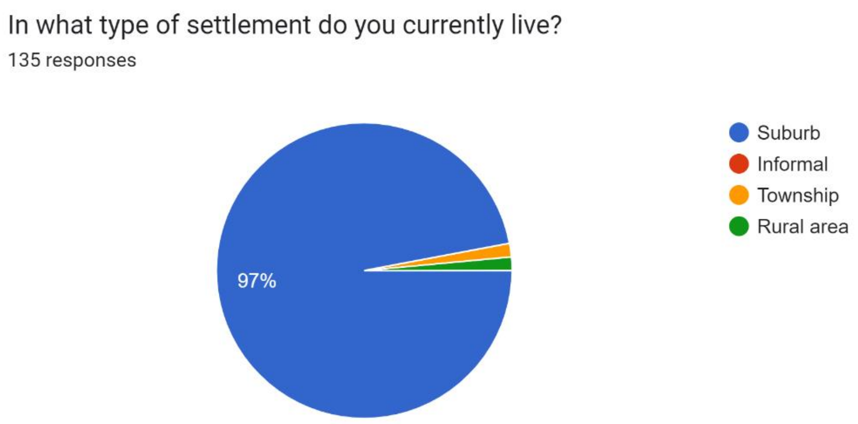

Figure 14: Settlement (Source: Google Forms from Research Questionnaire).

I large part of the respondents that completed the questionnaire, 103 (76.3%), indicated that they own property, with only 22 (16.3%) renting property. The remaining 10 (7.4%) responses received were from individuals who live with family or friends.

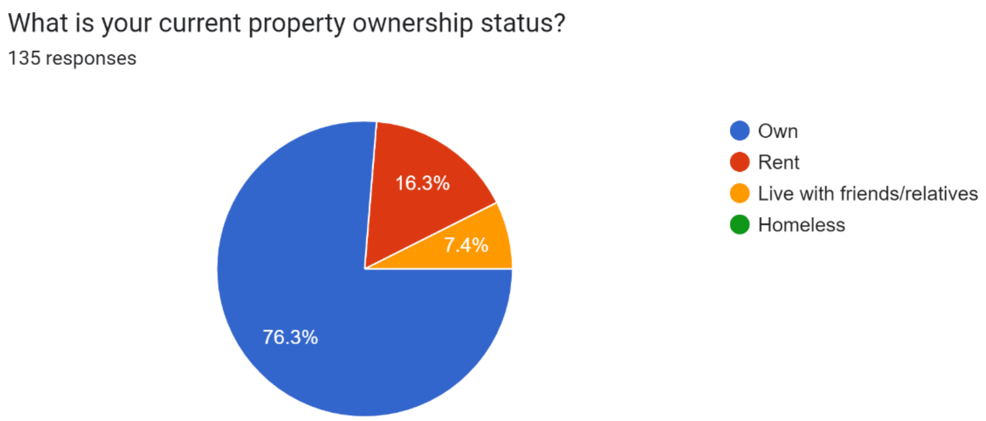

Figure 15: Property Ownership (Source: Google Forms from Research Questionnaire).

The last question within the demographic profile section of the questionnaire was aimed at assessing access to green energy and revealed that 59 of the 135 (43.7%) responses received were from individuals who do not have any access to green energy in the form of a rooftop solar installation. Further to this, as detailed in Figure 16 below, 42 (31.1%) indicated that they do have a rooftop solar installation at home. The third biggest group of responses, 16 (11.9%) was received from individuals who indicated that they have a friend or colleague with a rooftop solar installation at home. Another 11 (8.1%) responses were recorded for a rooftop solar installation at work, and the last group of 7 (5.2%) of the responses were received from individuals who have a rooftop solar installation at home and work.

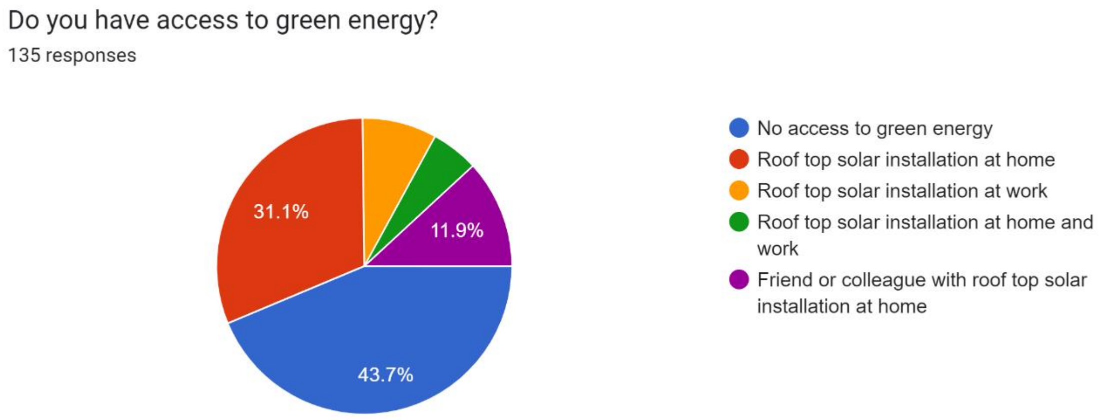

Figure 16: Access to Green Energy (Source: Google Forms from Research Questionnaire).

5.3 Descriptive Statistics

The descriptive statistics are calculated and presented in Table 1 to provide insights into the data collected. Descriptive statistics commonly includes minimums, maximums, means, and standard deviations (Creswell & Creswell, 2018). The descriptive statistics of the research data set were calculated using the IBM® SPSS statistics software.

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
INN1: If I hear about a new technology, I will look for ways to experiment with it.	135	1	5	3.95	.964
INN2: Among my peers, I am usually the first to explore new technologies.	135	1	5	3.33	1.106
INN3: I like to experiment with new technologies	135	1	5	3.79	1.025
INN4: In general, I am hesitant to try out new technologies.	135	1	5	2.42	1.109
RA1: The use of an electric vehicle would decrease my fossil fuels and CO2 emissions.	135	1	5	3.93	1.167
RA2: Buying an electric vehicle would be financially advantageous for me.	135	1	5	2.85	1.219
RA3: An electric vehicle replaces a vastly inferior alternative.	135	1	5	2.75	1.131

COMPAT1: Using an electric vehicle would enable my lifestyle in South Africa.	135	1	5	2.70	1.153
COMPAT2: It is easy to find electric vehicle charging stations.	135	1	5	1.93	1.005
COMPLEX1: Prior to driving an electric vehicle, I would be required to take a special course.	135	1	5	2.56	1.163
COMPLEX2: It is not easy to use someone else's electric vehicle, as it is difficult to operate.	135	1	5	2.48	.969
COMPLEX3: The concept behind an electric vehicle is difficult for me to understand.	135	1	5	1.96	.965
OBS1: By using an electric vehicle, I show that I care about the environment.	135	1	5	3.51	1.202
OBS2: An electric vehicle stands out visibly.	135	1	5	3.01	.946
TRIA1: Prior to buying an electric vehicle, it would be important to test-drive it.	135	3	5	4.49	.531
TRIA2: Prior to buying an electric vehicle, I would like to borrow it for a day or two.	135	1	5	4.01	.974
PS1: I am pleased to help my friends/colleagues in their activities.	135	2	5	4.24	.613
PS2: I try to help others.	135	2	5	4.37	.620
PS3: I am willing to make my knowledge and abilities available to others.	135	3	5	4.38	.545
SA1: I would consider buying an electric vehicle if there are government financial incentives like cash subsidies or tax rebates.	135	1	5	3.87	1.149

SA2: I would consider buying an electric vehicle if Eskom could provide reliable and stable electricity.	135	1	5	3.89	1.176
SA3: Eskom will resolve the current energy supply crisis in South Africa within the next 5 years.	135	1	5	1.99	1.165

Table 1: Descriptive Statistics (Source: IBM® SPSS and Researchers Data).

5.4 Data Coding and Preparation

The online questionnaire was developed with the use of Google Forms and was configured to exclusively record responses from participants who have completed all the questions, thus eliminating the need to manually edit the data and exclude any incomplete or partial responses. The questionnaire also did not request or record any personally identifiable information from the respondent further eliminating the need to remove any related information.

After closing the option to receive more response the data was downloaded from Google Forms into an Excel spreadsheet. As discussed in section 5.2, the first analysis of the data revealed that there were 136 responses with only 1 respondent declining the informed consent question before starting the survey. The response from this respondent was deleted from the original data set and decreased the total number of respondents to 135.

The next step in preparing the data involved re-coding the data from the responses to follow the standard coding applied to Likert scales, with the positive replies rated the highest by a 5, and the negative replies rated the lowest by a 1 Please see Table 2.

5 Point Likert Scale Coding	
Strongly Agree	5
Agree	4
Neither Agree nor Disagree	3
Disagree	2
Strongly Disagree	1

Table 2: 5 Point Likert Scale Coding (Source: Researchers Own Study).

Next, the researcher deleted the columns from the data set that recorded the time and date of the response, and the confirmation of consent as this was not required in any further analysis.

The rest of the demographic data from the responses was re-coded for analysis using IBM® SPSS statistics software as detailed in the Data Code Book contained in Appendix F.

The data set was loaded into the IBM® SPSS statistics software and in the "Variable View" option, all the "Measure" properties of the variables were changed the measure against "Scale" and not "Nominal". Lastly, the "Name" and "Label" fields were also updated against all the variables to add descriptive markers to assist with loading and identifying the questions and results when doing the analysis.

5.5 Instrument Validity and Reliability

As researchers develop and apply conceptual models to investigate and study identified problems, questionnaires are often used to collect and analyse data used to test these conceptual models (Surucu & Maslakci, 2020). Beneficial results from the study are important and to achieve these results the instrument used must have certain qualities (SURUCU & MASLAKCI, 2020). The first of these qualities is the Validity of the scale that determines whether the measuring instrument does measure the behaviour or quality it is intended to measure, and how well the measuring instrument performs this function (Hair et al., 2019; Surucu & Maslakci, 2020). The second quality required is that the scale is considered reliable (Surucu & Maslakci, 2020). Reliability is considered a measure of the stability of the measuring instrument where it is tested to deliver repeated measurements when applied under the same conditions (Surucu & Maslakci, 2020). The Validity and Reliability of the scales used in research are important and crucial factors to ensure the research delivers accurate results (Surucu & Maslakci, 2020, 2020; Taber, 2018).

5.5.1 Validity – Pearson Correlation

Confirming the validity of each question within the constructs measured was done through the bivariate correlation function in the IBM® SPSS statistics software (Hair et al., 2019). The Pearson correlation coefficient is often applied to data and is considered a crucial procedure to measure the similarity of multiple data variables within the measuring instrument (Zhu et al., 2019).

The sum of the responses for each question within the construct was calculated into a new column within the data set and labelled ETT Total. The IBM® SPSS statistics software was applied to run a bivariate correlation between each question and the calculated Item Total Score. The result of the bivariate correlation was used to determine if there is a significant relationship between each question and the Item Total Score for the specific construct, and what the strength of the relationship is. The summarised results that include Pearson's correlation are listed in Tables 3, 4, 5, and 6 below with the full results from the IBM® SPSS statistics software included in Appendix G: Bivariate Correlations.

Bivariate Correlations - Pearson Correlation			
Construct Group	**Question**	**ETT Total**	**Sig. (2-tailed)**
Consumer Innovativeness	INN1	.828**	< .001
	INN2	.867**	< .001
	INN3	.798**	< .001
	INN4	-.381**	< .001

** Correlation is significant at the 0.01 level (2-tailed)

Table 3: Bivariate Correlation INN (Source: IBM® SPSS and Researchers Data).

Bivariate Correlations - Pearson Correlation			
Construct Group	**Question**	**ETT Total**	**Sig. (2-tailed)**
Perceived Innovation Characteristics	RA1	.819**	< .001
	RA2	.854**	< .001
	RA3	.855**	< .001
	COMPAT1	.865**	< .001
	COMPAT2	.818**	< .001
	COMPLEX1	.843**	< .001
	COMPLEX2	.835**	< .001
	COMPLEX3	.791**	< .001
	OBS1	.812**	< .001
	OBS2	.671**	< .001
	TRIA1	.717**	< .001
	TRIA2	.925**	< .001

** Correlation is significant at the 0.01 level (2-tailed)

Table 4: Bivariate Correlation PIC (Source: IBM® SPSS and Researchers Data).

Bivariate Correlations			
Construct Group	**Question**	**ETT Total**	**Sig. (2-tailed)**
Prosocial Actions	PS1 – Pearson Correlation	.860**	< .001
	PS2 – Pearson Correlation	900**	< .001
	PS3 – Pearson Correlation	.800**	< .001

** Correlation is significant at the 0.01 level (2-tailed)

Table 5: Bivariate Correlation PS (Source: IBM® SPSS and Researchers Data).

Bivariate Correlations			
Construct Group	**Question**	**ETT Total**	**Sig. (2-tailed)**
SA Context	SA1 – Pearson Correlation	.816**	< .001
	SA2 – Pearson Correlation	.709**	< .001
	SA3 – Pearson Correlation	.563**	< .001

** Correlation is significant at the 0.01 level (2-tailed)

Table 6: Bivariate Correlation SA (Source: IBM® SPSS and Researchers Data).

The results of the bivariate correlation for each construct confirmed that all the questions had a significant correlation, at the < 0.01 level (two-tailed), with the calculated Item Total Score for that construct (Hair et al., 2019). The validity of each question within the constructs was thus confirmed through a Sig. value for each question that is less than 0.05 (Hair et al., 2019).

After the confirmation of validity, a further test for the measurement instrument was performed to determine the reliability.

5.5.2 Reliability – Cronbach's Alpha

After establishing the question validity for each construct, the measuring instrument was tested for reliability as a measure of its ability to consistently reproduce the same result for the construct linked to each question when applied under similar conditions (Hair et al., 2018; Taber, 2018). The combination of measurement instrument validity and reliability ensures more accurate and consistent results from the instrument (Hair et al., 2018).

Cronbach's alpha is a statistic that is commonly used within research to determine if tests and scales applied in the research are fit for purpose (Taber, 2018). The study conducted by Taber (2018) investigated how Cronbach's alpha was applied and presented within major journals over a single year and concluded that a value of 0.7 can be considered a sufficient measure of reliability or internal consistency of a measuring instrument. Therefore, the slightly lower value of 0.65 for Cronbach's alpha was applied for this study.

The reliability statistics, for the total of 22 variable questions grouped within 8 constructs where 5 variables belong to the higher order construct of Perceived Innovation Characteristics, was calculated using the IBM® SPSS statistics software 'Reliability Analysis" function. All the variables or items, associated with the same construct or lower-order construct, were grouped for the test. Below is a summary of the results for each construct with the complete detailed results from IBM® SPSS statistics software available in Appendix H.

The first construct tested was Consumer Innovativeness, and Cronbach's alpha result was calculated as below the set target value of 0.65 at a value of 0.59. Further investigation of the results, as summarised in the Item-Total Statistics Table 7 below, revealed that Cronbach's alpha value would be increased to 0.875 if question INN4 were deleted from the construct.

Item-Total Statistics	
	Cronbach's Alpha if Item Deleted
INN1: If I hear about a new technology, I will look for ways to experiment with it.	-.968
INN2: Among my peers, I am usually the first to explore new technologies.	-1.286
INN3: I like to experiment with new technologies	-.845
INN4: In general, I am hesitant to try out new technologies.	.875

Table 7: Cronbach's Alpha INN First Run (Source: IBM® SPSS and Researchers Data).

Question INN4 was removed, and the test was run a second time resulting in a Cronbach's alpha value of over the 0.65 target at 0.875, indicating that all the remaining items passed the reliability test as per Tabel 8.

Reliability Analysis		
Construct Group	**Construct**	**Cronbach's Alpha**
Consumer Innovativeness	INN1, INN2 and INN3	.875

Table 8: Cronbach's Alpha INN (Source: IBM® SPSS and Researchers Data).

The second set of tests performed was within the higher-order construct Perceived Innovation Characteristics, and Cronbach's alpha was calculated for each sub-construct that included RA, COMPLEX, OBS, and TRIA. The result calculated for each construct is summarised in Table 9 with the complete IBM® SPSS statistics software results available in Appendix H. The calculated Cronbach's alpha value for the constructs RA and COMPLEX were calculated as 0.796 and 0.758 respectively, indicating that both items passed the reliability test. However, Cronbach's alpha value for the constructs COMPAT, OBS, and TRIA were all under the set target of 0.65 with results of 0.587, 0.195, and 0.501 respectively. This indicated that all 3 items failed the reliability test and because the construct only consisted of 2 questions each the test could not be performed again.

Reliability Analysis		
Construct Group	**Construct**	**Cronbach's Alpha**
Perceived Innovation Characteristics	RA1, RA2 and RA3	.796
	COMPAT1 and COMPAT2	.587
	COMPLEX1, COMPEX2 and COMPLEX3	.758
	OBS1 and OBS2	.195
	TRIA1 and TRIA2	.501

Table 9: Cronbach's Alpha PIC (Source: IBM® SPSS and Researchers Data).

The construct of Prosocial Actions was tested next, and as summarised in Table 10, the calculated Cronbach's alpha value of 0.815 was above the 0.65 target, indicating that all the items passed the reliability test.

Reliability Analysis		
Construct Group	**Construct**	**Cronbach's Alpha**
Prosocial Action	PS1, PS2 and PS3	.815

Table 10: Cronbach's Alpha PS (Source: IBM® SPSS and Researchers Data).

The last construct tested was the South African Context, and Cronbach's alpha result was calculated as 0.466 which is below the set target value of 0.65. Investigation of the results on the Item Total Statistics as per Table 11 revealed that Cronbach's alpha value could be increased if question SA3 was deleted from the construct.

Item-Total Statistics	
	Cronbach's Alpha if Item Deleted
SA1: I would consider buying an electric vehicle if there are government financial incentives like cash subsidies or tax rebates.	-.059
SA2: I would consider buying an electric vehicle if Eskom could provide reliable and stable electricity.	.340
SA3: Eskom will resolve the current energy supply crisis in South Africa within the next 5 years.	.669

Table 11: Cronbach's Alpha SA First Run (Source: IBM® SPSS and Researchers Data).

As a result, question SA3 was deleted, and the test was run a second time. The calculated Cronbach's alpha value for the second test without question SA3 was 0.669, as summarised in Table 12. This value is above the 0.65 target value, indicating that all the remaining items passed the reliability test.

Reliability Analysis		
Construct Group	**Construct**	**Cronbach's Alpha**
SA Context	SA1 and SA2	.699

Table 12: Cronbach's Alpha SA Second Run (Source: IBM® SPSS and Researchers Data).

5.5.3 Conclusion

The summarised results of all the tests for Validity and Reliability are available in Table 13. The only questions selected to be deleted from the data set were items INN4 and SA3, as deleting these items resulted in a pass of Reliability of the remaining items in the construct. Even though items COMPAT, OBS, and TRIA failed the Reliability test, they did pass the Validity test, and the decision was made to retain these questions. The deleted questions INN4 and SA3 were removed from the data set for any further analysis.

Conclusion				
Construct Group	**Construct**	**Validity**	**Reliability**	**Retain Question**
Consumer Innovativeness	INN1, INN2, INN3 and INN4	YES	NO	DELETE INN4
	INN1, INN2, INN3	YES	YES	YES
Perceived Innovation Characteristics	RA1, RA2 and RA3	YES	YES	YES
	COMPAT1 and COMPAT2	YES	NO	YES
	COMPLEX1, COMPLEX2 and COMPEX3	YES	YES	YES
	OBS1 and OBS2	YES	NO	YES
	TRIA1 and TRIA1	YES	NO	YES
Prosocial Actions	PS1, PS2 and PS3	YES	YES	YES
SA Context	SA1, SA2 and SA3	YES	NO	DELETE SA3
	SA1 and SA2	YES	YES	YES

Table 13: Conclusion Table (Source: **R**esearchers Data).

5.6 Factor Analysis and Dimension Reduction

Factor analysis is a multivariate statistical technique that aims to identify the smallest possible number of hypothetical constructs, or factors, that can explain the correlated variation possible among a set of measured variables or indicators (Watkins, 2018). The desired result from a factor analysis is to identify common factors within the variables that explain the order and structure among these measured variables (Watkins, 2018). Factor analysis can be applied to investigate the underlying relationships within many variables to determine whether information can be condensed or grouped into a smaller set of components (Hair et al., 2019).

As the measurement instrument used in this study was adapted from existing instruments applied within previous studies, a confirmatory factor analysis (CFA) should be considered (Beavers et al., 2013; Hair et al., 2019; Watkins, 2018). However, sample sizes of below 200 responses are considered inadequate to perform a CFA as the results could be unreliable (Beavers et al., 2013; Hair et al., 2019). As the sample size from this study was 135 responses, the factor analysis selected for the data set was Exploratory Factor Analysis (EFA) (Beavers et al., 2013; Hair et al., 2019; Watkins, 2018).

The summarised results of the EFA, conducted using the IBM® SPSS statistics software “Dimension Reduction” and “Factor” function with Principal Component Analysis (PCA) as the extraction method, are described in Table 15 below with the complete analysis from the IBM® SPSS statistics software available in Appendix I.

The first consideration from the results is to ensure that all the variables listed in the Correlation Matrix have at least one correlation with a value higher than 0.3. As detailed in Table 15 all the variables correlated higher than the set target except for variables OBS1 and OBS2 which correlated only 0.111.

The second consideration from the results is the Kaiser-Meyer-Olkin Test of Sampling Adequacy (KMO). The KMO value is a measure of how the variance in the items is shared and follows the interpretation as detailed in Table 14.

KMO Value	Degree of Common Variance
0.90 to 1.00	Marvelous
0.80 to 0.89	Meritorious
0.70 to 0.79	Middling
0.60 to 0.69	Mediocre
0.50 to 0.59	Miserable
0.00 to 0.49	Don’t Factor

Table 14: Interpretation Guidelines for the KMO Test (Source: Beavers et al., 2013).

The results of the KMO test indicated that all the variables fall within the “Miserable”, “Mediocre”, and “Middling” categories with none falling in the ‘Don’t Factor” category (Beavers et al., 2013). The next consideration is Bartlett's Test of Sphericity with the requirement that the Sig. value should be < 0.05 as an indicator that the principal component analysis is correct and can be performed (Beavers et al., 2013). The results of Bartlett's Test of Sphericity indicated that all the variables had a Sig. value of less than 0.05, except for the OBS1 and OBS2 variable groups that had a Sig. value of 0.198 (Beavers et al., 2013; Watkins, 2018). The last result from the test to consider is the Total Initial Eigenvalues from the Total Variances Explained Table as an indicator of how many groupings can be made for each construct tested (Beavers et al., 2013; Watkins, 2018). The results indicated that there was only 1 Total Eigenvalue for each test above 1, thus each construct tested could be grouped into 1 group (Beavers et al., 2013; Watkins, 2018).

Summarised Result of the EFA							
Higher Construct Group	**New Construct Group**	**Questions**	**KMO**	**Correlation > .03**	**Bartlett' s Test of Sphericity**	**Sig < .05**	**Eigenvalue % of Variance**
Consumer Innovativeness	Innovativeness	INN1, INN2, INN3	.734	YES	<.001	YES	80.128%
Perceived Innovation Characteristics	EV Advantage	RA1, RA2 and RA3	.701	YES	<.001	YES	71.104%
Perceived Innovation Characteristics	EV Compatibility	COMPAT1 and COMPAT2	.500	YES	<.001	YES	70.949%
Perceived Innovation Characteristics	EV Complexity	COMPLEX1, COMPLEX2, and COMPLEX3	.688	YES	<.001	YES	67.892%
Perceived Innovation Characteristics	OBS1 and OBS2	OBS1 and OBS2	.500	NO	.198	NO	55.568%
Perceived Innovation Characteristics	EV Trialability	TRIA1 and TRIA1	.500	YES	<.001	YES	69.871%
Prosocial Actions	Prosocial	PS1, PS2 and PS3	.677	YES	<.001	YES	72.990%

SA Context	SA Energy	SA1 and SA2	.500	YES	<.001	YES	75.162%

Table 15: Factor Analysis Results (Source: IBM® SPSS and Researchers Data).

The summarised result of the EFA indicated that the 20 variables tested could be grouped into 7 new groups that were tabled as per Table 15 as “New Construct Group”. The only variables that could not be grouped into a new variable group are OBS1 and OBS2, and these variables were analysed individually. Considering the results of the test the data set was adjusted to include the averages of the variables per respondent that could be grouped to reduce the total amount of variables to be tested to 9.

5.7 Statistical Assumption Tests

5.7.1 ANOVA

The hypothesis for question 1 of the research was analysed using IBM® SPSS statistics software, through the ANOVA test, to determine if there is a significant statistical difference between the consumers who indicated that they have access to green energy and those who do not (Breitsohl, 2019; Kim et al., 2019; Wagner, 2020). The data set was updated because the EFA was further updated to only include respondents who indicated that they have no access to green energy, or they have access to green energy at home. This reduced the number of respondents to 101 from the initial 136 where 59 respondents had no access to green energy and 42 indicated that they do have a rooftop solar installation at home.

The first assumption of the ANOVA test, homogeneity, was tested using the IBM® SPSS statistics software function “Homogeneity of variance test” to perform Levene's test (Delacre et al., 2020; Hair et al., 2019). To meet the two-way ANOVA assumption of homogeneity the Sig., or *p*-value results of Levene's test must be above .05 (Delacre et al., 2017; Hair et al., 2019). If the result of the test returns a Sig., or *p*-value below .05 the assumption of homogeneity has not been met.

The results of the data set tested for homogeneity using Levene's test are summarized in Table 16 with the complete ANOVA result from the IBM® SPSS statistics software available in Appendix J.

Tests of Homogeneity of Variances		Levene's Statistic	Sig.
Innovativeness	Based on Mean	1.810	.991
	Based on Median	.354	.985
	Based on the Median and with adjusted df	.354	.985
	Based on trimmed mean	1.599	.993
EV Advantage	Based on Mean	.153	.329
	Based on Median	.243	.335
	Based on the Median and with adjusted df	.243	.335
	Based on trimmed mean	.141	.300
EV Compatibility	Based on Mean	.665	.327
	Based on Median	.388	.304
	Based on Median and with adjusted df	.388	.304
	Based on trimmed mean	.727	.304
EV Complexity	Based on Mean	1.535	.703
	Based on Median	1.644	.602
	Based on Median and with adjusted df	1.644	.602
	Based on trimmed mean	2.051	.631
OBS1: By using an electric vehicle, I show that I care about the environment.	Based on Mean	.121	.729
	Based on Median	.013	.909
	Based on Median and with adjusted df	.013	.909
	Based on trimmed mean	.118	.732
OBS2: An electric vehicle stands out visibly.	Based on Mean	.294	.589
	Based on Median	.161	.690
	Based on Median and with adjusted df	.161	.690
	Based on trimmed mean	.211	.647
EV Trialability	Based on Mean	.027	.220
	Based on Median	.140	.181
	Based on Median and with adjusted df	.140	.181
	Based on trimmed mean	.086	.238

Table 16: ANOVA Levene's Test (Source: IBM® SPSS and Researchers Data).

The results of Levene's test for homogeneity of variance indicated that all the variables had a Sig. or p-value, that is more than .05, and therefore the assumption of homogeneity for the data set is met and suitable for conducting the one-way ANOVA (Breitsohl, 2019; Delacre et al., 2020).

The second assumption of the ANOVA test, the normality of the data, was tested using the IBM® SPSS statistics software function "Descriptive Statistics" (Breitsohl, 2019; Delacre et al., 2020). The normality of the data set was tested using the skewness and kurtosis statistics from the disruptive statistics test (Breitsohl, 2019; Delacre et al., 2020; Hair et al., 2019). For the data set to meet the assumption of normality, the skewness and kurtosis statistic values must be below the absolute value of 2.0 b(Breitsohl, 2019; Delacre et al., 2017). Should the skewness or the kurtosis statistic be above the absolute value of 2.0 the data set is assumed to not be normal, and the one-way ANOVA should not be conducted. The results of the data set tested for normality are summarized in Table 17 with the complete ANOVA result from the IBM® SPSS statistics software available in Appendix J.

Kurtosis and Skewness				
Descriptive Statistics	**Skewness**		**Kurtosis**	
	Statistic	**Std. Error**	**Statistic**	**Std. Error**
Innovativeness	.347	.240	-1.918	.476
EV Advantage	-.570	.240	.116	.476
EV Compatibility	-.430	.240	-.174	.476
EV Complexity	.432	.240	-.176	.476
OBS1: By using an electric vehicle, I show that I care about the environment.	.524	.240	.153	.476
OBS2: An electric vehicle stands out visibly.	-.780	.240	-.028	.476
EV Trialability	.126	.240	-.891	.476

Table 17: Kurtosis and Skewness (Source: IBM® SPSS and Researchers Data).

The results of the test for normality indicated that all the variables had a skewness and kurtosis statistic value below the absolute value of 2.0, therefore the assumption of normality for the data set is met.

5.7.2 Simple Linear and Multiple Regression

As discussed in section 4.9.1, the hypothesis for research Question 2 was analysed using IBM® SPSS statistics software where MR was applied, and Question 3 was analysed using SLR (Hair et al., 2019; Majumder & Maity, 2018b; Olvera Astivia & Zumbo, 2019). Three key assumptions for regression were selected to be tested within this study and should these assumptions not be met, the results of the test may be considered unreliable (Gogtay & Thatte, 2017; Olvera Astivia & Zumbo, 2019).

The results of the SLR and MR performed for the dependent variables Prosocial and SA Energy are discussed further in this chapter with the complete IBM® SPSS statistics software output available in Appendix K.

The first regression assumption tested was for normally distributed variables as valid assumptions can only be made from the regression if the residuals follow a normal distribution (Gogtay & Thatte, 2017; Hair et al., 2019). The Predicted Probability (P-P) plots for all the variables tested were analysed and the summary is presented in Table 18.

P-P Plot Test for Normally Distributed Variables	
Construct	**Normally Distributed**
Prosocial and Perceived Innovation Characteristics	YES
SA Energy and Perceived Innovation Characteristics	YES
SA Energy and Innovativeness	YES
Prosocial and Innovativeness	NO

Table 18: P-P Plots for Normally Distributed Variables.

The P-P plots for constructs Prosocial and Perceived Innovation Characteristics, SA Energy and Perceived Innovation Characteristics, and SA Energy and Innovativeness had residuals that are normally distributed as they display a reasonable correspondence to the diagonal normality line indicated in the plot (Alita et al., 2021; Hair et al., 2019). Should the data be not normally distributed the residuals do not follow the normality line (Alita et al., 2021; Hair et al., 2019). However, the P-P Plot for Prosocial and Innovativeness did not display a good correspondence to the diagonal line and therefore did not meet the assumption of normally distributed variables (Alita et al., 2021; Hair et al., 2019).

The second assumption tested was no multicollinearity through analysing the results of the VIF values as detailed on the Coefficients Tables, from the IBM® SPSS statistics software MR, and summarised below in Table 19 for the dependent variable Prosocial and Perceived Innovation Characteristics, and Table 20 for the dependent variable SA Energy and Perceived Innovation Characteristics (Alita et al., 2021; Hair et al., 2019)**.** The assumption for multicollinearity was not tested for SLR as there is only 1 independent variable the VIF values for both tests will equal 1 (Alita et al., 2021; Hair et al., 2019).

Coefficients		
Model	Collinearity Statistics	
	Tolerance	VIF
EV Advantage	.367	2.725
EV Compatibility	.650	1.539
EV Complexity	.955	1.047
OBS1: By using an electric vehicle, I show that I care about the environment.	.467	2.143
OBS2: An electric vehicle stands out visibly.	.906	1.103
EV Trialability	.917	1.090

a. Dependent Variable: Prosocial

Table 19: Collinearity Prosocial and PIC (Source: IBM® SPSS and Researchers Data).

Coefficients		
Model	Collinearity Statistics	
	Tolerance	VIF
EV Advantage	.367	2.725
EV Compatibility	.650	1.539
EV Complexity	.955	1.047
OBS1: By using an electric vehicle, I show that I care about the environment.	.467	2.143
OBS2: An electric vehicle stands out visibly.	.906	1.103
EV Trialability	.917	1.090

a. Dependent Variable: SA Energy

Table 20: Collinearity SA Energy and PIC (Source: IBM® SPSS and Researchers Data).

The variance inflation factor (VIF) is a statistical value applied to evaluate the degree of collinearity between the independent variables in a model and is the reciprocal of the tolerance value, therefore small VIF values will indicate a low correlation among variables (Hair et al., 2019). As detailed in Tables 19 and 20, all values for VIF are below 10, therefore indicating that there is no multicollinearity and that the assumption is met (Alita et al., 2021; Hair et al., 2019).

The third assumption tested was homoscedasticity, which refers to the assumption that the dependent variables will have the same levels of variance across the independent variables (Hair et al., 2019; Osborne & Waters, 2002). For the assumption of homoscedasticity to be met the residual points on the scatterplots, of the data set, should be equally distributed above and below the 0 line found on the X-axis of the plot, and to the left and right of the 0 line on the Y axis (Hair et al., 2019; Osborne & Waters, 2002). Should the residuals not be equally spread around the 0 line, displaying a relatively even distribution, it would be an indication of heteroscedasticity and the assumption of homoscedasticity is not met (Hair et al., 2019; Osborne & Waters, 2002).

The results of the scatterplots generated through the regression function in IBM® SPSS statistics software are summarised in Table 21 with the detailed plots available in Appendix K.

Scatterplot Summary – Test for Homoscedasticity	
Construct	**Normally Distributed**
Prosocial and Perceived Innovation Characteristics	YES
SA Energy and Perceived Innovation Characteristics	YES
SA Energy and Innovativeness	YES
Prosocial and Innovativeness	YES

Table 21: Scatterplot Test for Homoscedasticity (Source: IBM® SPSS and Researchers Data).

All four scatterplots indicate that the residual points are reasonably equally distributed above and below the 0 line on the X axis, and to the left and right of the 0 line on the Y axis, indicating that the assumption for homoscedasticity has been met (Hair et al., 2019; Osborne & Waters, 2002).

5.8 Statistical Results

5.8.1 ANOVA Results – Green Energy

As discussed in Chapter 4 section 4.9.1 the collected interval data was analysed using IBM® SPSS statistics software to determine if there is a significant statistical difference between the consumers who have access to green energy and those who do not (Breitsohl, 2019; Kim et al., 2019; Wagner, 2020). The data recorded to include the two distinct groups of respondents did not consist of an equal number of responses and therefore the ANOVA test was applied (Breitsohl, 2019; Delacre et al., 2020). This section offers a summary of the ANOVA results, as per Table 22, generated through IBM® SPSS statistics software with the detailed results available in Appendix J.

ANOVA						
		Sum of Squares	**df**	**Mean Square**	**F**	**Sig.**
Innovativeness	Between Groups	2.433	1	2.433	3.096	.082

EV Advantage	Between Groups	.306	1	.306	.352	.554
EV Compatibility	Between Groups	.508	1	.508	.590	.444
EV Complexity	Between Groups	3.040	1	3.040	3.942	.050
OBS1	Between Groups	.144	1	.144	.109	.742
OBS2	Between Groups	2.048	1	2.048	2.193	.142
EV Trialability	Between Groups	1.869	1	1.869	4.523	.036

Table 22: ANOVA Results Summary (Source: IBM® SPSS and Researchers Data).

The result of the ANOVA test indicated a statistically significant difference between the two groups for the Perceived Innovation Characteristics subconstruct EV Trialability, with no other statistically significant difference within the constructs. As detailed in Table 23, the group that does not have access to green energy had a higher mean value of 4.347.

Descriptives						
		N	Mean	Std. Deviation	Std. Error
EV Trialability	No Green Energy	59	4.347	.645	.084
	Green Energy at Home	42	4.071	.640	.099
	Total	101	4.233	.654	.065

Table 23: Descriptive Statistics EV Trialability (Source: IBM® SPSS and Researchers Data).

5.8.2 Research Question 1: Hypothesis 1

Question 1: What impact does the availability of green energy have on consumer technology adoption of electric vehicles in South Africa?

Null Hypothesis 1 (H_o1): There is a statistically significant difference in the consumer Perceived Innovation Characteristics of electric vehicles between consumers who have access to green energy and those who do not.

Alternative Hypothesis 1 ($H_{1}1$): There is no statistically significant difference in the consumer Perceived Innovation Characteristics of electric vehicles between consumers who have access to green energy and those who do not.

Results H1 : *($H_{o}1$) Null* hypothesis accepted for EV Trialability.
: *($H_{o}1$) Null* hypothesis rejected for all other constructs.

: *($H_{1}1$): Alternative* hypothesis rejected for EV Trialability.
: *($H_{1}1$): Alternative* hypothesis accepted for all other constructs.

Significant correlation at the .036 level (p-value <.05) for EV Trialability, with the means value of the group that does not have access to green energy the highest at 4.347.

Null Hypothesis 2 ($H_{o}2$): There is a statistically significant difference in the Consumer Innovativeness of consumers who have access to green energy and those who do not.

Alternative Hypothesis 2 ($H_{1}2$): There is no statistically significant difference in the Consumer Innovativeness of consumers who have access to green energy and those who do not.

Results H2 : *($H_{o}2$) Null* hypothesis rejected.
: *($H_{1}2$) Alternative* hypothesis accepted.

No significant correlation (p-value <.05) for Innovativeness.

5.8.3 Simple Linear Regression Results – Prosocial Behaviour

The interval data collected to investigate if there is a significant relationship between the various constructs researched within this study was analysed using IBM® SPSS statistics software applying SLR and MR, as discussed in Chapter 4 section 4.9.2 (Majumder & Maity, 2018a; Olvera Astivia & Zumbo, 2019). SLR was selected for the analysis where there was only one independent variable for Innovativeness, and MR was applied where multiple predictor variables and one response variable were applied within the higher-order construct of Perceived Innovation Characteristics (Majumder & Maity, 2018). The following section offers a summary of the regression results for the dependent variable Prosocial and SA Energy as generated via the IBM® SPSS statistics software. The detailed result of the regression is available in Appendix K.

5.8.3.1 Dependant Variable Prosocial and Independent Variable PIC

As detailed in the model summary of the MR test, Table 88 Appendix K, the Adjusted R2 value indicated that 23.2% of the dependent variable can be predicted by the 6 predictors applied with the test, while the model fit Sig., or p-value, was <.001 indicating that this is a good and usable model. See Table 24 for the summarised results.

MR Results Summary – Dependant Prosocial / Independent PIC					
Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	2.742	.319		8.600	<.001
EV Advantage	.194	.066	.379	2.965	.004
EV Compatibility	-.078	.054	-.140	-1.459	.147
EV Complexity	-.036	.047	-.060	-.759	.450
OBS1	.029	.048	.069	.608	.544
OBS2	.011	.044	.021	.254	.800
EV Trialability	.258	.064	.326	4.037	<.001

Table 24: MR Results Summary – Prosocial and PIC (Source: IBM® SPSS and Researchers Data).

5.8.3.2 Dependant Variable Prosocial and Independent Variable Innovativeness

The model summary of the SLR test for Prosocial and Innovativeness, Table 100 Appendix K, had an Adjusted R2 value indicating that 27% of the dependent variable can be predicted by the independent variable. Further, the result had a model fit Sig., or p-value, of .56 indicating that this is not a good and usable model as a Sig., or p-value, of < .05 would indicate a good model. See Table 25 for the summarised results.

MR Results Summary – Dependant Prosocial / Independent Innovativeness					
Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	3.995	.178		22.399	<.001
Innovativeness	.090	.047	.165	1.927	.056

Table 25: MR Results Summary – Prosocial and Innovativeness (Source: IBM® SPSS and Researchers Data).

5.8.4 Research Question 2 and Hypothesis 3 and 4

Question 2: What impact does consumer prosocial behaviour have on the technology adoption of electric vehicles in South Africa?

Null Hypothesis 3 ($H_{0}3$): There is a significant relationship between consumer prosocial behaviour and the consumer Perceived Innovation Characteristics of electric vehicles.

Alternative Hypothesis 3 ($H_{1}3$): There is no significant relationship between consumer prosocial behaviour and the consumer Perceived Innovation Characteristics of electric vehicles.

Results H3 : *($H_{0}3$) Null* hypothesis accepted for EV Advantage and EV Trialability.
: *($H_{0}3$) Null* hypothesis rejected for all other constructs.

: *($H_{1}3$): Alternative* hypothesis rejected for EV Advantage and EV Trialability.
: *($H_{1}3$): Alternative* hypothesis accepted for all other constructs.

Significantly positive relationship, at the <.004 level (p-value <.05), between Prosocial Behaviour and EV Advantage.
Significantly positive relationship, at the <.001 level (p-value <.05), between Prosocial Behaviour and EV Trialability.

Null Hypothesis 4 ($H_{0}4$): There is a significant relationship between consumer prosocial behaviour and CI.

Alternative Hypothesis 4 ($H_{1}4$): There is no significant relationship between consumer prosocial behaviour and CI.

Results H4 : *(H_04) Null* hypothesis rejected.

: *(H_14) Alternative* hypothesis accepted.

No significant correlation (p-value <.05) for Innovativeness.

5.8.5 Multiple Regression Results – SA Energy

The interval data collected to investigate if there is a significant relationship between the dependant variable SA Energy and the various predictor variables was again analysed using IBM® SPSS statistics software (Majumder & Maity, 2018a; Olvera Astivia & Zumbo, 2019). SLR and MR were again selected for the analysis as there were single and multiple predictor variables (Majumder & Maity, 2018). The following section offers a summary of the regression results for the dependent variable SA Energy with the detailed results available in Appendix K.

5.8.5.1 Dependant Variable SA Energy and Independent Variable PIC

As per the model summary of the MR test, Table 94 Appendix K, the Adjusted R2 value indicated that 29.7% of the dependent variable can be predicted by the 6 predictors applied with the test, and the model fit Sig., or p-value, was <.001 indicating that this is a good and usable model. See the summary available in Table 26.

MR Results Summary – Dependant SA Energy / Independent PIC					
Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	1.060	.606		1.749	.083
EV Advantage	.393	.125	.386	3.154	.002
EV Compatibility	.039	.102	.035	.383	.702
EV Complexity	-.026	.090	-.022	-.292	.770
OBS1	.124	.091	.148	1.360	.176
OBS2	.058	.083	.055	.701	.484
EV Trialability	.219	.122	.139	1.802	.074

Table 26: MR Results Summary – Prosocial (Source: IBM® SPSS and Researchers Data).

5.8.5.2 Dependant Variable SA Energy and Independent Variable Innovativeness

The model summary of the SLR test for SA Energy and Innovativeness, Table 106 Appendix K, had an Adjusted R2 value indicating that 36% of the dependent variable can be predicted by the independent variable. The result had a model fit Sig., or p-value, of .27, indicating that this is a good and usable model as the Sig., or p-value, is <.05. Table 27 summarised the results of the SLR.

MR Results Summary – Dependant SA Energy / Independent Innovativeness					
Model	**Unstandardized Coefficients**		**Standardized Coefficients**	**t**	**Sig.**
	B	**Std. Error**	**Beta**		
(Constant)	3.118	.353		8.835	<.001
Innovativeness	.207	.093	.190	2.229	.027

Table 27: MR Results Summary – SA Energy and Innovativeness (Source: IBM® SPSS and Researchers Data).

5.8.6 Research Question 3 and Hypothesis 5 and 6

Question 3: What impact does the current electricity crisis in South Africa have on consumer technology adoption of electric vehicles?

Null Hypothesis 5 (H_o5): There is a significant relationship between the electricity crisis in South Africa and the consumer Perceived Innovation Characteristics of electric vehicles.

Alternative Hypothesis 5 (H_15): There is no significant relationship between the electricity crisis in South Africa and the consumer Perceived Innovation Characteristics of electric vehicles.

Results H5 : *(H_o5) Null* hypothesis accepted for EV Advantage.
: *(H_o5) Null* hypothesis rejected for all other constructs.

: *(H_15): Alternative* hypothesis rejected for EV Advantage.
: *(H_15): Alternative* hypothesis accepted for all other constructs.

Significantly positive relationship, at the <.002 level (p-value <.05), between SA Energy and EV Advantage.

Null Hypothesis 6 (H_o6): There is a significant relationship between the electricity crisis in South Africa and CI.

Alternative Hypothesis 6 (H_16): There is no significant relationship between the electricity crisis in South Africa and CI.

Results H6 : *(H_o6) Null* hypothesis accepted.

: *(H_16) Alternative* hypothesis rejected.

Significantly positive relationship, at the .027 level (p-value <.05), between SA Energy and Innovativeness.

5.9 Conclusion

This chapter detailed the results compiled using the IBM® SPSS statistical software and data collected from the survey instrument hosted on the Google Forms platform. The chapter detailed the preparation and testing of the collected data and summarised analysis applied leading to the answer to the research questions and hypothesis.

The demographic data, as a view into the respondents, has been summarised and the required re-coding and data preparation processes followed were described. The various constructs under examination through this study were detailed and descriptive statistics were presented offering a higher understanding of the dataset. This chapter also included the assessment of construct validity, instrument reliability, dimension reduction, and the required testing of the data requirements for the assumption of normality. The dataset was analysed for a variance through ANOVA, and linear regression models were applied to determine significant relationship between various variables. Underpinned by a robust and methodical approach this chapter offered the result of the research analytical journey leading to each perspective of hypothesis.

CHAPTER 6: Discussion of Results

6.1 Introduction

This chapter is dedicated to discussing the results of the study within the setting of the literature review and the research questions. It will analyse the results of the six hypotheses and the factors that impact the consumer technology adoption of EVs within the unique South African context. The quantitative research was conducted through a questionnaire, comprising 30 structured questions, digitally distributed via social media platforms and networks to gather data from 135 total respondents over a period of four weeks.

As described in Chapter 1, this research aimed to investigate the impact of green energy, pro-social behaviour, and the current electricity crisis in South Africa on the Perceived Innovation Characteristics of EVs and the Consumer Innovativeness of consumers in South Africa, through the lens of the DOI as the base theory (Caprara et al., 2005; Rogers, 2003). The DOI theory considers five stages within the innovation-decision process that include the initial knowledge that consumers have about an innovation, the persuasion required to form an approving attitude towards the innovation, the decision by the consumer to adopt the innovation, the actual implementation of the innovation, and lastly the continuous use of the innovation (Jung Moon, 2020; Rogers, 2003; Sahin, 2006).

The constructs considered at the persuasion stage of the innovation-decision process were investigated within each hypothesis and are defined as the Perceived Innovation Characteristics of the innovation (Jung Moon, 2020; Rogers, 2003; Sahin, 2006). The Perceived Innovation Characteristics of the innovation focus on five primary constructs, relative advantage (RA), compatibility (COMPAT), complexity (COMPLEX), trialability (TRIA), and observability (OBS) (Jung Moon, 2020; Rogers, 2003; Taherdoost, 2018). RA measures the extent to which an innovation is perceived as superior to the product, process, or idea it supersedes, while COMPAT evaluates the alignment of the innovation with the values, experiences, and needs of consumers (Jung Moon, 2020; Rogers, 2003; Sahin, 2006). COMPLEX assesses the perceived difficulty consumers might have in understanding and using the innovation, and TRIA considers the feasibility of experimenting with the innovation on a limited scale before a consumer fully commits to the innovation (Jung Moon, 2020; Rogers, 2003; Sahin, 2006). The last construct, OBS, measures the degree to which the results or usage of the innovation are visible to others within society (Jung Moon, 2020; Rogers, 2003; Sahin, 2006). These constructs are investigated within each research question and are integral to developing a better understanding of how potential adopters perceive innovations and ultimately how these constructs influence their adoption decisions (Jung Moon, 2020; Mohammadi et al., 2018; Sahin, 2006).

The DOI theory further classifies the adopter, or consumer, within five adoption steps according to their characteristics (Rogers, 2003). These include innovators, early adopters, early majority, late majority, and laggards (Rogers, 2003). The DOI theory defines each adopter category as a classification of adopters or consumers based on their innovativeness (Rogers, 2003). Each step is considered based on innovativeness as a measure of how certain members of society adopt new ideas early or change their habits sooner than others (Mohammadi et al., 2018; Rogers, 2003; Sahin, 2006).

Another construct of the DOI theory that is investigated through the hypothesis is Consumer Innovativeness which refers to the characteristics of the consumer, describing their preference to adopt new products, processes, or ideas (Jung Moon, 2020). Consumer Innovativeness plays an important role in the adoption of innovations as it influences the rate and extent to which new products and ideas are accepted by consumers (Li et al., 2021). As the Perceived Innovation Characteristics are concerned with the perceptions of consumers towards innovations, Consumer Innovativeness is concentrated on the characteristics of the consumer (Jung Moon, 2020).

The discussion of the results will start with the demographic data from the respondents and will further be guided by the three research questions as each addresses a unique factor and its impact on the technology adoption of EVs within South Africa.

6.2 Research Model

The research model presented in Figure 17 indicates the results of all the *null hypothesis* that was accepted for the research questions (Leicht et al., 2018; Taherdoost, 2018).

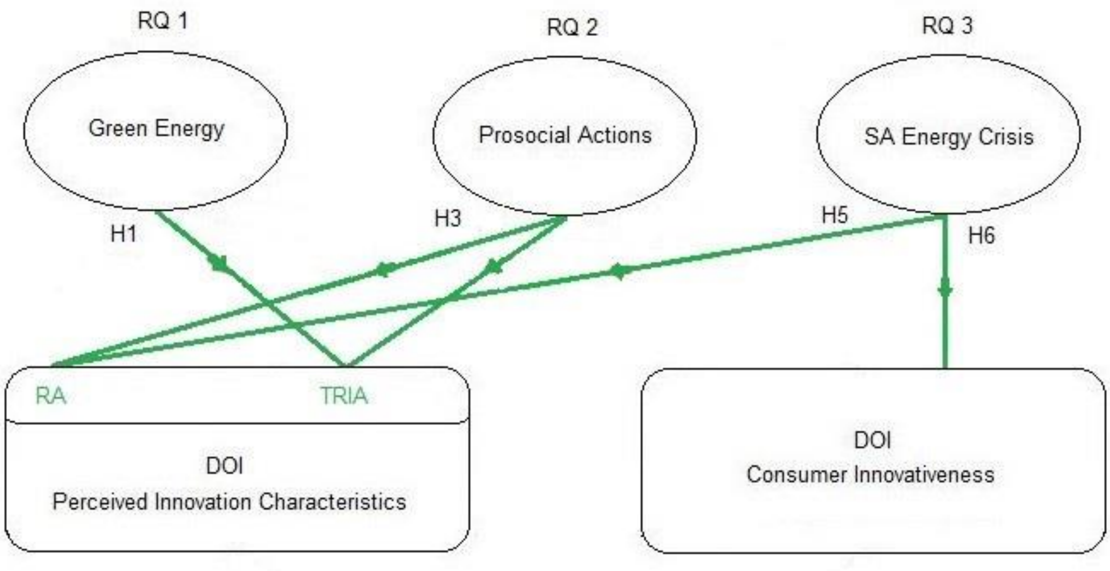

Figure 17: Research Model

6.3 Demographic Results

Section 1 of the research questionnaire consisted of 8 structured questions and was included to gather demographic data from the respondents to develop a better understanding of the population that participated in the survey.

The highest percentage of respondents fall within the age group of 45–54, consisting of 32.6% of the sample, followed closely by the age group 35–44 at 31.9%. This result differs from previous studies by Moeletsi (2021), Hamilton and Terblanche-Smit (2018), and Zhu (2016) who all reported the most responses from the age group 25 – 34. The age group of 25 – 34 from the survey was only the third highest age group with 21.5%. The three largest groups as detailed above represented a combined 86% of the total sample over the age group of 25 to 54.

The gender demographic of the respondents was 60% male and 40% female. This differs significantly from the study by Hamilton and Terblanche-Smit (2018) which reported 95.41% male responses as an overrepresentation within the data set. This gender bias in the data set resulted in an excessive limitation on the diversity of responses received (Hamilton & Terblanche-Smit, 2018). The gender of responses as collected from the survey also differs from the studies by Moeletsi (2021), which reported 50.45% male and 49.55% female responses, and Jung Moon (2020) who used an equal split of 50% each response between male and female.

The province of Gauteng had the highest number of responses at 81.5%, with the balance divided between KwaZulu-Natal (5.9%), Northwest (4.4%), Mpumalanga (3.7%), the Western Cape (3.7%), and Limpopo (0.7%). No responses were received from the Eastern Cape, Free State, and Northern Cape. The geographical distribution, therefore, follows a large bias towards the province of Gauteng which represents the economic and urban centre of South Africa (Hamilton & Terblanche-Smit, 2018; Statistics South Africa, 2022). Similarly, the study from Hamilton and Terblanche-Smit (2018) also considered all the provinces of South Africa, even though no geographical distribution was reported within the study, while the study by Moeletsi (2021) only considered the province of Gauteng as the target population. The geographical result is representative of the population of South Africa with the province of Gauteng having the largest population estimated at 16.1 million, a total of 26% of the total population of the country (Statistics South Africa, 2022). As discussed in Chapter 4, Gauteng, the Western Cape, and Kwazulu-Natal are the provinces that include households that purchase the most vehicles due to the availability of higher disposable income (Pillay et al., 2019).

Most of the respondents indicated that they own petrol or diesel vehicles with 63% and 33.3% respectively. Only 3.7% of the respondents owned an alternative fuel vehicle including 4 EVs and 1 hybrid vehicle. The results further confirm the slow uptake of EVs in South Africa and the identified need to accelerate the adoption towards reducing the GHG emissions from the transportation sector (Moeletsi & Tongwane, 2020; Naamsa, 2022; South African Department of Transport, n.d.). These results are also consistent with the study by Moeletsi (2021) that reported no alternative fuel owners were included in any of the responses to the survey as 81.7% owned petrol and 18.3% owned diesel vehicles.

Summarising the results of the total daily commute of all the responses revealed that 79.3% of all the respondents travel less than 100km daily. This is in alignment with the study by Moeletsi (2021) which revealed that 89.3% of respondents in Gauteng travel less than 99km per day. Understanding the daily commute distances of the respondents is crucial for assessing the practicality of EV adoption, as one of the major identified barriers to the large-scale adoption of EVs is the limited travel range with a single charge (Adhikari et al., 2020; Hamilton & Terblanche-Smit, 2018; König et al., 2021). Consumers who do not travel long distances for their daily commute are more likely to show interest and adopt EV technology (Adhikari et al., 2020). The daily travel patterns can inform and guide strategies and policies to promote EV adoption through improving charging infrastructure (He et al., 2021; König et al., 2021; Weiss & Helmers, 2019).

Understanding whether the respondents live in suburban or rural areas is an important consideration for the development of charging infrastructure to promote the adoption of EVs (Hamilton & Terblanche-Smit, 2018; He et al., 2021). Most respondents to the survey, 97%, reside in suburban areas and can be considered as the biggest potential target population for the large-scale adoption of EVs (Hamilton & Terblanche-Smit, 2018; Jung Moon, 2020). As the lack of EV charging infrastructure is a major barrier to the consumer's adoption of EVs, the development of the required infrastructure to promote EV adoption should be focused on areas with the highest potential for large-scale adoption (Jung Moon, 2020; Pardo-Ferreira et al., 2020; Weiss & Helmers, 2019). The possible reduction in noise pollution, as a result of the large-scale adoption of EVs, is more relevant within suburban areas (Pardo-Ferreira et al., 2020).

The property ownership status data from the survey revealed that 76.3% of the respondents own property, which can influence decisions regarding green energy as the rooftop solar installations are a permanent fixture to the property (Baker & Phillips, 2019; Zhu, 2016). Consumers who rent property (16.3%), and those living with family or friends (7.4%) may face different barriers to the adoption of green technologies and EVs, including the ability to install EV charging stations (Sefora et al., 2019; Weiss & Helmers, 2019; Xia et al., 2022).

The last demographic consideration from the questionnaire was set to ascertain the respondent's access to green energy as a construct to test if there is a statistically significant relationship between the perceptions and attitudes of consumers with access to green energy at home when compared to those who do not. The results of the statistical tests are discussed in detail in section 6.4 of this Chapter. The data collected from the survey indicated that 43.7% reported no access to green energy, with only 31.1% indicating that they have a rooftop solar installation at home.

The demographic insights revealed a diverse background of the respondents and provided a good context for understanding the sample population that completed the survey. The following sections shed more slight survey results considering the various factors that might influence consumer behaviour towards green energy and EV adoption within South Africa.

6.4 Green Energy and Electric Vehicle Adoption

The state-owned electricity utility in South Africa, Eskom Holdings SOC Ltd, plays a critical role in the electricity generation and distribution sector of the country (Hanto et al., 2022). In recent years, however, the utility has faced various electricity generation challenges that have seriously impacted the availability of electricity in the country (Laher et al., 2019). These challenges have also delayed the development of new energy infrastructure, especially developments towards renewable energy sources (Hanto et al., 2022; Schlösser et al., 2019).

This shortage of electricity has driven the introduction of new energy generation technologies into South Africa with the continued increase of private green energy generation, notably from rooftop solar installations (Baker & Phillips, 2019). Solar electricity has rapidly gained popularity and is enabling consumers to generate their green energy at home, reshaping the energy landscape in South Africa (Baker & Phillips, 2019). These developments are central to the context of the first research question.

6.4.1 Research Question 1

Question 1: What impact does the availability of green energy have on consumer technology adoption of electric vehicles in South Africa?

The first research question considered if the ability to generate private green energy would significantly influence the consumer behaviour and adoption of EVs through the factors of the DOI theory that include the Perceived Innovation Characteristics of EVs and the Consumer Innovativeness of consumers within the South African market (Rogers, 2003; Sahin, 2006). The dataset was tested between two groups, the first group with a rooftop solar installation at home, and the second group with no access to green energy.

6.4.2 Hypothesis H1 – PIC Constructs

The first hypothesis, H1, considered the availability of Green Energy and its impact on the Perceived Innovation Characteristics constructs of EVs.

Null Hypothesis 1 (Ho1): There is a statistically significant difference in the consumer Perceived Innovation Characteristics of electric vehicles between consumers who have access to green energy and those who do not.

Alternative Hypothesis 1 (H11): There is no statistically significant difference in the consumer Perceived Innovation Characteristics of electric vehicles between consumers who have access to green energy and those who do not.

The results from the ANOVA test indicated that the null hypothesis (Ho1) was accepted for the Perceived Innovation Characteristics construct EV Trialability and rejected for all other constructs tested. The results indicated that there is a statistically significant difference in the Perceived Innovation Characteristics construct of EV Trialability between the groups, with the mean value of the group that does not have access to green energy being the highest. Trialability within the DOI theory considers the ability to experiment with the innovation, on a limited basis before making a full commitment (Jung Moon, 2020; Rogers, 2003; Sahin, 2006). Dearing and Cox (2018) define trialability as the extent to which a decision to adopt an innovation can be reversed or managed in stages.

The questionnaire contained two questions for Trialability as below:
Question 24 (TRIA1): Prior to buying an electric vehicle, it would be important to test-drive it.
Question 25 (TRIA2): Prior to buying an electric vehicle, I would like to borrow it for a day or two.

The higher mean value for trialability, amongst the Perceived Innovation Characteristics, for the group that does not have access to green energy indicates that the respondents consider the possibility of test-driving an EV as an important factor within the DOI decision process (Jung Moon, 2020; Rogers, 2003). In comparison, the study by Jung Moon (2020) found that the Perceived Innovation Characteristics construct Trialability does not significantly affect the attitude of the respondents, but as Trialability has the highest mean of the five Perceived Innovation Characteristics it implied that the respondents do consider test-driving EVs as important. The DOI adopter groups associated with high levels of trialability are the Early Majority and Late Majority adopter groups (Jung Moon, 2020; Rogers, 2003; Sahin, 2006). These adopter groups are considered more risk-averse and require reassurance that the innovation is reliable, favourable, and relatively easy to adopt with limited disadvantages before they would consider adoption (Jung Moon, 2020; Rogers, 2003). The Early Majority and Late Majority adopter groups would often rely on the experiences and recommendations of the earlier adopter groups, like Early Adopters and Innovators before considering adoption themselves (Rogers, 2003; Sahin, 2006). The Innovators and Early Adopter groups are more open to experimenting, taking more risks, and adopting new ideas easier, therefore Trialability is less important to them (Rogers, 2003; Sahin, 2006). Innovators and Early Adopters could be more motivated towards adoption through the Perceived Innovation Characteristics constructs of Relative Advantage or Observability, as Trialability may make the innovation more attractive, but it is not considered a driver towards their adoption decisions (Rogers, 2003; Sahin, 2006).

Trialability is positively correlated to the rate of adoption as innovative products with high trialability are adopted into the market quickly (Jung Moon, 2020; Rogers, 2003; Sahin, 2006).

6.4.3 Hypothesis H2 – IC Construct

The second hypothesis, H2, considered the availability of Green Energy and whether there is a difference in Consumer Innovativeness between the two groups.

Null Hypothesis 2 (Ho2): There is a statistically significant difference in the Consumer Innovativeness of consumers who have access to green energy and those who do not.

Alternative Hypothesis 2 (H12): There is no statistically significant difference in the Consumer Innovativeness of consumers who have access to green energy and those who do not.

The result from the ANOVA test indicated that the null hypothesis (Ho2) was rejected for the construct of Consumer Innovativeness and the alternate hypothesis *(H12) was* accepted. The results therefore indicated that there is no statistically significant difference between the Consumer Innovativeness of the two consumer groups. As defined by Rogers (2003), Consumer Innovativeness is the extent to which a consumer will adopt new products, processes, or ideas earlier than their peers within a social system. Within the DOI theory, Consumer Innovativeness is considered a force that drives innovative consumer behaviour (Roehrich, 2004).

The questionnaire collected the data relating to the Consumer Innovativeness through the three questions below:
Question 10 (INN1): If I hear about a new technology, I will look for ways to experiment with it.
Question 11 (INN2): Among my peers, I am usually the first to explore new technologies.
Question 12 (INN3): I like to experiment with new technologies.

The responses to Question 10 (INN1) revealed that 33.3% of the responses received were from individuals who Strongly Agree, and 37.8% from individuals who Agree that they will look for ways to experiment with new technologies. Similarly, the responses to Question 11 (INN3) indicated that 24.4% of the respondents answered that they Strongly Agree, and 45.9% indicated that they Agree that they like to experiment with new technologies. The results indicated that the majority, 71.1% and 70.3% of the responses were received from individual who display high levels of Consumer Innovativeness. As individuals with higher Consumer Innovativeness are expected to adopt innovations quicker and have more experience with new innovative products, they are also expected to support their perceptions and attitudes towards innovation through their adoption of these products or services (Jung Moon, 2020). The result from the Descriptive test between the two groups, Table 23, did indicate a higher mean for the group that has a rooftop solar installation at home, but the result of the ANOVA test indicates that Consumer Innovativeness is not the driver for their adoption of renewable energy (Jung Moon, 2020; Roehrich, 2004). This result was also confirmed in the study by Nathaniel et al. (2019), which concluded that the recent attention and uptake of renewable energy in South Africa can be attributed to the energy crisis in the country and is not correlated to the innovativeness of individuals.

6.5 Prosocial Behaviour and Electric Vehicle Adoption

EV adoption differs from many other innovations as the adoption is not only driven by personal interests but also considers prosocial behaviour due to the potential benefits EVs offer the environment and society (Silvia & Krause, 2016). Understanding the primary motivations of prosocial actions is therefore important in considering how it affects the adoption of EVs (Silvia & Krause, 2016).

The research conducted by Asadi et al. (2019) and Cai et al. (2019) both concluded that consumer intentions to adopt environmentally friendly innovations, like EVs, are influenced by a combination of self-interest and prosocial motivations. Some consumers will adopt eco-friendly innovations and actions because of their interests and influences from being aware of environmental concerns (Asadi et al., 2019; Cai et al., 2019). These consumer personal interests show a positive correlation with prosocial behaviour and intentions to adopt EVs (Ashraf et al., 2021).

The research by Asadi et al. (2021) revealed that the adoption of EVs has a positive relationship with prosocial and environmental behaviours. As consumers become more aware and responsible for the negative impacts of their actions, they are more inclined to adopt prosocial behaviours that positively contribute to societal well-being and the preservation of natural resources (Asadi et al., 2021; Silvia & Krause, 2016). These considerations of prosocial behaviour, the benefits to society, and environmental awareness are critical elements of the second research question.

6.5.1 Research Question 2

Question 2: What impact does consumer prosocial behaviour have on the technology adoption of electric vehicles in South Africa?

The second research question set out to investigate the role consumer Prosocial Behaviour plays within the technology adoption of EVs. The question examined the relationship between consumer Prosocial Actions and the Perceived Innovation Characteristics of EVs, as well as the Consumer Innovativeness of the consumers (Rogers, 2003; Sahin, 2006).

Prosocial Behaviour was measured in the questionnaire through the following three questions:
Question 26 (PS1): I am pleased to help my friends/colleagues in their activities.
Question 27 (PS2): I try to help others.
Question 28 (PS3): I am willing to make my knowledge and abilities available to others.

6.5.2 Hypothesis H3 – PIC Constructs

The first hypothesis of Question 2, H3, considered consumer Prosocial Behaviour and the Perceived Innovation Characteristics constructs of the innovation.

Null Hypothesis 3 (Ho3): There is a significant relationship between consumer prosocial behaviour and the consumer Perceived Innovation Characteristics of electric vehicles.
Alternative Hypothesis 3 (H13): There is no significant relationship between consumer prosocial behaviour and the consumer Perceived Innovation Characteristics of electric vehicles.

The results from the regression analysis revealed that the null hypothesis (*Ho3)* was accepted for the Perceived Innovation Characteristics constructs EV Advantage and EV Trialability, while the null hypothesis was rejected for all other constructs. The result indicated that there is a statistically significant positive relationship between Prosocial Behaviour and the Perceived Innovation Characteristics constructs of EV Advantage and EV Trialability. Rogers (2003) defined Relative Advantage as a measure of how much an innovation is perceived by the consumer as being better than the product or service it is replacing. Elements of Relative Advantage includes the cost and social status as motivational consideration of the innovation (Rogers, 2003; Sahin, 2006). Similar to the availability of Green Energy investigated through hypothesis H1, Trialability defines the ability to experiment with the innovation before making a full commitment to adopt (Jung Moon, 2020; Rogers, 2003; Sahin, 2006).

The constructs of Relative Advantage and Trialability were measured in the questionnaire through the following questions:
Question 14 (RA1): The use of an electric vehicle would decrease my fossil fuels and CO2 emissions.
Question 15 (RA2): Buying an electric vehicle would be financially advantageous for me.
Question 16 (RA3): An electric vehicle replaces a vastly inferior alternative.
Question 24 (TRIA1): Prior to buying an electric vehicle, it would be important to test-drive it.
Question 25 (TRIA2): Prior to buying an electric vehicle, I would like to borrow it for a day or two.

The positive relationship between Prosocial Behaviour and the Relative Advantage of innovations, confirmed within this study, was also observed in the studies by Ashraf et al. (2021) and Jansson et al. (2017) where respondents with higher Prosocial Behaviour and norms are considered as more likely to adopt innovations based on their perceptions. These perceptions will also drive Prosocial Behaviour that will consider social considerations like intrinsic, extrinsic, and image motivation (Jansson et al., 2017; Silvia & Krause, 2016). The

DOI theory details that while the adopter groups of Innovators, Early Adopters, and Early Majority are all more motivated by status when considering the adoption of innovations, the Late Majority and Laggards perceive status as less important (Rogers, 2003; Sahin, 2006).

The Prosocial behaviours of consumers display a positive relationship to the Relative Advantage as the degree of the additional value of the innovation is determined by the consumer's perception of the relative economic, social, environmental, and technical advantages gained from the adoption of the innovation (Rogers, 2003; Sahin, 2006). The questions relating to the Relative Advantage of EVs within the survey considered the environmental, financial, and technological advantages and resulted in a positive relationship, similar to the study by Jung Moon (2020). Essential Relative Advantage factors considered within the DOI theory include the cost of the innovation, and the motivation for improved social status (Jung Moon, 2020). The adopter groups that include Innovators, Early Adopters, and Early Majority are more likely to be motivated by Prosocial factors (Jung Moon, 2020). The DOI theory categorises innovations into two groups, defined as preventive and non-preventive innovations (Rogers, 2003; Sahin, 2006). It further defines a preventive innovation as a new product or service that a consumer adopts now, motivated by the possibility of lowering some unwanted future event (Mohammadi et al., 2018; Rogers, 2003; Sahin, 2006). The positive relationship measured within this study, and the study by Jung Moon (2020), confirms that Prosocial Behaviour serves as a motivator for the adoption of preventative innovations considered environmentally friendly and advantageous towards consumer self-interest (Asadi et al., 2019; Cai et al., 2019; Jung Moon, 2020). It is also common for preventive innovations to have a slow adoption rate, as experienced with the low sales of EVs in South Africa, as the Relative Advantage of preventative innovations includes some level of uncertainty in contrast to non-preventive innovations that offer benefits within a shorter period (Mohammadi et al., 2018; Rogers, 2003).

The positive relationship measured between Prosocial Behaviour and EV Trialability again highlights that the respondents place a high value on the ability to test-drive an EV, within the stage of creating their perception of the innovation (Jung Moon, 2020; Rogers, 2003). The adopter groups of Innovators and Early Adopters are considered to be more motivated towards adoption through the Perceived Innovation Characteristics constructs of Relative Advantage or Observability, but the positive relationship between Prosocial Behaviour, Relative Advantage, and Trialability measured within this study suggests that more adopter groups would require test driving EVs before considering adoption (Cai et al., 2019; Mohammadi et al., 2018; Rogers, 2003; Sahin, 2006).

6.5.3 Hypothesis H4 – CI Construct

The second hypothesis of Question 2, H4, considered Prosocial Behaviour and the Consumer Innovativeness construct.

Null Hypothesis 4 (Ho4): There is a significant relationship between consumer prosocial behaviour and Consumer Innovativeness.

Alternative Hypothesis 4 (H14): There is no significant relationship between consumer prosocial behaviour and Consumer Innovativeness.

The result from the regression analysis indicated that the null hypothesis (Ho4) was rejected for the construct of Consumer Innovativeness and the alternate hypothesis *(H14) was* accepted. The results therefore indicated that there is no statistically significant relationship between Prosocial Behaviour and CI.

The questionnaire collected the data relating to the Consumer Innovativeness through the three questions:
Question 10 (INN1): If I hear about a new technology, I will look for ways to experiment with it.
Question 11 (INN2): Among my peers, I am usually the first to explore new technologies.
Question 12 (INN3): I like to experiment with new technologies.

The results from H3 indicated that Prosocial Behaviour had a significant positive relationship with the two Perceived Innovation Characteristics constructs of EV Advantage and EV Trialability. The results from the survey questions relating to Consumer Innovativeness also indicated that the responses were received from individual that responded indicating high levels of Consumer Innovativeness. Considering that no statistically significant relationship was measured between Prosocial Behaviour and Consumer Innovativeness, this indicates that Prosocial Behaviours are related to the Relative Advantage and Trialability, defined as the consumer's perceptions of the economic, social, environmental, technical advantages, and ease of testing does not include Consumer Innovativeness social factors such as novelty seeking, need for uniqueness, or independence towards the experience of others (Li et al., 2021; Roehrich, 2004; Rogers, 2003; Sahin, 2006).

This result contrasts with the findings by Persaud and Schillo (2017) who found that social identity and social influence through the consumer network have a significant positive relationship to the perceived advantage of environmentally friendly products and practices where Consumer Innovativeness moderates this relationship. Persaud and Schillo (2017) further concluded that Consumer Innovativeness can generally be considered a predictor of adoption behaviour.

6.6 South African Energy Crisis and Electric Vehicle Adoption

Eskom, the state-owned energy utility in South Africa, is currently in an operational and financial crisis that requires ongoing government financial bailouts while it struggles to address the abnormal costs of maintaining aging infrastructure and long overdue delivery of new coal plants (Hanto et al., 2022). Large-scale corruption and financial mismanagement have driven Eskom to high levels of debt and incapable of meeting the country's daily electricity demand (Hanto et al., 2022). The most notable consequence of the crisis within Eskom has been how the lack of power generation has led to the implementation of electricity load shedding in October 2007 (Hanto et al., 2022). Load shedding is a strategy employed by Eskom to limit the electricity supply deliberately in an attempt to prevent a complete breakdown of the electricity power system (Hanto et al., 2022; Laher et al., 2019). Frequent power outages and load shedding significantly disrupt the availability of electricity for businesses and households (Hanto et al., 2022).

This unreliable electricity supply has a negative impact on the economy of the country as frequent power outages disrupt manufacturing and other economic activities (Laher et al., 2019; Schlösser et al., 2019). Another noticeable consequence of the energy crisis in South Africa can be seen in the substantial increase in the cost of electricity where, between 2003 and 2017, the electricity price escalated by as much as 300% (Schlösser et al., 2019).

All these factors contribute to mounting public concern regarding Eskom's ability to resolve the energy crisis and deliver a dependable electricity supply in the future (Schlösser et al., 2019).

6.6.1 Research Question 3

Question 3: What impact does the current electricity crisis in South Africa have on consumer technology adoption of electric vehicles?

The last question considers the relationship between the current electricity crisis in South Africa and the consumer technology adoption of EVs. The two hypothesis explores the relationship between the energy crisis and the Perceived Innovation Characteristics of EVs, as well as Consumer Innovativeness (Rogers, 2003; Sahin, 2006).

The response's perceptions of the construct SA Energy were measured in the questionnaire through the following two questions:

Question 29 (SA1): I would consider buying an electric vehicle if there are government financial incentives like cash subsidies or tax rebates.

Question 30 (SA2): I would consider buying an electric vehicle if Eskom could provide reliable and stable electricity.

6.6.2 Hypothesis H5 – PIC Constructs

Hypothesis H5, as below, was applied to investigate the relationship between the construct of SA Energy and the Perceived Innovation Characteristics constructs of EVs.

Null Hypothesis 5 (Ho5): There is a significant relationship between the electricity crisis in South Africa and the consumer Perceived Innovation Characteristics of electric vehicles.

Alternative Hypothesis 5 (H_15): There is no significant relationship between the electricity crisis in South Africa and the consumer Perceived Innovation Characteristics of electric vehicles.

The results from the regression analysis revealed that the null hypothesis (*Ho5)* was accepted for the construct EV Advantage and rejected for all other constructs. The result indicated that there is a statistically significant positive relationship between the construct SA Energy and the Perceived Innovation Characteristics construct EV Advantage. As discussed in section 6.5, Relative Advantage is a measure of how much an innovation is perceived by the consumer as being better than the product or service it is replacing (Rogers, 2003).

The constructs of Relative Advantage were measured in the questionnaire through the following questions:

Question 14 (RA1): The use of an electric vehicle would decrease my fossil fuels and CO2 emissions.
Question 15 (RA2): Buying an electric vehicle would be financially advantageous for me.
Question 16 (RA3): An electric vehicle replaces a vastly inferior alternative.

The positive relationship between SA Energy and the Relative Advantage of EVs indicates, like the results for Prosocial Behaviour, that consumers have the perception that the EV is an innovation that offers financial and technical advantages over ICE vehicles (Rogers, 2003; Sahin, 2006; Xia et al., 2022). Relative Advantage is an essential factor in the DOI theory and considers that the cost of the innovation is related to the rate of adoption (Jung Moon, 2020; Rogers, 2003; Sahin, 2006). The adopter groups consisting of Innovators and Early Adopters are more motivated towards adoption through the Perceived Innovation Characteristics construct of Relative Advantage (Jung Moon, 2020; Rogers, 2003). When compared to the results for Prosocial Behaviours discussed in the previous section, the positive relationship to the Relative Advantage for SA Energy can be deducted as the degree of additional value the consumer places on the financial and technology gains through adoption, where the Prosocial

Behaviour also considered the environmental and social advantages (Jung Moon, 2020; Rogers, 2003; Sahin, 2006).

The results of the test for the relationship between SA Energy and EV Relative Advantage also correlate to the SA Energy questions in the survey as detailed in Figures 18 and 19 below (Hanto et al., 2022; Rogers, 2003; Sahin, 2006).

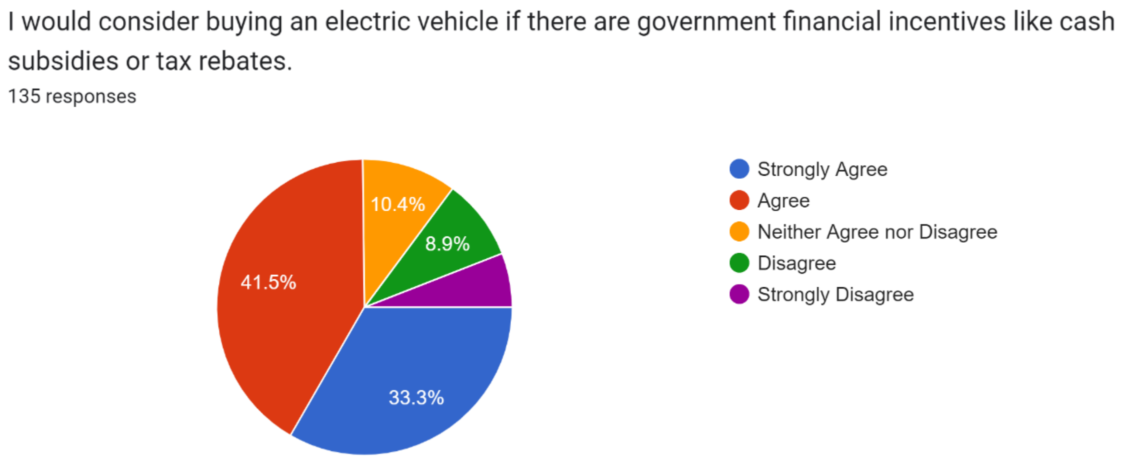

Figure 18: Government Incentives (Source: Google Forms from Research Questionnaire).

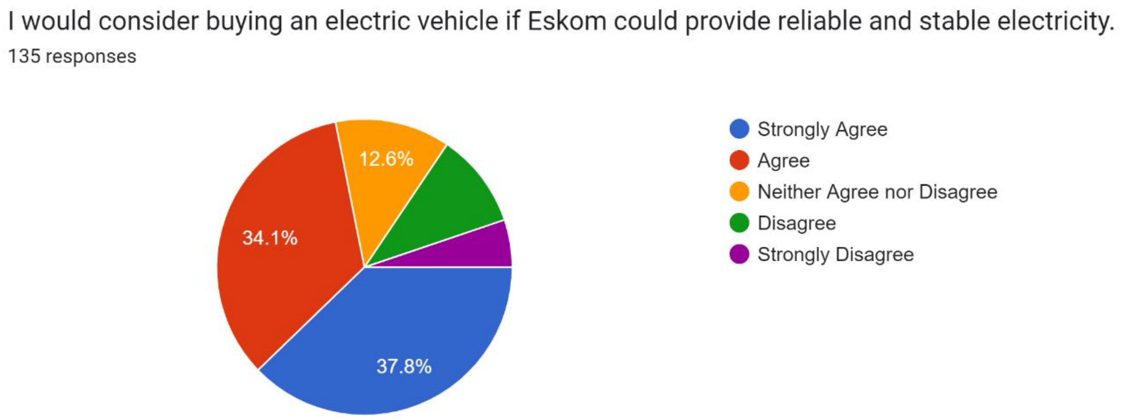

Figure 19: Reliable Electricity (Source: Google Forms from Research Questionnaire).

The EV Relative Advantage perceived by the responses, as discussed from the results of the hypothesis testing for Prosocial Behaviour and SA Energy, was further highlighted through the responses to the SA Energy questions where 74.8% of the responses indicated that they Agree (41.5%) and Strongly Agree (33.3%) that they would consider buying a EV should the Government provide incentives like cash subsidies and tax rebates (Ariely et al., 2007;

Broadbent et al., 2019; Moeletsi & Tongwane, 2020). A further 77.9% of the responses indicated that they Agree (37.8%) and Strongly Agree (34.1%) that they would consider buying an EV should Eskom provide reliable and stable electricity (Hanto et al., 2022; Schlösser et al., 2019).

6.6.3 Hypothesis H6 – CI Construct

The last hypothesis in the study, H6, considered the Energy Crisis in South Africa and CI.

Null Hypothesis 6 (Ho6): There is a significant relationship between the electricity crisis in South Africa and Consumer Innovativeness.

Alternative Hypothesis 6 (H16): There is no significant relationship between the electricity crisis in South Africa and Consumer Innovativeness.

The results from the regression analysis indicated that the null hypothesis (Ho6) was accepted for the construct IC and the alternate hypothesis *(H16) wa*s rejected. The result indicates that there is a statistically significant relationship between the Energy Crisis in South Africa and CI. As discussed in sections 6.4 and 6.5, the extent to which a consumer will adopt new products, processes, or ideas earlier than their peers is defined as Consumer Innovativeness and is considered a driving force for innovative consumer behaviour (Roehrich, 2004; Rogers, 2003).

The responses for Consumer Innovativeness were again collected through three questions:
Question 10 (INN1): If I hear about a new technology, I will look for ways to experiment with it.
Question 11 (INN2): Among my peers, I am usually the first to explore new technologies.
Question 12 (INN3): I like to experiment with new technologies.

The positive relationship revealed through H6 between SA Energy and Consumer Innovativeness highlights that the innovativeness of consumers is positively correlated to the availability of electricity as 77.9% of the responses indicated that they either Agree (37.8%) or Strongly Agree (34.1%) that they would consider buying a EV should Eskom provide reliable and stable electricity. The positive relationship on SA Energy has also revealed that CI, as a driving force for innovative behaviour, is positively influenced by incentives as 74.8% of the responses indicated that they Agree (41.5%), and Strongly Agree (33.3%), that they would consider buying an EV should the Government provide incentives like cash subsidies and tax rebates.

As previously stated in Sections 6.4 and 6.5, the adopter groups consisting of Innovators and Early Adopters are more motivated towards the adoption of innovations through the Perceived

Innovation Characteristics construct of Relative Advantage, while the Early Majority and Late Majority adopter groups are motivated more by the Trialability of the innovation (Jung Moon, 2020; Mohammadi et al., 2018; Rogers, 2003; Sahin, 2006). Because higher Consumer Innovativeness is associated with the adopter groups Innovators and Early Adopters, the statistically positive relationship with SA Energy can drive more adopters from the Late Majority to Early Majority group, and even Early Majority to the Early Adopter group (Mohammadi et al., 2018; Rogers, 2003; Sahin, 2006). As detailed in Section 6.4, individuals with higher Consumer Innovativeness are expected to adopt innovations quicker and will support their perceptions and attitudes towards innovation through their adoption (Jung Moon, 2020). The statistically positive relationship between SA Energy and Consumer Innovativeness indicates that the adoption of EVs can be accelerated through outcomes and incentives that positively influence Consumer Innovativeness (Jung Moon, 2020; Leicht et al., 2018; Roehrich, 2004).

6.7 Conclusion

This chapter was dedicated to discussing the results from the study within the setting of the literature review and the research questions, highlighting the relationships between the various constructs tested. The ANOVA and regression results from the six hypotheses were discussed and their impact on the consumer technology adoption of EVs within the South African context was unpacked.

The results from H1, as discussed in Section 6.4 revealed a statistically significant difference between consumers who have access to green energy and those who do not for the Perceived Innovation Characteristics construct EV Trialability, while H2 revealed no statistically significant difference between the groups for the construct CI.

Similarly, the results from H3, Section 6.5, confirmed a significantly positive relationship between Prosocial Behaviour, EV Relative Advantage, and EV Trialability, as H4 concluded that there is no significant relationship between consumer Prosocial Behaviour and CI.

Lastly H5, as per Section 6.6 indicated a significantly positive relationship between SA Energy and the Perceived Innovation Characteristics construct of EV Advantage, and H6 also indicated a significant positive relationship between SA Energy and CI.

The various hypotheses confirmed that consumers have the perception that EVs are an innovation that offers environmental, social, financial, and technical advantages over ICE vehicles (Rogers, 2003; Sahin, 2006; Xia et al., 2022). The hypothesis further revealed that the adoption of EVs can be accelerated through outcomes and incentives that positively influence Consumer Innovativeness (Jung Moon, 2020; Leicht et al., 2018; Roehrich, 2004).

CHAPTER 7: Conclusions and Recommendations

7.1 Introduction

The growing concern regarding climate change and its harmful effects has triggered worldwide commitments towards reducing carbon footprints (Gao & Souza, 2022; He et al., 2017). These commitments by South Africa, and many other countries, acknowledge the urgent need to decrease GHG emissions (South African Department of Transport, n.d.; United Nations, n.d.). The energy sector of South Africa relies heavily on coal for electricity generation and contributes up to 80% to the GHG emissions of the country (Hanto et al., 2022; South African Department of Transport, n.d.). This underscores the importance of transitioning to cleaner energy sources to align with South Africa's National Development Plan (NDP) and Integrated Energy Plan (IEP) goals (Hanto et al., 2022; Schlösser et al., 2019; South African Department of Transport, n.d.). These goals aim to create a less carbon-intensive society, reduce air pollution, and curb greenhouse gas emissions (Hanto et al., 2022).

The GTSSA calls attention to the significant impact that cleaner fuels and innovative technologies, such as EVs can have on mitigating GHG emissions as EVs produce no environmentally harmful gases (He et al., 2017; Rietmann et al., 2020). The large-scale adoption of EVs offers a sustainable solution for achieving the goals of reducing carbon emissions within the transport sector (He et al., 2017; Moeletsi & Tongwane, 2020; Rietmann et al., 2020).

South Africa faces a slow adoption rate of EVs with similar barriers to the adoption of EV technology as various other countries including the high upfront cost, the cost and availability of charging infrastructure, and range anxiety (He et al., 2017; König et al., 2021; Moeletsi, 2021; Naamsa, 2022; Weiss & Helmers, 2019). In addition to these barriers, South Africa faces an energy crisis as a result of the state-owned energy provider Eskom's inability to meet the country's electricity demand (Hanto et al., 2022; Laher et al., 2019). In response to this crisis, the number of rooftop solar installations in South Africa has increased, enabling consumers to generate green energy at home (Baker & Phillips, 2019; Schlösser et al., 2019). Two sections of the study were focused on exploring the impact of green energy, and what impact the energy crisis has on the technology adoption of EVs in South Africa (Baker & Phillips, 2019; Hanto et al., 2022; Schlösser et al., 2019).

The study further explored the consumer's perceptions of EVs through the base theory of DOI and the five Perceived Innovation Characteristics of an innovation (Rogers, 2003). These five main constructs included relative advantage, compatibility, complexity, trialability, and observability (Jung Moon, 2020; Rogers, 2003; Sahin, 2006). The process of diffusion is driven by various factors and the Perceived Innovation Characteristics of the innovation is fundamental in the innovation-decision process when consumers are making decisions about the adoption of innovations (Mohammadi et al., 2018; Xia et al., 2022). The second factor within the DOI theory applied to this study that has an impact on the adoption of innovative products is Consumer Innovativeness (Jung Moon, 2020; Rogers, 2003). Consumer Innovativeness forms a key part of the adoption process relating to the characteristics of the consumer, revealing their inclination to adopt new products, processes, or ideas (Jung Moon, 2020; Rogers, 2003).

Another construct investigated within this study involves the effect that Prosocial Behaviour has on the technology adoption of EVs (Asadi et al., 2019; Ashraf Javid et al., 2021; Lay & Hoppmann, 2015). Prosocial behaviour can be classified into three main motivation categories that influence consumer adoption of innovations (Ariely et al., 2007; Silvia & Krause, 2016). The first motivation category, Intrinsic Motivation, comes from an individual's natural desire to contribute to the greater good of society and is driven by altruistic concern for others, emotional satisfaction resulting from prosocial actions, or the need to maintain a positive self-identity (Lay & Hoppmann, 2015; Silvia & Krause, 2016). The second category is Extrinsic Motivations which considers the tangible rewards or advantages associated with engaging in prosocial behaviour (Lay & Hoppmann, 2015; Luengo Kanacri et al., 2021; Silvia & Krause, 2016). These can include government incentives like tax credits, rebates, or any added convenience that contributes to reducing the relative costs of prosocial actions (Ariely et al., 2007; Luengo Kanacri et al., 2021; Silvia & Krause, 2016). The third motivation category is Image Motivation which suggests that individuals naturally look for approval from their peers within their social networks and are concerned about how others perceive them (Asadi et al., 2019; Lay & Hoppmann, 2015; Silvia & Krause, 2016). Participating in prosocial actions that can put a positive social image forward for the individual is specifically relevant if these actions are visible to others (Asadi et al., 2019; Lay & Hoppmann, 2015; Silvia & Krause, 2016).

The research applied a quantitative methodology that included a mono methodological single technique of collecting data through a Likert-scale type survey that was digitally distributed through social media platforms WhatsApp and LinkedIn. (Fourie, 2023; Myres, 2023; Saunders & Lewis, 2017). Convenience sampling was applied to initiate the distribution of the online questionnaire and the initial respondents were encouraged to forward the questionnaire link to other respondents to create snowball sampling (Acharya et al., 2013; Saunders & Lewis, 2017). The target population of the study included all consumers who live in South Africa and use their private vehicles for their daily commute. Through a meticulous and robust research framework and descriptive and inferential statistical analysis, the study revealed valuable insights into the relationships of these various factors and constructs that impact the large-scale adoption of EVs within the unique, dynamic, and evolving landscape of South Africa.

7.2 The Large-Scale Adoption of EVs in South Africa

The large-scale adoption of EVs represents a significant advantage in the efforts to address environmental and social concerns that include the reliance on fossil fuels, the harmful effects of GHG emissions, and noise pollution through the transport sector (Ashraf Javid et al., 2021; Pardo-Ferreira et al., 2020; Silvia & Krause, 2016). Based on the findings of this study, various practical suggestions can be derived to promote the large-scale adoption of EVs in South Africa.

The research conducted in the study has highlighted that the consumer's perception of EV technology significantly influences their adoption decisions and intentions (Jansson et al., 2017; Jung Moon, 2020; Xia et al., 2022). To advance and accelerate the large-scale adoption of EVs it is therefore crucial for marketing strategies to be focused on the specific Perceived Innovation Characteristics that contribute to forming a positive attitude toward EV adoption (Jung Moon, 2020). The two Perceived Innovation Characteristics constructs found to have a significant positive relationship to the adoption of EVs in South Africa, through the results of the study, include Relative Advantage and Trialability (Rogers, 2003; Sahin, 2006). Based on these results it is important for marketing strategies to highlight the relative advantages EVs offer over conventional ICE vehicles and ensure that these strategies also encourage potential consumers to test drive EVs (Jung Moon, 2020; Rogers, 2003).

The consumer perceptions of EVs are enhanced when they are convinced of the significant relative advantage in environmental, social, financial, and technical considerations EVs offer over conventional ICE vehicles (Carlucci et al., 2018; Pardo-Ferreira et al., 2020; Weiss & Helmers, 2019; Zhu, 2016). A large majority of the respondents (74.8%) agreed that driving an EV would decrease their GHG emissions, therefore marketing strategies for EVs should highlight and drive the Relative Advantages EVs offer, including environmental benefits and reduced noise pollution, initially targeting the Innovator and Early Adopter groups that already have a positive perception of EVs (Rogers, 2003; Sahin, 2006). As soon as the Early Adopter group introduced more EVs into the market, the marketing strategies should shift to also include strategies to make EVs more accessible to test drive to as many possible potential adopters (Moeletsi, 2021; Pardo-Ferreira et al., 2020; Sefora et al., 2019). The results from the survey indicated that 83% of the respondents did not find the concept of the EV difficult to understand, but the responses to how easy an EV is to operate were widely diversified, highlighting the need for increased awareness and test driving opportunities (Hamilton &

Terblanche-Smit, 2018; Moeletsi, 2021). The study by Jung Moon (2020) revealed that innovations with high Trialability are adopted quickly, and offer the opportunity to be modified or improved while consumers are experimenting with the product, further emphasising the need for EVs to be available to consumers for test driving. EV test-driving opportunities increase the perceived Trialability further accelerating adoption (Jung Moon, 2020).

Marketing activities should also include creating more awareness of the social and environmental benefits available through EV adoption, reinforcing the Prosocial benefits, and driving the consumer motivation and desire to contribute to the larger society and environment (Asadi et al., 2019). Increasing the awareness among consumers of the Prosocial benefits associated with EV adoption will call on their intrinsic and image motivational factors to choose more sustainable transportation practices, contributing to a more sustainable and green future (Asadi et al., 2019). As the costs of generating renewable energy, especially private solar installations, have accelerated the shift towards cleaner renewable energy sources, the strategy to accelerate the large-scale adoption of EVs should also include the awareness that EVs can be charged through green energy sources, further enhancing their positive impact on the environment (Hanto et al., 2022; Sefora et al., 2019).

As a large portion of the respondents, 70.3% and 71.1%, indicated that they like to experiment with new technologies and look for ways to experiment with innovations, awareness campaigns should take advantage of these Consumer Innovativeness characteristics when considering how to improve the Trialability of EVs (Carlucci et al., 2018; Leicht et al., 2018).

Building on, and further enhancing the positive perceptions of EVs and the Relative Advantages they offer considering the environmental, social, financial, and technical factors must be emphasised through focused marketing activities that can include all forms of digital advertising, and awareness and test-drive initiatives aimed towards improving EV Trialability. These activities would contribute to addressing some of the known barriers to the adoption of EVs as well as focus on the identified factors to improve the adoption rate towards large-scale adoption.

7.3 National Policy, Incentive, and Infrastructure Considerations

The results of the survey revealed that 74.8% of the responses indicated that they would consider buying an EV should the Government provide incentives like cash subsidies or tax rebates, and 77.9% indicated that they would consider buying an EV should Eskom provide reliable and stable electricity.

Considering the positive responses gathered through the survey another option to drive the large-scale adoption of EVs exists with the Prosocial category of extrinsic motivations (Silvia & Krause, 2016). Extrinsic motivations consider the material rewards or benefits possible from actively participating in prosocial behaviour and include incentives that will reduce the relative cost of prosocial actions through tax credits and rebates (Silvia & Krause, 2016). As discussed in the studies by Silvia and Krause (2016), and Broadbent et al. (2019), Government involvement does not guarantee the large-scale adoption of innovative technologies like EVs, but still plays an important role in promoting EV sales. To improve the slow adoption rate of EV technologies experienced in South Africa to date, the Government should prioritise the advancement and uptake of EV technology by creating an environment that promotes the adoption (Naamsa, 2022; Silvia & Krause, 2016).

The focus point around Government policy and incentive discussions should include subsidies and tax rebates for individuals to make EV adoption more affordable to a wider consumer base (Broadbent et al., 2019; Silvia & Krause, 2016). More incentives could include national road toll exceptions and reduced annual vehicle licensing fees. Promoting the adoption of EVs and other green energy technologies will enable the acceleration towards a more environmentally friendly transportation sector and sustainable future (Hamilton & Terblanche-Smit, 2018).

Another well-known and studied barrier to the technology adoption of EVs, range anxiety, was also confirmed within this study as 77.1% of the respondents indicated that they do not agree that EV charging stations are easy to find (Carlucci et al., 2018; Hamilton & Terblanche-Smit, 2018; Moeletsi, 2021; Xia et al., 2022). The South African government should collaborate with the private sector to increase the charging infrastructure in the country, especially within and between densely populated areas like Gauteng, Kwazulu-Natal, and the Western Cape. This area would include the highest concentration of potential Early Adopters as consumers use their vehicles for short-distance daily commute (Hamilton & Terblanche-Smit, 2018; Nathaniel et al., 2019; Statistics South Africa, 2022). The results from the survey, which consisted of 81.5% responses from the province of Gauteng, indicated that most of the responses (79.3%) were received from consumers that travel less than 99km per day, comfortably within the range of a single charge for most EV models available in the market (Xia et al., 2022; Zhu, 2016).

Countries that prioritise the promotion of green technologies do display higher adoption rates of EVs and the GTSSA has shown positive intent from the South African government (Berkeley et al., 2018; Broadbent et al., 2019; Jansson et al., 2017; Zhu, 2016). The successful development and implementation of strategies between the government and the private sector are essential to drive the large-scale adoption of EVs, and to work towards achieving the sustainability goals set for South Africa, especially within the transportation sector (Silvia & Krause, 2016; South African Department of Transport, n.d.; United Nations, n.d.).

7.4 Limitations and Recommendations for Future Research

The first limitation of the research includes the small sample size of 135 responses as a higher response rate would have enabled the research to be more relevant in terms of the population of South Africa (Sung & Wu, 2018; Taber, 2018) The target population for the study included all the provinces of South Africa, but because most of the responses came from the province of Gauteng this limited the diversity of the research as more respondents would be more representative of the population. More analysis and results into specific behaviour with demographic data would have been possible with a larger and more diverse sample size (Hamilton & Terblanche-Smit, 2018). Considering the small sample size of the study, future studies should include more comprehensive sample sizes and geographical coverage to include more responses from all the provinces of South Africa as this would be more representative of the population. Future studies based on this research could also be conducted on more consumer groups that include different demographics like age, gender, and travel habits. More analysis should also be conducted to include geographic factors such as province and settlement locations between suburban and rural areas.

The Likert-scale type questionnaire is self-completed and does not include any prompting or probing questions, and this can limit the information obtained from the respondents, especially on more complex constructs (Sung & Wu, 2018; Taber, 2018). Likert scales also have the limitation of the response style that could affect the accuracy of the data as respondents might tend to select responses that are either neutral, midpoint, or extreme towards one side of the scale (Sung & Wu, 2018). Responses that follow this style might introduce a source of bias that dilutes the accuracy of respondents' genuine characteristics or traits (Sung & Wu, 2018). Future studies should be conducted applying a qualitative research approach to ensure more comprehensive data can be gathered from the respondents including their motivations, experiences, expectations, and perceptions toward EVs through in-depth interviews (Fourie, 2023; Myres, 2023; Saunders & Lewis, 2017).

Another limitation involves the fact that the study explored constructs and factors that influence individual perceptions towards innovations and adoption, and not the actual behaviour of consumers who have adopted EV technology (Kim et al., 2021; Xia et al., 2022). As discussed within this study, even though behaviour characteristics are regularly studied as factors that drive adoption, it is recommended that future studies gather empirical data from current EV owners to explore the factors that drove the actual adoption. These future studies can further apply the imperial data to explore the influencing factors that drive the purchase of different EV manufacturer brands available on the market.

This study also did not consider the type of EV available in the market between compact, sedan, and SUV. The class of EV was also not considered between sport, luxury, and economy. Future studies can offer more insights into consumer behaviour considering these factors analysed from richer data sets.

7.5 Conclusion

This chapter again highlighted the urgency of mitigating worldwide climate change by reducing GHG emissions in line with the commitments South Africa made to reduce the country's carbon footprint and move away from fossil fuels (Gao & Souza, 2022; South African Department of Transport, n.d.; United Nations, 2021). The study detailed the potential of EVs as a sustainable solution for reducing GHG emissions, specifically within the transportation sector (He et al., 2017; Rietmann et al., 2020). Previous research revealed that South Africa experiences similar barriers to the technology adoption of EVs, including high costs, limited charging infrastructure, and range anxiety (Hamilton & Terblanche-Smit, 2018; Moeletsi, 2021). A further unique barrier in South Africa includes Eskom's inability to meet the country's electricity demand (Hanto et al., 2022).

The research methodology for the study applied a quantitative approach, digitally distributing a Likert-scale type survey to collect data from consumers throughout South Africa (Fourie, 2023; Saunders & Lewis, 2017). The chapter also discussed the limitations of this study and recommendations for future research that should include larger sample sizes and geographic diversity.

The study utilised the DOI theory, the five Perceived Innovation Characteristics, and Consumer Innovativeness to develop a clearer understanding of the consumer perceptions of EVs and their behaviour toward Green Energy (Rogers, 2003; Sahin, 2006). Prosocial behaviour was also explored, rooted in the various motivations, as it plays a significant role in influencing consumer behaviour towards the adoption of innovations (Asadi et al., 2019; Lay & Hoppmann, 2015). The findings confirmed the importance of consumer perceptions in influencing their EV adoption decision process and the Perceived Innovation Characteristics constructs, Relative Advantage and Trialability, were identified as important within the South African context (Jung Moon, 2020; Rogers, 2003; Sahin, 2006). Based on these findings marketing strategies are recommended to focus on the Relative Advantages EVs can offer in environmental, social, financial, and technical considerations (Jung Moon, 2020; Rogers, 2003). The findings further concluded that Prosocial Behaviour has a role to play in the adoption of innovations through the consumers' awareness of the social and environmental benefits of EVs (Asadi et al., 2019). Government involvement is also crucial in supporting EV adoption through incentives that can include subsidies, tax rebates, toll, and vehicle licensing exemptions, and investment into charging infrastructure (Carlucci et al., 2018; Hamilton & Terblanche-Smit, 2018; Moeletsi, 2021).

In conclusion, this chapter recommends that marketing strategies should be customised to the different stages of the adoption process and adopter groups (Jung Moon, 2020; Rogers, 2003). Initially targeting the Early Adopters by highlighting the Relative Advantages of EV adoption, and once the Early Adopters have introduced more EVs into the market, the strategies should also include campaigns to make EVs more accessible to test drive, targeted to the Early Majority and Late Majority groups through higher Trialability (Jung Moon, 2020; Rogers, 2003; Sahin, 2006).

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APPENDIXES

Appendix A: Severy Questionnaire

Gordon Institute of Business Science
University of Pretoria

Technology Adoption of Electric Vehicles in South Africa

Dear Respondent,

I am a student currently studying at the University of Pretoria's Gordon Institute of Business Science and I am conducting research toward the fulfilment of my qualification. Thank you for your interest in participating in this research study focused on understanding the technology adoption of electric vehicles (EVs) within the South African context. Your insights are invaluable in contributing to a comprehensive understanding of the factors that influence individuals' decision making and this study aims to shed light on the dynamics of adopting sustainable and innovative transportation technologies.

The primary goal of this 3-minute questionnaire is to gather information about your attitudes, perceptions, and behaviours related to the adoption of innovations.

If you have any questions or concerns about this questionnaire or the research study, please contact me or my Research Supervisor at any time.

Supervisor:
Student:

Participation in this study is entirely voluntary. Your contribution will greatly assist us in enhancing our understanding of technology adoption and fostering sustainable transportation practices. However, if you choose not to participate or wish to discontinue at any point during the questionnaire, you are free to do so without any consequences. We want to assure you that your responses are completely confidential. No personally identifiable information will be collected, stored, or used in this research.

You are also welcome to distribute this questionnaire to anyone else you feel would be interested in completing it as we would appreciate diverse participation in the research to capture a wide range of perspectives.

Thank you for your time and valuable contribution to this study.
Best regards

Section 1: Demographic Profile

Question 1: Please click “Yes” to proceed with the survey.

- Yes, let’s proceed.
- No, thank you.

Question 2: What is your age?

- Under 18
- 18 - 24
- 25 - 34
- 35 - 44
- 45 - 54
- 55 - 64
- 65+

Question 3: What is your gender?

- Male
- Female
- non-Binary
- Transgender
- Not Listed

Question 4: In which province of South Africa do you live?

- Gauteng
- Eastern Cape
- Free State
- KwaZulu-Natal
- Limpopo
- Mpumalanga
- Northern Cape
- Northwest
- Western Cape

Question 5: What type of vehicle do you own?

- Petrol
- Diesel
- Hybrid
- Electric

Question 6: How many kilometres on average do you travel daily?

- Less than 20km
- Between 20km and 49km
- Between 50km and 99km
- Between 100km and 149km
- Between 150km and 199km
- Between 200km and 249km
- 250km and more

Question 7: In what type of settlement do you currently live?

- Suburb
- Informal
- Township
- Rural area

Question 8: What is your current property ownership status?

- Own
- Rent
- Live with friends/relatives
- Homeless

Question 9: Do you have access to green energy?

- No access to green energy
- Rooftop solar installation at home.
- Rooftop solar installation at work.
- Rooftop solar installation at home and work.
- Friend or colleague with rooftop solar installation at home.

Section 2: Consumer Innovativeness

Question 10 (INN1): If I hear about a new technology, I will look for ways to experiment with it.

1. Strongly Disagree	2. Disagree	3. Neither Agree nor Disagree	4. Agree	5.. Strongly Agree

Question 11 (INN2): Among my peers, I am usually the first to explore new technologies.

1. Strongly Disagree	2. Disagree	3. Neither Agree nor Disagree	4. Agree	5.. Strongly Agree

Question 12 (INN3): I like to experiment with new technologies.

1. Strongly Disagree	2. Disagree	3. Neither Agree nor Disagree	4. Agree	5.. Strongly Agree

Question 13 (INN4): In general, I am hesitant to try out new technologies.

1. Strongly Disagree	2. Disagree	3. Neither Agree nor Disagree	4. Agree	5.. Strongly Agree

Section 3: Perceived Innovation Characteristics

Question 14 (RA1): The use of an electric vehicle use would decrease my fossil fuels and CO2 emissions.

1. Strongly Disagree	2. Disagree	3. Neither Agree nor Disagree	4. Agree	5.. Strongly Agree

Question 15 (RA2): Buying an electric vehicle would be financially advantageous for me.

1. Strongly Disagree	2. Disagree	3. Neither Agree nor Disagree	4. Agree	5.. Strongly Agree

Question 16 (RA3): An electric vehicle replaces a vastly inferior alternative.

1. Strongly Disagree	2. Disagree	3. Neither Agree nor Disagree	4. Agree	5.. Strongly Agree

Question 17 (COMPAT1): Using an electric vehicle would enable my lifestyle in South Africa

1. Strongly Disagree	2. Disagree	3. Neither Agree nor Disagree	4. Agree	5.. Strongly Agree

Question 18 (COMPAT2): It is easy to find electric vehicle charging stations.

1. Strongly Disagree	2. Disagree	3. Neither Agree nor Disagree	4. Agree	5.. Strongly Agree

Question 19 (COMPLEX1): Prior to driving an electric vehicle, I would be required to take a special course.

1. Strongly Disagree	2. Disagree	3. Neither Agree nor Disagree	4. Agree	5.. Strongly Agree

Question 20 (COMPLEX2): It is not easy to use someone else's electric vehicle, as it is difficult to operate.

1. Strongly Disagree	2. Disagree	3. Neither Agree nor Disagree	4. Agree	5.. Strongly Agree

Question 21 (COMPLEX3): The concept behind an electric vehicle is difficult for me to understand.

1. Strongly Disagree	2. Disagree	3. Neither Agree nor Disagree	4. Agree	5.. Strongly Agree

Question 22 (OBS1): By using an electric vehicle, I show that I care about the environment.

1. Strongly Disagree	2. Disagree	3. Neither Agree nor Disagree	4. Agree	5.. Strongly Agree

Question 23 (OBS2): An electric vehicle stands out visibly.

1. Strongly Disagree	2. Disagree	3. Neither Agree nor Disagree	4. Agree	5.. Strongly Agree

Question 24 (TRIA1): Prior to buying an electric vehicle, it would be important to test-drive it.

1. Strongly Disagree	2. Disagree	3. Neither Agree nor Disagree	4. Agree	5.. Strongly Agree

Question 25 (TRIA2): Prior to buying an electric vehicle, I would like to borrow it for a day or two.

1. Strongly Disagree	2. Disagree	3. Neither Agree nor Disagree	4. Agree	5.. Strongly Agree

Section 4: Prosocial Actions

Question 26 (PS1): I am pleased to help my friends/colleagues in their activities.

1. Strongly Disagree	2. Disagree	3. Neither Agree nor Disagree	4. Agree	5.. Strongly Agree

Question 27 (PS2): I try to help others.

1. Strongly Disagree	2. Disagree	3. Neither Agree nor Disagree	4. Agree	5.. Strongly Agree

Question 28 (PS3): I am willing to make my knowledge and abilities available to others.

1. Strongly Disagree	2. Disagree	3. Neither Agree nor Disagree	4. Agree	5.. Strongly Agree

Section 5: South African Context

Question 29 (SA1): I would consider buying an electric vehicle if there are government financial incentives like cash subsidies or tax rebates.

1. Strongly Disagree	2. Disagree	3. Neither Agree nor Disagree	4. Agree	5.. Strongly Agree

Question 30 (SA2): I would consider buying an electric vehicle if Eskom could provide reliable and stable electricity.

1. Strongly Disagree	2. Disagree	3. Neither Agree nor Disagree	4. Agree	5.. Strongly Agree

Question 31 (SA3): Eskom will resolve the current energy supply crisis in South Africa within the next 5 years.

1. Strongly Disagree	2. Disagree	3. Neither Agree nor Disagree	4. Agree	5.. Strongly Agree

Appendix B: Reliability and Validity Measurements

Table 28: Reliability and Validity Measurements					
Construct	Indicators	Loadings	Indicator Reliability	Cronbach's alpha	Average
	Judgment criteria:	> 0,07	> 0,50	> 0,60	> 0,50
INNOVATIVENESS	INN1	0,949	0,900		
	INN2	0,937	0,878		
	INN3	0,963	0,927		
	INN4	0,940	0,884	0,962	0,897
RELATIVE ADVANTAGE	RA1	0,687	0,472		
	RA2	0,814	0,663		
	RA3	0,785	0,616	0,742	0,564
COMPATIBILITY	COMPAT1	0,875	0,766		
	COMPAT2	0,590	0,348	0,753	0,212
COMPLEXITY	COMPLEX1	0,435	0,189		
	COMPLEX2	0,09	0,008		
	COMPLEX3	0,804	0,646	0,753	0,212
OBSERVABILITY	OBS1	0,802	0,776		
	OBS2	0,753	0,567	0,766	0,662
TRIALABILITY	TRIA1	0,806	0,650		
	TRIA1	0,903	0,815	0,822	0,733

Table 28: Reliability and Validity Measurements.

Appendix C: Results for Discriminant Validity

Table 29: Results for discriminant validity						
Construct	RA	COMPAT	COMPLEX	OBSR	TRIA	INN
RA	0,751					
COMPAT	0.573	0.791				
COMPLEX	−0.056	−0.144	0.827			
OBSER	0.52	0.408	−0.096	0.813		
TRIA	0.226	0.112	−0.190	0.408	0.856	
INN	0.456	0.556	0.073	0.381	0.016	0.947

Table 29: Results for Discriminant Validity

Appendix D: Results for Collinearity Analysis

Table 30: Results for collinearity analysis		
Construct	Tolerance > 0.2	VIF < 5
RELATIVE ADVANTAGE	0.596	1.756
COMPATIBILITY	0.637	1.57
COMPLEXITY	0.944	1.059
TRIALABILITY	0.802	1.248
OBSERVABILITY	0.621	1.611

Table 30: Results for Collinearity Analysis.

Appendix E: Prosocial Scale

Table 31: The Prosocial Scale

Means, standard deviations, skewness, kurtosis, and adjusted, item-total correlations for the sixteen prosocialness items (N = 2574).

Item 1	3.67	0.96	−.50	0.08	0.48
Item 2	3.7	0.95	−.52	0.01	0.47
Item 3	3.7	0.92	−.28	−.46	0.7
Item 4	2.97	1.25	0.07	−.94	0.56
Item 5	3.69	0.98	−.45	−.28	0.65
Item 6	3.72	0.91	−.28	−.38	0.6
Item 7	3.28	1.01	−.19	−.37	0.65
Item 8	3.47	1.02	−.26	−.49	0.63
Item 9	3.79	0.93	−.61	0.19	0.59
Item 10	3.74	0.92	−.48	−.05	0.67
Item 11	2.96	1.14	−.02	−.71	0.52
Item 12	3.65	0.96	−.39	−.36	0.64
Item 13	3.35	0.96	−.19	−.24	0.73
Item 14	3.44	0.92	−.35	0.02	0.53
Item 15	3.43	0.97	−.32	−.25	0.56
Item 16	3.71	0.93	−.48	−.03	0.52

Table 31: The Prosocial Scale.

Appendix F: Data Code Book

Section 1: Demographic Profile

Question 1: What is your age?

40 = Under 18
41 = 18 - 24
42 = 25 - 34
43 = 35 - 44
44 = 45 - 54
45 = 55 - 64
46 = 65+

Question 2: What is your gender?

21 = Male
22 = Female
23 = non-Binary
24 = Not Listed

Question 3: In which province of South Africa do you live?

70 = Gauteng
71 = Eastern Cape
72 = Free State
73 = KwaZulu-Natal
74 = Limpopo
75 = Mpumalanga
76 = Northern Cape
77 = Northwest
78 = Western Cape

Question 4: What type of vehicle do you own?

80 = Petrol
81 = Diesel
82 = Hybrid
83 = Electric

Question 5: How many kilometres on average do you travel daily?

30 = Less than 20km

31 = Between 20km and 49km

32 = Between 50km and 99km

33 = Between 100km and 149km

34 = Between 150km and 199km

35 = Between 200km and 249km

36 = 250km and more

Question 6: In what type of settlement do you currently live?

60 = Suburb

61 = Informal

62 = Township

63 = Rural area

Question 7: What is your current property ownership status?

50 = Own

51 = Rent

52 = Live with friends/relatives

53 = Homeless

Question 8: Do you have access to green energy?

10 = No access to green energy

11 = Rooftop solar installation at home.

12 = Rooftop solar installation at work.

13 = Rooftop solar installation at home and work.

14 = Friend or colleague with rooftop solar installation at home.

Section 2: Consumer Innovativeness / Section 3: Perceived Innovation Characteristics

Section 4: Prosocial Actions / Section 5: South African Context

1 = Strongly Disagree
2 = Disagree
3 = Neither Agree nor Disagree
4 = Agree
5 = Strongly Agree

Appendix G: Bivariate Correlations

Correlations

		INN1: If I hear about a new technology, I will look for ways to experiment with it.	INN2: Among my peers, I am usually the first to explore new technologies.	INN3: I like to experiment with new technologies	INN4: In general, I am hesitant to try out new technologies.	INN TOTAL
INN1: If I hear about a new technology, I will look for ways to experiment with it.	Pearson Correlation	1	.667**	.683**	-.558**	.828**
	Sig. (2-tailed)		<.001	<.001	<.001	<.001
	N	135	135	135	135	135
INN2: Among my peers, I am usually the first to explore new technologies.	Pearson Correlation	.667**	1	.755**	-.590**	.867**
	Sig. (2-tailed)	<.001		<.001	<.001	<.001
	N	135	135	135	135	135
INN3: I like to experiment with new technologies	Pearson Correlation	.683**	.755**	1	-.720**	.798**
	Sig. (2-tailed)	<.001	<.001		<.001	<.001
	N	135	135	135	135	135
INN4: In general, I am hesitant to try out new technologies.	Pearson Correlation	-.558**	-.590**	-.720**	1	-.381**
	Sig. (2-tailed)	<.001	<.001	<.001		<.001
	N	135	135	135	135	135
INN TOTAL	Pearson Correlation	.828**	.867**	.798**	-.381**	1
	Sig. (2-tailed)	<.001	<.001	<.001	<.001	
	N	135	135	135	135	135

**. Correlation is significant at the 0.01 level (2-tailed).

Table 32: Bivariate Correlations INN (Source: IBM® SPSS and Researchers Data).

Correlations

		RA1: The use of an electric vehicle would decrease my fossil fuels and CO2 emissions.	RA2: Buying an electric vehicle would be financially advantageous for me.	RA3: An electric vehicle replaces a vastly inferior alternative.	RA TOTAL
RA1: The use of an electric vehicle would decrease my fossil fuels and CO2 emissions.	Pearson Correlation	1	.523**	.553**	.819**
	Sig. (2-tailed)		<.001	<.001	<.001
	N	135	135	135	135
RA2: Buying an electric vehicle would be financially advantageous for me.	Pearson Correlation	.523**	1	.622**	.854**
	Sig. (2-tailed)	<.001		<.001	<.001
	N	135	135	135	135
RA3: An electric vehicle replaces a vastly inferior alternative.	Pearson Correlation	.553**	.622**	1	.855**
	Sig. (2-tailed)	<.001	<.001		<.001
	N	135	135	135	135
RA TOTAL	Pearson Correlation	.819**	.854**	.855**	1
	Sig. (2-tailed)	<.001	<.001	<.001	
	N	135	135	135	135

**. Correlation is significant at the 0.01 level (2-tailed).

Table 33: Bivariate Correlations RA (Source: IBM® SPSS and Researchers Data).

Correlations

		COMPAT1: Using an electric vehicle would enable my life style in South Africa.	COMPAT2: It is easy to find electric vehicle charging stations.	COMPAT TOTAL
COMPAT1: Using an electric vehicle would enable my life style in South Africa.	Pearson Correlation	1	.419**	.865**
	Sig. (2-tailed)		<.001	<.001
	N	135	135	135
COMPAT2: It is easy to find electric vehicle charging stations.	Pearson Correlation	.419**	1	.818**
	Sig. (2-tailed)	<.001		<.001
	N	135	135	135
COMPAT TOTAL	Pearson Correlation	.865**	.818**	1
	Sig. (2-tailed)	<.001	<.001	
	N	135	135	135

**. Correlation is significant at the 0.01 level (2-tailed).

Table 34: Bivariate Correlations COMPAT (Source: IBM® SPSS and Researchers Data).

Correlations

		COMPLEX1: Prior to driving an electric vehicle, I would be required to take a special course.	COMPLEX2: It is not easy to use someone elses electric vehicle, as it is difficult to operate.	COMPLEX3: The concept behind an electric vehicle is difficult for me to understand.	COMPLEX TOTAL
COMPLEX1: Prior to driving an electric vehicle, I would be required to take a special course.	Pearson Correlation	1	.559**	.464**	.843**
	Sig. (2-tailed)		<.001	<.001	<.001
	N	135	135	135	135
COMPLEX2: It is not easy to use someone elses electric vehicle, as it is difficult to operate.	Pearson Correlation	.559**	1	.530**	.835**
	Sig. (2-tailed)	<.001		<.001	<.001
	N	135	135	135	135
COMPLEX3: The concept behind an electric vehicle is difficult for me to understand.	Pearson Correlation	.464**	.530**	1	.791**
	Sig. (2-tailed)	<.001	<.001		<.001
	N	135	135	135	135
COMPLEX TOTAL	Pearson Correlation	.843**	.835**	.791**	1
	Sig. (2-tailed)	<.001	<.001	<.001	
	N	135	135	135	135

**. Correlation is significant at the 0.01 level (2-tailed).

Table 35: Bivariate Correlations COMPLEX (Source: IBM® SPSS and Researchers Data).

Correlations

		OBS1: By using an electric vehicle, I show that I care about the environment.	OBS2: An electric vehicle stands out visibly.	OBS TOTAL
OBS1: By using an electric vehicle, I show that I care about the environment.	Pearson Correlation	1	.111	.812**
	Sig. (2-tailed)		.198	<.001
	N	135	135	135
OBS2: An electric vehicle stands out visibly.	Pearson Correlation	.111	1	.671**
	Sig. (2-tailed)	.198		<.001
	N	135	135	135
OBS TOTAL	Pearson Correlation	.812**	.671**	1
	Sig. (2-tailed)	<.001	<.001	
	N	135	135	135

**. Correlation is significant at the 0.01 level (2-tailed).

Table 36: Bivariate Correlations OBS (Source: IBM® SPSS and Researchers Data).

Correlations

		TRIA1: Prior to buying an electric vehicle, it would be important to test-drive it.	TRIA2: Prior to buying an electric vehicle, I would like to borrow it for a day or two.	TRIA TOTAL
TRIA1: Prior to buying an electric vehicle, it would be important to test-drive it.	Pearson Correlation	1	.397**	.717**
	Sig. (2-tailed)		<.001	<.001
	N	135	135	135
TRIA2: Prior to buying an electric vehicle, I would like to borrow it for a day or two.	Pearson Correlation	.397**	1	.925**
	Sig. (2-tailed)	<.001		<.001
	N	135	135	135
TRIA TOTAL	Pearson Correlation	.717**	.925**	1
	Sig. (2-tailed)	<.001	<.001	
	N	135	135	135

**. Correlation is significant at the 0.01 level (2-tailed).

Table 37: Bivariate Correlations TRIA (Source: IBM® SPSS and Researchers Data).

Correlations

		PS1: I am pleased to help my friends/colleagues in their activities.	PS2: I try to help others.	PS3: I am willing to make my knowledge and abilities available to others.	PS TOTAL
PS1: I am pleased to help my friends/colleagues in their activities.	Pearson Correlation	1	.690**	.490**	.860**
	Sig. (2-tailed)		<.001	<.001	<.001
	N	135	135	135	135
PS2: I try to help others.	Pearson Correlation	.690**	1	.599**	.900**
	Sig. (2-tailed)	<.001		<.001	<.001
	N	135	135	135	135
PS3: I am willing to make my knowledge and abilities available to others.	Pearson Correlation	.490**	.599**	1	.800**
	Sig. (2-tailed)	<.001	<.001		<.001
	N	135	135	135	135
PS TOTAL	Pearson Correlation	.860**	.900**	.800**	1
	Sig. (2-tailed)	<.001	<.001	<.001	
	N	135	135	135	135

**. Correlation is significant at the 0.01 level (2-tailed).

Table 38: Bivariate Correlations PS (Source: IBM® SPSS and Researchers Data).

Correlations

		SA1: I would consider buying an electric vehicle if there are government financial incentives like cash subsidies or tax rebates.	SA2: I would consider buying an electric vehicle if Eskom could provide reliable and stable electricity.	SA3: Eskom will resolve the current energy supply crisis in South Africa within the next 5 years.	SA TOTAL
SA1: I would consider buying an electric vehicle if there are government financial incentives like cash subsidies or tax rebates.	Pearson Correlation	1	.503**	.205*	.816**
	Sig. (2-tailed)		<.001	.017	<.001
	N	135	135	135	135
SA2: I would consider buying an electric vehicle if Eskom could provide reliable and stable electricity.	Pearson Correlation	.503**	1	-.028	.709**
	Sig. (2-tailed)	<.001		.743	<.001
	N	135	135	135	135
SA3: Eskom will resolve the current energy supply crisis in South Africa within the next 5 years.	Pearson Correlation	.205*	-.028	1	.563**
	Sig. (2-tailed)	.017	.743		<.001
	N	135	135	135	135
SA TOTAL	Pearson Correlation	.816**	.709**	.563**	1
	Sig. (2-tailed)	<.001	<.001	<.001	
	N	135	135	135	135

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Table 39: Bivariate Correlations SA (Source: IBM® SPSS and Researchers Data).

Appendix H: Cronbach's Alpha

Consumer Innovativeness (First Run)

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.059	.141	4

Table 40: Reliability Statistics INN First Run (Source: IBM® SPSS and Researchers Data).

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
INN1: If I hear about a new technology, I will look for ways to experiment with it.	9.54	2.131	.561	.525	-.968[a]
INN2: Among my peers, I am usually the first to explore new technologies.	10.16	1.729	.580	.614	-1.286[a]
INN3: I like to experiment with new technologies	9.70	2.165	.472	.709	-.845[a]
INN4: In general, I am hesitant to try out new technologies.	11.07	7.690	-.696	.529	.875

a. The value is negative due to a negative average covariance among items. This violates reliability model assumptions. You may want to check item codings.

Table 41: Cronbach's Alpha INN First Run (Source: IBM® SPSS and Researchers Data).

Consumer Innovativeness (Re-run)

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.875	.876	3

Table 42: Reliability Statistics INN Second Run (Source: IBM® SPSS and Researchers Data).

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
INN1: If I hear about a new technology, I will look for ways to experiment with it.	7.12	3.986	.720	.520	.859
INN2: Among my peers, I am usually the first to explore new technologies.	7.73	3.331	.776	.612	.811
INN3: I like to experiment with new technologies	7.28	3.577	.790	.628	.796

Table 43: Cronbach's Alpha INN (Source: IBM® SPSS and Researchers Data).

Perceived Innovation Characteristics (PIC)

RA – Relative Advantage

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.796	.796	3

Table 44: Reliability Statistics RA (Source: IBM® SPSS and Researchers Data).

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
RA1: The use of an electric vehicle would decrease my fossil fuels and CO2 emissions.	5.60	4.481	.597	.358	.766
RA2: Buying an electric vehicle would be financially advantageous for me.	6.68	4.099	.649	.434	.712
RA3: An electric vehicle replaces a vastly inferior alternative.	6.79	4.334	.674	.458	.686

Table 45: Cronbach’s Alpha RA (Source: IBM® SPSS and Researchers Data).

COMPAT – Compatibility

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.587	.591	2

Table 46: Reliability Statistics COMPAT (Source: IBM® SPSS and Researchers Data).

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
COMPAT1: Using an electric vehicle would enable my life style in South Africa.	1.93	1.009	.419	.176	.
COMPAT2: It is easy to find electric vehicle charging stations.	2.70	1.329	.419	.176	.

Table 47: Cronbach's Alpha COMPAT (Source: IBM® SPSS and Researchers Data).

COMPLEX – Complexity

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.758	.763	3

Table 48: Reliability Statistics COMPLEX (Source: IBM® SPSS and Researchers Data).

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
COMPLEX1: Prior to driving an electric vehicle, I would be required to take a special course.	4.44	2.861	.585	.352	.693
COMPLEX2: It is not easy to use someone elses electric vehicle, as it is difficult to operate.	4.53	3.326	.637	.406	.627
COMPLEX3: The concept behind an electric vehicle is difficult for me to understand.	5.04	3.550	.559	.322	.710

Table 49 Cronbach’s Alpha (Source: IBM® SPSS and Researchers Data).

OBS – Observability

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.195	.200	2

Table 50: Reliability Statistics OBS (Source: IBM® SPSS and Researchers Data).

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
OBS1: By using an electric vehicle, I show that I care about the environment.	3.01	.895	.111	.012	.
OBS2: An electric vehicle stands out visibly.	3.51	1.446	.111	.012	.

Table 51: Cronbach's Alpha OBS (Source: IBM® SPSS and Researchers Data).

TRIA Trialability

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.501	.569	2

Table 52: Reliability Statistics TRIA (Source: IBM® SPSS and Researchers Data).

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
TRIA1: Prior to buying an electric vehicle, it would be important to test-drive it.	4.01	.948	.397	.158	.
TRIA2: Prior to buying an electric vehicle, I would like to borrow it for a day or two.	4.49	.282	.397	.158	.

Table 53: Cronbach's Alpha TRIA (Source: IBM® SPSS and Researchers Data).

PS – Prosocial Actions

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.815	.814	3

Table 54: Reliability Statistics PS (Source: IBM® SPSS and Researchers Data).

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
PS1: I am pleased to help my friends/colleagues in their activities.	8.75	1.085	.666	.485	.746
PS2: I try to help others.	8.61	1.000	.750	.566	.654
PS3: I am willing to make my knowledge and abilities available to others.	8.61	1.285	.593	.370	.816

Table 55: Cronbach's Alpha PS (Source: IBM® SPSS and Researchers Data).

SA – South African Context (First Run)

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.466	.468	3

Table 56: Reliability Statistics SA First Run (Source: IBM® SPSS and Researchers Data).

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
SA1: I would consider buying an electric vehicle if there are government financial incentives like cash subsidies or tax rebates.	5.87	2.663	.509	.301	-.059[a]
SA2: I would consider buying an electric vehicle if Eskom could provide reliable and stable electricity.	5.86	3.226	.303	.271	.340
SA3: Eskom will resolve the current energy supply crisis in South Africa within the next 5 years.	7.76	4.063	.100	.065	.669

a. The value is negative due to a negative average covariance among items. This violates reliability model assumptions. You may want to check item codings.

Table 57: Cronbach's Alpha SA First Run (Source: IBM® SPSS and Researchers Data).

SA – South African Context (Second Run)

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.669	.670	2

Table 58: Reliability Statistics SA Second Run (Source: IBM® SPSS and Researchers Data).

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
SA1: I would consider buying an electric vehicle if there are government financial incentives like cash subsidies or tax rebates.	3.89	1.383	.503	.253	.
SA2: I would consider buying an electric vehicle if Eskom could provide reliable and stable electricity.	3.87	1.320	.503	.253	.

Table 59: Cronbach's Alpha SA (Source: IBM® SPSS and Researchers Data).

Appendix I: Exploratory Factor Analysis

Factor Analysis

Correlation Matrix

		INN1: If I hear about a new technology, I will look for ways to experiment with it.	INN2: Among my peers, I am usually the first to explore new technologies.	INN3: I like to experiment with new technologies
Correlation	INN1: If I hear about a new technology, I will look for ways to experiment with it.	1.000	.667	.683
	INN2: Among my peers, I am usually the first to explore new technologies.	.667	1.000	.755
	INN3: I like to experiment with new technologies	.683	.755	1.000

Table 60: INN Correlation Matrix.

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.734
Bartlett's Test of Sphericity	Approx. Chi-Square	208.376
	Df	3
	Sig.	<.001

Table 61: INN KMO and Bartlett's Test.

Total Variance Explained

	Initial Eigenvalues			Extraction Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.404	80.128	80.128	2.404	80.128	80.128
2	.352	11.724	91.852			
3	.244	8.148	100.000			

Extraction Method: Principal Component Analysis.

Rotated Component Matrix[a]

a. Only one component was extracted. The solution cannot be rotated.

Table 62: INN Total Variance Explained.

Factor Analysis

Correlation Matrix

		RA1: The use of an electric vehicle would decrease my fossil fuels and CO2 emissions.	RA2: Buying an electric vehicle would be financially advantageous for me.	RA3: An electric vehicle replaces a vastly inferior alternative.
Correlation	RA1: The use of an electric vehicle would decrease my fossil fuels and CO2 emissions.	1.000	.523	.553
	RA2: Buying an electric vehicle would be financially advantageous for me.	.523	1.000	.622
	RA3: An electric vehicle replaces a vastly inferior alternative.	.553	.622	1.000

Table 63: RA Correlation Matrix.

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.701
Bartlett's Test of Sphericity	Approx. Chi-Square	123.288
	df	3
	Sig.	<.001

Table 64: RA KMO and Bartlett's Test.

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.133	71.104	71.104	2.133	71.104	71.104
2	.492	16.398	87.502			
3	.375	12.498	100.000			

Extraction Method: Principal Component Analysis.

Rotated Component Matrix[a]

a. Only one component was extracted. The solution cannot be rotated.

Table 65: RA Total Variance Explained.

Factor Analysis

Correlation Matrix

		COMPAT1: Using an electric vehicle would enable my lifestyle in South Africa.	COMPAT2: It is easy to find electric vehicle charging stations.
Correlation	COMPAT1: Using an electric vehicle would enable my lifestyle in South Africa.	1.000	.419
	COMPAT2: It is easy to find electric vehicle charging stations.	.419	1.000

Table 66: COMPAT Correlation Matrix.

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.500
Bartlett's Test of Sphericity	Approx. Chi-Square	25.576
	Df	1
	Sig.	<.001

Table 67: COMPAT KMO and Bartlett's Test.

Total Variance Explained

	Initial Eigenvalues			Extraction Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	1.419	70.949	70.949	1.419	70.949	70.949
2	.581	29.051	100.000			

Extraction Method: Principal Component Analysis.

Rotated Component Matrix[a]

a. Only one component was extracted. The solution cannot be rotated.

Table 68: COMPAT Total Variance Explained.

Factor Analysis

Correlation Matrix

		COMPLEX1: Prior to driving an electric vehicle, I would be required to take a special course.	COMPLEX2: It is not easy to use someone else's electric vehicle, as it is difficult to operate.	COMPLEX3: The concept behind an electric vehicle is difficult for me to understand.
Correlation	COMPLEX1: Prior to driving an electric vehicle, I would be required to take a special course.	1.000	.559	.464
	COMPLEX2: It is not easy to use someone else's electric vehicle, as it is difficult to operate.	.559	1.000	.530
	COMPLEX3: The concept behind an electric vehicle is difficult for me to understand.	.464	.530	1.000

Table 69: COMPLEX Correlation Matrix.

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.688
Bartlett's Test of Sphericity	Approx. Chi-Square	100.935
	df	3
	Sig.	<.001

Table 70: COMPLEX KMO and Bartlett's Test.

Total Variance Explained

	Initial Eigenvalues			Extraction Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.037	67.892	67.892	2.037	67.892	67.892

2	.538	17.938	85.830			
3	.425	14.170	100.000			

Extraction Method: Principal Component Analysis.

Rotated Component Matrix[a]

a. Only one component was extracted. The solution cannot be rotated.

Table 71: COMPLEX Total Variance Explained.

Factor Analysis

Correlation Matrix

		OBS1: By using an electric vehicle, I show that I care about the environment.	OBS2: An electric vehicle stands out visibly.
Correlation	OBS1: By using an electric vehicle, I show that I care about the environment.	1.000	.111
	OBS2: An electric vehicle stands out visibly.	.111	1.000

Table 72: OBS Correlation Matrix.

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.500
Bartlett's Test of Sphericity	Approx. Chi-Square	1.654
	df	1
	Sig.	.198

Table 73: OBS KMO and Bartlett's Test.

Total Variance Explained

	Initial Eigenvalues			Extraction Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	1.111	55.568	55.568	1.111	55.568	55.568

2	.889	44.432	100.000			

Extraction Method: Principal Component Analysis.

Rotated Component Matrix[a]

a. Only one component was extracted. The solution cannot be rotated.

Table 74: OBS Total Variance Explained.

Factor Analysis

Correlation Matrix

		TRIA1: Prior to buying an electric vehicle, it would be important to test-drive it.	TRIA2: Prior to buying an electric vehicle, I would like to borrow it for a day or two.
Correlation	TRIA1: Prior to buying an electric vehicle, it would be important to test-drive it.	1.000	.397
	TRIA2: Prior to buying an electric vehicle, I would like to borrow it for a day or two.	.397	1.000

Table 75: TRIA Correlation Matrix.

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.500
Bartlett's Test of Sphericity	Approx. Chi-Square	22.778
	df	1
	Sig.	<.001

Table 76: TRIA KMO and Bartlett's Test.

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	1.397	69.871	69.871	1.397	69.871	69.871
2	.603	30.129	100.000			

Extraction Method: Principal Component Analysis.

Rotated Component Matrix[a]

a. Only one component was extracted. The solution cannot be rotated.

Table 77: TRIA Total Variance Explained.

Factor Analysis

Correlation Matrix

		PS1: I am pleased to help my friends/colleagues in their activities.	PS2: I try to help others.	PS3: I am willing to make my knowledge and abilities available to others.
Correlation	PS1: I am pleased to help my friends/colleagues in their activities.	1.000	.690	.490
	PS2: I try to help others.	.690	1.000	.599
	PS3: I am willing to make my knowledge and abilities available to others.	.490	.599	1.000

Table 78: PS Correlation Matrix.

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.677
Bartlett's Test of Sphericity	Approx. Chi-Square	146.550
	df	3
	Sig.	<.001

Table 79: PS KMO and Bartlett's Test.

Total Variance Explained

Component	Initial Eigenvalues Total	% of Variance	Cumulative %	Extraction Sums of Squared Loadings Total	% of Variance	Cumulative %
1	2.190	72.990	72.990	2.190	72.990	72.990
2	.521	17.374	90.364			
3	.289	9.636	100.000			

Extraction Method: Principal Component Analysis.

Rotated Component Matrix[a]

a. Only one component was extracted. The solution cannot be rotated.

Table 80: PS Total Variance Explained.

Factor Analysis

Correlation Matrix

		SA1: I would consider buying an electric vehicle if there are government financial incentives like cash subsidies or tax rebates.	SA2: I would consider buying an electric vehicle if Eskom could provide reliable and stable electricity.
Correlation	SA1: I would consider buying an electric vehicle if there are government financial incentives like cash subsidies or tax rebates.	1.000	.503
	SA2: I would consider buying an electric vehicle if Eskom could provide reliable and stable electricity.	.503	1.000

Table 81: SA Correlation Matrix.

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.500
Bartlett's Test of Sphericity	Approx. Chi-Square	38.695
	df	1
	Sig.	<.001

Table 82: SA KMO and Bartlett's Test.

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	1.503	75.162	75.162	1.503	75.162	75.162
2	.497	24.838	100.000			

Extraction Method: Principal Component Analysis.

Rotated Component Matrix[a]

a. Only one component was extracted. The solution cannot be rotated.

Table 83: SA Total Variance Explained.

Appendix J: ANOVA Results

Tests of Homogeneity of Variances

		Levene Statistic	df1	df2	Sig.
Innovativeness	Based on Mean	.000	1	99	.991
	Based on Median	.000	1	99	.985
	Based on Median and with adjusted df	.000	1	98.378	.985
	Based on trimmed mean	.000	1	99	.993
EV Advantage	Based on Mean	.963	1	99	.329
	Based on Median	.939	1	99	.335
	Based on Median and with adjusted df	.939	1	96.215	.335
	Based on trimmed mean	1.085	1	99	.300
EV Compatibility	Based on Mean	.969	1	99	.327
	Based on Median	1.068	1	99	.304
	Based on Median and with adjusted df	1.068	1	95.668	.304
	Based on trimmed mean	1.069	1	99	.304
EV Complexity	Based on Mean	.146	1	99	.703
	Based on Median	.273	1	99	.602
	Based on Median and with adjusted df	.273	1	97.337	.602
	Based on trimmed mean	.232	1	99	.631
OBS1: By using an electric vehicle, I show that I care about the environment.	Based on Mean	.121	1	99	.729
	Based on Median	.013	1	99	.909
	Based on Median and with adjusted df	.013	1	98.448	.909
	Based on trimmed mean	.118	1	99	.732
OBS2: An electric vehicle stands out visibly.	Based on Mean	.294	1	99	.589
	Based on Median	.161	1	99	.690
	Based on Median and with adjusted df	.161	1	98.794	.690
	Based on trimmed mean	.211	1	99	.647
EV Trialability	Based on Mean	1.524	1	99	.220
	Based on Median	1.818	1	99	.181
	Based on Median and with adjusted df	1.818	1	91.156	.181
	Based on trimmed mean	1.412	1	99	.238

Table 84: Test of Homogeneity of Variances

Descriptives

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean Lower Bound	95% Confidence Interval for Mean Upper Bound	Minimum	Maximum
Innovativeness	No Green Energy	59	3.582	.900	.117	3.347	3.817	1.000	5.000
	Green Energy at Home	42	3.897	.866	.134	3.627	4.167	2.000	5.000
	Total	101	3.713	.896	.089	3.536	3.890	1.000	5.000
EV Advantage	No Green Energy	59	3.158	.937	.122	2.914	3.402	1.000	4.667
	Green Energy at Home	42	3.270	.923	.142	2.982	3.558	1.000	5.000
	Total	101	3.205	.929	.092	3.021	3.388	1.000	5.000
EV Compatibility	No Green Energy	59	2.297	.896	.117	2.063	2.530	1.000	5.000
	Green Energy at Home	42	2.440	.970	.150	2.138	2.743	1.000	4.500
	Total	101	2.356	.926	.092	2.174	2.539	1.000	5.000
EV Complexity	No Green Energy	59	2.503	.874	.114	2.275	2.731	1.000	4.667
	Green Energy at Home	42	2.151	.884	.136	1.875	2.426	1.000	5.000
	Total	101	2.356	.891	.089	2.181	2.532	1.000	5.000
OBS1: By using an electric vehicle, I show that I care about the environment.	No Green Energy	59	3.542	1.164	.152	3.239	3.846	1.000	5.000
	Green Energy at Home	42	3.619	1.125	.174	3.268	3.970	1.000	5.000
	Total	101	3.574	1.143	.114	3.349	3.800	1.000	5.000
OBS2: An electric vehicle stands out visibly.	No Green Energy	59	2.949	.955	.124	2.700	3.198	1.000	5.000
	Green Energy at Home	42	3.238	.983	.152	2.932	3.544	1.000	5.000
	Total	101	3.069	.972	.097	2.877	3.261	1.000	5.000
EV Trialability	No Green Energy	59	4.347	.645	.084	4.179	4.516	3.000	5.000
	Green Energy at Home	42	4.071	.640	.099	3.872	4.271	3.000	5.000
	Total	101	4.233	.654	.065	4.104	4.362	3.000	5.000

Table 85: Descriptives.

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Innovativeness	Between Groups	2.433	1	2.433	3.096	.082
	Within Groups	77.796	99	.786		
	Total	80.229	100			
EV Advantage	Between Groups	.306	1	.306	.352	.554
	Within Groups	85.910	99	.868		
	Total	86.216	100			
EV Compatibility	Between Groups	.508	1	.508	.590	.444
	Within Groups	85.161	99	.860		
	Total	85.668	100			
EV Complexity	Between Groups	3.040	1	3.040	3.942	.050
	Within Groups	76.350	99	.771		
	Total	79.391	100			
OBS1: By using an electric vehicle, I show that I care about the environment.	Between Groups	.144	1	.144	.109	.742
	Within Groups	130.549	99	1.319		
	Total	130.693	100			
OBS2: An electric vehicle stands out visibly.	Between Groups	2.048	1	2.048	2.193	.142
	Within Groups	92.467	99	.934		
	Total	94.515	100			
EV Trialability	Between Groups	1.869	1	1.869	4.523	.036
	Within Groups	40.913	99	.413		
	Total	42.782	100			

Table 86: ANOVA.

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
Do you have access to green energy?	101	10	11	10.42	.495	.347	.240	-1.918	.476
Innovativeness	101	1.000	5.000	3.713	.896	-.570	.240	.116	.476
EV Advantage	101	1.000	5.000	3.205	.929	-.430	.240	-.174	.476
EV Compatibility	101	1.000	5.000	2.356	.926	.432	.240	-.176	.476
EV Complexity	101	1.000	5.000	2.356	.891	.524	.240	.153	.476
OBS1: By using an electric vehicle, I show that I care about the environment.	101	1	5	3.57	1.143	-.780	.240	-.028	.476
OBS2: An electric vehicle stands out visibly.	101	1	5	3.07	.972	.126	.240	-.891	.476
EV Trialability	101	3.0	5.0	4.233	.6541	-.265	.240	-.996	.476
Valid N (listwise)	101								

Table 87: Descriptives Statistics.

ANOVA Effect Sizes[a,b]

		Point Estimate	95% Confidence Interval	
			Lower	Upper
Innovativeness	Eta-squared	.030	.000	.121
	Epsilon-squared	.021	-.010	.112
	Omega-squared Fixed-effect	.020	-.010	.111
	Omega-squared Random-effect	.020	-.010	.111
EV Advantage	Eta-squared	.004	.000	.060
	Epsilon-squared	-.007	-.010	.051
	Omega-squared Fixed-effect	-.006	-.010	.050
	Omega-squared Random-effect	-.006	-.010	.050
EV Compatibility	Eta-squared	.006	.000	.068
	Epsilon-squared	-.004	-.010	.059
	Omega-squared Fixed-effect	-.004	-.010	.059
	Omega-squared Random-effect	-.004	-.010	.059
EV Complexity	Eta-squared	.038	.000	.134
	Epsilon-squared	.029	-.010	.126
	Omega-squared Fixed-effect	.028	-.010	.125
	Omega-squared Random-effect	.028	-.010	.125
OBS1: By using an electric vehicle, I show that I care about the environment.	Eta-squared	.001	.000	.046
	Epsilon-squared	-.009	-.010	.036
	Omega-squared Fixed-effect	-.009	-.010	.036
	Omega-squared Random-effect	-.009	-.010	.036
OBS2: An electric vehicle stands out visibly.	Eta-squared	.022	.000	.105
	Epsilon-squared	.012	-.010	.096
	Omega-squared Fixed-effect	.012	-.010	.095
	Omega-squared Random-effect	.012	-.010	.095
EV Trialability	Eta-squared	.044	.000	.143
	Epsilon-squared	.034	-.010	.134
	Omega-squared Fixed-effect	.034	-.010	.133
	Omega-squared Random-effect	.034	-.010	.133

a. Eta-squared and Epsilon-squared are estimated based on the fixed-effect model.

b. Negative but less biased estimates are retained, not rounded to zero.

Table 88: ANOVA Side Effects.

Appendix K: Regression Results

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	EV Trialability, OBS1: By using an electric vehicle, I show that I care about the environment., OBS2: An electric vehicle stands out visibly., EV Complexity, EV Compatibility, EV Advantage[b]	.	Enter

a. Dependent Variable: Prosocial

b. All requested variables entered.

Table 89: Prosocial and PIC Variables Entered/Removed.

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.482[a]	.232	.196	.45450788377

a. Predictors: (Constant), EV Trialability, OBS1: By using an electric vehicle, I show that I care about the environment., OBS2: An electric vehicle stands out visibly., EV Complexity, EV Compatibility, EV Advantage

b. Dependent Variable: Prosocial

Table 90: Prosocial and PIC Mode Summary.

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	7.999	6	1.333	6.454	<.001[b]
	Residual	26.442	128	.207		
	Total	34.441	134			

a. Dependent Variable: Prosocial

b. Predictors: (Constant), EV Trialability, OBS1: By using an electric vehicle, I show that I care about the environment., OBS2: An electric vehicle stands out visibly., EV Complexity, EV Compatibility, EV Advantage

Table 91: Prosocial and PIC ANOVA.

Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.	Collinearity Statistics Tolerance	Collinearity Statistics VIF
1	(Constant)	2.742	.319		8.600	<.001		
	EV Advantage	.194	.066	.379	2.965	.004	.367	2.725
	EV Compatibility	-.078	.054	-.140	-1.459	.147	.650	1.539
	EV Complexity	-.036	.047	-.060	-.759	.450	.955	1.047
	OBS1: By using an electric vehicle, I show that I care about the environment.	.029	.048	.069	.608	.544	.467	2.143
	OBS2: An electric vehicle stands out visibly.	.011	.044	.021	.254	.800	.906	1.103
	EV Trialability	.258	.064	.326	4.037	<.001	.917	1.090

a. Dependent Variable: Prosocial

Table 92: Prosocial and PIC Coefficients.

Collinearity Diagnostics[a]

Model	Dimension	Eigenvalue	Condition Index	Variance Proportions (Constant)	EV Advantage	EV Compatibility	EV Complexity	OBS1: By using an electric vehicle, I show that I care about the environment.	OBS2: An electric vehicle stands out visibly.	EV Trialability
1	1	6.600	1.000	.00	.00	.00	.00	.00	.00	.00
	2	.150	6.633	.00	.03	.14	.28	.04	.01	.01
	3	.090	8.576	.00	.01	.00	.32	.08	.49	.00
	4	.077	9.228	.01	.01	.56	.21	.15	.00	.02
	5	.051	11.411	.05	.02	.12	.20	.04	.46	.12
	6	.023	17.066	.01	.87	.16	.00	.68	.04	.00
	7	.009	26.419	.92	.06	.02	.00	.02	.00	.85

a. Dependent Variable: Prosocial

Table 93: Prosocial and PIC Collinearity Diagnostics.

Residuals Statistics[a]

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	3.5679223537	4.9991297722	4.3283950617	.24432732758	135
Residual	-.8762873411	1.0223542452	.00000000000	.44421580493	135
Std. Predicted Value	-3.113	2.745	.000	1.000	135
Std. Residual	-1.928	2.249	.000	.977	135

a. Dependent Variable: Prosocial

Table 94: Prosocial and PIC Residual Statistics.

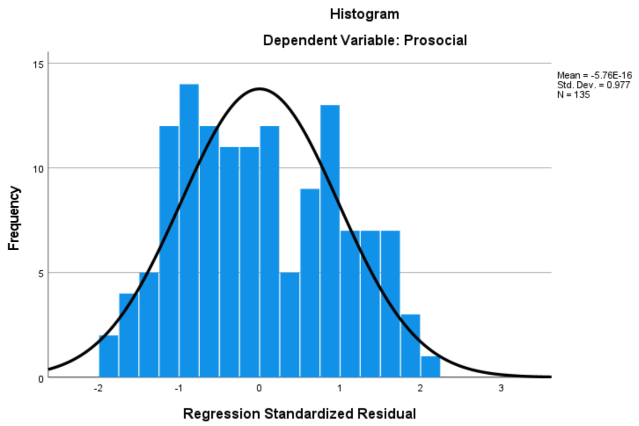

Figure 20: Histogram Prosocial and PIC (Source: IBM® SPSS and Researchers Data).

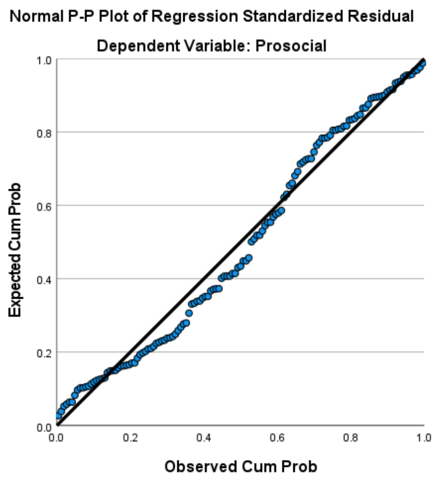

Figure 21: P-P Plot Prosocial and PIC (Source: IBM® SPSS and Researchers Data).

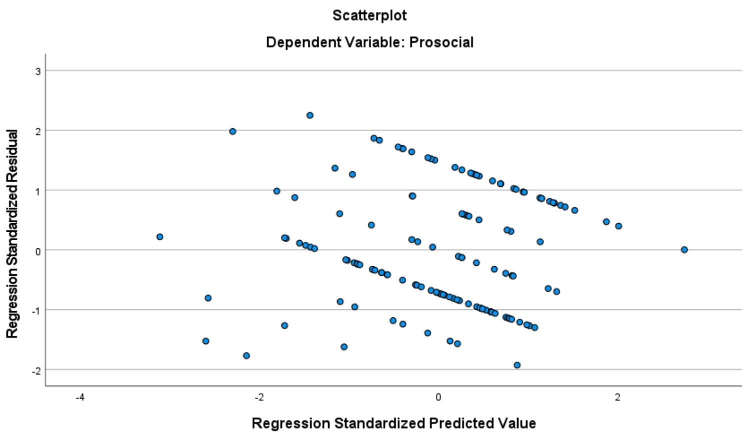

Figure 22: Scatterplot of Prosocial and PIC (Source: IBM® SPSS and Researchers Data).

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	EV Trialability, OBS1: By using an electric vehicle, I show that I care about the environment., OBS2: An electric vehicle stands out visibly., EV Complexity, EV Compatibility, EV Advantage[b]	.	Enter

a. Dependent Variable: SA Energy

b. All requested variables entered.

Table 95: SA Energy and PIC Variables Entered/Removed.

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.545[a]	.297	.264	.8645

a. Predictors: (Constant), EV Trialability, OBS1: By using an electric vehicle, I show that I care about the environment., OBS2: An electric vehicle stands out visibly., EV Complexity, EV Compatibility, EV Advantage

b. Dependent Variable: SA Energy

Table 96: SA Energy and PIC Mode Summary.

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	40.449	6	6.741	9.021	<.001[b]
	Residual	95.655	128	.747		
	Total	136.104	134			

a. Dependent Variable: SA Energy

b. Predictors: (Constant), EV Trialability, OBS1: By using an electric vehicle, I show that I care about the environment., OBS2: An electric vehicle stands out visibly., EV Complexity, EV Compatibility, EV Advantage

Table 97: SA Energy and PIC ANOVA**.**

Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.	Collinearity Statistics Tolerance	Collinearity Statistics VIF
1	(Constant)	1.060	.606		1.749	.083		
	EV Advantage	.393	.125	.386	3.154	.002	.367	2.725
	EV Compatibility	.039	.102	.035	.383	.702	.650	1.539
	EV Complexity	-.026	.090	-.022	-.292	.770	.955	1.047
	OBS1: By using an electric vehicle, I show that I care about the environment.	.124	.091	.148	1.360	.176	.467	2.143
	OBS2: An electric vehicle stands out visibly.	.058	.083	.055	.701	.484	.906	1.103
	EV Trialability	.219	.122	.139	1.802	.074	.917	1.090

a. Dependent Variable: SA Energy

Table 98: SA Energy and PIC Coefficients.

Collinearity Diagnostics[a]

Model	Dimension	Eigenvalue	Condition Index	Variance Proportions (Constant)	EV Advantage	EV Compatibility	EV Complexity	OBS1: By using an electric vehicle, I show that I care about the environment.	OBS2: An electric vehicle stands out visibly.	EV Trialability
1	1	6.600	1.000	.00	.00	.00	.00	.00	.00	.00
	2	.150	6.633	.00	.03	.14	.28	.04	.01	.01
	3	.090	8.576	.00	.01	.00	.32	.08	.49	.00
	4	.077	9.228	.01	.01	.56	.21	.15	.00	.02
	5	.051	11.411	.05	.02	.12	.20	.04	.46	.12
	6	.023	17.066	.01	.87	.16	.00	.68	.04	.00
	7	.009	26.419	.92	.06	.02	.00	.02	.00	.85

a. Dependent Variable: SA Energy

Table 99: SA Energy and PIC Collinearity Diagnostics.

Residuals Statistics[a]

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	2.416	5.009	3.881	.5494	135
Residual	-2.8183	2.0276	.0000	.8449	135
Std. Predicted Value	-2.667	2.052	.000	1.000	135
Std. Residual	-3.260	2.346	.000	.977	135

a. Dependent Variable: SA Energy

Table 100: SA Energy and PIC Residual Statistics.

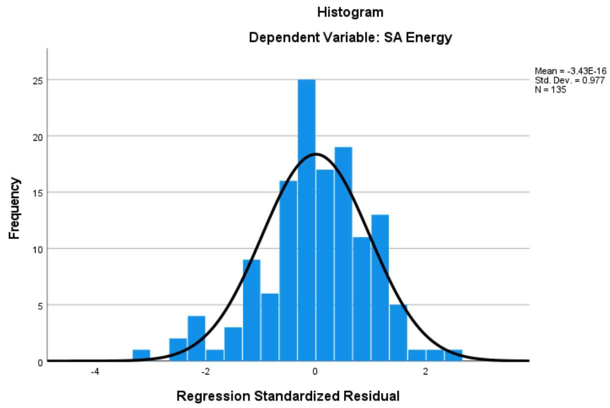

Figure 23: Histogram SA Energy and PIC (Source: IBM® SPSS and Researchers Data).

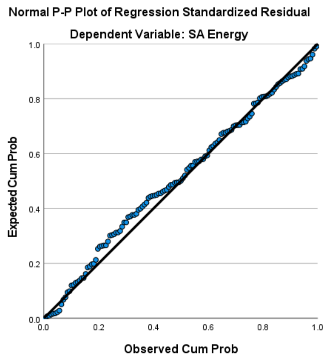

Figure 24: P-P Plot SA Energy and PIC (Source: IBM® SPSS and Researchers Data).

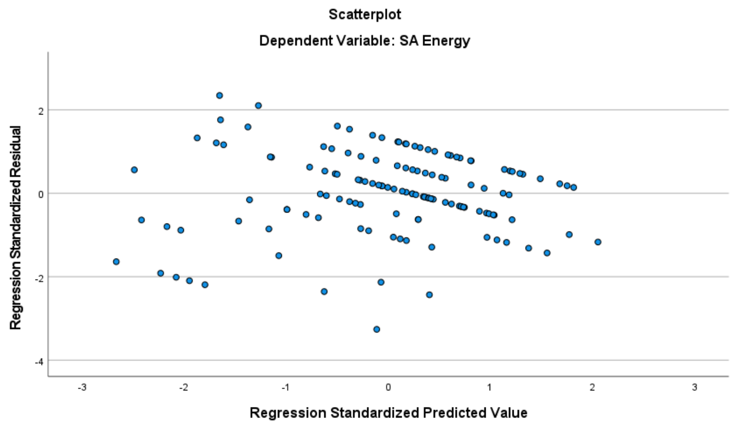

Figure 25: Scatterplot SA Energy and PIC (Source: IBM® SPSS and Researchers Data).

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	Innovativeness[b]	.	Enter

a. Dependent Variable: Prosocial

b. All requested variables entered.

Table 101: Prosocial and Innovativeness Variables Entered/Removed.

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.165[a]	.027	.020	.50191983733

a. Predictors: (Constant), Innovativeness

b. Dependent Variable: Prosocial

Table 102: Prosocial and Innovativeness Energy Mode Summary.

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.935	1	.935	3.713	.056[b]
	Residual	33.506	133	.252		
	Total	34.441	134			

a. Dependent Variable: Prosocial

b. Predictors: (Constant), Innovativeness

Table 103: Prosocial and Innovativeness ANOVA.

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	3.995	.178		22.399	<.001		
	Innovativeness	.090	.047	.165	1.927	.056	1.000	1.000

a. Dependent Variable: Prosocial

Table 104: Prosocial and Innovativeness Coefficients.

Collinearity Diagnostics[a]

Model	Dimension	Eigenvalue	Condition Index	Variance Proportions (Constant)	Innovativeness
1	1	1.970	1.000	.01	.01
	2	.030	8.134	.99	.99

a. Dependent Variable: Prosocial

Table 105: Prosocial and Innovativeness Collinearity Diagnostics.

Residuals Statistics[a]

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	4.0853581429	4.4469008446	4.3283950617	.08354655913	135
Residual	-1.356515050	.88451325893	.00000000000	.50004349492	135
Std. Predicted Value	-2.909	1.418	.000	1.000	135
Std. Residual	-2.703	1.762	.000	.996	135

a. Dependent Variable: Prosocial

Table 106: Prosocial and Innovativeness Residual Statistics.

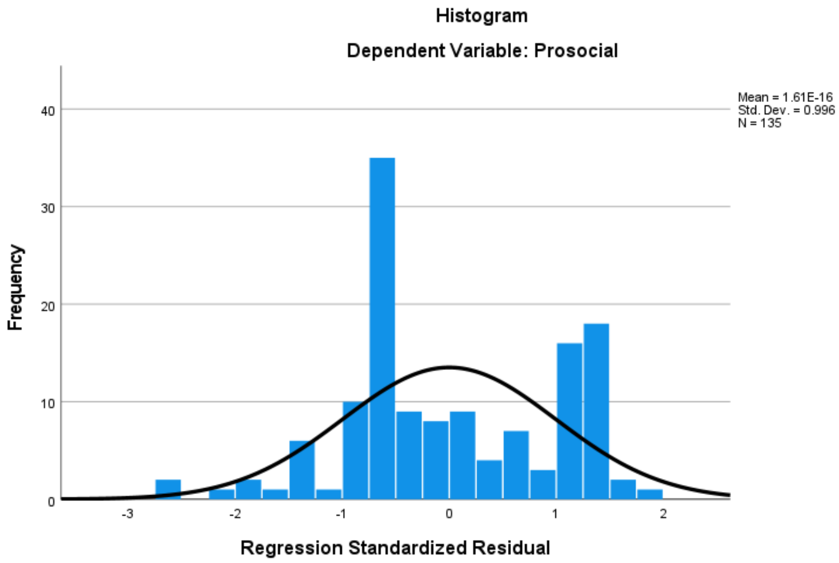

Figure 26: Histogram Prosocial and IC (Source: IBM® SPSS and Researcher Data).

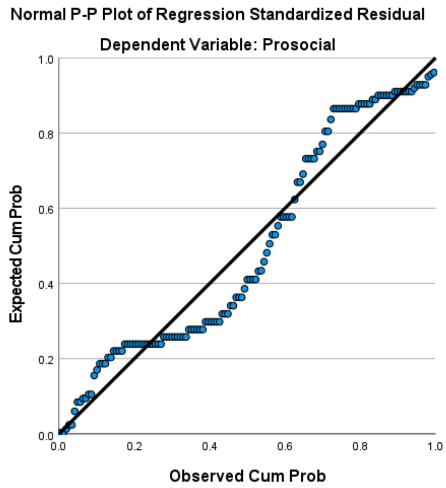

Figure 27: P-P Plot Prosocial and CI (Source: IBM® SPSS and Researchers Data).

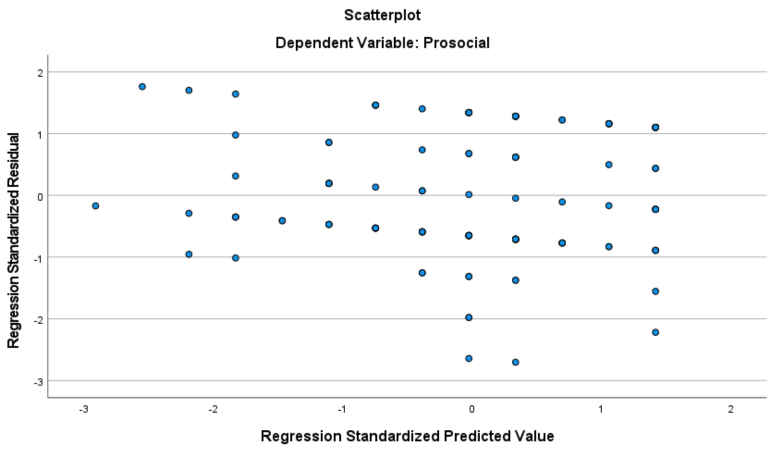

Figure 28: Scatterplot Prosocial and CI (Source: IBM® SPSS and Researchers Data).

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	Innovativeness[b]	.	Enter

a. Dependent Variable: SA Energy
b. All requested variables entered.

Table 107: SA Energy and Innovativeness Variables Entered/Removed.

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.190[a]	.036	.029	.9932

a. Predictors: (Constant), Innovativeness
b. Dependent Variable: SA Energy

Table 108: SA Energy and Innovativeness Energy Mode Summary.

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	4.901	1	4.901	4.969	.027[b]
	Residual	131.202	133	.986		
	Total	136.104	134			

a. Dependent Variable: SA Energy
b. Predictors: (Constant), Innovativeness

Table 109: SA Energy and Innovativeness ANOVA.

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	3.118	.353		8.835	<.001		
	Innovativeness	.207	.093	.190	2.229	.027	1.000	1.000

a. Dependent Variable: SA Energy

Table 110: SA Energy and Innovativeness Coefficients.

Collinearity Diagnostics[a]

Model	Dimension	Eigenvalue	Condition Index	Variance Proportions (Constant)	Innovativeness
1	1	1.970	1.000	.01	.01
	2	.030	8.134	.99	.99

a. Dependent Variable: SA Energy

Table 111: SA Energy and Innovativeness Collinearity Diagnostics.

Residuals Statistics[a]

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	3.325	4.153	3.881	.1913	135
Residual	-3.1528	1.5369	.0000	.9895	135
Std. Predicted Value	-2.909	1.418	.000	1.000	135
Std. Residual	-3.174	1.547	.000	.996	135

a. Dependent Variable: SA Energy

Table 112: SA Energy and Innovativeness Residual Statistics.

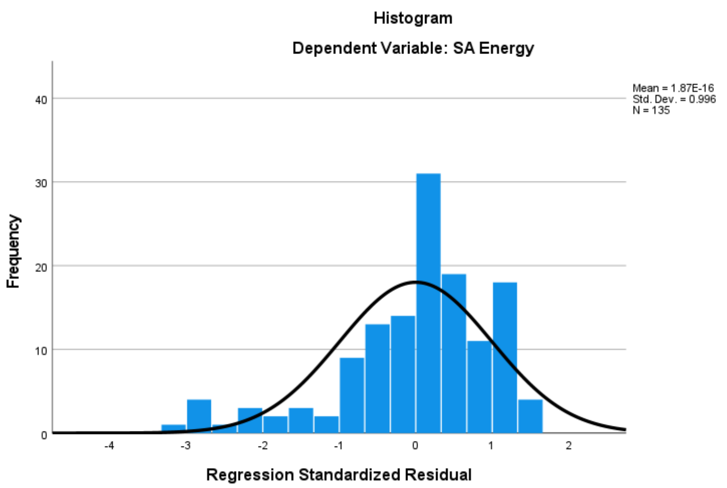

Figure 29: Histogram SA Energy and CI (Source: IBM® SPSS and Researchers Data).

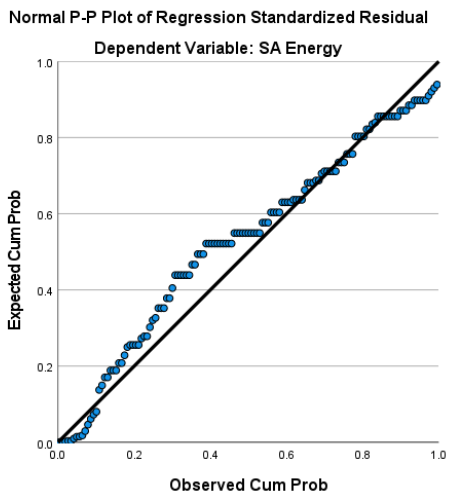

Figure 30: P-P Plot SA Energy and CI (Source: IBM® SPSS and Researchers Data).

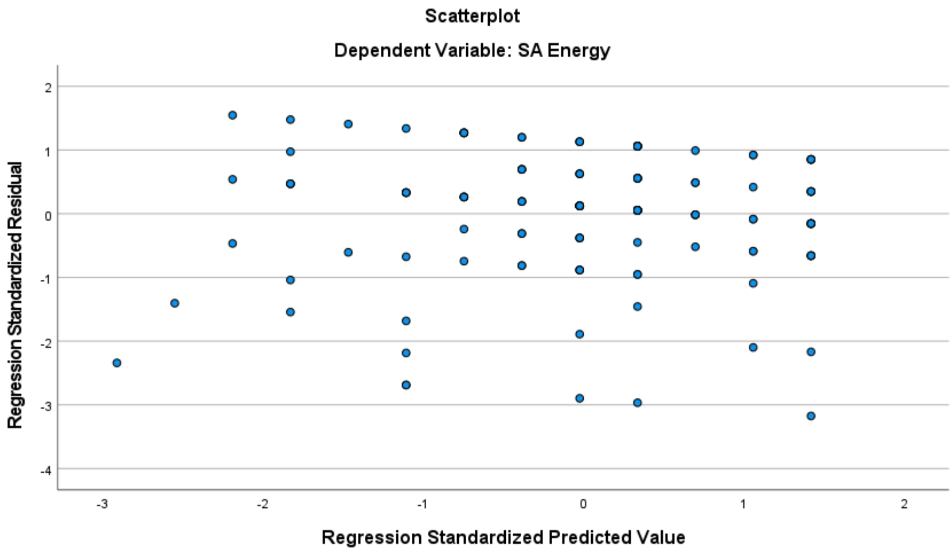

Figure 31: Scatterplot Prosocial and CI (Source: IBM® SPSS and Researchers Data).

Appendix L: Consistency Matrix

Questions / Hypotheses	Main Literature	Data Collection Tool	Analysis
Research Question 1 What impact does the availability of green energy have on consumer technology adoption of electric vehicles in South Africa?	Baker & Phillips, 2019 Broadbent et al., 2019 Gao & Souza, 2022 Hamilton & Terblanche-Smit, 2018 He et al., 2017 König et al., 2021 Laher et al., 2019 Moeletsi & Tongwane, 2020 Nathaniel et al., 2019 Pardo-Ferreira et al., 2020 Rietmann et al., 2020 Schlösser et al., 2019 Sefora et al., 2019 Shahbaz et al., 2020 Weiss & Helmers, 2019 Zhu, 2016	Questionnaire Section 1 Question 9 Section 2 Questions 10 to 13 Section 3 Questions 14 to 25	Descriptive Statistics Validity and Reliability Bivariate Correlations Cronbach's Alpha Exploratory Factor Analysis Inferential Statistics ANOVA
Research Question 2 What impact does consumer prosocial behaviour have on the technology adoption of electric vehicles in South Africa?	Ariely et al., 2007 Asadi et al., 2019 Ashraf Javid et al., 2021 Batson & Powell, 2003 Berkeley et al., 2018 Cai et al., 2019 Jansson et al., 2017 Lay & Hoppmann, 2015 Martí-Vilar et al., 2019 Silvia & Krause, 2016	Questionnaire Section 2 Questions 10 to 13 Section 3 Questions 14 to 25 Section 4 Questions 26 to 28	Descriptive Statistics Validity and Reliability Bivariate Correlations Cronbach's Alpha Exploratory Factor Analysis Inferential Statistics ANOVA Simple Linear Regression
Research Question 3 What impact does the current electricity crisis in South Africa have on consumer technology adoption of electric vehicles?	Baker & Phillips, 2019 Hanto et al., 2022 Laher et al., 2019 Nathaniel et al., 2019 Schlösser et al., 2019 Shahbaz et al., 2020	Questionnaire Section 2 Questions 10 to 13 Section 3 Questions 14 to 25 Section 5 Questions 29 to 31	Descriptive Statistics Validity and Reliability Bivariate Correlations Cronbach's Alpha Exploratory Factor Analysis Inferential Statistics ANOVA Multiple Regression

Table 113: Consistency Matrix