A STRATEGIC MODEL FOR ADVANCING ENVIRONMENTAL SUSTAINABILITY AND SERVICE EFFECTIVENESS IN THE AUTOMOTIVE SUPPLY CHAIN IN SOUTH AFRICA

by

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ACADEMIC INTEGRITY DECLARATION

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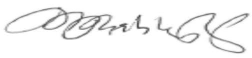
SIGNATURE:  **DATE: 20 July 2026**

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ABSTRACT

Environmental sustainability has become a key topic of discussion in the global automotive industry, as well as in South Africa. However, the South African automotive industry lacks clear guidelines for implementing environmentally sustainable practices and linking these practices to service performance. The aim of this study was to develop and test a model that facilitates the implementation of environmentally sustainable practices and enhances service effectiveness in the automotive supply chain in selected regions of South Africa. The study was grounded on Institutional Theory (IT) and the Resource-Based Theory (RBT). Quantitative data were collected using structured questionnaires in a cross-sectional design from 392 supply chain professionals, including waste managers, auto-parts suppliers and technicians across automotive workshops and supply chains in Gauteng, Limpopo, Mpumalanga, and the Free State, achieving a high response rate. The structured online questionnaire was administered through Google Forms. The collected data were tested using a partial least squares structural equation modelling (PLS-SEM) through Smart-PLS 3 and the Statistical Package for the Social Sciences (SPSS) for data screening (descriptive statistics).

Key findings reveal that compliance and certification, as well as optimised inbound logistics, are the primary and significant antecedents driving environmental sustainability (ES) adoption within this sector. Contrary to some expectations, factors such as top management support and technology adoption had no direct, significant impact. Furthermore, achieving environmental sustainability demonstrably enhances multiple dimensions of service effectiveness, including productivity, quality, innovation, and customer relationships. However, environmental sustainability did not have a significant direct effect on supplier relationships. Based on these empirically validated relationships, this study develops and proposes a focused, practical implementation model for the South African automotive supply chain. The model strategically prioritises leveraging regulatory compliance and certification, as well as optimising inbound logistics, as key drivers for achieving environmental sustainability, which subsequently enhances productivity, quality, innovation, and customer engagement.

Theoretically, the study's findings contribute to institutional theory by showing that, in weak-enforcement contexts in South Africa, compliance and certification tend to spread because organisations copy what others are doing, rather than being forced to do so. In addition, the study identifies inbound logistics as a strategic capability that generates sustainability outcomes in SME-dominated settings where more capital-intensive capabilities do not.

Key recommendations include strengthening government policy support, implementing systematic carbon footprint tracking, integrating sustainability into innovation strategies, and fostering long-term customer partnerships aligned with environmental goals. This study provides a vital roadmap for the industry to translate sustainability commitments into tangible operational performance improvements.

Keywords: Environmental Sustainability. Environmental Sustainability Practices, Service Effectiveness, South African Automotive Industry

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LIST OF ABBREVIATIONS/ACRONYMS

Abbreviation	Full Meaning
6Rs	Reduce, Reuse, Recycle, Rethink, Refuse, Repair
ACEA	European Automobile Manufacturers Association
AFVs	Armoured Fighting Vehicles
AIAG	Automotive Industry Action Group
AIEC	Automotive Industry Export Council
ANC	African National Congress
APDP	Automotive Production and Development Programme
AVE	Average Variance Extracted
B-BBEE	Broad-Based Black Economic Empowerment
BEE	Black Economic Empowerment
β	Path Coefficient (Beta)
CE	Circular Economy
CFA	Confirmatory Factor Analysis
CFI	Comparative Fit Index
CMV	Common Method Variance
CO_2	Carbon Dioxide
CR	Composite Reliability
CR	Customer Relationships
CRM	Customer Relationship Management
CSR	Corporate Social Responsibility
CSCs	Cross-Sectoral Collaborations
d_G	Geodesic Discrepancy
d_ULS	Unweighted Least Squares Discrepancy
DTI	Department of Trade and Industry
ECOWAS	Economic Community of West African States
ECSR	Environmental Corporate Social Responsibility
EE	Energy Efficiency
EEA	Employment Equity Act

Abbreviation	Full Meaning
EFA	Exploratory Factor Analysis
EMAS	Eco-Management and Audit Scheme
EMS	Environmental Management System
ES	Environmental Sustainability
ESC	Electronic Stability Control
EU	European Union
EVs	Electric Vehicles
FDI	Foreign Direct Investment
FSC	Forest Stewardship Council
GDP	Gross Domestic Product
GFI	Goodness-of-fit Index
GR	Government Regulations & Incentives
GRI	Global Reporting Initiative
HDIs	Historically Disadvantaged Individuals
HTMT	Heterotrait-Monotrait Ratio
ICE	Internal Combustion Engine
ICT	Information and Communication Technology
IL	Inbound Logistics
IMS	Intelligent Manufacturing Systems
IN	Innovation
IoT	Internet of Things
ISPs	Independent Service Providers
ISO	International Standards Organisation
LEED	Leadership in Energy and Environmental Design
LV	Latent Variables
MIDP	Motor Industry Development Programme
NAACAM	National Association of Automotive Component and Allied Manufacturers
NAAMSA	National Association of Automobile Manufacturers of South Africa
NEMA	National Environmental Management Act
NFI	Normed Fit Index

Abbreviation	Full Meaning
NOx	Nitrogen Oxides
OEM	Original Equipment Manufacturer
OICA	International Organisation of Motor Vehicle Manufacturers
OL	Outbound Logistics
PAA	Productive Asset Allowance
p	P value
PCF	Product Carbon Footprint
PLS	Partial Least Squares
PM	Particle Mass
PR	Productivity
QL	Quality
R&D	Research and Development
RBV	Resource-Based View
RBT	Resource-Based Theory
RFID	Radio Frequency Identification
SAAM	South African Automotive Masterplan
SC	Sustainability Culture
SCM	Supply Chain Management
SE	Service Effectiveness
SEZs	Special Economic Zones
SEM	Structural Equation Modelling
SMEs	Small and Medium-sized Enterprises
SPSS	Statistical Package for the Social Sciences
SR	Supplier Relationships
SRMR	Standardised Root Mean Square Residual
SSCM	Sustainable Supply Chain Management
TBL	Triple Bottom Line
TA	Technology Adoption
TPS	Top Management Support
TSAM	Toyota South Africa Motors

Abbreviation	Full Meaning
VIF	Variance Inflation Factor
VRIO	Value, Rarity, Inimitability, Organisation
WCM	World Class Manufacturing
WTO	World Trade Organisation

CHAPTER 1: ORIENTATION OF THE STUDY

1.1 INTRODUCTION

This study proposes a model to facilitate the implementation of environmental sustainability practices (ESP) and enhance service effectiveness (SE) in the automotive supply chain in selected regions of South Africa. The automotive industry is undoubtedly one of the largest and most complex sectors worldwide (Orsato & Wells, 2007; Kannegiesser & Gunther, 2014). Globalisation has led to increasingly complex supply chains, prompting the establishment of the Automotive Industry Action Group (AIAG), a non-profit organisation founded in 1982 by Chrysler, Ford, and General Motors. The AIAG's commitment is to promote ethical and responsible business practices among member companies. Since its founding, membership has sharply increased globally. Despite efforts to implement strategies that will completely transform the sector to renewable energy sources, the automotive industry remains a significant emitter of greenhouse gases, negatively impacting the environment. As one of the world's largest and most influential industries, it has substantial potential to contribute to a sustainable society (Kannegiesser & Gunther, 2014). The industry encompasses companies involved in the design, development, manufacturing, sale, and marketing of automobiles and their spare parts.

According to Wellbrock et al. (2020), sustainability management in the automotive industry requires a holistic approach, beginning with the conception and continuing through to series production. Several authors have examined specific materials for their sustainability potential in the industry. For example, Kumar and Das (2017) studied the suitability of bio-composites, particularly for dashboards, while Dunne et al. (2016) focused on natural fibres.

Incorporating sustainability principles into business strategies and operations is therefore critical. The automotive repair and maintenance sector is vital to economic growth and trade, shaping industry, cities, and communal and individual life. Since Henry Ford began mass-producing vehicles, banks have created specific loans to finance their acquisition.

The automotive repair and maintenance sector also supports other economic sectors. It is the second-largest market for the steel industry, consuming approximately 15% of total production (Parliamentary Monitoring Group, 2014). Other related industries include aluminium (5%), petrochemicals, particularly plastics (7%), and glass. Automotive products influence daily life, the economy, society, and the environment (Parliamentary Monitoring Group, 2014). For example, carbon dioxide (CO_2), a leading greenhouse gas, contributes significantly to air pollution, with climate change increasingly impacting human rights. (Wewerinke-Singh, 2019).

The automobile industry has made remarkable positive contributions to the world economy. It is among the most important economic sectors in terms of revenue. For instance, its turnover is equivalent to that of the sixth-largest economy in the world (Rae & Binder, 2017). However, stakeholder pressure increases in emerging countries experiencing economic growth (Carter & Liane Easton, 2011). Projections indicated approximately 1.644 billion vehicles worldwide in 2021; at current production rates, there will be 2.8 billion vehicles by 2036 (Autokunbo, 2025).

While these global trends are concerning, the environmental sustainability challenge manifests differently across national contexts. This study narrows its focus to South Africa, emerging market where the automotive industry faces distinct pressures: weaker regulatory enforcement, a fragmented aftermarket dominated by small and medium enterprises (SMEs), and growing stakeholder demands for environmental accountability despite limited government guidance.

In South Africa, the automotive industry encompasses manufacturing, distribution, service, and maintenance of motor vehicles and components (South Africa-Country Commercial Guide (SACCG), 2021). Original Equipment Manufacturers (OEMs), official dealers, and repair specialists collaborate to provide maintenance and repair services (SACCG, 2021). They cooperate to ensure warranty service, driver safety, environmental protection, spare part availability, and information about technical improvements (Ibid). Sustainability remains a key topic, in emerging market economies.

Transitioning toward sustainability in low-income developing countries differs from high-income, industrialised countries due to lower political and economic stability, weaker government institutions, less stable regimes, and ineffective enforcement of government regulations, increasing the importance of informal institutions (Wieczorek, 2018).

Within the South African automotive sector, this study specifically focuses on the automotive repair and maintenance aftermarket. The automotive repair and maintenance market is defined as the independent manufacturers, sellers, distributors, and installers of automotive replacement parts and accessories operating outside Original Equipment Manufacturer (OEM) networks (Semykina, Zagorodnii,Novikov & Novikov, 2020). This sub-sector was selected because it is under-researched compared to OEM manufacturing, yet faces unique sustainability challenges including waste management, parts recycling, and customer pressure for environmentally responsible service delivery.

In South Africa, the automotive industry contributes to the economy by directly impacting many important economic policy goals, such as gross domestic product (GDP), employment, skills development, economic linkages and innovation. The independent aftermarket manufacturers, sells, distributes, and installs automotive replacement parts and accessories through independent retailers and repair shops rather than OEMs, also engaging in re-manufacturing (SACCG, 2020).

The import value of replacement parts rose from R 56.97 billion in 2018 to R 64.45 billion in 2019 (South African Revenue Service (SARS), 2019). The contribution of the automotive industry to South Africa's GDP in 2019 was 6.4% (4.0% manufacturing and 2.4% retail). Beyond economic impact, the industry significantly influences societal well-being. Morelli (2011) defines environmental sustainability as meeting the resource and services needs of current and future generations without compromising the health of the ecosystems that provide them. Achieving this requires collective action within the automotive industry.

Sustainability in the automotive industry has become increasingly critical due to past corporate scandals, with topics such as electric motors, lightweight construction and CO_2, emission reduction being key issues (Wellbrock et al., 2020). The automotive repair and maintenance sector remains central to economic and trade development. It can pollute water, soil, and air, creating noise, waste and landfills, damaging land use impacts on health, and disrupt the ecosystem if environmental sustainability (ES) measures are neglected (Kolinski, Dujak & Golinska-Dawson, 2020). Developing a framework applicable throughout the automotive supply chain is therefore essential.

The automotive industry is evolving both locally and globally. Therefore, technical proficiency and leadership are essential elements of health and safety. Long-term success depends on consistent innovation strategies, strong branding, global efficiency in the value chain, and qualified, motivated employees. The supplier industry is also adapting and undergoing fundamental changes (Koers, 2014; Pischinger & Seiffert, 2016; Fuchs et al., 2021). Service effectiveness reflects perceptions of internal service, including communication, productivity, and responsiveness. It can be measured through customer surveys, monitoring service calls, tracking customer complaints and speed of problem resolution.

Service effectiveness is crucial for customer retention, because it measures a company's service effectiveness and evaluates areas that need to be worked on (Johnson, 2018). It is a long commitment to meet the continuous and increasing needs and wishes of customers. Quality ensures organisational durability, and benefits both producers and customers. Striving for quality service is considered essential for continued effectiveness, expansion, and sustaining a competitive global marketplace (Chuang, Chen& Tsai (2015). Customers now expect simplicity and rapid decision-making, taking approximately 15 hours to purchase a car and 50 hours across all service processes. A report by McKinsey and Company (2020) revealed that in 2025, approximately 45% of car buyers will be "millennials" (those born from1981 to 1996), who are, more than other generations, accustomed to a fluid, one-to-one relationship with brands. Satisfying customers lead to repeat purchases, brand loyalty, and positive word-of-mouth.

A report by Almquist, Senior and Bloch (2016) highlights that value elements directly influence revenue, market share, customer loyalty, and willingness to pay. It costs six to seven times more to acquire a new customer than to retain one. Baffour-Awuah (2018) notes that service sectors provide logistics, spare parts, documentation, start-up services, improved products, insurance, warranties, call centre services, training, maintenance and repairs. Competitive pressures require automotive companies to deliver effective services locally and globally. To address these pressures, this study develops a practical, comprehensive model that facilitates the implementation of environmental sustainability practices (ESP) and enhances service effectiveness in the automotive supply chain across selected regions of South Africa.

This study aims to develop and propose a practical and comprehensive model to facilitate the implementation of ESP and enhance the automotive supply chain in selected regions of South Africa. The implementation of environmentally sustainable practices leads to a sustainable environment and, consequently, more effective customer service. The emphasis is on reducing parts, rationalising materials and reusing components. Green manufacturing focuses on optimising material usage, and reusing components. There are several different circular strategies popularly referred to as the 6Rs, namely, reduce, reuse, remanufacture, redistribution, refurbishment, and recycling. However, circular economy (CE) transitions should foster strategies such as repair and maintenance that prolong the lifetime of a product (Luedeke-Freund, Gold & Bocken, 2019).

In addition to the 6Rs, green manufacturing also focuses on waste management, environmental protection, pollution control and other allied requirements (Rehman, Seth, & Shrivastava, 2016; Masoumi, Kanzemi & Abdul-Rashid, 2019). As the industry grows and vehicle production increases, more cars appear on the roads, leading to several societal challenges: air pollution, which worsens air quality and contributes to global warming; water and noise pollution; and the accumulation of materials such as steel, plastic, and glass, which are costly and difficult to recycle or dispose of. Therefore, the model proposed in this study addresses these challenges by guiding the integration of sustainability measures into automotive companies, thereby reducing environmental harm while enhancing service effectiveness (Mathivathanan & Haq, 2017).

1.2 PROBLEM STATEMENT

The research problem addressed in this study is the absence of a model to guide the implementation of environmentally sustainable practices (ESPs) in the South African automotive industry and to link these practices to service performance (SP). Both the South African government and the automotive industry acknowledge that climate change and ecological deterioration are among the greatest challenges affecting the global economy. Consequently, the automotive industry has committed to adopting and implementing environmentally sustainable practices. Despite this commitment, the South African government has not provided clear implementation guidelines for environmental sustainability. Furthermore, a key concern shared by many automotive industry stakeholders is the uncertainty regarding the impact of environmental sustainability practices on service effectiveness, which is crucial for business success.

Existing international literature has examined environmental sustainability in the automotive sector, but predominantly through isolated analytical lenses. For example, various international studies have investigated the relationship between environmental sustainability and individual service outcomes such as productivity (Suarez, Cusumano & Kahl, 2013; Crozet & Milet, 2017; Sousa & da Silveira, 2017), quality (Nair & Choudhary, 2016) and innovation (Bessant & Tidd, 2007; Behnam, Cagliano & Grijalvo, 2018).

However, a critical gap still remains. There is a limitation in studies that comprehensively modelled the relationship between multiple environmental sustainability practices, environmental sustainability (as a mediating construct), and all five dimensions of service effectiveness, such as productivity, quality, innovation, supplier relationships, and customer relationships, simultaneously within a single empirical framework. Furthermore, the existing literature is disproportionately dominated by studies from developed-economy contexts where regulatory enforcement is strong and institutional pressures are well-defined (Wieczorek, 2018).

This gap is significant for two reasons. First, without a comprehensive model, the relative importance of different sustainability practices cannot be compared, leading to inefficient resource allocation for industry managers. Second, findings from developed economies may not generalise to emerging markets such as South Africa, where weaker regulatory enforcement, SME-dominated supply chains and distinct logistical challenges create a fundamentally different context.

To date, there is a paucity of literature, both international and local, offering insights into the implementation of environmental sustainability practices and their influence on service effectiveness. Existing international studies have largely examined isolated aspects of service effectiveness, such as environmental sustainability and productivity (Suarez, Cusumano & Kahl, 2013; Crozet & Milet, 2017; Sousa & da Silveira, 2017), environmental sustainability and quality (Nair & Choudhary, 2016) and environmental sustainability and innovation (Bessant & Tidd, 2007; Behnam, Cagliano & Grijalvo, 2018). However, limited research has comprehensively explored the relationships between environmental sustainability practices and all aspects of service effectiveness, including productivity, quality, innovation, supplier relationships, and customer relationships. The lack of environmental sustainability guidelines in the automotive repair and maintenance sector contributes to uncertainty regarding the effectiveness of implementing these practices. In response to this gap, the current study seeks to propose a practical and comprehensive model that facilitates the implementation of environmentally sustainable practices and enhances service effectiveness in the automotive supply chain of selected regions of South Africa.

1.3 RESEARCH OBJECTIVES

The study sought to address the following objectives:

1.3.1 Primary objective

The primary objective was to develop and test a model for implementing environmental sustainability and enhancing service effectiveness in the automotive supply chain in South Africa.

1.3.2 Secondary objectives

The primary objective of the study was achieved through the following secondary objectives:

1. To evaluate the degree of application of environmental sustainability practices within the automotive industry in South Africa.
2. To measure the service effectiveness of the South African automotive industry.
3. To determine the drivers of environmental sustainability in the South African automotive industry.
4. To examine the relationship between environmental sustainability practices and service effectiveness in the South African automotive industry.
5. To propose a model that can facilitate the implementation of environmental sustainability practices and enhance service effectiveness in the automotive supply chain in the South African automotive industry.

1.3.3 Research questions

This study aimed to develop and test a model that facilitates the implementation of environmental sustainability practices and enhances service performance in the automotive supply chain across selected regions of South Africa. The following research questions were thus investigated:

1. To what extent is the South African automotive industry applying each of the environmental sustainability practices identified in this study, namely, government regulations and incentives, technology adoption, top management support, sustainability culture, environmental CSR, compliance and certification, inbound logistics and outbound logistics?
2. What is the current service effectiveness of the South African automotive industry?
3. What are the drivers of environmental sustainability in the South African automotive industry?

4. What is the relationship between environmental sustainability and service effectiveness in the South African automotive industry?
5. What model can be proposed to facilitate the implementation of environmentally sustainable practices and enhance service effectiveness in the automotive supply chain in the South African automotive industry?

1.4 CONCEPTUAL MODEL OF THE STUDY

Figure 1.1 below outlines the conceptual model that guided the study. Eight environmental sustainability practices (government regulations and incentives, technology adoption, top management support, sustainability culture, environmental CSR, compliance and certification, inbound logistics and outbound logistics) are placed as predictors that influence environmental sustainability (mediating variable). In turn, environmental sustainability influences service effectiveness, which is the outcome variable, represented by its five sub-components, namely: productivity, quality, innovation, supplier relationships, and customer relationships.

The model indicates that environmental sustainability can be achieved through the adoption and implementation of the following practices:

- Government regulations and incentives (H1): According to Richter and Medunic (2020), lawmakers pressure firms to conform to new regulations to ensure environmentally sustainable business operations. To comply with these regulations, firms implement changes through modifications and adaptations of products using new technologies. The regulations will push the organisations in the automotive industry to increase service effectiveness through improvements in productivity (H9), quality (H10), innovation (H11), customer relationships (H12) and supplier relationships (H13).
- Technology adoption (H2): The technological dimension indicates how much businesses invest in infrastructure that is more ecologically friendly. Considerations include using renewable energy sources, virtualizing and consolidating servers, switching from older to more environmentally friendly applications and technology, and creating solutions to support corporate-wide sustainability objectives. Technology adoption will improve product quality (H9), new technologies are associated with an increase in productivity (H10), technology adoption in itself is innovation (H11), and it strengthens customer relationships (H12) and supplier relationships (H13).

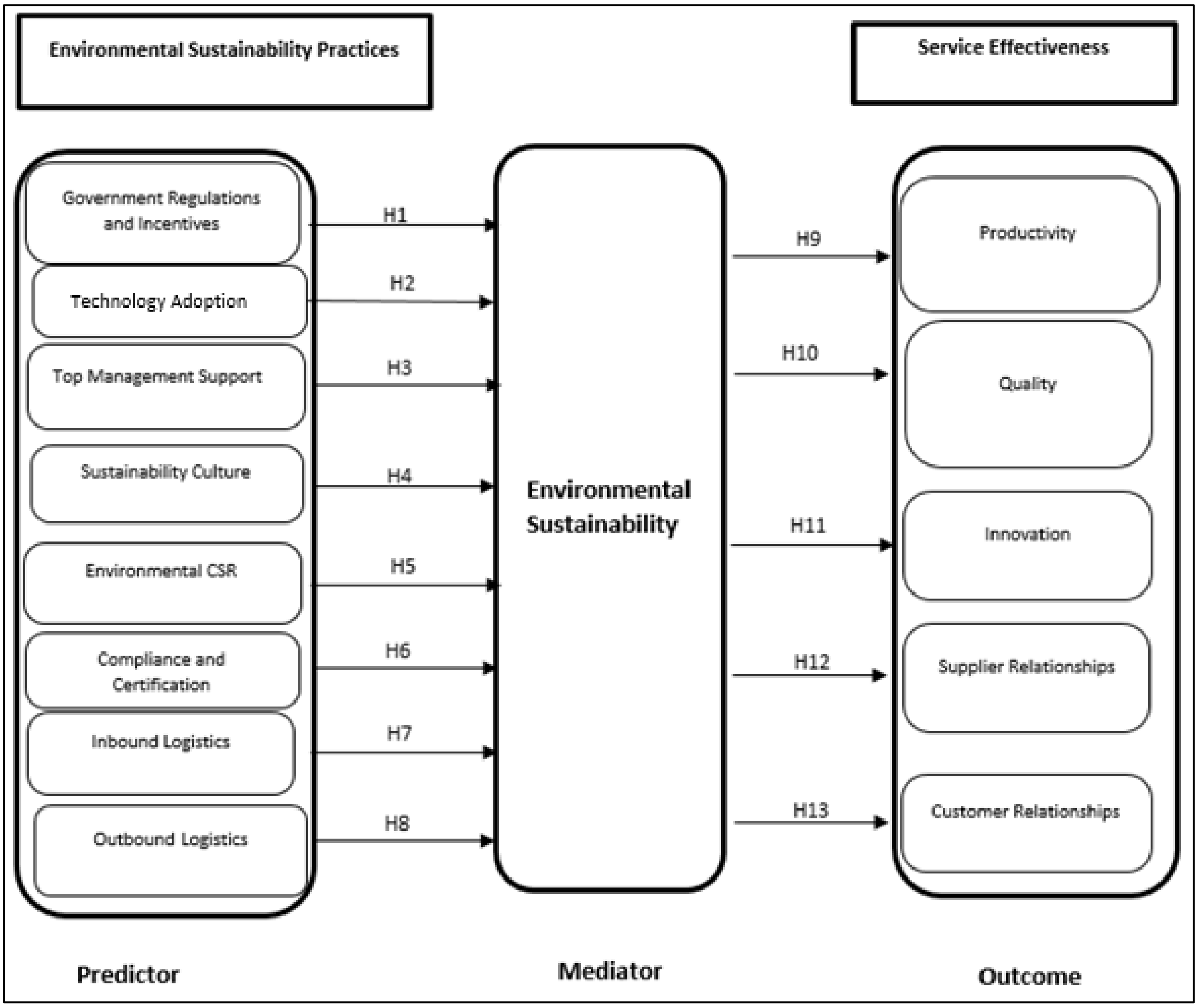

Figure 1.1: Research Model

Source: Author's own compilation

- Top management support (H3): Senior management support proposes not only that the organisation strives for environmental excellence but also that it helps with "issue legitimation," which involves transforming the organisation's identity in favour of environmental activities (Burki, Ersoy & Najam, 2019). With top management support, investments in innovative ideas are supported, resulting in increased productivity (H8). In addition, management ensures that the adoption of environmental sustainability practices, with the new technology it requires, results in improved product quality as well as relationships with customers and suppliers.
- Sustainability culture (H4): Since an organisation's culture significantly influences how its employees act, change initiatives that are compatible with the current organisational culture are more likely to be successful (Hoffman & Georg, 2012; Ben-Eli, 2018). An

organisation with a strong sustainability culture promotes innovative ideas that enhance product quality. Technology adoption will improve product quality (H9), new technologies are associated with an increase in productivity (H10), technology adoption is innovation (H11), and it strengthens customer relationships (H12) and supplier relationships (H13).

- Environmental CSR (H5): Public pressure can assist businesses in making the move toward more environmentally friendly corporate practices, such as using green ICT (Chen et al., 2018). Businesses that go above and beyond compliance frequently develop a positive public reputation and have an impact on consumer behaviour and attitudes towards brands and products (Suryawanshi & Narkhede, 2015). This reputation is associated with the company's competitive advantage. Therefore, increased productivity, quality, and innovation lead to improved relationships with customers and suppliers who align with the environmental sustainability practices.
- Compliance and certification (H6): Compliant automakers have a strong incentive to follow the laws in place because doing so results in environmental protection (Xing et al., 2019). According to Agus Harjoto and Salas (2017), following the law improves green development practices related to environmental sustainability. This green innovation enhances productivity and quality and fosters relationships with green-compliant suppliers and customers.
- Inbound logistics (H7): The connections between inbound logistics (IL) operations have been linked to organisational resilience (Costa et al., 2020). To that end, a resilient organisation strives to improve product quality, enhance productivity and is innovative. This competitive advantage helps build customer and supplier relationships.
- Outbound logistics (H8): Outbound logistics practices, such as the use of rail, are less expensive and environmentally friendly. In terms of green packaging, companies are more inclined to convert packaging materials from conventional materials into reusable materials, such as cardboard and renewable plastics (Smith, 2015). Recycling has helped reduce packaging costs.

The model shows that environmental sustainability factors have a positive influence on service effectiveness. The explanations provided above show the link between environmental sustainability practices and service effectiveness in the automotive repair and maintenance sector.

1.5 RESEARCH THEORIES

Research theories provide significant guidelines for conducting research by identifying areas most likely to be fruitful, that is, those in which meaningful relationships among variables are likely to be found. In addition, these theories have the potential to improve thinking abilities; hence, they are considered the keystone of knowledge production in the field of interest. Theories help organise relevant empirical facts to create a context for understanding phenomena (Johnson, 2018). Theory testing in areas such as Sustainable Supply Chain Management (SSCM) provides a basis for developing a greater understanding of the field through existing theoretical lenses, tests their relevance, and is critical for their application (Touboulic & Walker 2015). Institutional Theory (IT) has facilitated the conceptualisation of the evolution of the role of business in increasing sustainability requirements. This section presents two theories, namely, IT and RBT, which help this study develop an environmental sustainability and service performance framework that will contribute towards the body of knowledge (Di Maggio & Powell, 1983; Glanz, 2017).

1.5.1 Institutional theory (IT)

Institutional Theory (IT) was introduced in the late 1970s by John Meyer and Brian Rowan to explore how organisations fit with, are related to and shaped by their societal, state, national, and global environments. Tuczek, Castka & Wakolbinger (2018) affirm that this theory explains why firms' practices converge and become isomorphic instead of being different. Institutional Theory highlights three isomorphic pressures: coercive, normative, and mimetic. Coercive pressure originates from powerful actors in the organisation's environment and takes the form of standards, mandates or regulations; these actors can use their power to enforce standards.

The legitimacy, institutional pressure, and environmental awareness of firms have been studied and reported in recent studies (Dubey, Gunasekaran, & Samar Ali, 2015; Roscoe et al., 2019). The umbrella legislation governing pollution and environmental concerns in South Africa is the National Environmental Management Act (NEMA), (Act No. 107) of 1998. Its purpose is to prevent, minimise, remedy and punish actions that threaten or damage the environment and those who live in it. All stakeholders in the automotive industry needs to be aware of these laws and implement preventive and control measures in repair and service workshops to protect land, air, water, and soil, thus minimising environmental impact.

Currently, environmental laws such as NEMA encompass a wide range of subjects, such as air and water quality, hazardous waste, and biodiversity. Adherence to these laws minimises adverse environmental effects in automotive maintenance and repair activities. Normative pressure takes the form of beliefs, expectations, norms and values held by a larger community, such as societal groups, regulators, consumers and suppliers. Under mimetic pressure, companies imitate the actions of competitors in the automotive industry, hoping to replicate their success and subsequently achieve legitimacy. An example is Bosch Automotive, which complies with Toyota Workshop's effective waste disposal strategy (Sarkis, Zhu, & Lai, 2011; Yang et al., 2019).

The International Organisation for Standardisation (ISO)14001, an internationally recognised standard for Environmental Management System (EMS) adoption, leads to better planning, organisation, leadership, and control of the EMS, as well as a greater awareness of compliance with relevant regulations (Camilleri, 2022).

The rationale for choosing IT is that it promotes environmental compliance in the automotive service and repair sector by preventing water and air pollution. This compliance is achieved by minimising carbon emissions from vehicle exhaust systems and ensuring the proper disposal of used old car parts to prevent water and soil pollution. It also ensures that automotive workshops comply with environmental laws through penalties and prosecutions for non-compliance. Compliance with NEMA enables the effective implementation of a practical and comprehensive environmental sustainability framework in the automotive repair and maintenance sector, thereby ensuring societal well-being and environmental sustainability.

1.5.2 Resource-based theory (RBT)

The roots of RBT can be traced to several intellectual origins, including Phillip Selznick in the 1950s and even David Ricardo in the 19th century. The resource-based view (RBV) is a strategic approach used by organisations to understand the elements of the business that generate long-term competitive advantage. This theory emerged during the 1980s to 1990s through the work of Wernerfelt, Hamel, Prahalad, and Barney, and views organisational resources as central to superior performance. According to the RBV, green entrepreneurial orientation is a strategic resource embedded in corporate culture and a dynamic capability that assists firms in recognising, seizing, and sustaining environmental initiatives. To achieve a sustainable competitive advantage, management should focus on resources and capabilities that competitors cannot easily imitate, such as unique expertise, specific process knowledge, corporate image or a strong brand (Doleski, 2015; Makhloufi et al., 2022). The RBT's central premise is that a firm's economic profit stems from its ability to generate added value relative to its competitors (Barney, Ketchen & Wright, 2021).

The RBT is relevant to the current study because it emphasises the optimal and profitable utilisation of company resources to ensure service effectiveness. Effectiveness is key to achieving and sustaining competitive advantage and superior overall supply chain performance in automotive services and repair centres (Grant, 1991; Elorata & Turumen, 2015; Meekaewkunchorn et al. 2021). Effective service influences customer satisfaction, which subsequently impacts customer loyalty, retention, reduction in costs and increased profitability.

Two types of resources in an automotive repair and service workshop are tangible and intangible. Tangible assets include physical things, buildings, machinery and equipment such as the Bosch Diagnostic Machine and Bosch air conditioning regas machine. Since these assets are imitable and can be acquired by competitors, they confer a slight advantage to the company. Intangible assets refer to non-physical resources owned by a firm, such as brand reputation, trademarks, and intellectual property.

The Bosch brand, whose slogan is "Invented for life," is globally recognised. Such intangible assets are primary sources of competitive advantage because they are rare, difficult to imitate and not easily substitutable (Jurevicius, 2013). Therefore, implementing service effectiveness strategies that promote service innovation, is essential for achieving competitive advantage, growth, and long-term sustainability. Whipple, Weidmer and Boyer (2015) argue that effective management of buyer-supplier relationships is necessary to achieve superior supply chain performance.

The South African automotive industry operates in a highly competitive environment characterised by increasing local and international competition and more demanding customers. To remain relevant amid changing market conditions, firms must continuously enhance their value propositions. Barney (1991) and Doleski (2015) identified a valuable, rare, inimitable resources and organisation (VRIO) framework that examines whether resources are valuable, rare, costly to imitate and organise. For an automotive service and repair centre to gain and sustain a competitive advantage, it must possess VRIO-qualified resources.

1.6 PRELIMINARY LITERATURE REVIEW

This section provides a summary of the literature on the research constructs. These include environmental sustainability practices and service effectiveness.

1.6.1 External pressures driving Environmental Sustainability Practices (ESPs)

Environmental Sustainability Practice (ESP) may be defined as the practices, actions, and methods that positively affect the natural environment (Sendawula et al., 2020). Numerous ESPs are implemented in various organisations worldwide. Their role is essential in developing and increasing the environmental performance, economic performance, and social performance of an organisation (Wang & Gunasekaran, 2017). Langton, Mafini and Maotoawe (2023) defined these practices as Green Supply Chain Management (GSCM). It is further defined as a "set of managerial practices" whereby a combination of supply chain management (SCM) environmental challenges or concerns is integrated to ensure environmental compliance and improve the sustainability of the supply chain (Langton et al., 2023). Several researchers identify government regulations and incentives, technology adoption, top management support, sustainability culture, environmental corporate social responsibility, compliance and certification, inbound logistics and outbound logistics as the most dominant environmental sustainability practices (Neeveditah, Karishma & Devi 2017; Venkatesh & Davis, 2000; Kiesnere & Baumgartner, 2019; Di Pillo et al., 2017; Ayantoyinbo & Gegeleso, 2018; Klumpp & Heragu, 2019).

In this study, the following practices are considered: (a) government regulations and incentives, (b) technology adoption, (c) top management support, (d) sustainability culture, (e) environmental corporate social responsibility, (f) compliance and certification, and (g) inbound logistics and outbound logistics. The rationale for choosing these practices is that environmental sustainability practices are crucial for the automotive repair and maintenance sector in achieving the strategic goal of increasing sustainability in terms of profitability, ecological responsibility, and socially compatibility.

Businesses can no longer operate with the sole aim of making profits at the expense of the environment, society, the economy, consumers, and employees. New product and production technologies must be integrated; new cooperations must be managed; and customer satisfaction must be enhanced through localisation and individualisation. In contrast, production costs may remain competitive because of intelligent and flexible factories.

The automotive industry can be described as a backbone in many developed countries and an enabler of economic prosperity in developing countries. It has made remarkable positive contributions to the world economy and people's mobility. However, its products and processes are a significant source of environmental impacts, such as global warming from greenhouse gas emissions (Environmental Protection Agency (EPA), 2024). The automotive industry is also faced with challenges such as high expenditures in logistics, long order-to-delivery lead times and non-compliance, hence, there is a need to develop an efficient supply chain model that can meet the challenges of customers and manufacturers.

1.6.1.1 Government regulations and incentives

Regulations are laws, policies, and rules promulgated by the government and other regulatory bodies to serve and protect the world at large and address public concerns over environmental and social well-being. Concerns over the depletion of natural resources and increases in emissions have resulted in more environmental policies, standards, and regulations being implemented globally. These environmental policies aim to promote and maintain standardisation and quality where safety, health, consumer protection, and the environment are important (Neeveditah et al., 2017).

Government regulation refers to environmental laws, regulations and policies enacted by government departments or environmental protection agencies, and its fundamental characteristic is that it is mandatory. Davis-Sramek et al. (2019) suggest that regulation practices provide a roadmap for companies to adapt their strategies and business activities to create harmony in implementing sustainable practices and mitigating discrepancies effectively. For example, the South African Bureau of Standards (SABS) provides a range of standards that guide the operations of the automotive industry, from quality management systems to testing methods for specific materials or parts. These help the organisation enhance customer satisfaction; meet regulatory, safety and reliability requirements; and ensure consistency of quality throughout the supply chain.

Standards play an essential role in the economy by enabling business interaction, assisting companies in complying with relevant laws and regulations, accelerating the introduction of innovative products into the market and enhancing compatibility between new and existing products, services and processes.

South Africa faces the enormous challenge of securing a supply of electricity and reducing its greenhouse gas emissions. The introduction of tax incentives can encourage the implementation of energy efficiency (EE) and renewable energy by energy consumers, thus promoting the transition to a greener economy. According to Braathen (2007), the ideal situation is one in which everyone who contributes to a given environmental problem should have an economic incentive to alter their behaviour to become more environmentally friendly.

On the 11th of December 2017, Section 12B of the Income Tax Act (South Africa) introduced two tax incentives, an EE income tax incentive and a renewable energy income tax incentive, to encourage and support businesses looking to green their offices and buildings. Regulations create opportunities for maximising earnings through internal efficiency measures. A reduction in both capital and operating expenditures reduces the environmental impact of businesses, which in turn improves business sustainability and promotes competitive advantage because green companies and brands are typically more appealing to clients, customers and employees.

If properly designed and effectively implemented, environmental regulation can mitigate the emission of pollutants to achieve green industrial development and stimulate more green innovation, which can eventually offset regulatory costs and even generate additional profits (Todor, 2019).

1.6.1.2 Environmental Corporate Social Responsibility (ECSR)

Environmental corporate social responsibility (ECSR) refers to a business's deliberate focus on the environmental aspects of corporate social responsibility (CSR). Firms, particularly in energy-intensive industries, have historically been viewed as contributors of environmental degradation (Hu & Wang, 2021). This negative perception stems from the damage to the ecological environment caused by excessive industrial production (Dou, Su & Wang, 2019). The ECSR is viewed as a firm's contribution to sustainable development, balancing and improving environmental impacts without compromising economic performance.

The automotive repair and maintenance sector has long been associated with potential negative environmental impacts, notably CO_2 emissions (Hu & Wang, 2021). With growing concerns about global warming and social issues, the automotive supply chain industry faces increased pressure from stakeholders and regulatory agencies to achieve sustainability. Consequently, many organisations now voluntarily implement environmental and social responsibility initiatives that go beyond regulatory compliance to support broader environmental sustainability (Agus & Salas, 2017).

Environmental Corporate Social Responsibility (ECSR) can be categorised into two main types. The first involves active ECSR, which relates to business practices adopted voluntarily by an organisation that goes beyond typical regulatory requirements because the organisation wants to support environmental sustainability. The second involves passive ECSR, which is the practice of adopting ECSR rules by a company to comply with environmental regulatory standards imposed by the government with minimum effort. Chen et al., (2018) suggest that CSR activities can increase a company's competitive advantage when new customer benefits can be increased or created successfully.

Properly implemented ECSR strategies provides organisations with various competitive advantages. These include extended access to capital and markets, increased sales and profits, or cost savings. It is an indicator of a company's success as a whole and as a possible way to achieve sustainable development (Slavic & Berber, 2015). Regardless of industry or company size, ECSR initiatives can foster environmental stewardship, support sustainable development, and promote long-term organisational success.1.6.7 Compliance and certification

Environmental compliance refers to a firm's adherence to environmental laws, regulations, standards and other requirements, such as site permits and operational licenses. It shows confidence in and acceptance of laws, and lawmakers view that environmental compliance plays a crucial role in the survival of a firm (Neevedish, Wijethilake & Ekanayake, 2017). However, achieving compliance can be hindered by a lack of accountability, transparency, and participation which may slow progress in implementing environmental sustainability initiatives. Environmental sustainability certification represents more than formal recognition it reflects a business's commitment to adopting efficiency-driven strategies and best practices stipulated by the ISO.

Sustainability certification typically involves a business owner investing in a program that outlines a set of green initiatives that can be reviewed for completion or added to a list of new projects to launch; non-compliance poses a severe threat to the firm. The South African Bureau of Standards (SABS) actively supports environmental conservation through the ISO 14001 certification scheme, which represents state-of-the-art environmental management practices worldwide and enhances a firm's competitive advantage across the entire industry (Boakye, 2018).

Environmental compliance at the firm level is exhibited through internal environmental policies, possession of environmental excellence certificates, adoption of environmental certifications such as the ISO 14001 and the absence of environmental fines and penalties (Di Pillo et al., 2017). Environmental compliance covers a broad range of laws, regulations and standards framed by governments and other regulatory bodies to protect the environment even when businesses continue to manufacture and reach several markets. This compliance enables organisations to think about their impact on the environment. It reduces pollution, protects wildlife and improves green cover to bequeath a greener world to posterity while pursuing economic development.

The benefits of compliance and certification are multifaceted. They include cost reduction, minimisation of carbon footprint, operational efficiency, enhanced CSR, and improved business profitability. Environmental compliance enables the company to achieve operational efficiency in meeting quality requirements and product specifications, thereby improving the firm's competitive advantage. Asongu, Le Roux & Biekpe, (2017) argue that solid and stringent environmental policies compel firms to commit fully to environmental protection.

1.6.1.3 Compliance and certification

Environmental compliance means conforming to environmental laws, regulations, standards and other requirements, such as site permits to operate. It shows confidence in and acceptance of laws, and lawmakers view that environmental compliance plays a crucial role in the survival of a firm (Neevedish et al., 2017). However, a lack of accountability, transparency, and participation can hinder progress in the environmental sustainability agenda. Environmental sustainability certification for businesses is more than just a stamp of approval but a commitment to implement the efficiency-driven strategies stipulated by the (ISO).

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Compliance and certification play the following roles: cost reduction, reduction of the carbon footprint through the adoption of sustainable business practices, recognition of corporate social responsibility, and enhancement of business profitability, as compliance with regulatory standards results in cost savings and operational efficiency. Environmental compliance enables the company to achieve operational efficiency in meeting quality requirements and product specifications, thereby improving the firm's competitive advantage. Asongu et al. (2017) argue that solid and stringent environmental policies compel firms to commit fully to environmental protection.

The literature classifies three sources of external pressure that influence sustainable environmental practices in the supply chain as: government policies and regulations and subsidies (coercive isomorphism), sustainable ECSR (normative isomorphism), and adherence and accreditation (mimetic isomorphism). These three constructs are treated as precursors in the conceptual model of this study. Specifically, the model suggests that the following three factors: government regulations and incentives (H1), environmental CSR (H5), and compliance and certification (H6) positively affect environmental sustainability. The South African automotive aftermarket provides an ideal context to examine whether these external pressures are substantiated in an emerging market context characterised by weak institutional enforcement.

1.6.2 Internal Capabilities Driving Environmental Sustainability Practices

Although Institutional Theory accounts for the effects of external pressures, RBT is concerned with the internal organisational competencies that enable the organisation to gain a competitive advantage. The theory asserts that organisations are heterogeneous in terms of their resources and capabilities, and those that possess resources and capabilities that are value-creating, rare among existing and potential competitors, difficult to imitate, and not easily substitutable will realise superior performance (Barney, 1991). In terms of environmental sustainability, technology adoption, top management support, and sustainability culture, inbound and outbound logistics are internal competencies that automotive workshops can leverage to deliver sustainability. The following subsections elaborate on each capability and its predicted association with environmental sustainability.

1.6.2.1 Technology adoption

Technology is the sum of many techniques, skills, methods, and processes used to produce goods or services or accomplish objectives, such as scientific investigation (Liddell, Scott & Berry, 2007). According to Ahuja and Muthiah (2021), green computing aims to reduce energy consumption and carbon emissions, and to recycle and reuse energy in a beneficial and efficient manner. The term “green information technology” denotes environmentally friendly ways of using digital technology. The South African automotive industry needs to develop a technology and associated skills development roadmap to align its evolution with each key objective of the South African Automotive Masterplan (SAAM).

Green information technology promotes the design, manufacture, and management of information technology equipment and minimises energy consumption throughout its life cycle, thereby reducing the environmental impact (Singh & Sahu, 2020). The Department of Trade and Industry (DTI), (2016) previously commissioned a detailed study and associated project to formalise a SAAM to guide South African automotive value chain development through 2035.

Green technology, such as solar panels and wind turbines, can help replace practices and methods that damage or deplete natural resources with more sustainable, efficient alternatives. Information technology, enabled by the internet, computers, data centres, servers, and other machinery, is applied in almost every industry, helping organisations become smarter by increasing profitability and operational efficiency in the competitive global marketplace. Some scholars (Li et al., 2024; Zhang et al., 2020) have reported that companies' technology compatibility, innovation capability, and policy and market orientation are directly impacted by green readiness.

On the other hand, the increased use of technology that results in greater energy consumption is responsible for the carbon footprint and greenhouse gas emissions that cause harm to climate and climate change. Hopkins and Hawkins (2018) believe that the introduction of the industrial internet, the Internet of Things (IoT), and Industry 4.0 concepts offers many opportunities to reduce energy consumption, such as a cyber-physical system manufacturing services layer, a fog manufacturing services layer, a cloud manufacturing services' layer, and blockchain-based service-oriented middleware. According to Ahujah and Muthiah (2021), green computing aims to reduce the consumption of energy and carbon emissions and to recycle and reuse energy beneficially and efficiently. Eco-efficiency is a crucial concept encompassing economic and environmental aspects to promote more efficient use of resources and lower emissions.

Eco-efficiency is a crucial concept encompassing economic and environmental aspects to promote more efficient use of resources and lower emissions. Failed investments in technology may cause financial losses and lead to employee dissatisfaction (Belucio et al., 2020). Eco-friendly companies can utilise information communication technology (ICT) and e-business models more in their operations to ensure sustainability benefits (Venkatesh, 2000; Dalvi-Esfani et al., 2020).

The Eurostat publication (2009) on the environmental goods and services sector states that this sector consists of a heterogeneous set of producers of technologies, goods, and services. These technologies measure, control, restore, prevent, treat, minimise, conduct research, and mitigate environmental damage to air, water, and soil related to waste, noise, biodiversity, and landscapes. The implication is that services must use green technology that helps prevent or minimise pollution and both measure and prevent resource depletion.

1.6.2.2 Top management support

Top management commitment is one of the critical driving forces for implementing green SCM and improving environmental performance (Chu et al., 2017). Senior managers provide resources and design incentives for employees to promote sustainability initiatives, strongly influencing organisational culture and company-wide decision-making processes through their commitment and leadership (Kiesnere & Baumgartner, 2019). The extant literature reveals that support from top- and mid-level managers significantly influences the continuous improvement of environmental performance (Mackey, 2008; Habib, Bao & Ilmudeen, 2020).

Top executives' attitudes and support levels also shape the participation of organisational members or organisational partners in adopting practices, management activities, and systems. It is almost impossible for members actively involved in these activities, or their partners, to provide high-level collaboration without active support and commitment from top management. Fernando et al. (2018) argue that management commitment can inspire other internal stakeholders in the supply chain to adopt green practices, enhancing sustainability and environmental performance. To discuss the impact of eco-friendly collaboration with supply chain respondents on environmental performance within the green supply chain, the degree of support and attitudes of top internal management must be considered (Burki, Ersoy & Dahlstrom, 2018; Burki et al., 2019). Top management plays a pivotal role in guiding internal members and external partners, shaping the value chain, and ensuring the effective implementation of sustainability initiatives. Their involvement is one of the critical success factors for achieving sustainable development in organisations.

1.6.2.3 Sustainability culture

Responsibility for environmental degradation and climate change cannot be placed on a single individual. Versey (2021) emphasised that any intersectional policy on climate change must coordinate action among all stakeholders. To address ecological challenges, organisations must foster new cultures of sustainability, integrating environmentally responsible behaviours into everyday operations. The company's culture reflects its willingness to embrace environmental change through decisions and strategies informed by sustainability training. (Galpin, Whitttington & Bell, 2015).

Many day-to-day behaviours are social practices embedded in broader cultural norms and systems. Psychological approaches to sustainability often focused on individual behaviour but may insufficiently address the physical and social contexts influencing employees, limiting meaningful and long-lasting change (Coleman & Robinson, 2018). A sustainability culture is characterised by shared organisational assumptions and beliefs about balancing economic efficiency, social equity, and environmental accountability. Organisational culture is vital in shaping employee’s actions, and change initiatives are more successful when aligned with existing cultural norms (Linnenluecke, Russell & Griffiths, 2009; Salvioni, Franzoni & Cassano, 2017; Adam et al., 2018; Niedlich et al., 2020).

Reputation management, employment branding, and cost savings are additional reasons why embracing sustainability is beneficial for businesses. To integrate sustainability effectively, it must become part of the company's core culture. Sectors such as the automotive repair and maintenance are significant contributors to sustainability challenges but also have the potential to address unsustainable production and consumption patterns. This can be achieved by reducing resource use, designing sustainable products and services, providing equitable access, particularly in developing regions, and creating dignified employment and living conditions.

A critical limitation in advancing sustainability goals is the potential for diverse and sometimes conflicting interpretations of sustainability. Understanding and articulating sustainability is rarely explicitly articulated in change efforts (Hoffman & Georg, 2012; Ben-Eli, 2018). Global challenges, such as greenhouse gas emissions from the automotive repair and maintenance sector, cannot be solved without active engagement from all resource consumers. Business responsibility now extends beyond producing goods and services to addressing broader social outcomes (Franz, 2012).

1.6.2.4 Inbound logistics

Inbound logistics refers to the activities associated with the transportation, storage, and management of inputs required to produce a product, including material handling, warehousing, inventory control, vehicle scheduling, returns to suppliers, and delivery of goods to the production facility (Ayantoyinbo & Hegelese, 2018). The purpose of the logistics process is to ensure that the correct quantity and quality of materials or services are available at the right place, at the right time, for the right client, and at the right price. Inbound logistics is concerned with managing the relationship between companies and their suppliers effectively.

Inbound logistics are associated with the portion of business logistics that addresses a set of operations designed to create a flow of materials and information, from the source of raw materials to the factory entrance (Takita & Leite, 2019). For example, automotive assembly plants rely on multiple suppliers for parts such as tyres, engines, and electronic components. All transportation used for inbound logistics directly releases CO_2 gas into the atmosphere. Companies trying to be more sustainable usually start with their operation and soon determine that most of the impacts are caused by actions from their supply chain rather than in-house (Scott, 2023).

Studies indicate that supply chain activities, including inbound logistics, can produce up to 5.5 times more greenhouse gas emissions than in-house operations (Scott, 2023). Researchers have focused on the sustainable improvement of SCM both within the manufacturer and between companies because it is seen as a source of competitive advantage. Many multinational manufacturers are committed to sustainability more than ever before. However, most of them have concerns over logistic efficiency and the implementation of sustainability strategies, as they have a feeling of incompatibility.

Improving inbound logistics enhances operational efficiency, reduces costs, and strengthens supply chain flow. Hakim, Zaqiah, and Teuku (2018) emphasise that the main goal of inbound logistics is to reduce total costs while ensuring timely and accurate delivery of materials. With supply chain flows, a business's goal is to ensure that costs are managed concerning creating value moving forward (Hakim et al., 2018). Efficient inbound logistics also facilitates scalability, allowing firms to increase production in the short term or expand operations in the long-term. Strong supplier relationships form the bedrock of optimised inbound logistics; prioritising these relationships helps the company better understand its business and its needs while ensuring that the suppliers it works with can help facilitate its goals.

1.6.2.5 Outbound logistics

Outbound logistics refers to the transportation of goods from a firm to external associates. It is designed to help businesses within a supply chain maximise the reliability and efficiency of their distribution network, further reducing and minimising transportation and storage costs (Ayantoyinbo & Gegeleso, 2018). Outbound logistics play a critical role in customer satisfaction and overall supply chain performance, as it directly affects how products reach end users.

The primary function of outbound logistics is to deliver products to customers (Rajahonka & Bask, 2016). Distribution and outbound processes are essential for many companies because they directly connect them with customers in a value chain (Klumpp & Heragu, 2019). Market and customer demand relative to the quality, speed, and information and service orientation of logistics processes matter in terms of overall evaluation, and satisfaction with consumer expectations and delivery volumes are continually increasing. This side of the shipping cycle garners increasing attention, as businesses aim to increase customer satisfaction and loyalty rates. Transport is the largest source of environmental impact in logistics systems because of

CO_2 and greenhouse emissions. Purchasing considerations include suppliers' locations, which affect transport distances (McKinnon, 2010; Abushaikha, Salhieh, & Towers, 2018).

Outbound logistics encompasses several activities, including collection, storing, and physically distribution of products to buyers. It also involves warehousing of finished goods, material handling, delivery vehicle operation, order processing, and scheduling. Organisations must coordinate with upstream and downstream partners within the supply chain to optimise outbound logistics, as it forms an essential flow to the chain, creating significant value if an organisation continuously improves cost reduction and waste minimisation while increasing service levels.

The RBT argues that elements of the internal firm-specific environment such as the capabilities related to technology adoption, top management support, sustainability culture, inbound logistics, and outbound logistics can be viewed as resources exerting competitive advantage. In the conceptual model of this research, these five constructs serve as precursors to environmental sustainability. More specifically the model suggests that technology diffusion (H2), top management support (H3), sustainability culture (H4), inbound logistics (H7), and outbound logistics (H8) are positively related to environmental sustainability. The RBT perspective leads to the prediction that internally capable workshops will be able to attain higher levels of environmental sustainability, which will lead to improved service effectiveness.

1.6.3 Environmental sustainability as a mediating construct (ES)

Environmental sustainability (ES) can be defined as the practices, actions, and methods that positively impact the natural environment (Sendawula et al., 2020). It is concerned with the natural environment and its ability to remain productive and resilient, thereby supporting human life (Mensah & Casadevall, 2019). Organisations worldwide are increasingly integrating environmental sustainability into their operations to balance profit generation with environmental responsibility (Jaca et al., 2018). Environmental sustainability has been a dominant focus of environmental bodies globally (Vasanth, Raju, & Harinarayana, 2016).

According to Masocha and Fatoki (2018), the environment plays a crucial role in the ecosystem, as it supplies all the resources required to sustain all human activities. For decades, the automotive industry has been one of the most lucrative and flourishing businesses. This success is not surprising, given that there are 1.4 billion cars worldwide that will require maintenance and repair at some point. The demand for car repair has forced millions of car repair shops to open doors and become ready to fix and serve customers. However, the car repair industry has also left a significant carbon footprint on the environment.

It is essential to incorporate environmentally sustainable practices to give the business a good reputation, further attracting even more customers. Growing the market effectively and having a wider reach can help ensure that the business gains even more revenue (Du & Kang, 2016). The importance of increasing the degree of environmental sustainability commitment cannot be underestimated because the environment plays a crucial role in supplying all the resources required to sustain all human activities (Trumpp & Guanther, 2017). According to Asongu et al. (2017), discussions about environmental sustainability intensified after 2015 due to concerns about environmental degradation. Most developed countries have already started investing seriously in sustainability issues. However, African states have been identified as laggards when adopting the environmental sustainability agenda because they still rely heavily on fossil fuels regardless of rising concerns over environmental damage (Asongu et al., 2017; Cantore et al., 2017).

Sustainability in business is not just good for the environment or society at large; it is also suitable for the business itself. Operating a sustainable business has the following benefits: reducing costs, in the long run, improving business reputation, providing a competitive advantage and increasing the bottom line. The automotive industry is the largest industry globally and employs more than 10% of the total workforce with its supporting supply chain. With growing concerns about global warming and social issues, the automotive supply chain industry is confronted with increased pressure from stakeholders and regulatory agencies to achieve sustainability.

A good firm strategy is no longer characterised by its ability to boost profits only and how it caters to the environment; an environmental strategy is an issue that requires a firm to produce a profound environmental sustainability commitment strategy (Kiron et al., 2017). Environmental Sustainability (ES) strategy should be integrated into the primary business strategy rather than being treated as a different strategy to be effective (Cici, 2017). Businesses are required to adapt to change to address the effects of climate change, meet demand for production efficiency and grow public and legislative pressures for environmentally sustainable and ethical business operations. Long-term success in the automotive industry is achieved primarily through consistent innovation strategies, strong branding, global efficiency in the value chain and qualified and motivated employees.

In the conceptual model, environmental sustainability (ES) is the mediating factor between the eight antecedent practices and the five service effectiveness results. This orientation represents elements of both the Institutional Theory and the Resource- Based Theory. The model suggests that ES is not an end result, but rather a means through which the impact of certain practices on service performance is enhanced. Without the mediation of ES, the effect of the separate individual practices on service results would be left underdetermined. This research provides an empirical assessment of whether ES is a significant mediator of these relationships in the context of the South African automotive aftermarket.

1.6.4 Service Effectiveness Outcomes

Service effectiveness (SE) refers to the extent to which the service provided by a service provider meets customer requirements and expectations. A provider's service comprises three dimensions: service capability, the service approach, and service efficiency (Wang & Chiou, 2018). It measures customer's perceptions and impressions of internal service, including communication, productivity and responsiveness. It can be measured through customer surveys, monitoring customer service calls, counting customer complaints and the speed of problem resolution. Customer service in automotive maintenance and service centres is an important factor in retaining customers, maintaining high profits, and securing new customers. This is crucial because it measures customer service performance and evaluates areas requiring improvement. Businesses grow and gain a competitive advantage if they meet the needs and expectations of customers (Heskett Sasser & Schlesinger, 2015; Tao, 2014; Edgeman, 2018).

Service quality is paramount, especially for service-sector business enterprises (Rahaman, Abdullah & Rahman, 2011). It works as a key determinant of customer satisfaction. Competition in the automotive repair and service sector today is intense, and it can be quite challenging for a company to set itself apart from competitors in the view of its customers. Service effectiveness improves customers' perception of the brand, and companies that take it seriously can attract and retain consumers. Customer service can be an excellent competitive weapon because it is more difficult for competitors to imitate, and consumers are more inclined to buy goods and services from companies that provide excellent customer service. These companies will find that they have a strong competitive advantage in the market.

The fundamental strategy for the success and survival of any business organisation is the delivery of quality services to customers (Murphy & Knemeyer, 2018). The quality of services offered determines customer satisfaction and long-term loyalty. Service quality is an approach to managing business processes to ensure customer satisfaction and, in turn, help increase the competitiveness and effectiveness of the service industry. Service quality is important for the growth and development of service-sector business enterprises.

Numerous service effectiveness factors are implemented in various organisations worldwide. Some studies (Kumar et al., 2014; Fernandes et al., 2017; Van Weele, 2017; Zhang & Huo, 2013; Kulangara, Jackson & Prater, 2016) identify productivity, quality, innovation, supplier relationships and customer relationships as the most dominant service effectiveness practices. In this study, the following service effectiveness factors are considered: productivity, quality, innovation, supplier relationships, and customer relationships. The RBT highlights the benefits of the optimal and profitable utilisation of company resources to ensure service effectiveness, which is crucial in achieving and sustaining competitive advantage and superior overall supply chain performance in the automotive service and repair sector. The rationale for selecting these factors is that service efficiency factors improve the performance of the automotive supply chain as global economies move towards digital technology. In addition, effective service impacts customer satisfaction, loyalty and retention, while reducing costs and increasing profitability.

1.6.4.1 Productivity

Productivity is the efficiency with which goods or services are produced, as measured by specific performance indicators. Kumar et al. (2014) argue that for a company to achieve financial and other objectives such as brand image, vendor integration, goodwill and customer satisfaction, it must manage its operations effectively. Productivity growth is advantageous because it provides more goods and services to consumers; as a result, it can generate higher profits. As productivity increases, an organisation can turn resources into revenues, pay stakeholders, and retain cash flows for future growth and expansion. Abolhassani and Jaridi (2016) reported that the production process is crucial in any generic value chain and is therefore an appropriate area for productivity improvement.

Engaging employees means that they work collaboratively with the organisation to achieve its goals and objectives and that their contribution can provide the organisation with a competitive advantage. Employee engagement can improve productivity, job satisfaction, motivation and commitment, and reduce turnover rates.

1.6.4.2 Quality

Quality is described by Fernandes et al. (2017) as the ability of a product or service to meet or exceed customer expectations. Organisations that pursue both quality objectives and supply chain goals are more likely to achieve a competitive advantage. Service quality plays an essential role in customer satisfaction, particularly in automotive after-sales service. After-sales service is commonly defined as services carried out for the consumer during the product's life cycle after purchase. It is a significant contributor to a firm's ability to enhance its competitiveness (Shokouhyar, Shokouhyar & Safari, 2020). These after-sales services primarily include the repair and maintenance of products by automotive companies.

The provision of high-quality services in the automotive repair and maintenance sector enhances customer retention rates, assist in attracting new customers through word-of-mouth advertising, increases productivity, and leads to higher market share. It also lowers staff turnover and operating costs while improving employee morale, financial performance and profitability. Therefore, delivering quality service to customers is necessary for success and survival in today's competitive environment (Nunkoo et al., 2020). According to Zhang et al. (2017), supplier and customer quality integration are two critical practices used to align inter-organisational strategies, practices, and procedures into collaborative and synchronised quality-related processes to fulfil customers' quality requirements. Poor-quality products and services cause business disruption, financial loss, costly lawsuits, and long-lasting damage to the brand and corporate image of the organisation.

1.6.4.3 Innovation

Innovation is defined as the introduction of new products or services that have never existed. Innovation can be measured by several factors, such as improved product design, product feature enhancement, and new product creation (Kulangara et al., 2016). In the current socio-economic context, businesses are facing severe challenges and are increasingly forced to find better and new methods to remain competitive, increase their profit levels, and improve their overall performance. Innovation has always been critical for long-term business success. Organisations that have innovated successfully have typically been rewarded with growth, profits, and access to new markets (Bessant & Tidd, 2007; Behnamet al., 2018).

Service innovation focuses mainly on the development of new service concepts and contributions, including generating new ideas to meet customer demand and enhance service contributions (Kindström & Kowalkowski, 2014). The automobile service industry plays a vital role in providing after-sales services that ensure vehicle maintenance. In addition to maintaining and improving service quality, companies must pursue service innovation to remain competitive and sustainable. Innovation has become a strategic necessity for the automotive industry because of the intensely competitive nature of the environment. Innovation represents a critical pathway to organisational success and is essential for sustaining competitiveness in a highly competitive market.

Existing products are vulnerable to changing customer needs and preferences, new technologies, shortened product life cycles, and increased international competition. It is, therefore, generally accepted that all firms should innovate regardless of their size or sector to compete and survive in the market (Maier et al., 2018). Countries that continuously innovate tend to experience sustained economic growth. Countries such as the United States of America (USA), Japan and several European countries that exhibit high levels of patent activity or research and development (R&D) investment intensity are regarded as leaders in economic development (Ahmed & Shepherd, 2012).

1.6.4.4 Supplier relationship

The buyer–supplier relationship is the extent to which buyers and suppliers can work together to manage inter-organisational processes effectively and efficiently to provide products, services, information, and financial flows (Zhang & Huo, 2013). Yu, Zhang and Huo (2019) argue that collaborating with suppliers can also help address environmental issues and improve environmental performance. The functional relationships between buyers and suppliers can lead to a range of benefits, including cost savings, improved production quality, inventory level reductions, increased visibility, improved technology, and prevention of the bullwhip effect (Hudnurkar, Jakhar & Rathod, 2014). Proficient suppliers will ship the correct number of items on time and are in good condition.

In addition to large suppliers, small suppliers are also reliable and equally crucial as backup suppliers. Therefore, splitting orders between large and small suppliers is essential because it provides the company with operational flexibility and supply security. According to Jain et al. (2014), a trusting relationship between a buyer and its suppliers allows both parties to share critical resources and strategic information freely. Consequently, these partners may be able to obtain significant operational and strategic resources that may improve the operational performance of their suppliers in terms of responsiveness, reliability, and effectiveness in strategic problem resolution.

According to Jassim, AL-Mubarak and Hamdan (2020), collaborating with suppliers can lower their environmental impact by purchasing green and recyclable materials from them. The strategic role of buyer–supplier relationships as a lever for economic sustainability is more pronounced now than before. These issues are relevant to managers, as their stakeholders, customers, regulatory bodies, non-governmental organisations, and even employees increasingly demand that organisations address and manage economic issues that will affect future generations (Van Weele, 2017).

Buyer–supplier relationships have become "strategic" in recent years. The process of relationship development is accelerated as automotive repair, and maintenance sectors strive to establish relationships that support organisational goals. An important phenomenon in buyer–supplier relationships is that many procurers are developing single-source suppliers under pressure to increase quality, reduce inventory, implement just-in-time systems, and shorten time-to-market. The goal in developing these capabilities is to reduce costs while maintaining service reliability.

1.6.4.5 Customer Relationships

Customer relationship management is a customer service approach that focuses on building long-term and sustainable customer relationships and adding value for both the customer and the company (Pohludka & Štverková, 2019). Supply chain management (SCM) involves coordination and collaboration in the flow of information and resources among channel partners, suppliers, and customers (Gupta, Palsule-Desai, 2011; Agarwal, 2018). Owing to recent changes in the business environment, namely, increasing customer turnover, decreasing brand loyalty, and lowering profitability, companies in all industries have realised that strong customer relationships are one of the most critical assets to possess.

Customer experience management involves shifting from product- and brand-centric marketing approaches to a customer-centric approach, whereby the organisation aligns its processes, people, products, places, and policies with customer feedback (Adrodegari, Bonetti & Saccani, 2017). The automotive industry faces unique challenges in the modern economy, as intense competition between the new and used car markets intensifies. To stay ahead of their competitors in the marketplace and survive, firms need to build solid and long-lasting relationships with customers while simultaneously increasing their profits.

It costs significantly less to retain an existing customer than to acquire a new one. Kim and Lee (2018) assert that engaging with the customer helps an organisation understand their demands, perceptions, and expectations, enabling firms to align their products and services, delivery processes, product design, and product life cycles with customer preferences to enhance profitability. Improved customer experience and satisfaction lead to higher revenues for organisations and contribute to the economic development of communities and countries in general. These revenue gains are attributed to customer retention, reduced price sensitivity, increased wallet share, customer loyalty, and positive word-of-mouth.

Customer satisfaction and experience are also drivers of stock performance, as customers tend to remain loyal to responsible and engaged organisations; hence, the saying 'customer is king'. A 5% improvement in customer retention can lead to a 25% to 75% increase in the profit of automobile companies (Reichheld & Sasser, 1990; Ahi, Jaber & Searcy, 2016).

Service effectiveness consists of five elements: productivity, quality, innovation, supplier relationships, and buyer relationships. In the conceptual model, these five concepts are conceptualised as the outcome (dependent variable). It hypothesises environmental sustainability as a positive predictor of all the dimensions: productivity (H9), quality (H10), innovation (H11), supplier relationships (H12), and customer relationships (H13). The RBT implies that ES capabilities can drive improvements in multiple service outcomes.

1.7 FORMULATION OF HYPOTHESES

Based on the preliminary literature reviewed in the previous sections, this section presents the hypotheses.

1.7.1 The relationships between environmental sustainability practices and environmental sustainability.

Markets are becoming increasingly competitive, and the pace of change is putting companies under unprecedented pressure to not only succeed but also sustain their success into the future. Environmental practices, such as the use of environmentally friendly technologies and business activities, can create unique value for products and services that lead to sales growth. Moreover, green practices help firms reduce operational costs by saving energy and other resources, product-return costs and liability fees, which, together, improve the firm's financial performance (Reyes-Rodríguez, Ulhøi & Madsen, 2016). The RBV postulates that companies possess distinctive capabilities such as sustainable development practices, which, if strategically exploited, are likely to obtain a competitive advantage, resulting in firms' sustainability and greater financial performance (Alshehhi, Nobanee & Khare, 2018). The development of corporate strategies to do "well" by doing "goodly" and turning companies into responsible organisations that care about the environment and social aspects is becoming increasingly necessary rather than a choice to lead in future markets (Busse, 2016).

The issue of ES has dominated the agendas of concerned environmental bodies globally (Vasanth et al., 2015). Masocha and Fatoki (2018) assert that the environment plays a crucial role in the ecosystem, as it supplies all the resources required to sustain all human activities. Studies have shown that organisations that uphold responsible environmentally sustainable practices can benefit from doing good and thus improve the economic success of an organisation (Vasanth et al., 2015). Consequently, Sendawula et al. (2020) suggest that responsible environmental sustainability practices can influence reputation, bolster competitive advantage and improve market positioning for an organisation.

In addition, (Yu & Tsai, 2018) concur with and allude to those efforts by a firm to implement ESPs such as reducing its carbon emissions to improve its longevity and sustainability. Therefore, there is a positive relationship between the implementation of environmental sustainability practices and the establishment of environmental sustainability.

The above insights lead to the following hypotheses:

- **H1:** Governmental regulations and receiving incentives significantly positively affect environmental sustainability.
- **H2**: Technology adoption has a significant positive effect on environmental sustainability.
- **H3:** Top management support exerts a significant positive effect on environmental sustainability.
- **H4**: A sustainability culture has a significant positive effect on environmental sustainability.

- **H5**: The implementation of environmental SCR has a significant positive effect on environmental sustainability.
- **H6**: Compliance and certification have significant positive effects on environmental sustainability.
- **H7**: Inbound logistics exert a significant positive effect on environmental sustainability.
- **H8**: Outbound logistics exert a significant positive effect on environmental sustainability.

1.7.2 The relationships between environmental sustainability and service effectiveness

The rising prominence of natural environmental challenges such as waste management; greenhouse gas emissions; pollution and contamination management; natural resource management; and food, water and energy security has triggered organisations to develop and implement innovations that curb environmental degradation (Al-Ansari et al., 2017). For organisations to improve their environmental innovativeness and ensure service effectiveness, they must direct their resources towards eco-innovation because it contributes to environmental responsibility and sustainability goals by realising new ideas, behaviours, products, and processes (Munodawafa & Johl, 2019). Furthermore, customer service represents an important factor in retaining customers, maintaining high profits, and securing new customers.

Improving the level of customer service from the perspective of sustainability is essential for a company's orientation towards ensuring customer satisfaction through customer loyalty, which costs much less than regaining lost customers or attracting new customers (Heizer et al., 2020; Edgeman, 2018). The results of meeting corporate sustainability objectives can be highlighted through an integrative culture for sustainability and responsible practices (Alshehhi et al., 2018). The RBT highlights the benefits of optimal and profitable utilisation of company resources to ensure service effectiveness, which is key to achieving and sustaining competitive advantage and superior overall supply chain performance in the automotive service and repair centre.

Effective customer service is crucial in ensuring a sustainable competitive advantage (Tao, 2014). A company cannot grow and be competitive if it does not fully meet the needs and expectations of customers. Consequently, some authors (Thiel, 2015; Masocha, 2018) view sustainable development as being utilised by business organisations as a competitive strategy.

Eco-innovativeness reduces costs, minimises risks, enhances sales and profitability using premium organic brands, improves reputation and brand value, enhances attractiveness as an employer and increases innovation capabilities (Klewitz, Zeyen & Hansen, 2012; Bossle De Barcellos & Vieira, 2016). Eco-innovativeness is a new technology that ensures service effectiveness by eliminating environmental impacts while maximising resource efficiency and enhancing performance and competitiveness (Costantini et al., 2017).

Therefore, the following hypotheses are proposed:

- **H9**: Environmental sustainability exerts a significant positive influence on productivity.
- **H10**: Environmental sustainability exerts a significant positive influence on quality.
- **H11**: Environmental sustainability exerts a significant positive influence on innovation.
- **H12**: Environmental sustainability exerts a significant positive influence on supplier relationships.
- **H13**: Environmental sustainability exerts a significant positive influence on customer relationships.

1.8 DELIMITATIONS OF THE STUDY

This section describes the delimitations of the study. Four delimitations concerning the scope of this study were identified. These methods include sample delimitation, geographical delimitation, theoretical delimitation, and methodological delimitation.

1.8.1 Sample delimitation

The unit of analysis in this study was restricted to supply chain professionals, waste managers, major parts suppliers and automotive technicians. The rationale for choosing them was their positions and their knowledge of environmental sustainability in the automotive industry they possess.

1.8.2 Geographical delimitation

The study was conducted mainly at an aftermarket automotive workshop in Gauteng Province, and it was extended to other provinces, such as Limpopo, Mpumalanga and Free State. The choice to focus primarily on Gauteng was motivated by the idea that Gauteng is the economic hub of South Africa and is the centre of local and global businesses, including the automotive repair and maintenance sectors. The choice for Limpopo, Mpumalanga and Free State

Provinces was due to their proximity to Gauteng Province and their various automotive industries and suppliers.

1.8.3 Theoretical delimitation

The study covered ESPs, ES and SE in the South African automotive industry. The dimensions of ESPs that were considered are government regulations and incentives, technology adoption, top management support, sustainability culture, ECSR, compliance and certification, inbound logistics and outbound logistics. In terms of SE, the study considered the following dimensions: productivity, quality, innovation, supplier relationships and customer relationships.

1.8.4 Methodological delimitation

This study was oriented towards a deductive approach and a positivist paradigm The positivist paradigm assumes a naive realist ontology, believing that there is a single truth or reality that remains stable and can be measured. Human understanding is gained through a process of experimentation to test hypotheses, provide explanations, make predictions or search for cause-and-effect relationships among variables (Hunter, 2015). Furthermore, descriptive research refers to a scientific method of collecting data to find answers to questions by observing and describing a phenomenon without influencing it (Leedy & Ormrod, 2015).

Finally, a quantitative research approach was utilised because the data obtained from the quantitative study helped to measure relationships between variables to make generalisations and contribute to existing knowledge. The constructs that were measured are environmental sustainability practices, environmental sustainability and service effectiveness. Although the positivist paradigm is appropriate for testing hypothesised relationships and achieving generalisable findings, it carries inherent limitations. Positivism assumes that social reality is objective and measurable, yet constructs such as sustainability culture and top management support are inherently subjective and may be oversimplified when reduced to numerical scores (Saunders, Lewis & Thornhill, 2019). Additionally, the cross-sectional design captures relationships at a single point in time and cannot establish causality. Readers are therefore cautioned that the findings represent a partial view of reality, and future qualitative research is recommended to complement and deepen understanding of the non-significant findings.

1.9 LIMITATIONS OF THE STUDY

The study utilised a cross-sectional research design, and the probability sampling method was used for collecting data due to time constraints and a lack of resources. Empirical researchers use cross-sectional designs at a single point in time to describe a population of interest; they record information but do not manipulate variables (Allen, 2017). However, this study was limited to a cross-section of the aftermarket automotive workshop repair and maintenance sectors in the selected provinces of South Africa.

1.10 SIGNIFICANCE OF THE STUDY

From academia's perspective, this study contributes to the body of knowledge on environmentally SSCM in the automotive repair and maintenance sector. The findings contribute to understanding the interplay between the implementation of ESPs and ES through a practical and comprehensive environmental sustainability model to achieve service effectiveness in the automotive repair and maintenance sector in the selected provinces of South Africa.

Practically, the model served as a design structure for a wide range of sustainability assessment methods and tools and provided guidance on what needs to be measured in an integrated sustainability assessment of vehicles. It leaves the choice of what to include in the decision-making process at the aftermarket automotive workshops in four chosen provinces and the automotive industry in South Africa at large. The proposed model can be used as a decision-support tool at the early stages of the vehicle development process. This approach allows source and sustainability issues to be identified throughout the entire vehicle life cycle and provides a means to sharpen the analysis and discussion of these issues.

The results of this study can be utilised by executives at aftermarket automotive workshops to evaluate alternative technologies for compliance with environmental sustainability regulations and contribute to reducing the impact of vehicles on the environment, ultimately contributing to climate change mitigation. The research also creates awareness and significantly adds to the body of knowledge. The proposed framework provides direction for the implementation of renewable energy and EE technologies, improved soil and water management, sustainable travel, waste minimisation, and recycling.

The scope of this research addressed each of these areas and covered all the actions and responsibilities associated with the aftermarket automotive workshops and organisations that are part of the supply chain in South Africa. The results of the study benefit automotive companies and can be instrumental for most national organisations whose key strategies are limited in the execution stage. The study also helps South African automotive companies be better situated and prepared for future strategy execution since essential execution procedures are highlighted.

1.11 RESEARCH METHODOLOGY

Research methodology is a framework for conducting a research project and guides the selection of a plan that is appropriate for collecting and analysing data (Taherdoost, 2021). It shows how researchers formulate their research problem and objectives and presents their results from the data obtained during the study period. The research methodology for this study highlighted the approach, research design, sampling design, target population, sampling frame, sampling size, sampling approach and techniques, data collection method and procedures, data analysis and statistical approaches, data reliability and validity, ethical considerations and chapter outlines.

1.11.1 Research approach and design

This study adopted a quantitative research approach. Bhandari (2020) defines quantitative research as the process of collecting and analysing numerical data. It can be used to find patterns and averages, make predictions, conduct causal tests, and generalise results to broader populations. The use of the quantitative method for this study was considered appropriate because it empirically showed the strength and extent of the relationship between ESPs and service effectiveness as mediated by environmental sustainability. Furthermore, the quantitative method supports the positivist paradigm. The positivist approach to research is about determining the underlying factors and principles that are perceived to have caused a phenomenon. Deductive reasoning is typically suitable for research under positivism because it primarily involves a large volume of measurable information and is based on experimentation (Mertens, 2019). Research design refers to the plan and structure of an investigation aimed at answering research questions (Blumberg, Cooper & Schindler, 2014). This study employed a correlational design, which aims to explain relationships among variables (Blumberg et al., 2014). More detailed information on the research approach and design is presented in Section 5.3.

1.11.2 Research methods

There are four basic types of quantitative methods: observation studies, correlational research, developmental design, and survey research (Leedy & Ormrod, 2015). The primary strategy employed for this study was a survey design using a questionnaire data collection method, as it is a relatively inexpensive, quick, and efficient way of obtaining large amounts of information from large populations with relative ease. More detailed information on the research methods is presented in Section 5.3.

1.11.3 Time horizon

This study used a cross-sectional design. This choice is motivated by the fact that cross-sectional studies are observational and provide a "snapshot" of a population at a specific point in time (Bryman et al., 2016). This facilitated a simultaneous comparison of all variables of interest (Sharma et al., 2023). For example, in this study, determining whether environmental sustainability is related to service effectiveness may be achieved only if the views of the supply chain and quality control professionals at the aftermarket automotive workshop maintenance and repair centres are assessed at a specific point in time. Cross-sectional studies are ideal for studies that aim to determine the views and perceptions of respondents (Sharma et al., 2023).

1.11.4 Sampling Design

Sample design refers to the plans and methods to be followed in selecting a sample from the target population, as well as the estimation technique formula for computing the sample statistics (Singh, 2019). These statistics are the estimates used to infer the population parameters. This allows the study to draw interpretations of the relationships between variables. The sampling design for the present study encompasses the population, sample frame, sample size, sampling approach, and sampling techniques.

1.11.5 Population and target population

A population is a grouping or collection of people who have similar traits. The population can refer to the whole population of a country or city (Sharma, 2017). This full group of people shares certain features, such as demographic, geographical, and temporal traits (Thacker, 2020). The population for the current study comprised supply chain professionals, automotive technicians, waste managers, and major parts suppliers, all of whom are part of the aftermarket automotive workshop in South Africa. In research, a target population refers to the complete pool of research candidates from which a sample is drawn (Cook & Kamalodeen, 2019). A target population can also be defined as "a complete set of all research candidates interested in meeting the research objectives" (Kumar, 2014). The population of this study comprises supply chain professionals, waste managers, major parts suppliers, and automotive technicians working at aftermarket automotive workshops, as well as their supply chain partners, in the provinces of Gauteng, Limpopo, Mpumalanga, and the Free State. Thus, the study's target population was 450 supply chain professionals, waste managers, major parts suppliers and automotive technicians across the chosen supply chain entities.

1.11.6 Sampling

For this study, a probability sampling approach was employed. Since the number of units in the target population is known, probability sampling is also appropriate for quantitative research as well as for collecting data from a large sample size (Babbie, 2020; Cohen, Manion & Morrison, 2013; Cook & Kamalodeen, 2019; Sharma, 2017). The cluster sampling technique was employed to select respondents because it is highly feasible when dealing with a large population and minimises variation (Eifil & Negida, 2017).

1.11.7 Sample size

Sample size refers to the number of candidates that make up the sample (Treiman, 2014). The target population was 450. The sample size was calculated using the Raosoft sample size calculator. Based on the calculation, the sample size of the present study was n=392. However, during data collection, more responses were received. A total of 450 potential responders received invitations. A remarkable 98% response rate was obtained from the 394 responses that were received. A final sample size of 392 valid questionnaires was kept for analysis following data cleaning, which included removing two useless responses. The findings' representativeness and dependability are improved by this high response rate.

Larger sample sizes are preferred in studies using Structural Equation Modelling (SEM), particularly with SmartPLS, which benefits from larger sample sizes to improve the reliability of complex model estimates, reduce standard error, and enhance statistical power, even though 392 was statistically adequate for detecting effects at a 95% confidence level (In'nami & Koizumi, 2013).

1.11.8 Sample access

The study accessed the sample using known personal and business networks. Saunders, Lewis and Thornhill (2014) assert that using networks is one of the most effective ways of reaching the desired sample. This approach is essential because researchers generally face sample access challenges, especially when they fail to reach gatekeepers (Saunders et al., 2014).

1.11.9 Data collection procedures

The study employed secondary and primary data collection methods. The secondary data are the data gathered from published sources, meaning that the data are already gathered by someone else. Data for the empirical study were collected using a survey questionnaire for data collection. The use of a survey questionnaire allowed for the effective collection of data with standardised responses that facilitate comparative quantitative analysis (Cook & Kamalodeen, 2019; Rose, Spinks & Canhoto, 2014; Treiman, 2014). The questionnaire was developed from a combination of existing questionnaires by Banerjee, Iyer & Kashyap (2003), Department of Environmental Affairs (2008), Jiang (2012) and Huang (2012).

1.12 DATA ANALYSIS

The data were analysed quantitatively via the latest version of the Statistical Package for Social Sciences version (SPSS) and SMARTPLS software. Statistical techniques such as frequencies, measures of central tendency (means and standard deviation), normality tests (skewness and kurtosis), reliability tests, exploratory factor analysis (EFA) and SEM via partial least squares (PLS) were applied in this study. To test the hypothesis, descriptive statistics (means and standard deviations) were calculated for all the variables, namely, ESPs, ES and SE. In addition, inferential statistics were used to test the research hypotheses (Amrhein, Trafimow & Greenland, 2019). For this study, inferential tests included the use of the PLS Technique to test the hypotheses. A confirmatory factor analysis (CFA) was used to test the hypotheses. Three tests that form the central part of the CFA procedure, namely: validity, reliability and model fit, were used to establish the accuracy of the measurement model.

1.13 RELIABILITY AND VALIDITY

Reliability and validity are essential indicators of the effectiveness of research instruments and processes in contributing to accurate research outcomes. Reliability is a consistency measure based on the view that an accurate tool and process will yield similar results if used again within the same context (Rose et al., 2014). On the other hand, validity is a measure of precision. It measures the degree to which the research instruments and processes can measure what they are intended to measure (Bell Bryman & Harley, 2018).

Cronbach's alpha, a reliability measure that assesses whether related statements and variables indeed measure a common underlying construct, was used to test for internal consistency (Saunders et al., 2014). For example, a Cronbach alpha above 0.7 will be interpreted as an indication of internal consistency. In addition, a pilot test was conducted to assess whether the structured questionnaires indeed captured the constructs it was designed to capture.

Several forms of validity were assessed in this study. The first is face or content validity, which is defined as the degree to which the instrument assesses or measures the construct of interest (Bolarinwa, 2020). This type of validity was ascertained through a panel review of the questionnaire by academics, who are experts in the field of study.

The second is construct validity, which addresses the question of what construct or characteristics the scale is measuring (Malhotra, Nunan & Birks, 2017). To ensure construct validity, a pilot test was conducted. A questionnaire pilot test is a miniature version of the study conducted to test the questionnaire for flaws and to refine the questionnaire to collect the required data reliably (Bryman, 2016). For this purpose, the questionnaire was pilot tested on a convenience sample of 40 respondents. It was tested explicitly for language and grammar, meaning and clarity, and completion time (Kumar, 2014; Lambert & Newman, 2023). After the pilot test, no changes to the questionnaire were made. The third type of validity that was tested is criterion-related validity, which considers whether the test accurately predicts future behaviour (DuPlooy-Cilliers, Davis & Bezuidenhout, 2014). The standardised regression weights (betas) for the outcomes of the hypothesised relationships between variables were considered as indicators of criterion-related validity.

1.14 RESEARCH ETHICS

Research processes carry moral and ethical risks that may violate research candidates' rights (Saunders et al., 2014; Kumar, 2014). Research ethics refer to the study's obligation to protect the rights of research candidates (Saunders et al., 2014). Commonly discussed ethical issues are confidentiality and anonymity, protection from harm, informed consent and voluntary participation (Bell et al., 2018).

To ensure that confidentiality is not compromised, no personal information that results in direct or indirect disclosure was collected. While data such as gender, age and other demographic factors are primarily generic, specific titles and department names can eliminate the identity of respondents when dealing with small samples (Saunders et al., 2014). The data collection instrument was designed to ensure that such data were not requested by the respondents. In addition, the study informed the respondents not to include such data if they strongly felt that it could lead to their identification.

In research ethics, voluntary participation concerns the degree and level of freedom and independence one participates in a study (Babbie, 2020; Bell et al., 2018). To ensure that the right to voluntary participation was respected, the study fully informed all respondents of their rights (Kumar, 2014; Bryman, 2016; Bell et al., 2018). These included informing the participant of their right to withdraw, and there will be no consequences for the withdrawal. According to Babbie (2020), voluntary participation involves complete knowledge about participation in a research study. This concern is covered under another ethical guide, the right to informed consent. To ensure the avoidance of harm, the study sought permission from organisations from which the respondents were drawn to protect them from potential legal harm. The study collected data via simplified, relatively short questionnaires that reduced pressure on the respondents (Saunders et al., 2014). The respondents were not asked about their names in any part of the questionnaire. The respondents who agreed to participate in the study were requested to sign the consent letter if they agreed to participate in the study, and this was kept for the record. Additionally, the informed consent letter informed the respondents about their other rights and how they would be protected during and after the study. The study ensured that an ethical clearance certificate was obtained from the relevant higher education institution before the data were collected.

1.14.1 Thesis integrity

Thesis integrity in the context of academic research refers to the ethical and honest presentation of research in a thesis or dissertation (Bowden & Green, 2019). Maintaining thesis integrity involves upholding academic standards, avoiding plagiarism, and accurately representing the methods, results, and conclusions of one's research (Bowden & Green, 2019). All sources of information, such as books, articles, and magazines, were acknowledged through referencing. The study’s findings and, therefore, conclusions emanated from unbiased and objective data analysis practices.

1.15 DEFINITION OF TERMS

This section describes the definitions of the key constructs and terms of this study.

The automotive supply chain refers to a network of interconnected processes and entities involved in the production, assembly, distribution, repair and disposal of automotive components and vehicles and includes raw material suppliers to manufacturers and dealers (Al-Doori, 2019).

- **Environmental sustainability practices:** Numerous environmental sustainability practices are implemented in various organisations worldwide. Their role is essential for developing and increasing the environmental performance, economic performance, and social performance of an organisation (Wang & Gunasekaran, 2015). These practices are the inputs or antecedents that organisations adopt. In this study, eight ESPs are examined: government regulations and incentives, technology adoption, top management support, sustainability culture, environmental corporate social responsibility, compliance and certification, inbound logistics, and outbound logistics. Their role is essential for developing and increasing the environmental, economic, and social performance of an organisation (Wang & Gunasekaran, 2015; Neeveditah et al., 2017; Venkatesh & Davis, 2000; Kiesnere & Baumgartner, 2019; Di Pillo et al., 2017; Ayantoyinbo & Gegeleso, 2018; Klumpp & Heragu, 2019).
- **Environmental sustainability:** Environmental sustainability refers to the outcome or state achieved when an organisation successfully reduces its negative impact on the natural environment. Unlike ESPs (which are the actions taken), ES is the mediating condition that results from implementing ESPs. In this study, ES is defined as the degree to which an organisation's operations positively affect the natural environment by reducing waste, emissions, and resource consumption (Sendawula et al., 2020)
- **Government regulations and incentives:** Regulations are laws, policies, and rules promulgated by the government and other regulatory bodies to serve and protect the world at large and public concerns over environmental and social well-being (Neeveditah, et al., 2017).

  Technology adoption refers to the application of various techniques, skills, methods, and processes to produce goods or services or achieve objectives, such as scientific investigation (Liddell et al., 2007).

  Top management support refers to the commitment given by top managers to organisational members or partners to inspire other internal stakeholders in the supply chain to adopt green practices, thereby moving towards sustainability and improving environmental performance. (Chu, Yang, Lee & Park, 2017).
- **Sustainability culture:** A sustainability culture is one in which organisational members share common assumptions and beliefs about the importance of balancing economic

efficiency, social equity, and environmental accountability. (Niedlich et al., Kummer, Bauer, Rieckmanna & Bornmanna, 2020).

- **Environmental corporate social responsibility (ECSR):** Environmental corporate social responsibility (ECSR) refers to a business's focus on the environmental aspects of CSR. (Hu & Wang, 2021).
- **Compliance and certification:** Environmental compliance means conforming to environmental laws, regulations, standards and other requirements, such as site permits to operate. (Boakye, 2018).
- **Inbound logistics:** Inbound logistics can be defined as activities associated with transportation, storage, and dissemination of inputs to the product, such as material handling, warehousing, inventory control, vehicle scheduling, returns to suppliers, and the delivery of goods into the location of a business (Ayantoyinbo & Hegelese, 2018).
- **Outbound logistics:** Outbound logistics refers to the transportation of goods from the firm to external parties. It is designed to help businesses within a supply chain maximise the reliability and efficiency of their distribution network, further reducing and minimising transportation and storage costs (Ayantoyinbo & Gegeleso, 2018).
- **Service effectiveness:** Service effectiveness is the extent to which provided services meet the desired customer needs. The key drivers of service effectiveness for this study are productivity, quality, innovation, supplier relationships and customer relationships.
- **Productivity**: Productivity is the efficiency of producing goods or services expressed by some measure. (Kumar et al., 2014)
- **Quality:** Quality is defined as meeting or exceeding customer expectations. (Fernandes et al., 2017).
- **Innovation**: Innovation is defined as offering new products or services that have never existed. Innovation can be measured by several factors, such as improved product design, product feature enhancement, and new product creation (Kulangara et al., 2016).
- **Supplier relationships:** The buyer–supplier relationship is the extent to which buyers and suppliers can work together to manage inter-organisational processes to provide

products, services, information and financial flows effectively and efficiently (Zhang & Huo, 2013).

- **Customer relationships**: Customer relationship management (CRM) is a customer service approach that focuses on building long-term and sustainable customer relationships and adding value for both the customer and the company (Pohludka & Štverková, 2019).

- **Service performance framework**: A service performance framework is a structured system of guidelines and measures designed to assess and optimise the effectiveness, efficiency, and quality of services provided by an organisation (Kumari & Chahal, 2017).

1.16 CHAPTER CLASSIFICATION

The final thesis structure is organised as follows:

Chapter 1: Introduction and background of the study

This chapter provides sufficient background information regarding environmental sustainability practices and challenges in the automotive supply chain. The background is supported by the problem statement, research objectives and research questions. The chapter also presents the significance of the study, delimitations, preliminary literature review and a summary of the research methodology.

Chapter 2: Literature review

This chapter is dedicated to a review of the literature on the automotive supply chain and all research constructs, as well as the research theories. The literature is drawn from international, regional and South African perspectives.

Chapter 3: Literature review on Environmental sustainability

This chapter reviews the literature on environmental sustainability, with a focus on both international and national contexts. The theoretical model serves as a foundation for the review of the literature, as well as for the methodology and analysis. IT and resource-based theory (RBT) were used as theoretical lenses for this study.

Chapter 4: Literature review on service effectiveness and hypothesis testing

The chapter presents the literature on service effectiveness and develops the hypotheses that were tested and the results presented in Chapter 6. First, this chapter provides a working definition of service effectiveness and then presents the influencing factors of service effectiveness. The key drivers of service effectiveness, namely, quality, innovation, supplier relationships, and customer relationships, are discussed, along with their influence on the automotive industry.

Chapter 5: Research methodology

In the methodology chapter, the study discusses the methodological processes followed in the study. The key methodological areas include reasoning, paradigms, approaches, and design, as well as procedures for data collection, data analysis methods and techniques, ethical considerations, and conclusions.

Chapter 6: Analysis of data and interpretation of research results

This chapter presents an analysis of the collected data and an interpretation of the results. First, the results of the pilot study are discussed. Second, the results of both descriptive and inferential statistics are presented. Finally, the scale accuracy assessment, in terms of the validity and reliability of the data, is discussed in line with the study's objectives.

Chapter 7: Conclusions and recommendations, limitations and implications for future research

This is the concluding chapter of the thesis, where the study's conclusions, aligned with each of the research objectives, are presented. Furthermore, the chapter presents the recommendations necessary to enhance environmental sustainability, improve practices, and increase service effectiveness in the automotive supply chain. Implications for future research and limitations of the study are provided.

1.17 CONCLUSION

This chapter provides a comprehensive introduction to the global automotive industry, with a particular emphasis on South Africa. Background information regarding challenges in the automotive supply chain and environmental sustainability has also been presented. The chapter further presents the problem statement and provides the research argument, which served to justify the present study. The research purpose, objectives, and questions that guided the study were also stated. The purpose of this research is to conceptualise a framework to improve sustainability in the automotive industry. This includes providing supply chain scholars and practitioners with a framework that offers a blueprint for enhanced analytics and informed decision-making. The chapter concludes by providing a summary of this study and its results.

CHAPTER 2:
OVERVIEW OF THE AUTOMOTIVE INDUSTRY AND ENVIRONMENTAL SUSTAINABILITY

2.1 INTRODUCTION

The previous chapter discussed environmental sustainability practices and challenges in the automotive supply chain in the South African context. This chapter presents a review of existing literature within the automotive industry in the context of sustainability. It begins by discussing the key elements and structure of the automotive industry before examining sustainability-related issues within the sector. These include a global perspective on the automotive industry, followed by a South African viewpoint that discusses the history of the South African automotive industry, from pre-democracy times to the current post-democracy era. The major sectors of the automotive industry are also discussed, with particular emphasis on the interrelationships among these sectors. The chapter then examines the legislative and policy framework that supports South Africa's automotive industry. Finally, the key challenges currently confronting the automotive industry are discussed. The purpose of the literature review is to establish a theoretical foundation, demonstrate how the study contributes to the existing body of knowledge, conceptualise the research variables, and provide a basis for interpreting empirical findings. To this end, both international and South African literature was reviewed, and the chapter concludes by identifying research gaps and findings emerging from the literature.

2.2 THE GLOBAL CONTEXT OF THE AUTOMOTIVE INDUSTRY

The automotive industry is one of the most competitive industries in the world, with car manufacturers competing for market share and innovation. Most automotive production activities are concentrated in Japan, China, India, and Thailand primarily due to the availability of low-cost raw materials and the growing local demand for automotive products (OICA, 2020). An examination of the global automobile industry, with specific reference to the European, Asian, and African markets, is essential. First, the European automotive ecosystem employs 14.6 million people, accounting for 6.7% of total employment within the European Union (EU) (European Automobile Manufacturers Association (ACEA), 2020). The car manufacturing sector alone employs 2.7 million people at 226 sites across the EU, representing

8.5% of total manufacturing jobs in Europe (ACEA, 2020). The automobile industry therefore plays an important role to the EU economy.

In terms of output, the EU produced 18.5 million vehicles in 2019, accounting for 20% of global motor vehicle production (Vaz, Rauen & Lezana, 2017). The automotive repair and maintenance sector also exerts a significant influence on international trade. With motor vehicle exports valued at €136 billion and imports at €62 billion, the sector generated a trade surplus of €74 billion. Furthermore, the automotive industry plays a pivotal role in fostering innovation, with research and development (R&D) investment amounting to €61 billion (ACEA, 2020).

Second, the Asian automotive industry is dominated by three major markets: Japan, Asia, and China. Companion entrepreneurship continues to thrive throughout Asia, and foreign finance has begun to increase appropriately (Warokka et al., 2020). Asia's automakers have concentrated production activities within the region not only to strengthen their regional market presence but also to improve their manufacturing competence.

Third, the Asian automotive repair and maintenance sector have evolved into a global vehicle production and export hub (Amighini & Sanfilippo, 2014). Exports of vehicles and automotive components from Asia have increased exponentially. The Chinese automobile market is rapidly expanding and ready to make a difference in the global automotive market. India, on the other hand, is cementing its presence in Africa and expanding into new markets (Warokka et al., 2020). Indonesia's automotive industry is largely characterised by contract assembly arrangements dominated by major Japanese vehicle manufacturers.

Fourth, the relationships between automakers and OEMs relationships, as well as the nations in which these multinational corporations operate, provide both possibilities and constraints (Lamprecht, 2006). According to Klier and Rubenstein (2007), 75% of the parts of a typical vehicle are manufactured by an automotive component supplier. The global automotive component industry is characterised by a small number of large multinational suppliers alongside numerous smaller enterprises operating on a national or regional basis.

Finally, the African automotive supply ecosystem is notably mature, with Automotive OEMs and tier businesses investing in the nation not only to serve local demand but also to capitalise on the country's appealing resources and cost structures for exports (EAC, 2021). The Economic Community of West African States (ECOWAS), the Egypt-UAE/Agadir

Agreement, and other highly desirable trade agreements, as well as preferential import duties as low as 0 to 2.5% that countries have among other African countries, as well as with the United States, Mexico, and the EU, all contribute to the growth of the African automotive industry (EAC, 2021).

South Africa has a strong presence of Asian, European, and American OEMs, as well as a supply network of well over 500 tier suppliers, and manufactured 350 000 passenger cars in 2019 (EAC, 2021). Morocco, Tunisia, Algeria and Egypt all have 8 to 10 EU and Korean OEMs, with 600 000 passenger vehicles produced in 2019. The base of tier providers permits local value additions of up to 60% in Morocco, with government initiatives aiming for —80 to 90% by 2024 to 2025. Legacy tier firms such as Bosch, Valeo, Leoni, Delphi Automotive, and Nexteer, as well as electronics and sensor companies such as TE Connectivity and Marquardt, have a substantial presence in Morocco, Tunisia, Algeria, Egypt and South Africa (Deloitte,2016).

The Bavaria Motor Works (BMW) Group, Renault, Stellantis, Mercedes-Benz, and VW Group SKD facilities are in Egypt and Algeria, respectively, whereas Stellantis and Renault SKD plants are in Morocco (Deloitte, 2016). Tunisia is part of a broader Asian cluster that includes Hyundai and Ssangyong of Korea, as well as TATA Motors and Mahindra of India. Morocco is the largest producer of passenger vehicles in North Africa. Sub-Saharan African nations, particularly Ghana, Nigeria, and Kenya, are currently receiving significant attention (Awuah, 2019). The OEMs have assembly plants in Nigeria, with up to 20% localisation (Black, Makundi, & McLennan, 2017). Nissan, Kia, Honda, and Hyundai from Asia; Stellantis from the EU; and Ford from the United States are among these OEMs (Baffour-Awuah, 2018).

Ghana, which is also located on the west coast, has experienced an increase in the OEM assembly footprint. The VW Group has started assembling hatchbacks, sedans, and SUVs at its Ghana factory, which has a capacity of 5 000 vehicles per year. Kenya has three domestic automobile assembly plants in East Africa, and the VW Group has been producing hatchbacks since 2019. As in Nigeria and Ghana, passenger vehicle localisation is currently limited to 15 to 20% (EAC, 2021).

2.3 BACKGROUND OF THE AUTOMOTIVE INDUSTRY IN SOUTH AFRICA

The South African automobile industry has a long and complex history, which can be divided into two distinct periods: pre-democracy and post-democracy. These periods are covered in the following sections.

2.3.1 Pre-Democracy Context

South Africa's automotive industry has historically focused on the manufacture and export of vehicles and components. The industry was highly protected before trade liberalisation in the 1990s. In the 1920s, Ford and General Motors established operations in South Africa in 1924 and 1926, respectively. This resulted in an increase in new automotive sales of approximately 13 500 units to 20 500 units between 1925 and 1929. The beginning of the Great Depression in the 1930s halted industry expansion until 1938/39, when automobile sales began to rise. The National Motor Assembly of Johannesburg entered the market in 1939, becoming the third assembly firm.

Following World War II, the South African car industry expanded rapidly. Durban and East London were the first locations to have Motor Assemblers and Car Distributors Assembly in 1945. The Chrysler Corporation then opened a factory in Cape Town in 1984. South African Motor Assemblers and Distributors built a facility in Uitenhage in 1949. The British Motor Corporation with operations in Cape Town in 1955 (Flatters & Netshitomboni, 2006).

In the early 1960s, South Africa began employing import substitution tactics. For the automobile industry, this took the form of local content efforts (either by mass or by value), which were supported by high tariffs and strict import prohibitions. These laws effectively created an anti-export bias in the automobile industry (Mashilo, 2019). In the late 1980s, the development model based on industrial import substitution began to present severe challenges. The policy was revised in 1989 with the execution of Phase VI of the local content project to address the issues of an inward-focused sector with low-volume output and high pricing. It allows companies to incorporate exports within their local content criteria.

The Motor Industry Development Programme (MIDP) was adopted in 1995 to increase competitiveness through market-based policies, and it was critical in commencing the process of industrial transformation necessary for effective integration into global markets (Barnes, 2013). It reduced tariffs at a quicker rate than South Africa's World Trade Organisation (WTO) criteria required.

2.3.2 Post-Democracy Context

The South African automotive repair and maintenance sector includes the manufacture, distribution, service, and repair of motor vehicles and components (South Africa-Country Commercial Guide, 2021). In 1998, eight light-vehicle manufacturers produced 301 000 units, 8.4% of which were exported. With decreasing protection in the 1990s, imports increased, accounting for 18.2% of domestically manufactured automobiles in 1998.

One of the distinctive elements of the South African automobile industry is its unusual ownership structure. All assemblers are now wholly or partially owned by their parent companies in Japan, the United States, or Europe (Black, Barnes & Monaco, 2018). The corporate governance frameworks that accompany it have far-reaching implications for technology transfer and industrial integration into global markets. Local firms, for example, may gain access to new technologies and penetrate current markets through their "parent" businesses' networks and supply chains (Mashilo, 2019).

2.4 MAJOR AUTOMOTIVE INDUSTRY PLAYERS IN SOUTH AFRICA

The global vehicle industry can be divided into three fundamental divisions (Barnes & Morris, 2008). The first and possibly most important group is OEMs, which are the companies that design and produce the vehicles and related goods that the final customer buys and uses (Black et al., 2018). The second segment includes automotive component producers, which are companies that produce automotive components and accessories for use in automobile production and sale through established manufacturing channels. The third largest category is the independent aftermarket (Mukondeleli, Kanaka, & Laseinde, 2016). Automotive components and accessories are sold by companies in this market through independent merchants and repair businesses. This section focuses on two manufacturing segments: OEMs and component manufacturers.

2.4.1 Original Equipment Manufacturers (OEMs)

The expansion and evolution of the automotive component industry are dependent on the growth of the automobile manufacturing business, notably the OEM sector (Mukondeleli et al., 2016). The seven OEMs that now build passenger and light commercial vehicles in South Africa (BMW, Ford, Isuzu, Mercedes-Benz, Nissan, Toyota, and Volkswagen) were all present during the previous era of strong tariff protection, artificial market stimulation, and weight-based local content requirements (Mashilo, 2019). During the previous political system, only

Volkswagen and BMW remained owned, with other corporations considering several options, including completely disinvesting (like General Motors and Ford did) and maintaining a fraction (as Mercedes-Benz) (DTI, 2016).

2.4.2 Component manufacturers

The South African automotive component manufacturing industry emerged soon after the first car manufacturers entered the market in the 1920s, but it was concerned primarily with the production of materials that were costly to import, such as glass and rubber (Hartzenberg & Marudzikwa, 2002). Since then, the industry has evolved and grown, and South Africa presently has over 350 component manufacturers (Barnes, 2013; SA Fact, 2022).

According to Rüdele and Wolf (2023), four distinct segments in the component-manufacturing industry are acknowledged. This industry is divided into four tiers. All first-tier component manufacturers provide components for direct distribution to automobile manufacturers. The second-tier manufacturers provide sub-components for the first-tier manufacturers' manufacturing process, whereas the third-tier manufacturers provide components or processed materials to the second-tier manufacturers. The multiple levels are illustrated by a tier 3 supplier producing plastic pellets that are melted by a tier 2 supplier and moulded into sheets (Mashilo, 2019). These sheets are then provided to a tier-one supplier, which cuts or moulds them into plastic dashboard panels for distribution to OEMs and final assembly.

Aftermarket fitment, suppliers are a fourth tier that comprises any car-related things that are not directly attached to or used by vehicle manufacturers (Rüdele & Wolf, 2023; Black et al., 2018). An alloy wheel manufacturer is an example of a company in this category since it designs and manufactures its wheels and sells them to consumers for aftermarket installation on their vehicles. All four tiers of component manufacturers are present in South Africa, and several firms have represented them at various phases of industrial protection in the automobile industry (Rüdele & Wolf, 2023; Mukondeleli et al., 2016).

As the preceding assessment of the vehicle manufacturing sector demonstrated, throughout South Africa's first five phases of industrial strategy and tariff protection, the automotive manufacturing industry, in general, was inwardly oriented and significantly inefficient (Barnes, 2013). The artificially stimulated and protected market, as well as the regulatory requirement that OEMs obtain a certain percentage of their goods from South African component manufacturers, caused inefficiencies in the automobile market (Barnes & Kaplinsky, 2000; Barnes et al., 2017).

The OEMs and Tier 1 suppliers are crucial to South Africa's current automotive value chain. Tier 2 and Tier 3 activities, on the other hand, are still in their infancy. Figure 2.1, below, depicts the situation schematically.

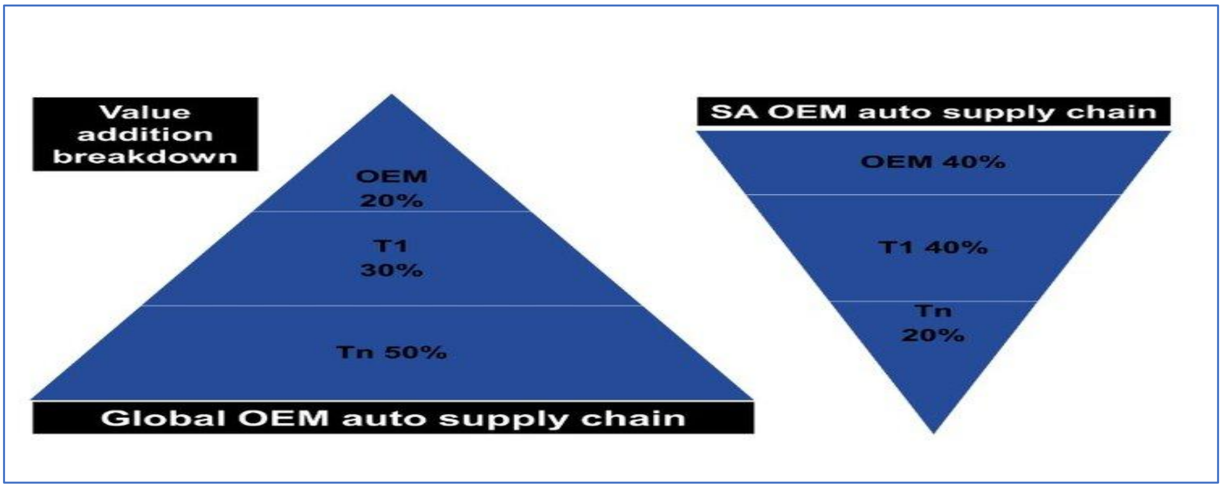

Figure 2.1: Value addition breakdown of global and South African automotive supply chains

Source: Barnes (2014)

Global OEMs are estimated to constitute 40% of the total value added in the South African automotive value chain. Upstream firms generate just 20% of components, whereas Tier 1 component producers produce 40%. Because of this concentration, the car industry may be compared to an island, with weak connections existing between the OEM and Tier 1 operations and the rest of the domestic industry (Black et al., 2018).

2.4.3 Auto retailers

The problems plaguing the South African automobile retail industry date back to 2007, when the government adopted the New Credit Act (NCA). The NCA changed the criteria for acquiring assets using credit. After the first month, the ability to acquire financing declined (Moos & Sambo, 2018). Shortly after the new law was passed, interest rates began to rise gradually for external and internal reasons, such as the Reserve Bank raising the prime lending rate. In addition to the problems confronting the automotive retail industry, new and cheaper Chinese vehicles began to emerge in South Africa. As a result, local vehicle dealerships experienced a significant drop in sales. The combination of these factors is largely accountable for the decline in automotive sales (Deloitte, 2019). Other factors contributing to the sector's rise include the political and legal climate, globalisation, and black empowerment schemes.

2.5 CONTRIBUTION OF THE AUTOMOTIVE INDUSTRY IN SOUTH AFRICA (SA)

2.5.1 Contribution to the economy

The South African automobile industry is the country's largest manufacturing subsector (Black et al., 2017). The sector is supported by an export-led growth paradigm, with an emphasis on increasing productive capacity by assisting local automotive industry players in gaining access to international markets, adopting best practices, and reaping economic benefits from trade liberalisation and global integration (Deloitte, 2019).

The automobile industry is the largest contributor to the GDP. According to National Association of Automobile Manufacturers of South Africa (NAAMSA, 2022), the automobile sector generated 4.9% of GDP in 2020 (2.8% manufacturing and 2.1% retail). Prior to the COVID-19 pandemic, the industry's contributions to GDP were higher, reaching 6.4% in 2019. Furthermore, the automotive industry provides a significant 18.7% value addition to domestic manufacturing output from car and automotive component manufacturing activities (NAAMSA, 2022).

The automotive industry is attracting foreign direct investment (FDI). As reported by NAAMSA (2022), the industry remained one of the most significant sectors drawing FDIs in 2020, with the seven OEMs investing a record R9,2 billion and the component sector investing R2.4 billion. With 110 000 people employed across automobile and component manufacturers, South Africa's automotive repair and maintenance sector currently contributes significantly to GDP, accounting for 6.8%. (RMB, 2021). Approximately 1.5 million people are believed to experience indirect repercussions. In 2020, it accounted for approximately 4.9% of the nation's GDP, with retail contributing 2.1% and vehicle component manufacturing accounting for 28% (RMB, 2021). With ambitions to increase local participation in the automobile sector by 2015, the industry is expected to make an even greater contribution to the South African economy.

The automotive repair and maintenance sector, which produces both automobiles and automotive components, is the country's primary manufacturing industry. This activity contributed a sizable 18.7% of value added to domestic manufacturing output (Brand South Africa, 2025). As a result, South Africa's automotive repair and maintenance sector, as well as its broader value chain, continues to be portrayed as a critical component in the country's industrialisation process (SACCG, 2021). The automotive industry also plays a major role in contributing significant tax revenues from vehicle sales, usage-related levies, personal income taxes, and business taxes.

2.5.2 Supporting local businesses

According to Deloitte, 2019, upskilling is another way the automotive industry assists local businesses since it spans a wide range of development, from technical training at R&D centres to fundamental financial and management training on business readiness. Individual business demands should be met through skill development. Some suppliers, for example, require better technology and must be assisted to go to the next stage of manufacturing. Others may require negotiating and prediction skills training. Depending on the circumstances, collaborating with global experts to develop local competency may be useful. Another option is incubation programmes in industrial parks or Special Economic Zones (SEZs). These programmes help small businesses acquire access to favourable SEZ agreements as well as critical exposure to OEMs and tier 1 suppliers.

The automobile sector is expected to take the lead in furthering black empowerment. To achieve this goal, the South African Automotive Master Plan (SAAM) 2035 proposes increasing yearly car manufacturing from 600 000 to 1.4 million. This will be accomplished by assisting black-owned automotive suppliers in expanding their operations and possibly cooperating with major multinational suppliers. To accomplish this, automakers, also known as OEMs, have pledged to support transformation, which would assist the inclusion of Black Economic Empowerment (BEE) firms in the supply chain (Deloitte, 2019). South African Automotive Master Plan (SAAM) 2035 aims to increase the number of employees in the automotive repair and maintenance sector from 112 000 to 224 000 (Ansara & Davids, 2018).

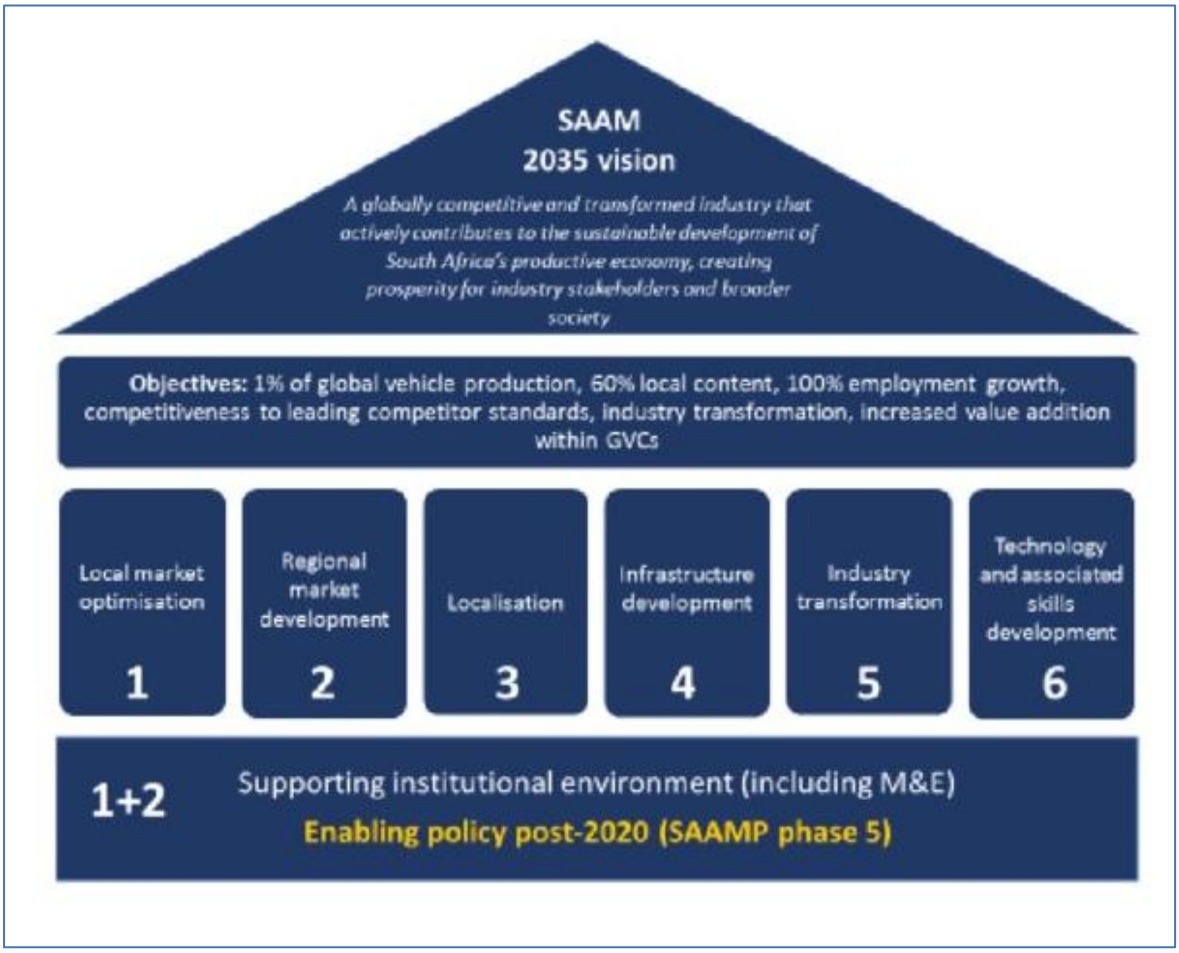

Figure 2.2: South African Automotive Masterplan's 2035 vision, objectives, and strategic focus areas

Source: Black et al. (2018)

The achievement of SAAM's core aims and aspirations would be necessary for the South African automotive repair and maintenance sector to significantly expand its contribution to the local economy by 2035. This will greatly increase local content, production, and employment (Black et al., 2018).

2.5.3 Employment creation

The South African car sector directly employed more than 110 000 people in 2018 and contributed approximately 6.8% of GDP (4.3%) manufacturing and 2.5% retail (Automotive Repair and Maintenance Sector Export Council, 2019). The car sector employs over 200 000 individuals, the majority of whom work in sales, maintenance, and repair (NAAMSA 2012). Owing to the increase in possibilities in the automotive and allied sectors, the automotive industry maintains direct relationships with a significant number of support services and SMMEs and has a high multiplier impact (Automotive Industry Export Council, 2020).

Owing to its strong forward and backwards links with virtually every sector of the economy, the car industry has a substantial multiplier impact, which contributes to the development of the South African economy (Mashilo, 2019). The car industry's economic importance may be traced back to a variety of critical industrial processes, including the manufacture of steel, textiles, paint and rubber; petrochemicals; and component manufacturing. The industry is also considered a source of connections with other industrial sub-sectors such as textiles, leather, and plastics (Automotive Industry Export Council [AIEC], 2020).

Employment trends in car component and assembly plants from 1995 to 2011. Research has shown that employment in the car sector has been relatively stable since 1995, with OEMs frequently spending a significant amount of labour in South African production, indicating a high degree of elasticity. According to the ITAC (2000), the major goal of the MIDP was to strengthen the worldwide competitiveness of the automobile sector. Furthermore, it was recognised that creating jobs in the car sector would be difficult; as a result, the emphasis was on retaining employment at current levels.

According to Black et al. (2018), globalisation has reorganised and transformed domestic businesses. As a result, the sector today faces challenges such as relatively high costs associated with low-volume production, reliance on foreign technology, and constricted R&D expenditures. The pursuit of continuous improvement and greater efficiency by new industrial technologies resulted in the outsourcing and subcontracting of full-time positions, stifling labour-force expansion.

2.5.4 Fostering Research and Development (R&D) Innovation

Innovation is required to transition to higher value-added economic activity and achieve long-term growth sustainability; R&D investment is critical to innovation (Lin & Tang 2013). Three types of innovation, including electric mobility, autonomous cars, and shared mobility, are critical in delivering low-carbon transitions for the transportation sector as it moves towards more sustainable modes of mobility. (Sheller & Urry, 2016; Sperling, 2018) refer to them as "three revolutions" as well as "new" transportation mobilities. The consumer desire for greater product variety, better performance, increased economy and safety, lower CO_2 emissions, and lower costs drive automakers' R&D expenditures. The automotive industry's supply chain integration and modular sourcing have also had an impact.

Automakers were among the first corporations to delegate direct job duties, such as design, engineering, R&D, and buying, to suppliers, and by focusing on core operations, they have increased profitability and supplied specialised markets more effectively. Sperling (2018) noted that the gasoline-powered automobile manufacturing industry must be disrupted owing to the harmful impact on the environment and that the disruption will unfortunately result in a lifestyle transition.

2.6 LEGISLATIVE FRAMEWORK FOR THE AUTOMOTIVE INDUSTRY IN SOUTH AFRICA

Regulations are created to assist the consumer while also protecting the environment, and customers have a say in how vehicles are built, how their parts are manufactured, and what safety features are incorporated. In recent years, government laws have worked to define the degree of fuel economy required of vehicles. The DTI provides many incentive programmes to the automobile sector, which necessitates the use of specialised assurance services to verify that monies are used properly. The legislation that backed the government's vision for the automobile sector was described earlier in the section on the history of the automotive industry. This section focuses on current legislation that benefits the automobile sector.

2.6.1 Automotive Production and Development Program (APDP)

The APDP initiative was launched on January 1, 2013, and is still in existence. The APDP program's principal aim was to increase local manufacturing capacity while adhering to WTO subsidy regulations. The APDP seeks to double South Africa's vehicle output to 1.2 million units by 2020, giving the country's automotive repair and maintenance sector a global market share of more than 1%. An increased market share will generate more interest and investment, resulting in greater business. The APDP seeks to replace the export orientation with one that emphasises value addition and scale in car manufacturing. The project seeks to boost worldwide competitiveness by redirecting incentives towards the development of local industrial potential.

The purpose of the APDP is to create an environment that will allow the domestic industry to significantly expand production volumes and add local value, resulting in the creation of additional job opportunities along the value chain. The APDP is intended to encourage the continuous expansion of top-tier automobile component manufacturing. The APDP promotes large-scale automobile production, investment, and output in the automotive repair and maintenance sector (DTI, 2012).

According to National Association of Automotive Component and Allied Manufacturers [NAACAM] (2013), the APDP will mark a quantum leap in terms of procedures, technology, and the scale on which the domestic sector has functioned. The purpose of the APDP is to expand local content manufacturing and obtain more semi-finished items from the domestic automotive market, allowing the sector to have a greater impact on the economy and employment levels at the state and national levels.

The DTI (2012) defined the four critical aspects that drive the APDP initiative. These are: the production incentive, the import tariff exemption, the vehicle assembly allowance, and the automotive investment plan. In the case of component exports or replacement parts, the OEM or component maker will be the end producer who will obtain the production incentive as it passes through the supply chain. The value-added aid is designed to encourage growing levels of local value addition along the automotive value chain, with positive spill over effects on employment creation. Tariffs on imports are meant to provide only the proper level of protection to ensure that domestic vehicle manufacture continues.

The Vehicle Assembly Allowance (VAA) effectively lowers the tariff rate for regional manufacturers, which should be enough to encourage the production of large numbers of cars to meet the aim of doubling output. The Automotive Investment Scheme (AIS) is a system that encourages OEM and component manufacturer investments in a way that permits equipment upgrades.

2.6.2 The Employment Equity Act (EEA) 55 of 1998

South Africa is a culturally, ethnically, and economically diverse country globally. To promote workplace equality, the Employment Equity Act (EEA) was implemented to ensure that everyone has equal opportunity and fair treatment (Nomadolo, 2021). Begeny et al., (2020) argue that gender bias continues even as women become more prevalent in the office and that more needs to be done to address gender inequalities in the workplace.

The purpose of the act is to achieve equity in the workplace by:

- Eliminating unjust discrimination in the workplace to promote equal opportunity and fair treatment.

- Implementing affirmative action steps to address the employment disadvantages faced by specified groups (such as black people, women, or persons with disabilities) to assure their fair representation in all occupational categories and levels of the workforce.

Except for the South African National Defence Force (SANDF), National Intelligence Agency (NIA), and South African Secret Services (SASS), the Act applies to all workers and employers (BEE News, 2019). Although the EEA has not been fully implemented in certain quarters of the economy where white supremacy is still visible, it has led to black people's involvement in once white-dominated economic activities, such as the manufacturing and distribution of automotive components. Before 1994, this sector was mostly dominated by Whites, a few Coloureds, and Indians. The promulgation of the EEA not only achieved equity in workplaces but also assisted the once underprivileged blacks in owning their automotive workshops in South Africa.

2.6.3 Broad-Based Black Economic Empowerment (BBBEE) Act 53 of 2003

South Africa had its first democratic elections in 1994, having previously operated in an environment marked by racial discrimination, the exclusion of the Black population from the country's economic operations, and being demoted to second-class citizens by apartheid. The African National Congress (ANC) secured most votes and subsequently assumed power as the ruling party.

The BEE Act was passed in 1994 and became the main driver of the South African Government's efforts to address the inequalities of colonial history and the Apartheid regime. It was amended by the DTI in 2003 (RSA, 2003), and its focus was on three pillars: ownership, human resource development, and indirect empowerment (Musabayana & Mutambara, 2022). Black Economic Empowerment (BEE) had a minimal influence on poverty and transformation progress ten years later; it was strongly criticised by the people for just benefiting a few politically well-connected Black elites, leading to the passage of the Broad-Based Black Economic Empowerment (B-BBEE) Act in 2003.

In 2013, the government decided to update the 2007 Codes of Good Practice. The revised Codes of Good Practice required examining scorecards via a new scoring system that focused more on the factors of ownership, skill development, and enterprise development, making it more difficult to earn a high score (DTI, 2013). The B-BBEE plan was "great," but the expectations for the automotive repair and maintenance sector, particularly Small and Medium-sized Enterprises (SMEs), were unattainable. According to Thomas Schaefer, managing director and chairperson of Volkswagen South Africa, the Deal and Industry Department accused manufacturers of dragging their feet and failing to do enough to deal with black-owned firms.

2.6.4 Regulating competition in the automotive industry

Section 79(1) of Competition Act, (Act No. 89) of 1998 governs competition throughout the South African automotive value chain. The Act provides that the Competition Commission may establish guidelines to outline its perspective on any topic coming within the Act's authority. The Competition Act was created in response to an upsurge in anti-competitive activity accusations in the automotive value chain.

Exclusionary agreements and/or arrangements between OEMs and approved motor-body repairers, exclusion of independent service providers (ISPs) from markets for service, maintenance, and mechanical repairs for in-warranty motor vehicles, unfair work distribution by insurers, limitations on the sale of original spare parts to ISPs, high entry barriers that exclude SMEs, and historically disadvantaged groups are examples of unfair practices. The objectives of the framework are as follows:

- To reduce entry barriers and allow more firms, particularly those owned and operated by Historically Disadvantaged Individuals (HDIs) and SMEs, to perform service, maintenance, and repair work on motor vehicles during the warranty term.
- Increase consumer choice and openness in automobile services, maintenance, and repairs.
- Increasing consumer alternatives and encouraging competition in replacement and value-added product markets.

2.6.5 South African Automotive Masterplan

The MIDP, which was later succeeded by the APDP in 2013, established the policy objectives that regulated South Africa's automotive repair and maintenance sector. The SAAM which is expected to be in force from January 2021 to 2035, presently provides policy objectives for the next time. The master plan aims to create a framework for increased productivity and investment. The strategy is guided by the objective of developing a "globally competitive and transformed industry that actively contributes to the sustainable development of South Africa's productive economy, creating prosperity for industry stakeholders and the broader society." The Masterplan is guided by the following goals (Automotive Industry Export, 2020):

- Increase domestic auto production to 1% of the global output (140 million vehicles each year by 2035).
- Increase local content to 60% of autos manufactured in South Africa (up from 39% in 2015).
- Overall employment in the automotive value chain has more than quadrupled (from 112 000 to 224 000).
- The car industry's competitiveness with that of major international competitors should be increased.
- Transform the industry throughout the value chain.
- Increase the worth of a product or technology.

2.7 CHALLENGES FACING THE AUTOMOTIVE INDUSTRY SUPPLY CHAIN IN IMPLEMENTING ENVIRONMENTAL SUSTAINABILITY PRACTICES

While the automotive industry faces global supply chain challenges, this section focuses specifically on those confronting the South African automotive repair and maintenance sector. These are supply chain challenges, industrialisation challenges, the Coronavirus Disease (COVID-19) pandemic, liquidity challenges, vehicle production's local challenges, and infrastructural and technological challenges.

2.7.1 Supply chain challenges

The South African automotive repair and maintenance sector faces diverse problems, in addition to fierce competition (Naude, 2013). The South African automotive repair and maintenance sector is ahead of other sectors in terms of SCM, but there are issues with the improvement of services and reduction in costs, according to the 2017 supply chain foresight evaluation. Ambe (2014) asserts that most companies in the South African automotive industry are inefficient in working together. They also do not respond to shifting market conditions. Naude and Badenhorst-Weiss (2011) claim that the automotive repair and maintenance sector's supply chain is more vulnerable than ever because of the drastic shifts in demand and volume caused by the current financial crisis.

According to Naude (2009), the automotive repair and maintenance sector in South Africa faces challenges in terms of cost-competitive production and the ability to reliably and quickly adjust to the demands of the first-world market. Naude (2009) argues that the main supply chain issues in the South African automobile sector are OEM coercion to lower material prices, cancel orders, keep excess stock, use the unreliability of rail transport as well as capacity issues, exorbitant port fees, obsolete technology replacement costs, and the widespread use of BBEEE. One of the primary issues confronting the South African automotive value chain is the production of raw materials such as metal pressings and plastic moulded products, which reduce shares of automotive value in comparison to finished goods such as electronics, powertrains, telematics, and advanced safety products. The 2035 Master Plan lists further obstacles that must be addressed to increase local content to 60%, including inbound and outbound logistic expenses, South Africa's factor cost profile, the demand for skill and technology upgrades, and the cost of services that are run by the government.

2.7.2 Industrialisation challenges

Industrialisation refers to several economic and social processes, including the search for more effective ways to create value (Simandan, 2020). In the automobile sector, industrialisation, which is linked to economic development, is not as prevalent. According to Gollin, Jedwab, and Vollrath (2016), many African cities, particularly those in nations that depend on the export of natural resources, are “consumption cities” rather than “productive cities.” Manufacturing and production are frequently viewed as the starting points for inclusive growth because of their ability to increase employment, deepen and widen local value chains, progress technology, and develop regional expertise. To hasten the restoration of the manufacturing base, Sibanda and Straus (2020) urge the Government of South Africa to be actively involved in the transfer of global technology.

2.7.3 The Coronavirus Disease (COVID-19) pandemic and Liquidity Challenges

The Coronavirus Disease 2019 (COVID-19) pandemic, which was discovered in Wuhan city in China in December 2019, has spread throughout the globe, causing a global health problem. Many countries, including South Africa, have implemented forced lockdowns to contain the pandemic and prevent the spread of this virus. The lockdown had a significant negative economic effect. Owing to reduced operating margins and limited access to credit lines, smaller, second-tier automotive component manufacturers appear to be the most impacted, according to Barnes (2020). Rebuilding sales requires extra expenditures, which are frequently funded by bank loans (capex, tooling, and growth capital impacting operations) (Deloitte, 2020).

The COVID-19 pandemic and ensuing lockdown measures severely hampered the South African economy. In the first quarter of 2020 (January to March), the real GDP was R 782 billion. Strict lockdown restrictions resulted in economic production decreasing to R 652 billion in the second quarter of 2020 (April to June). Figure 2.3, below, shows the impact of the COVID-19 pandemic on the economy.

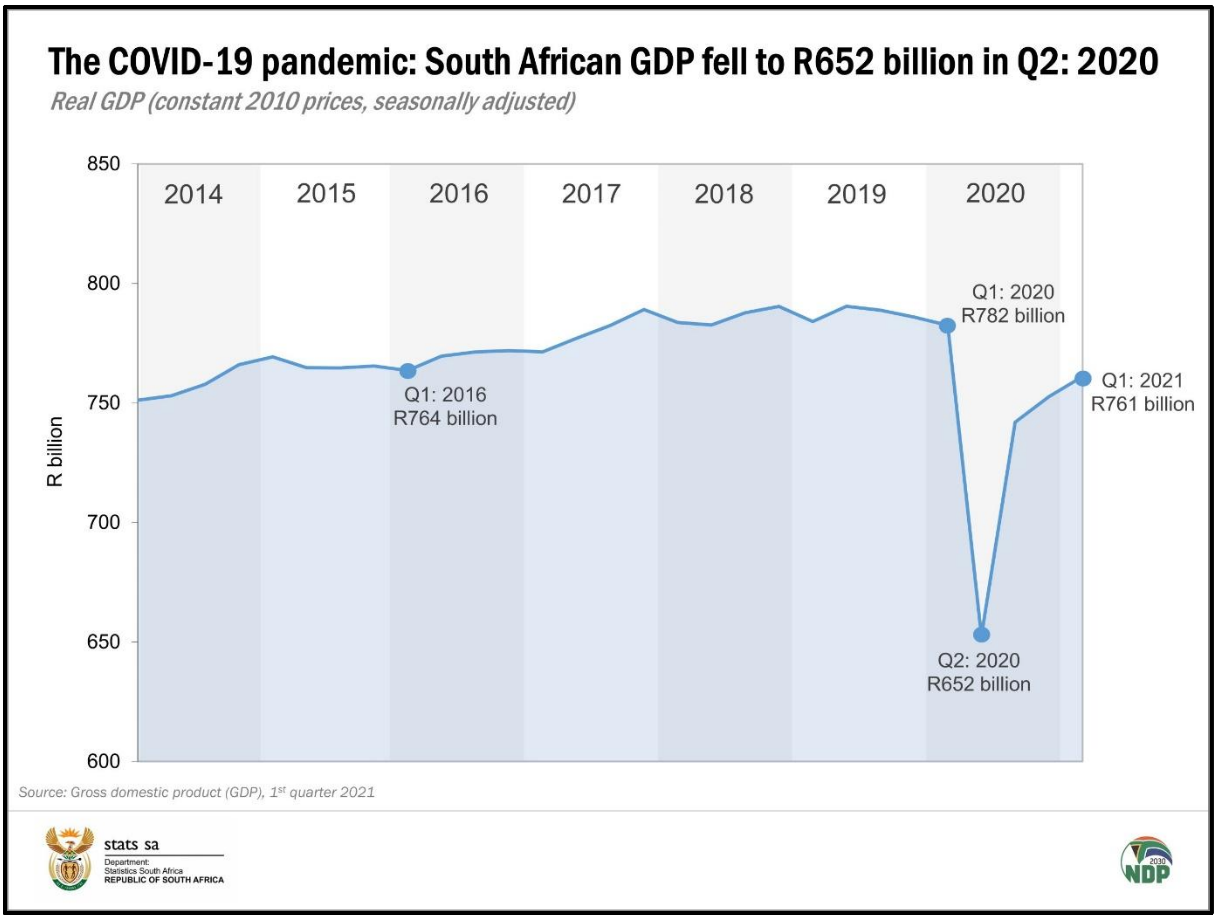

Figure 2.3: The COVID-19 pandemic’s effect on 2020 gross domestic product
Source: Statistics South Africa (2021)

The easing of lockdown restrictions improved economic activity in line with GDP increasing to R 761 billion in the first quarter of 2021.

2.7.4 Vehicle production’s local challenges

The COVID-19 pandemic severely disrupted local vehicle production by exposing vulnerabilities in supply chains, particularly South Africa’s reliance on imported components, which led to production slowdowns and threatened long-term manufacturing targets such as those outlined in the SAAM 2035. These pandemic-related disruptions extended beyond reduced output to include logistical challenges and increased costs, weakening the automotive value chain's resilience (TIPS, 2023).

2.7.4.1 Production of the vehicle dropped

The production of vehicles decreased to 15.8% globally in 2020. Manufacturers produced fewer vehicles in 2020 than in 2019, the latter of which was already a tough year, with global production having declined 5.2%.

Table 2.1: The production of vehicles from 2014 to 2020

	2014	2015	2016	2017	2018	2019	2020	% change 2020 / 2019
Global Production	89.77	90.84	95.06	96.67	96.87	92.18	77.62	-15.8%
South Africa Production	0.568	0.617	0.600	0.601	0.61	0.63	0.45	-29.2%
SA Share of Global Production	0.63%	0.68%	0.63%	0.62%	0.64%	0.69%	0.58%	-15.9%

Source: NAAMSA, 2020

There was a decline in the share of global vehicle production from 0.69% in 2019 to 0.58% in 2010 in South Africa according to the NAAMSA report. The production of vehicles decreased by 29% between 2019 and 2020. Compared with that in the second quarter of 2021, production more than doubled (173%).

2.7.5 Natural disasters

Given that natural disasters may damage businesses beyond national borders through the globalisation of supply networks, businesses are now more exposed to disaster risk (Linghe & Masato, 2012). Additionally, the amount of interconnection among businesses has grown due to offshore and outsourcing operations, which has increased vulnerability because the interruption of even a small portion of the global supply chain might force the other portions to cease operating. The recent floods that occurred in the Province of KwaZulu Natal, South Africa, in March 2022 disrupted the entire automotive value chain. According to Dunn (2022), Toyota South Africa Motors (TSAM) experienced severe damage to their prospecting facility, including losses of equipment and materials as well as damage to cars and production lines. In addition, the TSAM lost an estimated 45 000 units of production due to floods, forcing the company to temporarily halt the production of the Hilux, Fortuner, HI Ace, Corolla Cross and Corolla Quest ranges of cars (Dunn, 2022).

Disasters cause supply chain disruptions in areas with high concentrations of production facilities, thus resulting in large structural losses to the whole production network and related industries (Linghe & Masato, 2012). This view concurs with the impact of the KwaZulu Natal floods on the automotive repair and maintenance sector in South Africa and beyond.

2.7.6 Infrastructural challenges

The automotive repair and maintenance sector in South Africa is facing challenges in infrastructure. One of these challenges is caused by criminal activities that target rail infrastructure, thus reducing its capacity. The effects of cable theft reduce corporate productivity and economic growth, directly reducing employment creation. South Africa's everyday economic growth and freight railway operations are crucial.

In addition, the National Rail Operator has several difficulties, including inadequate service levels, a lack of flexibility, and a delay in capital investments (Akinlabi & Mbohwa, 2016). This results in greater traffic congestion, higher car maintenance expenses, and a significant burden on the road infrastructure, most of which is already in poor condition. This has the effect of increasing travel lengths, which results in longer turnaround times, decreasing automotive supply chain efficiency overall (Ambe & Badenhorst-Wess, 2013). The recent floods that occurred during March 2022 in KwaZulu Natal Province destroyed both the road and rail infrastructure, which has had a long-term impact on the automotive supply chain (Dunn, 2022).

2.7.7 Technological challenges

The automobile industry is facing a very dramatic change in its development trajectory, and it must also cope with a different danger that might be much more existential, particularly with the wide range of technological disruptions caused by Industry 4.0 (Barnes, 2020). Assemblers of vehicles as well as manufacturers of vehicle components need to investigate the emerging role of additive manufacturing, other new material developments, the use of "big data" and advanced computing power that has fostered machine learning and artificial intelligence capabilities that are powering completely new intra- and interfirm process and product technologies with the ability to refashion entire value chains of the automotive repair and maintenance sector (Arbib & Seba, 2017). Each of these disturbances might have extremely negative and wide-ranging effects. For instance, the established mode of car consumption may be altered because of additive manufacturing.

2.8 INSIGHTS FROM THE LITERATURE REVIEW

The literature review revealed that the automotive repair and maintenance sector plays an important economic function globally, making it one of the largest employers in the EU, China, Japan, India, Thailand and South Africa. In addition, the South African automotive industry is dominated by OEMs from Asia, Europe and America. However, several policies have been put in place to promote the growth of local OEMs and component manufacturers as well as to manage competition. These legislations include the APDP, Competition Act, (Act No. 89) of 1998, EEA, (Act No. 55) of 1998, Broad-Based Black Economic Empowerment Act, (Act No.53) of 2003 and South African Automotive Master Plan. Finally, the literature reveals that the automotive industry faces several challenges, with the COVID-19 pandemic being one of the major challenges affecting the industry.

2.9 RESEARCH GAPS

The literature provides convincing documentation of the economic contribution of the automotive repair and maintenance sector. However, there is a scarcity of literature that documents the issues of environmental sustainability and specific strategies that players in the industry are doing. In addition, the current COVID-19 pandemic poses a serious threat to the South African automotive industry. The current literature has not fully explored the extent of the challenges specifically facing the industry and strategies to harmonise the support for the industry as well as support for environmental sustainability strategies.

2.10 CONCLUSION

This chapter reviews the literature on the automotive industry, sustainability and service effectiveness. First, the history of the South African automotive industry before the global scale was considered. The SA automotive industry suffered pressure as an emerging market, causing it to constantly seek better methods, such as improving standard operating procedures, to remain competitive prior to liberalisation in 1990. In addition, the chapter explored automotive industry players and their role. These players include OEMs, automotive component producers and the independent aftermarket. The literature review further emphasised the role of the automotive industry in the economy in terms of employment creation, BEE, supporting local businesses and fostering (R&D) innovation. The chapter further focuses on environmental sustainability. Environmental sustainability in the automotive supply chain requires that resources and services are provided in a manner that meets the needs of both present and future generations without compromising ecosystem health. The study highlights that adopting green information technology can be an effective approach in developing countries to achieve this goal, as it enables more efficient energy use and reduces environmental waste. Furthermore, this chapter discussed the current state of environmental sustainability in South Africa. In addition, the challenges faced in implementing sustainability practices were discussed. These challenges include supply chain challenges, industrialisation challenges, the COVID-19 pandemic, liquidity challenges and vehicle production challenges. The next chapter reviews the literature on environmental sustainability, with a focus on international and national contexts.

CHAPTER 3:
THEORETICAL FRAMEWORK AND ENVIRONMENTAL SUSTAINABILITY

3.1 INTRODUCTION

The previous chapter reviewed the literature on sustainability in the automotive repair and maintenance sector, with a focus on the history of the South African automotive industry from pre-democracy times to the current post-democracy era. This chapter reviews the literature on environmental sustainability, with a focus on international and national contexts. The theoretical framework serves as a foundation or anchor point for the review of literature, as well as methodology and analysis (Grant & Osanloo, 2014). To this end, the chapter opens with a discussion of theories that were used as lenses for this study. The institutional theory and RBT were used as theoretical lenses to explain the institutional forces that influence technology adoption as well as the economic value of technology adoption theory. Previous research that employed these theories is reviewed, as is the application of the theory to this study. Thereafter, the chapter reviews the literature on environmental sustainability, focusing on the following key areas: environmental sustainability and environmental sustainability practices. Both local and international studies are used in the review. The chapter concludes with a review of previous studies on environmental sustainability.

3.2 RESEARCH THEORIES

Theories provide significant guidelines for the conduct of research in the sense that they help to organise relevant empirical facts to create a context for understanding phenomena. To explain environmental sustainability in the automotive repair and maintenance sector, institutional theory and the RBV provide lenses through which the role of institutions and an organisation's resources influence the adoption of environmental sustainability practices.

3.2.1 The Institutional Theory (IT)

Institutional theory (IT) provides a theoretical lens for analysing policy-making institutions and understanding the politics of policymaking related to the automobile industry in South Africa (Greenwood et al., 2011). The theory follows approaches such as rational choice models, institutional economics, or collective action approaches, which are most frequently used in research that examines the political economy of the automotive repair and maintenance sector (Miörner, 2020; Voronov & Weber, 2020). The afore-mentioned methods make use of an economics paradigm where the allocation of limited resources is the primary focus of the study and where efficiency is prioritised. Nevertheless, such a strategy falls short of covering the full gamut of political economics and the politics of industrial policy, especially in a developing nation such as South Africa. When considering history, the political process, power relations, and normative issues as the primary concerns in making policy decisions, this rational choice approach falls short (Berthod, 2018). Unlike these approaches, institutional theory is based on agency theory, which holds that actors have a fixed set of preferences and act solely to achieve those goals, which presuppose considerable knowledge and includes an emphasis on maximising utility (Greenwood et al., 2011).

According to IT, institutions are a crucial theoretical lens for analysing what influences, facilitates, and constrains the interactions of economic agents to determine developmental outcomes (Burch & Crowson, 2020). The analysis of institutions considers more extensive informal institutional restraints, such as norms, values, and ingrained customs, in addition to policies, constitutions, and laws (Ordonez-Ponce, 2021). According to the theory, institutions are bodies that contain the fundamental social norms, customs, values, and laws that control economic actors within a particular institutional environment (Berthod, 2018). Institutions determine social, economic, and political results to achieve this goal. Three significant new institutionalism paradigms have been identified by research: historical institutionalism, sociological institutionalism, and rational choice institutionalism (Wagner, Huemann & Radukkov, 2022). These institutionalism paradigms concur that institutions play a crucial role in organisational choices and practises, and are discussed in detail below:

- **Historical institutionalism**

Institutions are defined by historical institutionalism as routines, norms, standards of conduct, and conventions incorporated into the organisational framework of the political economy or polity, whether they are official or informal (Burch & Crowson, 2020; Voronov & Weber, 2020 &Wagner et al., 2022), that shape the interactions between actors in different polity and economic entities. The crucial premise is that actors' rationality is institutionally constrained (Burch & Crowson, 2020). Because options are institutionally limited, political actors' choices are constrained, and their pursuit of these choices may not always be as important as they believe. Furthermore, their preferences are products of political and social constructions.

The state has historically been viewed as a complex network of institutions that interact with both social and political institutions. Institutionalists note that 'history matters' because political decisions on certain policies take place within historical contexts, which has direct consequences for the institutional setting. For example, in South Africa, the B-BBEE policy was designed to redress the historical imbalances of apartheid, which isolated black communities from playing a part in critical sections of the economy (Pike, Puchert & Chinyamurindi, 2018). Therefore, this policy has an impact on the automotive industry as well.

- **Sociological institutionalism**

The sociological perspective views institutions as social structures composed of regulative, normative, and cultural cognitive elements that, along with associated activities and resources, provide stability and meaning to social interactions (Gang, 2020; Miörner, 2020). Institutions are seen as formal rules, procedures or norms, symbol systems, cognitive scripts, and moral templates that provide the "frame of meaning" guiding human actions.

- **Rational choice institutionalism**

Economic theory, which employs deductive reasoning to ascertain how institutions shape the behaviour of economic players, is the foundation of rational choice institutionalism (Ebrahimi & Koh, 2021). The rational choice institutionalism movement has been crucial in identifying issues with collective action decisions in policy. However, critics of the theory argue that examining how actors behave in the manner they do, by pre-set guidelines or in response to incentives, is insufficient to comprehend the true purpose underlying actors' behaviour (Ordonez-Ponce, 2021). There is more to how and why some actors behave in each situation than can be seen from a cost–benefit perspective alone. These subtleties are absent from rational choice institutionalism, and they ignore other facets of how institutions shape actors' interactions and behaviour (Miörner, 2020). This is because institutions are restricted by historical background and normative constraints, which affect how actors frame policy problems and pick particular action paths.

3.2.1.1 Previous research applications of the Institutional Theory (IT)

Several studies within the business domain have utilised the IT to achieve varying objectives. These include the works of Zhang, Wei and Zhou (2018), Yang et al., (2019), Burch and Crowson (2020), Franco and Franco (2022), Gang (2020), Sony and Aithal (2020) and Wagner, Huemann and Radukko (2022). Studies (Burch & Crowson) indicate that from the institutionalist perspective, organisations follow similar organisational patterns regardless of where they are located. Franco and Franco (2022) investigated the trends and relationships between institutional theory and innovation. The study's findings revealed that there is a positive relationship between IT and innovation. This view is shared by Garg (2020), who reported that institutional changes in China's manufacturing industry led to the introduction of new policies that promoted innovation. In a related study, Sony and Aithal (2020) indicate that India's engineering industry can generate a competitive advantage if it takes advantage of technology and innovation.

Research interest in environmental sustainability has increased globally. Gang (2020) reviewed and analysed institutional change and the growth of China's automotive repair and maintenance sector to determine the function of institutions in the development of the automotive industry. Research has shown that automobile industry policy significantly influences the growth of Chinese automakers, who should thus seize these chances to improve their technological innovation, resource integration, and other skills (Gang, 2020).

In another study, Miörner (2020) elaborates on several aspects of the institutional setting in Sweden where path transformation takes place and suggests a fresh analytical framework for examining the function of institutional agency in path development. The concept specifies various institutional agency types that are focused on "legitimating," "anchoring," and "allowing" new approaches (Miörner, 2020). The analysis shows that actors use existing institutional relationships to inform their strategy rather than focusing largely on institutional transformation (Miörner, 2020).

A recent study by Ordonez-Ponce (2021) investigated the institutional contexts of any organisational system and how they affect its structures and procedures related to sustainable practises in Italy. The study examined the institutional contexts of the sustainable Bristol Green Capital Partnership at the local, national, and international levels. The study's conclusions showed that institutional normative and cultural-cognitive environment factors are most important for ensuring local sustainability.

In the context of this study, IT is particularly relevant because the South African automotive aftermarket operates in a weak institutional environment where regulatory enforcement is limited (Berthod, 2018). As indicated by the literature, institutions play a central role in driving policies and strategies that align organisations with the global call for environmental sustainability within the automotive industry.

3.2.1.2 Applicability of institutional theory to the study

Politics cannot be isolated from the formulation of economic policy since it is influenced by the domestic institutional structure in which actors are entrenched. Therefore, the IT will be used in this study together with historical and sociological paradigms (Durand & Thornton, 2018). To achieve this, IT offers a window of opportunity for comprehending the historical backdrop and uncovering power relations that structure the interaction between key actors in policymaking within the automobile sector (Gang, 2020; Ordonez-Ponce, 2021).

The dominating normative and cognitive aspects that shape actors' behaviour in a specific institutional environment are of interest from a sociological perspective. For example, society's cultural lens is used to understand nature rather than viewing it separately. Scientific findings, such as those concerning environmental sustainability, are reframed by culture through discussion and negotiation so that practices in the automotive repair and maintenance sector that were once advantageous to the sector and society at large have changed due to widespread support for green technologies (Miörner, 2020; Ebrahimi & Koh, 2021). This study shows how politicians, bureaucrats, and "chosen" industrial organisations can mobilise, prioritise, and organise finite resources through policy-making institutions, which influences the creation of industrial policy. It does this by using the role of institutions.

3.2.2 Resource-Based Theory (RBT)

The RBT of the firm describes how a company can achieve a durable competitive advantage when it uses unique resources that rivals cannot duplicate, hence erecting a competitive barrier (D'Oria et al., 2021, Zhang et al., 2020).

According to the RBT, a company has resources that can help it gain a competitive edge (Sarjanaet al., 2017; Kumar & Rodrigues, 2020). This advantage stems from the firm's ability to use a variety of resources, which, when used correctly, can produce greater long-term performance and above-average rent. The resources are divided into three categories: organisational capital, physical capital, and human capital (Kumar & Rodrigues, 2020; Chand & Tarei, 2021). A resource must meet four essential requirements to be designated a key resource: it must be valuable, scarce, unrepeatable, and non-substitutable. A company's resources can also comprise its financial, human, and technological capital (Holdford, 2018).

The RBT emphasises that resources, which can be either tangible or immaterial, are something that a corporation possesses. Infrastructure is an example of a tangible resource, whereas organisational knowledge and organisational learning are examples of intangible resources (Rotjanakorn, Sadangharn, & Na-Nan, 2020; Chen & Ji, 2022). A competitive advantage is produced by combining these material and immaterial resources. In the era of advanced technology adopted by the automobile industry, cutting-edge technology can be exploited as a resource by an organisation to gain a competitive advantage (Sarjana et al., 2017). Therefore, an organisation must create and keep an engaged, competent, and creative workforce if it is to preserve this competitive value advantage (Sony & Aithal, 2020; Zheng, & Ge, 2022). An environment that fosters the development of human capital, as measured by improved knowledge, motivation, and engagement, can become a competitive advantage that is very challenging for rivals to copy (Burvill, Jones-Evans & Rowlands, 2018; Suh, 2018).

In relation to environmental sustainability, physical resource like technology, logistics infrastructure (Sarjana et al., 2017, Kumar & Rodrigues, 2020) and intangible resource such as leadership, organisational culture and knowledge (Holdford, 2018; Rotjanakorn, Sadangharn & Na-Nan, 2020) are capable of generating capabilities that results in enhanced environmental performance. The relevance of RBT to this study is that the South African automotive aftermarket is flooded with SMEs that are resource-scarce (Burvill, Jones-Evans & Rowlands, 2018), and the theory provides insight into what kind of internal capabilities are more likely to produce environmental sustainability outcomes.

3.2.2.1 Previous research and industry areas where this theory has been applied

The RBT has been used in several studies on a variety of topics. For example, Holford (2018) contends that the RBT provides a foundation for comparing findings from various research frameworks and studies on service innovations, service processes, and service business models. In support of the view that businesses should be innovative to have a competitive advantage, Suh (2018) conducted a study using RBT to explore strategies that can be used by car dealership owners and managers to remain profitable and sustain operations beyond the first five years. Previous studies indicate that for businesses to survive, they should adopt business practices that bring competitive advantage.

In a related study, Sarjana et al. (2017) empirically examined the relationships among the resource-based perspective, competitive strategy, and competitive advantage. The findings demonstrated that a perspective based on resources has an effective and advantageous direct effect on competitive strategy. Competitive advantage is directly and positively affected by competitive strategy. Additionally, this study showed that competitive strategy mediates the impact of competitive advantage. This discovery incorporates competitive strategy framework insights into an industry-wide generalisation of competitive advantage.

A multi-case study was carried out by Suh (2018) to investigate the methods used by managers and owners of used vehicle dealerships to maintain profitability and run their businesses for more than five years. The study's conclusions showed that the proprietors of auto dealerships relied heavily on customer service, aggressive marketing, and business activities. The results demonstrated that vehicle dealership managers and owners need to utilise methods to compete in the market and maintain growth. To analyse the adoption of Industry 4.0, Sony and Aithal (2020) used RBT. The pressures on businesses to implement Industry 4.0 are analysed via the terms "coercive," "normative," and "mimetic." The results showed that the Indian engineering industry employed an RBV to analyse how "physical, human, organisational, technological, financial, and reputational capital" could be exploited to gain a competitive edge.

3.2.2.2 Reasons why the Resource-Based Theory (RBT) is suitable for this research

Organisations must add value for their clients or consumers to succeed in any market. The process by which the initial value is formed is not as crucial as the perceived value's longevity, rarity, and superior utility in comparison to others (Rotjanakorn et al., 2020; Chen & Ji, 2022). Therefore, businesses need to ensure that they can provide their clients with additional benefits at a given price. The RBT can be used by the government and other automotive value chain participants to decide on official and informal laws and policies to support the adoption of sustainable practices in the sector (Sony & Aithal, 2020).

3.3 ENVIRONMENTAL SUSTAINABILITY

Environmental sustainability can be explained in three coequal parts or elements: the environment, the economy and equity (Bask et al., 2018). The environment, economy and equity form the three pillars of the concept, sometimes overlapping (see Figure 3.1 below). The argument for the three is that sustainability can be achieved only when economic growth, environmental protection and the promotion of equity work together, hand in hand, to meet the earth's carrying capacity (Afzal & Lim, 2022).

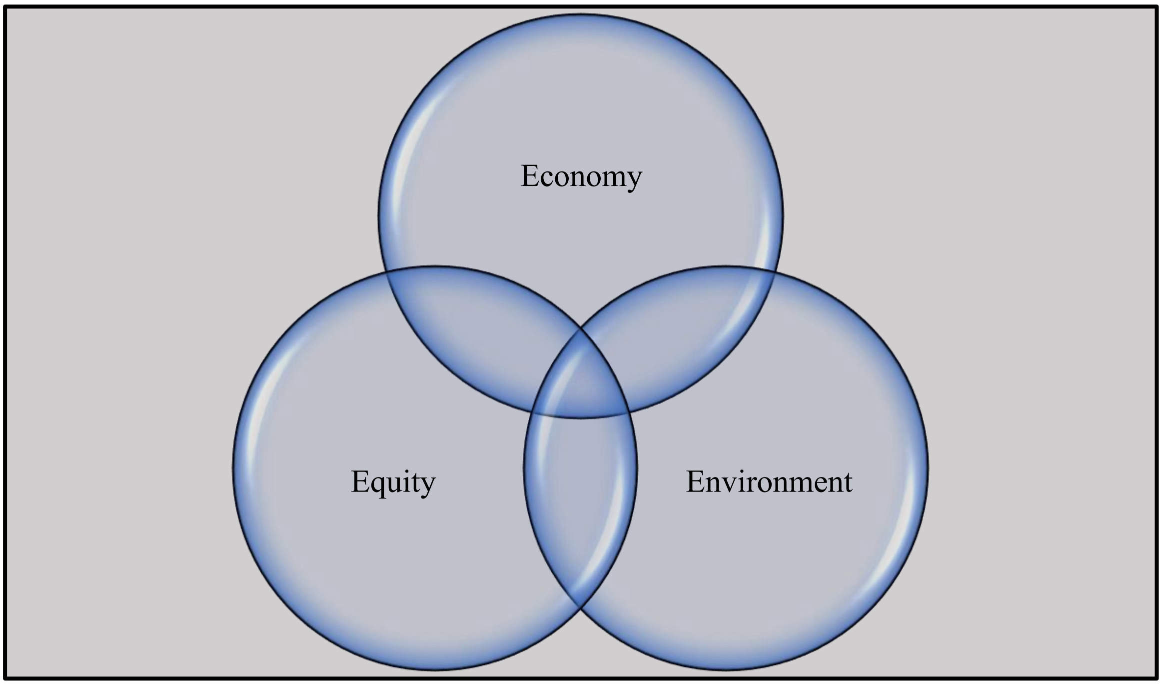

Figure 3.1: Key elements of environmental sustainability
Source: Portney (2015)

3.4 DEFINITIONS

There are several definitions of the term environmental sustainability, but all of them are rooted in the three principles of economy, equity and the environment.

Understanding and using the word "environmental" often tends to be associated with some kind of human impact on natural systems (Hernandez & Ona, 2016). This context distinguishes it from the word "ecological," which can be characterised as a concept of the interdependence of elements within a system.

"Environmental sustainability" refers to providing the resources and services that both present and future generations require without jeopardising the health of ecosystems (Hernandez and Ona 2016). Environmental sustainability can also be described as a state of equilibrium, adaptability, and connectivity that permits human civilisation to meet its requirements without jeopardising the ability of its supporting ecosystems to continue to renew the services required to do so or by reducing biological diversity as a result of our actions (Moktadir et al., 2025), as cited by Radu, 2018. Environmental sustainability refers to making decisions in life that assure an equivalent or better standard of living for future generations (Bohas and Poussing, 2016). Finally, sustainability in the environment refers to the rates of pollutant production, non-renewable resource depletion, and renewable resource harvesting that may be maintained eternally (Anthony, Majid & Romli, 2018).

The fundamental definitions of environmental sustainability presented in this study broaden our understanding of the meaning of human activity and its connection with the ecological concept of interdependence, thus defining the boundaries of the use of "sustainability" to correspond to the overlay of human activity upon the functioning of the supporting ecosystem. Ecological sustainability is therefore the only thing that environmental sustainability can be and becomes a subset of it.

3.5 DRIVERS OF ENVIRONMENTAL SUSTAINABILITY

In the coming years, organisations will prioritise efforts to embrace environmental sustainability practices because doing so is both economically necessary and environmentally beneficial because it helps organisations cut expenses, their environmental footprint, and their public perception (Radu, 2018; Suhi et al., 2019). Most organisations are implementing environmental sustainability efforts, as revealed by an examination of the literature already published, because they must adhere to government rules, enhance their reputation, cut costs, and provide services more effectively (Figure 3.2) (Hernandez & Ona, 2016; Mondragon, Mondragon & Coronado, 2017).

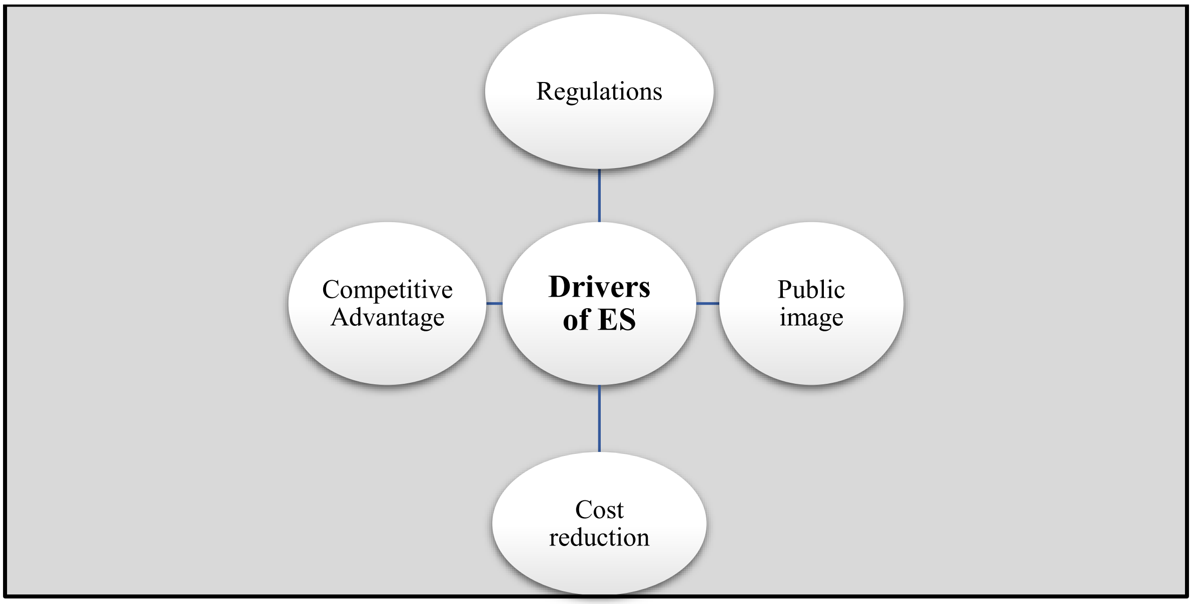

Figure 3.2: Drivers of environmental sustainability

Source: Author's compilation

3.5.1 Regulatory Pressures

The adoption of environmentally sustainable practices is significantly influenced by legislative requirements and regulatory restrictions. Even if an organisation does not wish to implement environmental sustainability in its business operations or new technology, government rules may nevertheless force them to do so (Radu, 2018). For example, government rules affect waste disposal and automobile technologies (Mondragon et al., 2017). Non-compliance may result in penalties and legal problems, which damage an organisation's reputation (Hernandez & Ona, 2016; Boggia et al., 2018). Policies and regulations can facilitate technological adoption by providing incentives and subsidies (Hernandez, 2020).

Government incentives and awards are known to hasten the adoption of green practices (Hankel, Heimeriks & Lago, 2018). As an illustration, corporate organisations in Denmark are mandated by law to include a budget that supports environmental sustainability in their yearly reports (Hankel et al., 2018). Companies adhere to requirements even though they purchase only energy-efficient equipment to demonstrate their CSR (Bohas & Poussing, 2016). There are laws and regulations governing ES in the automotive industry in South Africa; however, they are insufficient and ineffectively implemented to have any real impact (Lawhon, 2013).

3.5.2 Public Image

In the 1990s, as environmental concerns gained more attention, the business world had a tremendous chance to establish lucrative businesses that also demonstrated excellent corporate responsibility (Dezdar, 2017; Anzolin, Zanfei & Andreoni, 2020). The adoption of green technologies has the potential to significantly reduce costs while improving organisations' public perception (Bohas & Poussing, 2016). Sustainability initiatives enhance businesses' reputations. Establishing a positive corporate social responsibility reputation is also connected to profitability (Asadi, Hussin & Saedi, 2016).

Some businesses want their customers and the public to recognise their efforts in addition to improving the effectiveness of their organisational operations (Anthony et al., 2018). Green initiatives offer businesses the chance to establish a positive reputation for social responsibility and stewardship (Verdecchia et al., 2017). Public pressure can have a significant effect on organisations' decisions to adopt greener business practices, such as green ICT techniques (Zhu, Yu & Shi, 2015). Companies that go above and beyond the call of duty tend to build a strong public image that is known to influence how consumers behave and think about a company's brands and goods (Suryawanshi & Narkhede, 2015). However, the significance and concern for the public image are noted to be of less concern to organisations as well as consumers in developing countries such as South Africa, as opposed to developed countries (Taruna, Singh & Joshi, 2014; Burawat, 2019).

3.5.3 Competitive Advantage

Environmental sustainability projects can also give organisations a competitive advantage. Making proper decisions, such as eco-investments, can improve an organisation's success (Fernandez et al., 2015). As an organisation looks for ways to acquire a competitive advantage, adoption and implementation are also driven by competitive forces (Butler et al., 2015). Environmental sustainability is a business approach that enables organisations to save money and is in line with CSR, which helps businesses stand out from their rivals (Fernandez et al., 2015). Environmental sustainability initiatives enable businesses to efficiently provide the same or better service while using fewer resources.

3.5.4 Cost Reduction

When deciding whether to adopt and implement new ideas, a cost-benefit analysis is conducted, and the cost savings that result from the adoption of environmental sustainability serve as a driving force for organisations (Kamilaris et al., 2015). The adoption of environmental sustainability not only helps companies become more eco-conscious but also reduces total technology ownership costs while increasing the overall environmental value of ownership (Lundfall et al., 2015). Employing environmental sustainability practices, such as telecommuting and giving up paper, enables organisations to reduce their energy use and other operating costs (Fernandez et al., 2015). Increasing user knowledge and acceptance is necessary for the implementation of sustainable and new technology to do better and different things (Park & Baek 2018; Ah-Lian, Eric, Karl, Jari & Georges, 2019). Understanding earlier research on the adoption of innovation is crucial.

3.6 IMPORTANCE OF ENVIRONMENTAL SUSTAINABILITY

The goal of environmental sustainability is to ensure that industrial activities preserve the environment while preserving the viability and profitability of the company. This section focuses on the expenses involved in combating climate change and fostering sustainability, highlighting that these risks worsen all environmental challenges. Importantly, major change will result in winners and losers, and the losers will experience displacement to achieve a low-carbon transition (Ekins, & Zenghelis, 2021). These worries need to be properly controlled since they can result in delays, backlash, opposition, and resource waste, according to a brief survey of the world political economy (Kamilaris et al., 2020). Environmental sustainability activities can produce benefits such as innovation, inventive networks and spill overs, triple bottom line (TBL), and economic development if they are properly managed.

3.6.1 Innovation

Our capacity for divorce growth and consumption from resource depletion and environmental deterioration depends critically on innovation (Paipa-Sanabria, Gonzales Montoya & Coronado Hernandez, 2025). Several climate economic models have tried to include innovation. Innovation does not 'happen' by accident. It is dependent on three different types of path dependencies: network effects and scale economies, deployment and uptake, and R&D (Aghion, Akcigit & Howitt, 2014; Vesal, Siahtiri & O' Cass, 2021). Without direct state action, it is initially challenging to change the innovation system from dirty to clean technologies because of significant inertia and high switching costs.

Further deployment and investment in supporting networks, infrastructure, and institutions are accelerated by positive and reinforcing feedback resulting from lower technological costs. This is the result of both strong network effects and significant switching costs (Abdul Wahab, 2021). Investments in enabling infrastructure create network externalities, which drive technological tipping points. For example, as infrastructure for electric vehicles (EVs) has developed, there are more incentives to perform R&D on electric automobiles than on combustion engine (or fuel cell) vehicles (Zhou, Levin, & Plotkin, 2016; Xue et al., 2021).

3.6.2 Innovative networks and spill overs

Network analysis was used by Hidalgo & Hausmann (2008)) and Mealy and Teytelboym (2017) to show that it is simpler for nations to compete in new green products that need comparable production capacities and know-how to existing sectors. Since governments that successfully invest early in green capabilities have greater success diversifying into future green product markets, green transitions are therefore extremely path dependent (Aasness & Odeck, 2015). The. This theory is supported by several studies, which show that an organisation's decision to innovate depends on the industrial practices of the nations where its researchers and inventors are based and that organisations tend to focus innovation on their existing strengths. For example, research on solar and wind energy technology has spread information across the country. For that purpose, academics (Xue et al., 2021; Gupta & Gupta, 2020) propose that governments prioritise early targeted R&D in sectors where they have complementary advantages.

3.6.3 Achieving the Triple Bottom Line (TBL)

The TBL idea is founded on the understanding that many programme and investment choices can have a variety of co-benefits in the areas of economy, environment, health, and other social factors (Yang, Song & Tong, 2017; Correia, 2019). By this strategy, rather than using a single lens, success is assessed via a combination of social, environmental, and financial performance metrics. The advantages of sustainability best practices for the environment and society are typically obvious. The "TBL" can aid local stakeholders and leaders in understanding the costs and benefits of sustainability projects (Foerstl et al., 2015). Reduced agency spending and improved revenue are some of the fiscal benefits of environmental sustainability. Investment in environmental sustainability initiatives may have benefits that include the following:

- Budget savings through decreased agency spending on things such as building and maintaining infrastructure as well as paying for energy and water.
- Increasing tax and fee collections by driving up property values and economic activity.
- Lowering operating expenses and cost savings to reduce long-term liabilities.
- Financial stability should be increased during unpredictable times, such as prospective increases in the price of water and energy.
- Directing these savings toward wise investments that promote increased revenue, consumption, and economic expansion.

Economic development, which includes enhancements in economic growth, competitiveness, and vibrancy of a community, is the main success of environmental sustainability (James et al., 2015;). Sustainability initiatives can boost a company's financial performance, improve the physical environment, and draw new companies to more liveable and rejuvenated neighbourhoods. These initiatives are essential for enticing both locals and visitors to spend money and invest in a region, hence promoting further economic growth.

By using less water, electricity, gas, and other resources, sustainability best practices save money for both citizens and companies (Correia, 2019). These local savings can subsequently be used to finance additional local economic activity and investments. Well-planned communities with a range of housing alternatives, commercial developments, and reliable and practical transit options draw capital investments for new and expanded businesses. These investments have the potential to increase local employment and economic activity while saving both workers and businesses time and money (Hourneaux Jr., Gabriel & Gallardo-Vázquez, 2018). SMEs, which are the main drivers of job development, must be retained and supported for them to remain competitive. This calls for well-designed communities and effective transportation systems (Hourneaux Jr. et al., 2018).

Communities with healthier citizens typically provide residents with more opportunities to engage in physical activity and make good eating choices (Correia, 2019). Less expensive healthcare for businesses, workers, and government organisations, more productive workers, and kids who are better able to learn are just a few of the economic advantages.

3.7 ENVIRONMENTAL SUSTAINABILITY PRACTICES

Environmental sustainability practices are implemented in various organisations worldwide to improve supply chain efficiency; their role is essential for developing and increasing the environmental performance, economic performance, and social performance of an organisation (Wang & Gunasekaran, 2015). The following practices are considered in this study: government regulations and incentives, technology adoption, top management support, sustainability culture, environmental corporate social responsibility, compliance and certification, inbound logistics and outbound logistics. The rationale for choosing practices is that environmental sustainability practices are crucial for the automotive repair and maintenance sector in achieving the strategic goal of increasing sustainability in terms of being profitable, ecologically, and socially compatible.

3.7.1 Government regulations and incentives

Government incentives and regulations refer to the use of rewards and penalties to motivate organisations to take a business path they may not be ready to take by themselves. The main objective of incentives is to achieve the desired results, rewards, or potential profits. People benefit from their actions differently when incentives are there than they would if none were: they gain money, social standing, better health, or something similar. Regulation practices provide a roadmap for companies to adapt their strategies and business activities to create harmony in implementing sustainable practices and mitigating discrepancies effectively (Davis-Sramek, Omar & Germaine 2017). The costs of environmental laws must be compared against the advantages they offer, which serve as the basis for the legislation's initial justification. The advantages are frequently substantial and grossly underrated. The significance of government's environmental sustainability laws and incentives is covered in this section.

3.7.2 Inducing innovation in green technologies

Environmental rules encourage the development of clean technologies and stifle the R&D of conventional (polluting) technologies (Denning & Lewis, 2020). Environmental laws can therefore aid nations in shifting away from a polluting economic trajectory and toward a "clean" trajectory. A growing number of studies have attempted to quantify the relationship between environmental legislation and technological progress because enterprises' competitiveness in today's knowledge-based economy depends heavily on innovation (José et al., 2018; Hooks et al., 2022).

Regulated companies are encouraged to make operational adjustments and financial investments that lower the emission intensity of their output when the cost of polluting emissions is higher than other production costs (Anwar et al., 2020). Porter (1991) introduced the "induced innovation" theory in the context of environmental legislation and proposed that some of this new investment will lead to the creation of novel emission-reducing technologies.

3.7.3 Increase in Productivity

Numerous studies have shown that production is either unaffected by or boosted by environmental regulation, even though the question of whether ES regulations can lead to higher or decreased output is still controversial (Cheng, Hu & Zhou, 2019; Anwar et al., 2020). For instance, according to Miguel and Alejandro (2019), local environmental regulations in Mexico increased the productivity of the food-processing sector, whereas the same regulations in the United States did not affect the profitability or productivity of the country's food manufacturing sector. They conclude that domestic environmental regulation has made the Mexican food industry more competitive than the United States of America does, contrary to expectations, and that more stringent environmental laws in the United States have not provided Mexican enterprises with a cost advantage (Miguel & Alejandro, 2019).

3.7.4 Employment Creation

Discussions concerning how environmental restrictions affect competitiveness are frequently portrayed as pitting "jobs against the environment", especially in emerging nations such as South Africa, where declining manufacturing employment has been a significant political issue. Many analysts worry that employment losses will occur owing to rising environmental regulation-related expenditures. Environmental rules, however, may ultimately lead to substitution between polluting and non-polluting activities, even if there may undoubtedly be considerable adjustment costs when people transfer from declining (polluting) to expanding (clean) sectors. Unknown is how this substitution affects net employment (Brahmbhatt, 2014). The available information is conflicting, but if anything, it suggests statistically negligible or minor effects on employment in regulated areas.

As previously mentioned, environmental sustainability initiatives require innovation and cutting-edge infrastructure. Many organisations might not have the resources necessary to quickly invest in green technologies. To do this, incentives play a critical role in accelerating the adoption of environmental sustainability techniques. A study by Reimers (2021) focused on the effects of the afore-mentioned governmental incentives for Armoured fighting vehicles on the short- and long-term effects of fiscal policies on the European automotive market from 2010 to 2018 lends support to this viewpoint. The author makes the case that government regulations in a market that is becoming increasingly interventionist, rather than true customer demand, are primarily responsible for the very good sales evolution of Armoured Fighting Vehicles (AFVs). In countries such as South Africa, where there are no clear government policy or incentives for EVs, the cost of EVs is too high; thus, customers are discouraged from purchasing. To define the impact of fiscal incentives on the purchase decision of consumers, one needs to calculate all the fiscal incentives and see them in comparison with the net price of the individual electric vehicle.

Although it has been demonstrated that financial incentives have a positive effect on the adoption of environmental sustainability practices, some nations are considering eliminating them or taxing EVs, according to Xue et al. (2021). For example, China declared that after 2020, all incentives for EVs were eliminated. To compensate for the lost money from the fuel tax, state legislators in more than 20 US states have put annual taxes on EVs (Brückmann, Willibald, & Blanco, 2021; Xue et al., 2021).

To attract more customers, fiscal incentives are frequently combined with other non-financial incentives, including fee waivers, road priorities, and access to restricted traffic. This is because these marketing campaigns can increase consumers' knowledge of environmental sustainability. For example, parking fees and tolls are eliminated for EVs, and priority is given to roads in areas with limited traffic. Additionally, it aids in increasing public awareness of green automobiles on roadways. These non-monetary incentives are particularly prevalent in several of the world's most developed economies, including the US, Sweden, Norway, and Denmark (Zhou et al., 2016; Langbroek, Franklin, & Susilo, 2016). Additionally, charger density can directly reflect the strength of infrastructure incentives. The advanced development of infrastructure is the key force in promoting the development of EVs because it helps overcome range anxiety.

3.7.5 Technology Adoption

There are several definitions of the term 'technology adoption', but researchers seem to have reached a consensus on what technology adoption entails. Rogers (2003) defines technology adoption as" "… the choice to fully utilise an innovation (a phrase used synonymously with new technology), typically by passing through several stages to adoption …." Technology adoption refers to the process of accepting, integrating, and utilising new technology in society (Harrison & Thiel, 2017). Finally, Agar (2020) defines technology adoption as: "… the successful integration of new technology into an organisation …".

3.8 DRIVERS OF TECHNOLOGY ADOPTION

Environmental sustainability is viewed as a practical solution for lowering greenhouse gas emissions in the energy and transportation sectors (Kannangara et al., 2025; Rüdisüli et al., 2022). However, there are significant barriers that prevent the implementation of this technology, which has prompted several authors to research this issue (Adhikari et al., 2020; Arinze et al., 2025). Some of the elements affecting electric vehicle adoption are discussed in the following section.

Policy: Although technical issues and high costs continue to be the main barriers to the adoption of environmental sustainability, automotive practices repair and maintenance sector, government laws related to environmental sustainability remain the most compelling factor (Rezvani, Jansson & Bodin, 2015). In contrast, purchase subsidies do not encourage the adoption of environmental sustainability practices in the absence of a legislative framework and political will (Harrison & Thiel, 2017; Li et al., 2019; Alotaibi & Eltamaly, 2022). The absence of comprehensive rules to assist adoption, however, cannot be disregarded given that environmental sustainability culture is still relatively new in many countries (Egnér & Trosvik, 2018; Adhikari et al., 2020; Brückmann et al., 2021). These are a few of the most typical policy drawbacks:

Lack of long-term planning: The government must find, approve, and create new energy technology in most nations (Ragland et al., 2011; Lu et al., 2020). As a result, national environmental sustainability practices and economic growth should be in line with the nation's aspirations for sustainable development (Nykvist & Nilsson, 2015; Ford & Hardy, 2020). While the EU has created a voluntary target framework, California and China have rules that require automakers to sell more zero-emission vehicles (Rokadiya, Yang & Bandivadekar, 2019). Canada, Chile, Costa Rica, India, and New Zealand are other nations with expanding policy initiatives to support EVs (IEA, 2020).

Economic people are less motivated to purchase greener vehicles since they appear to be more expensive than conventional vehicles are (Goel et al., 2021; Agar, 2020; Gunawan et al., 2022). This perceived benefit is frequently seen as a major barrier to the widespread adoption of environmental sustainability practices. As previously mentioned, many nations are already offering a variety of financial incentives to persuade people to buy vehicle items made following environmental sustainability principles. These studies have shown that, with the right incentives, economic difficulties may be overcome (Adhikari et al., 2020).

Higher purchase price: The introduction of modern technologies, which are frequently expensive, is related to the acceptance of technology. As a result, product costs could be astronomically higher. For example, because of high production costs, EVs cost more to purchase than internal combustion engine (ICE) automobiles do (Adhikari et al., 2020). Subsidies for green technology are a well-liked method of increasing interest in many nations (Murugan & Marisamynathan, 2022). Langbroek et al. (2016) questioned whether the effect of proposed subsidies varied depending on the consumer segment. Range, incentives, and reliability were revealed to be the top indicators of electric vehicle purchase intentions in Spanish research (Ghosh & Sarkar, 2025; Higueras-Castillo et al., 2020). Owing to the limited supply of accessible EVs, which are advertised as luxury vehicles, and the high cost of EVs, wealthy households account for most electric vehicle sales (Bauer et al., 2021). The authors also emphasise the great potential for increasing electric vehicle affordability in the electric vehicle sector.

Social Barriers: Social barriers to ES adoption may be just as important as technological barriers (Egbue & Long, 2012). Customers' purchasing decisions are heavily influenced by their understanding of the benefits of green technology and goods (Rezvani et al., 2015; Krishna, 2024). As a result, the recognition of customer social characteristics should be given more weight. The communication of pertinent information is crucial in this regard. According to Rezvani et al. (2015), a customer's decision to purchase green items is influenced by their education, experience, concerns, and perceptions of environmental sustainability. Therefore, different stakeholders within the automotive value chain should communicate these attitudes by expanding advertising and launching more information campaigns (Forman, Goldfarb & Greenstein, 2018).

Technological: Although using sustainable manufacturing techniques can lower emissions and increase the economy of transportation, there are substantial barriers to adoption (Adhikari et al., 2020). Below is more information on some of the most typical technical challenges this technology faces. For example, range anxiety has prevented the use of EVs in the car industry (Bonges & Lusk, 2016). According to Adhikari et al. (2020), consumers who do not frequently need to travel long distances are more likely to be interested in EVs. However, a study performed in Beijing by Zhang et al. (2020) and Ziegler et al. (2021) reported a negative correlation between the charging pace and an electric vehicle's state of charge, suggesting that rapid charging might increase the charging rate while reducing range anxiety. Additionally, Mashhoodi and van der Blij, (2021) noted that range anxiety decreased as the number of charging stations increased.

3.9 IMPORTANCE OF TECHNOLOGY ADOPTION

Nations are facing the atrocities of COVID-19 pandemic worldwide. Researchers have argued that technology adoption can mitigate the impact of the pandemic on SMEs by helping employees work from remote locations while avoiding physical touch. Papadopoulos, Baltas & Balta (2020) and Kumar & Ayedee (2021) argued that technology adoption could be critical for SMEs to counter the problems of COVID-19 pandemic and that implementing different types of technology can improve operations at the SME level. Furthermore, Priyono, Moin and Putri (2020) argue that SMEs, because of their flexibility, can align their business models based on digital technologies better and quicker than well-established firms can and help overcome the repercussions of the COVID-19 pandemic. Switching over to technology adoption can save marketing and promotion costs because traditional marketing is very costly compared with technology-based digital marketing. Bai and Satir (2020) affirm that Industry 4.0 paves the way for a social and technological transformation that would dramatically transform the whole globe. The manufacturing lines, business processes and teams can be enabled to collaborate regardless of location, time zone, network and other aspects.

Industry 4.0 technologies empower the connection of all stakeholders, in addition to raw materials and products, into a resource for sustainability and future growth; its promising aspect is that it converges with the virtual and physical worlds. (García-Muiña et al., 2020)

Outcome: Digital technology positively affects various sectors and has an increasing impact on their smart supply chains. Sustainability advantages that favour workers and the environment, such as increased resource and energy productivity, deployment of sustainable infrastructure, worker health and safety, and improved quality of life (Sony, 2018).

3.9.1 Top Management Support

Top management support is defined as: "…the level and type of support that the project leader anticipates from the top management for the project and for himself as a leader …" (Zhang, Wei & Zou, 2018). One of the most important factors that can moderate the achievement of project success is commitment and strong leadership at the top management level. While top management support is virtually always necessary for project success, high-level planning and/or assistance from top management are occasionally adequate (Liu, Liu & Yang, 2020). Top management support has been investigated in numerous studies as one of the crucial success variables and is necessary for projects to succeed. According to Yu et al. (2022), top management assistance can take many different forms, such as assisting teams in overcoming obstacles, demonstrating a dedication to the task at hand, and motivating staff. Top management assistance typically entails the timely deployment of financial, human and other physical resources, as well as the delegation of the required authority to project leaders and the project team for the accomplishment of projects.

3.9.2 Importance of Top Management Support

Top management directs the direction of organisational operations because of its position within the company. The final development direction of a company is determined by the activities, initiatives, and efforts of top management. The most significant fundamental aspect determining the success of a project is top management support because of its crucial role. Support from top management is essential for the adoption of environmental sustainability practices. Numerous studies have recognised the crucial role that top management support plays in green procurement (Dubey et al., 2013).

Top management support for the automotive value chain encourages environmentally friendly development. Additionally, it serves as a foundation and assurance for the organisation's adoption of environmental sustainability practices. Additionally, top management makes decisions about how to allocate resources inside an organisation. It can assign enough human resources to support organisational environment initiatives. According to Kumar et al. (2019), top management support is crucial because of its capacity to fully affect other elements related to human resources.

Top internal management supports the impact of eco-friendly collaboration with supply chain participants on environmental performance within the green supply chain (Burki, et al., 2018; Burki et al., 2019).

3.9.3 Sustainability Culture

According to García-Machado, & Martínez-Ávila (2019), an organisation's culture broadly refers to the shared presumptions, convictions, and values that underlie the norms and behaviours among its members. It develops over time as the company learns to solve problems together (Schönborn et al., 2019). The visible expressions of these assumptions and ideals are the result of invisible assumptions about proper ways of interacting with professed values (Martelo-Landroguez et al., 2018). Therefore, altering deeply held beliefs about how organisational operations should feel and look is necessary to create an organisational culture that produces desirable behaviours (Zhao, Teng & Wu, 2018). Marshall et al., (2015) define sustainability culture as “a company's recognition of the impact of the company's activities on society and communities and the need to minimise it, which translates into a philosophy and values that drive the decision-making process of the firm". Considering this, a strong organisational culture that prioritises sustainability would be one in which unseen presumptions and beliefs support desired and visible sustainability behaviours (Sathasivam, Che Hashim & Abu Bakar, 2021; Szász Levente, Csíki Ottó, & Rácz Béla-Gergely, 2021).

These definitions reveal that sustainability culture includes the development of sustainability objectives, engagement with general sustainability issues, dedication to sustainability, disposition toward sustainability, and perceptions of sustainability programs.

3.9.4 Factors Influencing Sustainability Culture

Numerous studies conducted over the past 20 years have provided information on various sustainability strategies and the present state of implementation used by construction companies worldwide (Burawat, 2019; Toni et al., 2021; Ketprapakorn, & Kantabutra, 2022). For example, in the UK, research has examined the attitudes of UK construction companies towards sustainability since their public disclosure information and revealed that some exceptionally large construction firms are beginning to acknowledge sustainability. However, smaller and unlisted firms were slow toward embracing a positive attitude toward sustainability. Research shows that the slow implementation of sustainable initiatives is due mainly to skill deficits in sustainable practices and technologies.

Studies reporting positive outcomes related to technology adoption indicate that an increasing number of individuals recognise sustainable management as a source of competitive advantage.

The literature on the adoption of environmental sustainability frequently mentions certain themes or problems, such as the following:

- Their clients were not on board with sustainable initiatives
- Time and cost are still the primary performance criteria
- Compliance-driven sustainability implementation
- The level of organisational sustainability implementation is dependent on organisational profitability
- Organisational sustainability implementation is still in its infancy within the industry.

3.9.5 Outcomes of Sustainability Culture

Sustainability cannot be realised without creativity, and innovation thrives in a culture that embraces and supports learning and change (Zhao et al., 2018). This seems to support the argument that businesses must adopt a learning organisational culture since it would develop employees' commitment to achieving the desired organisational sustainable performance by encouraging innovative behaviour and no-blame attitudes (Alhadid & Abu- Rumman, 2014).

3.9.6 Importance of Sustainability Culture

Research indicates that sustainability culture is important for organisations, as environmental sustainability practices are embedded in organisational culture. Therefore, they become the norm. The following are the sustainability practices that are initiated by sustainability culture:

Self-regulation: This involves the implementation of voluntary initiatives and adopting best practices in the absence of, or in advance of, regulation. The organisation creates and adopts industry-wide or internally generated voluntary codes of conduct (Sanders & Karmowska, 2020). The transition from a compliance-based business to one that is pursuing sustainability frequently begins with voluntary activities. Self-regulation involves making decisions and being ready to impose limitations on how an organisation functions to move more quickly towards a desired goal (Sparkman, & Walton, 2017; Steensen, 2019). Going beyond compliance to adopt voluntary standards or practices can be a vehicle for creating a shared identity around sustainability.

Adherence to standards: This involves compliance with a recognised set of standards related to environmental and/or social performance. The benefits of compliance include gaining certification from outside agencies and gaining certification for EMS or sustainability management systems (Mori, Franks & Ali, 2016). Many organisations seeking to embed sustainability choose to invest in some form of EMS or sustainability management system (Delmas & Pekovic, 2013). Some organisations opt to develop in-house sustainability management systems, while others prefer to implement recognised external systems such as AccountAbility (AA 1000), Eco-Management and Audit Scheme (EMAS), Global Reporting Initiative (GRI), or ISO 14001. Companies may also pursue product- or process-specific certifications such as Fairtrade, Ecologo, the Forest Stewardship Council (FSC) or the Leadership in Energy and Environmental Design (LEED) green building system. Adhering to outside standards may signal both internally and externally that a firm is taking responsibility and moving towards sustainable development and that things are being 'done correctly' (Makita, 2016). Other researchers have suggested that adhering to standards and seeking certification can reinforce sustainability objectives, lead to continuous improvement and improve internal morale (Delmas & Pekovic, 2013).

3.10 ENVIRONMENTAL CORPORATE SOCIAL RESPONSIBILITY

Environmental corporate social responsibility (ECSR) is defined by Shava (2016) as " … a concept about companies going above and beyond to integrate environmental concerns into their business operations and interactions with their stakeholders ...". It is defined as “enterprises' contribution to sustainable development by balancing and improving environmental impacts while maintaining or enhancing economic performance” (Rahman, 2011; Murakwani, Nyirenda, & Fokoya, 2017). Corporate social responsibility (CSR) is a management concept that serves as the foundation for integrating economic, social, and environmental issues into corporate operations that are mutually dependent on their stakeholders. When a company focuses on the environmental components of CSR, it is described as ECSR.

Legislation framework such as the B-BBEE, which are implemented through scorecards, has primarily fuelled CSR activities (Venske, 2016). Scorecards for reporting have been chastised for reducing CSR to a check-the-box exercise to simply meet the legislated criteria. This technique would bring the effort into question (Shava, 2016). Mining companies such as Anglo-American plc promote their joy in granting scholarships to individuals desiring to study mining engineering at surrounding colleges on their websites (Mutasa, 2017). Both the bursary programmes of Impala Platinum Holdings Limited (Implats) and the Anglo-American plc, as part of their CSR initiatives, specifically encourage female candidates.

3.11 DRIVERS OF ENVIRONMENTAL CORPORATE SOCIAL RESPONSIBILITY

Volvo Cars gave 300 000 euros to the Volvo Ocean Race Science Programme in 2017 and 2018. This initiative outfits boats with various sensors to collect data that may be used to combat marine plastic pollution (Volvo Cars, 2019) (Volvo Cars, 2018). In 2018, approximately 2 000 employees from 20 countries went out to clean their local beaches and shorelines in support of the United Nations Environment's Clean Seas campaign (Volvo Cars, 2018; Willis et al., 2022). Volvo Cars is involved in some programmes that promote social mobility and diversity. One initiative aims to minimise socio-economic segregation in Gothenburg by encouraging young people to pursue higher education and pique their interest in working in the automotive repair and maintenance sector. This is accomplished through school visits and study trips. They also offer mentor schemes that assist new immigrants to Sweden in integrating into the local labour market. Volvo Cars offers students summer work and has many summer positions, specifically for those with function variants. (Volvo Cars, 2019).

3.11.1 Competitive Advantage

According to Ordonez-Ponce (2021), the notion of CSR assumes that a win–win situation may be achieved by discretionary responsibility. This is accomplished by permitting competitive advantage based on the literature's definition of the following major justifications for CSR (Bask et al., 2018). These include: (1) reputation, (2) enlightened self-interest, (3) stakeholder dialogue, (4) enhanced risk management, (5) moral obligation, and (6) worker commitment.

To some extent, these arguments may be regarded as mutually reliant (Porter, 1991). When the benefits are considered in greater depth, this interdependence becomes clear. Corporate identity is related to reputation (Reimers, 2021). Values are created by positive reputation (Szász Levente et al., 2021; Haidar & Aguilar Rojas, 2022; Lee & Clemons, 2018). A positive reputation strengthens brands, improves corporate image, energises morale, and increases stock value (Liu, Rouse, & Hanawalt, 2018; Severo et al., 2017). Consumers are increasingly purchasing value, which means that a firm may gain a competitive edge over its competitors by developing a favourable reputation (Ordonez-Ponce, 2021). Enlightening self-interest is based on the concept of the TBL: through CSR, companies can operate sustainably in the long term, saving resources and improving environmental and social impacts, allowing them to reduce costs and improve their reputation (Giampieri et al., 2019; Xue et al., 2021).

3.11.2 Importance of Environmental Corporate Social Responsibility (ECSR)

The use of ECSR as an innovation catalyst is common in studies that relate CSR to green and non-green (organisational) developments. Rodrigues, Rauenm, and lvaro (2017), for example, investigated the impact of CSR on social and environmental innovations and concluded that corporate social performance can promote such innovations. Furthermore, Rashida, Khalidb, and Rahman (2015) investigated the impact of CSR on firms' propensity to innovate in both products and processes, concluding that businesses that engage in strategic CSR are more innovative in both products and processes than those with lower or responsive levels of CSR adoption. Rashida et al. (2015) even state explicitly that CSR and sustainability are ‘‘key drivers for innovation’’.

Previous research on environmental CSR as a driver of innovation has concentrated on certain forms of innovation, such as eco-innovation. Cai and Zhou (2014), for example, investigated the variables that impact eco-innovative processes and concluded that they are both external (driven by regulation, clients, suppliers, and other stakeholders) and internal, whereas Shava (2016) concluded that internal firm factors are the primary drivers. Environmental CSR is a key driver of innovation (Severo et al, 2017; Yang et al., 2019). Environmental practices that exceed regulatory requirements may encourage R&D investments, which can result in both process and product improvements (Mutumi & Simatele, 2017). Environmental CSR may inspire innovation since it attempts to lessen environmental effects, which may require technology advancements requiring R&D (Lioui & Sharma, 2012). Finally, environmental CSR initiatives can help organisations create creative capacities (Sharma & Vredenburg, 1998).

3.11.3 Compliance and Certification

Through some sort of assurance system, an unobservable product quality is made known to the client through the certification procedure (Mori et al., 2016). For example, if a product has a high environmental quality rating, it signifies that throughout its lifecycle, it adheres to the natural environment. Many standards in the automobile sector were created with suppliers' and customer needs in mind. It has a wide range of distinct specifications and standards that put pressure on suppliers (Makita, 2016). Standard certifications apply to all internal and external suppliers of goods, raw materials, and service providers to the OEM. The requirements represent the motor industry's perspective. Only a handful of the eight clauses include the scope, application, terminology and definitions, quality management system, management accountability, resource management, product realisation, and monitoring and measurement. Conforming to environmental laws, rules, standards, and other requirements, such as operating permissions, is what environmental compliance entails. Because the implementation and certification of an EMS necessitate respect to legal standards, it is important to provide reference to some relevant SA legislation. The South African Bureau of Standards (SABS) actively promotes environmental conservation through the ISO 14001 certification scheme, which represents the state of the art in environmental management practise worldwide and improves a firm's competitive advantage in the industry (Boakye, 2018).

Some of the relevant laws that apply to manufacturing operations promulgated by the South African Government include the NEMA (Act No.107) of 1998, the National Road Traffic Act (Act No. 93) of 1996, and the Atmospheric Pollution Prevention Act (Act No. 45) of 1965. The NEMA (Act No. 107) of 1998 guides the coordination and collaboration of state activities and entities involved in environmental management. The automotive industry determines the state entities that assess environmental matters along different parts of its supply chain. The National Road Traffic Act (Act No. 93) of 1996 determines the quality of road traffic, including the allowable materials and pollution levels associated with these vehicles. For instance, it controls and penalises carbon emissions in vehicles. The NEMA provides the legal basis for municipal-level by-laws on air pollution control. For instance, the City of Johannesburg's Air Pollution Control By-law, (2021) prohibits motor vehicles from emitting visible dark smoke. Section 15 (20) of these by-laws states that "No owner of a vehicle powered by diesel fuel may instruct nor allow any person to drive such vehicle on a public road if it emits dark smoke." The Atmospheric Pollution Prevention Act (Act No. 45) of 1965 sets national standards and norms for the management of air quality, offering a structure for planning and reporting, along with various regulatory tools to control air pollution, ensuring compliance through an enforcement regime.

3.12 DRIVERS OF COMPLIANCE AND CERTIFICATION

Poor supplier quality affects a company's profitability as well as its market share, cost of goods, reputation, and brand image (Kadam, Teli, & Gaikwad, 2015). Nearly 67% of the expense of poor quality, according to an AMR survey, can be attributed to supplier failure. Therefore, the firm must reduce the expense of low quality by putting a quality management system in place. The following factors affect compliance and certification:

- Recognition as a reliable provider on a global scale - certification is acknowledged as a standard in the automotive supply chain.
- Customer satisfaction achieved by continually delivering goods that satisfy customers' needs.
- Lower costs for adhering to customer requirements owing to the use of a single management system and fewer audit requirements
- Lower operating expenses because of ongoing process optimisation and the consequent operational savings
- Better interactions with stakeholders, such as employees, clients, and suppliers
- Understanding how statutory and regulatory requirements affect the organisation and its clients will help with legal compliance

- The opportunity to acquire additional business, particularly where procurement specifications include certification as a condition to supply.
- Improved risk management through increased uniformity and traceability of goods.
- Proven business credentials, such as a track record of successfully meeting regulatory requirements or industry standards.

3.13 IMPORTANCE OF COMPLIANCE AND CERTIFICATION

The primary process of any activity is quality. Higher productivity and lower production costs give quality a competitive edge. One of the most sought-after international standards is ISO 9000, and certification following this standard is regarded as a passport for excellence. The goal should be to satisfy customers by continuously increasing the calibre of products and services (Makita, 2016). This indicates the need for a thorough and organised Quality Certification procedure that may be used in the automotive industry. The methods for obtaining a quality certification include determining the need for quality, evaluating it, and determining how it affects total quality management and development (Mori et al., 2016).

3.14 INBOUND LOGISTIC

According to Ayantoyinbo and Hegelese (2018), inbound logistics are regarded as activities associated with the transportation, storage, and distribution of product inputs such as material handling, warehousing, inventory control, vehicle scheduling, supplier returns, and delivery of goods into a business location. Inbound logistics is further defined by Boysen et al., (2015) as “the delivery of parts from a supplier's facility to an OEM's plan.” A key component of the supply chain, inbound logistics, is ingrained in the value chain of the company. To show how actions that add value to a firm's products and services for consumers are connected, Michael Porter used examples of many company functions (Porter, 1991). Primary activities and support activities make up the two main categories of value-adding activities. The value created by the main activities, inbound logistics, outbound logistics, operations, service, marketing, and sales, usually outweighs the associated costs. The four primary support activities are procurement, human resource management, technological development, and infrastructure. These actions work together to give the business the chance to obtain a competitive advantage. The company can obtain a competitive edge by optimising one or more main or secondary operations in the value chain. However, one important thing to keep in mind is that one activity's optimisation should not come at the expense of the other activities' sub-optimisation (Van Weele, 2017).

3.15 DRIVERS OF INBOUND LOGISTICS

Automotive inbound logistics in the automobile sector encompasses more than just moving various materials via air, land, or sea (Wang et al., 2021). It is more difficult to maintain a strong supply network that would carry out the essential task of ensuring a constant flow of materials. Automobile manufacturers have been forced to change their attention from the supply network where inventory was pushed to dealerships to draw products from consumers due to rising consumer demand.

Automakers need to be agile and adhere to a low-cost structure to achieve a competitive edge (Sharma & Gandhi, 2017). The push tactics are created with the understanding that bulk shipping lowers trip costs, but they also present difficulties such as dead stock, a lack of essential components, and excessive inventory prices. As such, traditional production in the automobile industry is increasingly focusing more on just-in-time and built-to-order production rather than mass production. Demand-pull and hybrid strategies are now used by these businesses in their inbound logistics. According to Wang et al. (2021), the demand–pull method is more adaptable for inbound logistics and focuses on developing partnerships with suppliers and manufacturers.

3.16 IMPORTANCE OF INBOUND LOGISTICS

According to Coyle et al., (2017), inbound logistics are important nodes of the value chain since they may aid in improving value creation for consumers while also making the business financially sustainable by increasing sales and improving cash flow.

3.17 OUTBOUND LOGISTICS

The movement of items from the end of the assembly line or the warehouse to the customer is referred to as outbound logistics (Ahmed, 2017). Similarly, Ayantoyinbo and Geleso, 2018) define outbound logistics as "the transportation of goods out of business to external associates." It helps businesses within a supply chain maximise the reliability and efficiency of a distribution network. According to recent developments in logistics terminology, outbound logistics is the process of anticipating consumer needs and wants and optimising the network of producers of goods or services to quickly fulfil requests from customers. The main function of outbound logistics is to deliver products to customers (Rajahonka & Bask, 2016). This study may suggest that outbound logistics involves customer-focused operation management.

3.18 FACTORS INFLUENCING (DRIVERS OR ANTECEDENTS) OUTBOUND LOGISTICS

The primary drivers and prerequisites are divided into the following categories: societal issues, environmental concerns, new technology, increased competition, and shifting consumer demand (Ahmed, 2017). This classification was chosen after researching the relevant theory, and it is thought to offer a simple-to-read and comprehended frame of reference. Since the categories are frequently interconnected, some areas may fall under more than one category. However, only once will each topic be looked at in depth.

3.18.1 Globalisation

Most markets are now dominated by major multinational corporations and brands, and larger enterprises frequently buy smaller ones; as these large organisations stretch out, they are fighting hard to maintain their independence (Sabadka, 2016). Most markets will likely be dominated by multinational corporations in the next few years (Wang, et al., 2021) and maintain that increased global customer distribution is a result of increased availability via the internet and other new communication methods. The global market is more accessible than ever, and this has intensified rivalry since, for example, skilled labour and manufacturing resources are now available everywhere in the world (Sharma & Gandhi, 2017). Market and competitive globalisation have been extensively covered in the literature. It is presented as a trend that is anticipated to continue growing rather than just something that has already happened. According to Sabadka (2016), the following factors contribute to pushing logistical arrangements in Europe toward a more global market:

- Eliminating obstacles to trade and transportation
- The development of new marketplaces in Eastern Europe
- The adoption of a single euro currency
- The development of quick communication systems and information technology.
- The emergence of pan-European logistics service providers that provide quick, dependable, and affordable distribution throughout Europe.

These factors are unique to South Africa. Wang et al. (2021) indicated that globalisation is driven by the reduction of trade and transportation restrictions, the opening of new markets, the advancement of information technology, and the creation of quick communication networks.

Increased competition and changing customer demand: According to the literature, firms today work in a more intensively competitive environment, with more demanding clientele, among other things (Sabadka, 2016). One of the primary drivers of this growth is globalisation. There is discussion about the origins of these two primary issues and their consequences for outbound logistics. It is appropriate to use the phrase 'competitive advantage' when addressing these topics. To confront rising competition, you must keep ahead of your competitors, and to stay ahead of competitors, you must satisfy client demand.

3.18.2 Environmental issues

The importance of environmental issues has increased over the past ten years (Bask et al., 2018; Suhi et al., 2019), and businesses are now more cognizant of how costly environmental pollution incidents in their supply networks may be due to fines, clean-up costs, and consumer reactions (Vesal et al., 2021). Global climate change caused by a carbon-rich lifestyle poses a threat to the extinction of several small island states, the instability of other nations, and ripple effects that shake even the richest nations (Ab Wahab, 2021).

Environmental considerations can influence a variety of logistical choices made along the supply chain, including facility location, raw material procurement, and mode of transportation (Goswami et al., 2020). According to Zahraee, Mamizadeh and Vafaei (2018), one of the main causes of environmental issues and the main contributor to environmental risks in the logistics system is transportation (Gupta, & Vijayvargy, 2021). In the EU, fuel combustion in the transportation sector is responsible for one-fifth of all greenhouse gas emissions, one-third of all particulate matter emissions, and nearly half of all precursor emissions to tropospheric ozone (Goswami et al., 2020). The transportation of commodities, especially road freight, contributes to increased problems such as congestion, accidents, and noise, in addition to air pollution (Abdul Wahab, 2021). In terms of overall importance as well as specific types of difficulties, environmental challenges have varying effects on supply chains around the world.

3.18.3 New Technology

There are two basic categories in which to place the literature on new technologies in logistics. The technology in the first area is specifically intended to add value to supply chain and logistics operations. The bulk of the information on this topic is focused on various information and communication technology (ICT) systems, such as various Enterprise Resource Planning (ERP) systems and web-based solutions (Denning & Lewis, 2020). The theory also examines new technologies as they relate to managing transportation and warehousing, such as various types of load carriers and Radio Frequency Identification (RFI), a subject that has received much attention recently. The second major topic covered in the literature is often new technology in product development, which has an impact on and may affect logistical processes (Intarakumnerd, 2021).

3.18.4 Societal issues

There are a few other concerns that are referenced in the literature in addition to all the drivers and criteria that have already been covered, even though they are not as frequently discussed or mentioned. However, we have decided to address these difficulties and map out every potential component that could have an impact on logistical evolution. Four major variables could affect how supply chains are designed in the future. These four large variables are as follows:

- More media exposure: concerns about war and terrorism.
- Increased diversity in the workforce.
- Altered worker standards.
- Increasing propensity for everyday people to take immediate action.

According to Intarakumnerd (2021), media can quickly spread knowledge simultaneously to remote parts of the world because of its omnipresence. This will affect how customers and markets develop and respond, ultimately altering the structure and efficiency of the supply chain. Intarakumnerd (2021) noted that the instability brought about by the prospect of war and terrorism will have a negative effect on the creation of international alliances as well as the dependability, performance, and cost structure of the supply chain.

3.19 PREVIOUS STUDIES ON ENVIRONMENTAL SUSTAINABILITY

Environmental sustainability has attracted much interest from researchers, with a focus on both South Africa and the global scale. To begin this review with international studies on ES, a focus will be given to studies in Europe, Asia, the Middle East and Africa. A paradigm called the best–worst method was proposed by Suhi et al. (2019) to evaluate the environmental standards for sustainability in a few Bangladeshi companies. The best–worst method was used to evaluate and weigh numerous industrial activities or criteria that have an impact on the environment in various ways. The opinions of 34 experts were solicited to choose the most appropriate indicators from our initial literature review, ensuring the effectiveness and correctness of this framework. This study's findings, which were supported by a sensitivity analysis, indicated that "waste management" was crucial for achieving environmental sustainability in industries in Bangladesh (Moyano-Fuentes, Maqueira-Marín & Bruque-Cámara, 2018, Suhi et al., 2019).

A framework was created by Yadav et al. (2020) to increase the adoption of sustainability by manufacturing organisations in developing countries utilising Industry 4.0 technologies. A framework was created and tested within an Indian manufacturing case organisation based on empirical analysis. Research has shown that managerial, economic, and environmental enablers have a significant effect on the adoption of sustainability (Yadav et al., 2020). These results are consistent with research by Boggia et al. (2018), who created a model for evaluating the environmental sustainability of events.

The importance of innovation in environmental sustainability has been studied in the literature (Denning & Lewis, 2020; Gupta, & Gupta, 2020; Hooks et al., 2022). These studies demonstrate that ES practices encourage innovation, as an organisation strives to reduce costs and achieve a competitive advantage. In relation to competitive advantage, Mutumi and Simatele (2017) discussed how the automotive repair and maintenance sector may adhere to environmental sustainability principles within national, regional, and international regulatory frameworks. The study also revealed a link between the "green economy" and sustainable development, with a focus on environmental sustainability. Using the South African automotive repair and maintenance sector as a case study due to its similarity with other developing countries that contribute approximately the same percentage to their national GDP and have similar automotive industry sizes, Ikome, Laseinde, and Katumba (2022) conducted a related study. In this study, the authors present research findings on the key factors that influence the competitiveness of the automotive industry. The results demonstrate the need for immediate measures to prevent industry competitiveness from declining.

3.20 CHAPTER CONCLUSION

This chapter presents a literature review focusing on environmental sustainability. In line with the research objectives on environmental sustainability, the chapter provided theoretical underpinnings of the study and discussed key thematic constructs underlying environmental sustainability. The theories that informed this study are IT and the RBT. From the theoretical review, environmental sustainability was found to be largely related to innovation and competitive advantage. The literature review on environmental sustainability set off with an operational definition of the term. The remaining sections discuss relevant literature to sub-research questions 2, 3, and 4, which examined the current state of environmental sustainability in the automotive industry's service and repair sector in selected South African regions, the drivers of environmental sustainability, and the impact of environmental sustainability on service effectiveness. These sub-questions will be empirically addressed in subsequent chapters. The next chapter describes the research technique, which is the research path used throughout this investigation.

CHAPTER 4:
A LITERATURE REVIEW OF SERVICE EFFECTIVENESS AND HYPOTHESES FORMULATION

4.1 INTRODUCTION

This chapter also discusses productivity and its drivers, which include regulation, investment, competition, innovation, enterprise, and skills. In addition, the chapter develops a hypothesis for the constructs discussed in the literature. This chapter therefore helps highlight what literature already exists on sustainability in general and in the automotive industry, thus indicating research gaps.

4.2 SERVICE EFFECTIVENESS (SE)

The Latin word effectivus, which means efficacy, is the root of English term effectiveness. Effectiveness is often described as the outcome of business activities as measured by the ratio of output to input (Rangaraju, Nedunchezhian & Kumar, 2020). Most people define effectiveness as a company functioning in a way that maximises output given specific (constant) inputs. Effectiveness is also understood as the means of assessing the efficiency of the personnel in charge of providing services to clients (Gandhi, Sachdeva & Gupta, 2017). In the automotive industry, resources include both the labour force and all the equipment available to provide services. The time taken in working these resources is referred to as "Efforts."

High-quality services are a priority for service providers trying to develop and deliver value to their clients (Bruce & Ching-Chin Chen, 2019; Kato, 2021). Businesses may increase consumer satisfaction and loyalty by providing high-quality services, which will lead to long-term success (Gandhi et al., 2017). To attain high levels of service quality and, as a result, generate value for its clients, an organisation must plan the delivery of its services and ensure that the actual plan is effectively implemented (Rangaraju et al., 2020). Service efficacy is measured by the ratio of the actual result to what was planned to happen (Mihaiu et al., 2021). According to this study, effectiveness requires a connection between outputs and results. In this view, it is necessary to distinguish between the production and the result. For example, in the automotive business, the level of customer loyalty, service quality, and employee happiness all serve as indicators of output. As a result, the outcomes of the implementation of a programme are influenced by outputs as well as by other outside influences (Australian Government, 2013).

Therefore, service effectiveness, which reflects how successfully resources are employed to achieve the goals pursued, is more difficult to attain because it can be altered by external influences (Mandl, Dierx, & Ilzkovitz, F, 2008). Additionally, it can be challenging to assess and quantify results that frequently lack a physical component and are therefore intangible and impossible to measure directly.

Essential factors influencing service effectiveness include productivity, quality, innovation, supplier relationships, and customer relationships. These factors will be described below.

4.3 PRODUCTIVITY

Productivity is defined as: "… the relationship between production and the tools used to attain it …" (Coyle, 2021). Another common definition of productivity is the ratio of input to output volume, which measures how well an economy employs labour and capital as production inputs to produce a certain quantity of output (Frsund, 2018). Productivity measures how well a company uses its resources to produce its services and goods (Faggio, Salvanes & Van Reenen, 2010; Maican & Orth, 2018). In addition, another term for productivity is production efficiency (Driffield et al., 2021). Productivity is a term that is frequently used in production firms because it is simple to measure with the input and output of production (Coyle & Lu, 2020). Additionally, productivity can be assessed in a variety of ways based on the many inputs and outputs of a particular industry (Maican & Orth, 2018). However, research indicates that there is no ideal technique for quantifying productivity (Almström & Kinnander, 2010).

A better degree of productivity in the automobile industry is impacted by factors such as the utilisation of technology and machines in addition to the efforts or efficiency of labour input (Mashilo, 2010). A company can make significant profits, but that does not mean that it is using its resources effectively. As a result, even a highly lucrative company may not be employing its capacity to its full potential (Fried, Lovell & Schmidt, 2008). According to Moshikaro (2019), when a firm's productivity increases from one year to the next, growth may be the result not only of increased efficiency but also of technical advancement or the use of economies of scale. Additionally, the appropriate adoption of lean and World Class Manufacturing (WCM) strategy can help firms in different manufacturing sectors expand their product range and offer a more personalised range, thus improving productivity. Pareira and Romero (2017) believe that manufacturing companies respond to the challenges faced by today's competitive world by implementing Intelligent Manufacturing Systems (IMS), smart factories and Industry 4.0.

Mukhopadhyay (2016.p.2) defines 360-degree performance appraisal as " … the systematic collection and feedback of performance data on an individual or group, derived from several stakeholders on their performance, which in turn helps the organisation identify performance gaps to build the required competencies among individuals and groups …" and it is the appropriate tool to increase labour productivity in the automotive repair and maintenance sector. 360-degree performance appraisal, according to Business Victoria (2016), promotes innovative productivity improvement among employees, and innovation supports productivity through new uses of technology in business, improved industry methods, meeting changing customer demands, and better systems and processes.

Research on factors that influence productivity in the automotive industry has revealed that elimination of waste, continuous improvement, multi-functional teams, and vertical information systems are some of the key strategies used to increase productivity (Rathilall & Singh, 2011).

4.3.1 Drivers of productivity

Based on earlier research on productivity and construction, productivity factors were chosen. For example, Gunduz and Abu-Hijleh (2020) named regulation, investment, competition, innovation, enterprise, and skills drivers of productivity. These factors are discussed below:

4.3.1.1 Regulation

Privatisation, liberalisation of potentially competitive markets, and pro-competitive regulation of natural monopoly markets were the three primary components of the extensive product market changes enacted over the previous 20 years (Naumova, Berbasova & Panteleeva, 2020). Reformers frequently contend that these changes enhance the framework for growth by increasing corporate governance and increasing competitive pressure (Balatsky & Ekimova, 2019; Botnar, Naumchik & Shilova, 2017). While reforming nations frequently saw a considerable increase in productivity during the past ten years, many nations with product market rules that remained anti-competitive (e.g., with relatively high values of the regulatory indicator) failed to reverse the generalised productivity slowdown (Gondlekar & Kamat, 2016).

Productivity is improved more successfully in nations where the public ownership of businesses is constrained and entry barriers are minimal than in nations where restrictions restrict competition and where public companies are pervasive (Kalaitzandonakes, Bredahl & Gehrke, 2019). Regulations that restrict private governance and competition tend to reduce long-term productivity potential, and at least in the manufacturing sector, their burden seems to increase the farther a given nation is from best-practice technology (Gondlekar & Kamat, 2016). That is, severe regulation makes it more difficult for people to accept existing technologies, possibly by lowering the pressure from competition, the spread of new technology, or the entry of new high-tech companies (Mason & Shetty, 2019). Both entry liberalisation and privatisation are thought to increase incentives and competitive pressures, which are seen to increase productivity.

All specialised institutions, from national governments and autonomous institutions to common institutions of regional unions, have prioritised environmental protection in recent years (ACEA, 2017). The primary goal is to improve everyone's quality of life and preserve the atmosphere by lowering the emissions of greenhouse gases such as CO_2, nitrous oxide and methane gas. The automotive industry is the industry that is most impacted by these restrictions. Making new vehicles that not only look nice but also function well and adhere to all technical, safety, and environmental laws while being reasonably priced has been a difficult task for all automobile manufacturers (Pusavec et al., 2010). The rules governing environmental agencies also regulate pollution with nitrogen oxides (NOx) and particle mass (PM). Despite being present in all automobile types (whether they have petrol or diesel engines), these two contaminants are more prevalent in the emissions from diesel engines. As a result, in recent years, diesel technology has undergone significant improvement to adhere to the law (Cârstea, 2017).

4.3.1.2 Competition

The premise that competition is good for the economy, causing an increase in productivity and ultimately improving the performance of the nation's economy, is supported empirically by a large body of economic literature (Andrews et al., 2022). The effect of competition on production is difficult to assess. It is challenging to quantify the level of competitiveness in each industry because it depends on many different variables (Autor, Dorn, Katz, Patterson & Van Reenen, 2020). Additionally, unlike most production factors such as capital or technology, competition does not have a direct and observable impact on productivity. Instead, it plays a significant role in determining the circumstances in which productivity growth takes place and in which high productivity levels may appear (Backus, 2020).

Research indicates that a firm's exposure to competition is directly correlated with how much it uses modern technology (Backus, 2020; Bloom et al., 2015). A company in a shielded market has limited incentives to select an efficient technology and minimise resource use, but it can utilise the rent it collects to fund organisational slackness and technical inefficiency (Decker et al., 2020). According to De Loecker, Eeckhout and Unger (2020), the degree of technology adoption is strongly correlated with the degree to which the entire industry is exposed to competition with best-practice firms. The level of competition influences productivity development to some extent (Backus, 2020; Decker et al., 2020). The increase in labour productivity appears to be negatively impacted by tariff policies, whereas the productivity of exports is positively impacted (Autor et al., 2020). These findings support the idea that exposure to global competition encourages an increase in productivity.

Since the automotive repair and maintenance sector is a competitive market and the engine of the global economy, it is critical for organisations to establish a culture of continuous improvement that includes all stakeholders in the organisation. Continuous process improvement, increased efficiency, and waste elimination result in a significant gain in market competitiveness, both economically and technologically. According to the International Organisation of Motor Vehicle Manufacturers (OICA) (2017), the automotive industry is founded on innovation and quality, whereas the automotive components business is founded on three primary pillars: competitiveness, delivery time, and quality. Different vehicle brands are competitive (Antoniolli et al., 2017).

4.3.1.3 Innovation

According to the literature on innovation, it is one of the most important elements for company performance, survival, and lasting competitive advantage (Atalaya, Anafarta & Sarvan, 2013). Research indicates that the number of innovations attained by enterprises has a favourable effect on their operational profit margin (Aboal & Garda. 2016; Aboal & Tacsir, 2017). Additionally, researchers argue that inventive organisations are generally more lucrative than non-innovative enterprises are, even while the impact of breakthroughs on firm profitability is usually minor in scale (Eliseeva Yu & Agafonova, 2016).

Innovation should produce economic benefits and, simultaneously, a socially and environmentally good environment in line with sustainability initiatives, but this is difficult to achieve given the uncertainties that innovations bring about (Aboal & Tacsir, 2017). Innovation reduces environmental risk, pollution, and other adverse effects of the use of resources, particularly energy, in contrast to applicable alternatives, enabling the automobile industry to achieve environmental sustainability (Essletzbichler, 2015). The literature indicates that there is a correlation between company performance and innovation (Bain, 2016; Boschma, 2011). Other studies that have investigated the links among innovativeness, quality, growth, profitability, and market value at the company level revealed that quality mediates the association between innovativeness and profitability, whereas quality mediates the relationship between innovativeness and growth (Essletzbichler, 2015; Bain, 2016; Brunow, Hammer & McCann, 2020).

4.4 INNOVATION IN THE AUTOMOTIVE INDUSTRY

Innovation plays a central role in driving competitiveness and sustainability within the automotive industry, as firms continuously seek to meet evolving customer demands and address global challenges such as environmental performance and safety. Studies show that innovation in this sector is multifaceted, encompassing product, process, organisational, and service innovations that collectively shape how vehicles are designed, manufactured, and delivered to the market. For example, product innovation is evident in the development of EVs and autonomous driving systems, which are redefining traditional mobility paradigms and encouraging the adoption of new technologies to enhance EE and user experience. Research highlights that the level of innovation varies among automotive companies, influenced by factors such as organisational culture, available resources, and business environment, with advanced firms often outperforming competitors through strategic innovation inputs and outputs (Srai & Gregory, 2008; Bohnsack, Pinkse & Kolk, 2014).

In addition to technological advancements, innovation in the automotive industry also extends to eco-innovation and business model transformation, which are critical for achieving long-term sustainability objectives. Eco-innovation practices, such as integrating sustainable materials, adopting energy-efficient production processes, and implementing advanced safety and digital systems, have been shown to positively influence both environmental and business performance outcomes (Horbach, 2008; del Río, Peñasco & Romero-Jordán, 2016). Research indicates that firms that embed sustainability into their innovation strategies are better positioned to improve operational efficiency and adapt to regulatory pressures, although barriers such as resource constraints and organisational resistance remain significant obstacles.

These findings demonstrate that innovation not only supports competitive advantage and market relevance but also contributes to broader industry transformation toward greener and more customer-centric business models (Chen, 2016; Bohnsack et al., 2014).

4.5 REPAIR AND MAINTENANCE SECTOR

The automotive industry is one of the most technologically advanced, with innovations ranging from hybrid, electric, and self-driving smart cars to IIoT integration in the form of IoT-connected cars (Blanco-Novoa et al., 2018). Numerous Industry 4.0 technologies, such as robots and cyber-physical systems, must be used to address the complexity of the automobile industry, which is plagued by operational inefficiencies and security difficulties that lead to cyber-attacks. Tapscott and Tapscott (2016) assert that Blockchain is the latest technology that can benefit the automotive. repair and maintenance sector in the sense that it improves data security, privacy, anonymity, traceability, accountability, and integrity. Dobrovnik et al. (2018) and Freight Waves (2018) suggested that blockchain predicts that capital can be freed up, transaction costs can be reduced, processes can be accelerated, and security and trust can be provided, as well as enabling automotive components to be tracked throughout the supply chain, making product recalls more precise and less costly, and improving maintenance records.

In the automobile sector, innovation refers to new goods, fresh viewpoints, and beneficial concepts (Holtskog, 2017). In recent years, innovations connected to zero-emission automobiles, i.e., electric cars, have gained popularity; however, the decrease in detrimental impacts on the environment may also be achieved by adding bamboo element manufacturing. Bamboo is increasingly being used by automotive businesses as part of the automobile interior or as useable parts; for example, Lexus CT employs bamboo in installed speakers to improve and expand the quality and timbre of sound. Lexus embraces new technologies based on renewable resources to replace plastic and fibreglass parts and components with bamboo elements, such as the steering wheel and dashboard. Lexus' innovation approach is characterised as both technological and eco-innovation since it increases the comfort of driving by employing environmentally friendly materials (Saritas, Meissner, & Sokolov, 2019 & Kupczyk et al. 2020).

4.5.1 Skills

The primary determinant of competitive advantage in the global economy is trained and well-developed human capital that can adjust innovations to handle new manufacturing procedures (Nawawi, 2016). A prerequisite for increasing productivity, better social and economic indicators, effective governance, and overall economic development is an educational system that is prepared to handle difficulties (Bender et al., 2018). Employee training and development are currently among the main subjects of discussion, according to Raza, Jawaid & Hassan, (2015), because they benefit firms in a variety of ways. Some workers or employees are required to execute everyday maintenance and business operations, which is possible only if staff members have the training and development needed. The performance of the workforce will undoubtedly grow because of training and development (Konings & Vanormelingen, 2015). Training and development function as a root toward success or a better outcome and are crucial for any type of business, whether it is a small operation with four to five employees or an enormous operation with a certain number of employees.

The current skill requirements for the automotive industry are tool making, flow dynamics, computer-aided design and programmable logic control (Laseinde & Kanakana, 2017). The future skills that the automotive industry will require include leadership, programming, robotics, automotive knowledge, refrigeration and advanced problem solving.

The auto sector is one of the largest and most influential industries in the world, and it involves a large variety of companies that render critical skills such as the design, development, manufacturing, selling, and marketing of automobiles and their spare parts. It contributes to the well-being of society as well as the world's economic turnover, which is equivalent to the sixth largest economy in the world (Rae & Binder, 2017; Mathivathanan & Haq, 2017).

The automotive manufacturing industry is now experiencing a scarcity of high-end talent in developed markets, including the USA, the United Kingdom (UK), and the EU (Centre for Automotive Research, 2013). This phenomenon has multiple causes. One factor is the "Baby Boomer" generation's impending retirement, which is creating a skills gap (Cameron, 2015). The rapid advancement of technology has generated a skill gap in the automobile industry in addition to the loss of highly skilled individuals due to aging. According to Manyika et al. (2023), 60 million to 375 million people worldwide may need to change their occupations by 2030 due to technological disruption.

4.6 QUALITY

Customer happiness and service quality are growing in importance and popularity because of their influence on the typical performance of enterprises and organisations (Aman & Gomiek, 2015). As a result, several ideologies have served as the foundation for different definitions of quality and services. Balinado et al. (2021) defined quality as “an evaluation of the degree of consistency and reliability in terms of the quality standard as perceived by the customer.” Quality is also defined by Kotler (2009) as “the overall characteristics and nature of goods and services that affect the ability to meet the stated or implied needs of consumers.”

According to Balinado et al. (2021), the customer is the only factor in determining the quality of a service. Other researchers (Nunkoo et al., 2020; Tahanisaz & Shokuhyar, 2020) argued that early researchers tended to focus more on tangible items and products than intangible services when defining quality. Hong and Kim (2020) defined the quality of commodities as items that adhere to the demands of their clients. Ramya, Kowsalya, and Dharanipriya (2019), on the other hand, defined quality from a business perspective, noting that it is a product attribute that meets the needs of the client and ultimately results in satisfaction, even while attempting to do so results in more investment and increased product cost.

In today's global economic system, car manufacturers must develop products that meet the expectations of their customers. Quality research is generally established in the automobile sector by examining brand image and legacy, aesthetic quality, and numerous technical elements linked to material quality, sound quality, and other characteristics (Stylidis, Wickmana, & Söderberg, 2015). Aesthetic quality is one method of assessing quality in the automobile industry. Cosmetic quality is defined as the “appearance” of a product as perceived by the client (Stylidis et al., 2015). According to studies, most buyers judge quality, including workmanship and material quality, based on the inside of the car (Hagtvedt & Adam Brasel, 2017). The consumer’s perception of quality has a considerable positive effect on repurchase intentions (Choi & Kim, 2013; Wu & Chen, 2014). This shows that consumers are more inclined to repurchase when they perceive greater product quality.

Increasing the quality of service and products would enhance operating efficiency (Firli et al., 2017). Customers make purchases based on superior quality as the primary factor before price, according to Dolealová et al. (2016). Customers also value freshness as a key quality factor and place less emphasis on the organic food they purchase. According to Guatam (2014), safety, look, form, interior features, and presale and post-sale features influence buyers' decision to purchase an automobile. Compared with other brands, Hyundai and Volkswagen appear to be highly powerful brands in this category. The perception of a product influences its quality (Shukla & Garg, 2017). Quality is the totality of features and characteristics of a service that relies on its ability to satisfy the needs of a consumer (Kotler and Keller, 2009). The following are included in the product quality criteria in the automotive industry: safety, comfort and air pollution; ergonomic requirements; product design; and functional quality, such as output or kilometres per litre.

4.6.1 Drivers of quality

Two types of factors influence perceived product quality. Intrinsic cues, which are physical qualities of the product, such as size, colou, and appearance, constitute one form of cue. Consumers can use these physical traits to determine the quality of a product. As a result, some firms make significant investments in enhancing the physical properties of their products (Ariffina et al., 2016). Extrinsic cues are not built into the product. The price, brand image, manufacturer's image, retail shop image, country of origin, distribution channels, brand image, certificates, warranty, advertising, market share, brand name, or store name are examples of extrinsic signals (Thuy & Nguyen, 2015).

4.6.2 Outcomes of Service Quality

The quality of a product affects not only profit margins but also brand equity, power and market share, perceived value, Returns On Investment (ROI) and profitability, and consumers' willingness to buy, as shown in Figure 4.1, below.

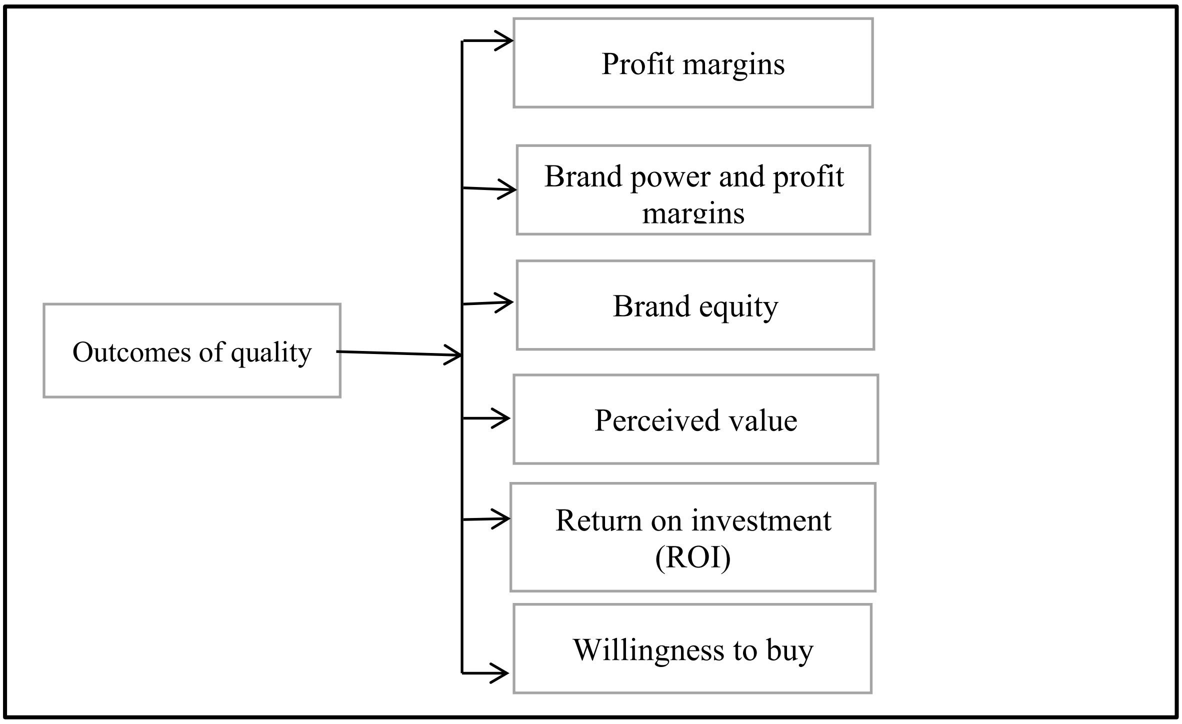

Figure 4.1: Outcomes of quality
Source: Vantamay (2007).

Profit margins: Return on sales is related to market-perceived quality. Customers often rely on perceived brand quality because they want to acquire the best items available, and the tremendous profits that successful owners expect will imply high quality in related contexts as well (Juga et al., 2018).

Brand power and market share: Product quality, as shown in Figure 4.1, may lead to brand strength and a dominant market share. To establish strong brands, entrepreneurs and managers must first understand the demands and wants of a certain group of clients (Armawan, 2021). They develop goods and deliver services that are outstanding at meeting those demands (Halim et al., 2014). Effective 'quality control techniques guarantee that products and services are delivered correctly the first time" (Arslan & Zaman, 2014). Consequently, they attain greater quality in customer-important areas while retaining a cost structure no higher than that of lower-quality rivals.

Brand equity: When a buyer is neither motivated nor able to perform a full investigation, perceived quality has a direct influence on purchasing decisions and brand loyalty (Halim et al., 2014). It can also sustain a premium price, providing a profit that can be reinvested in brand value. Customers gain from brand equity by boosting their (1) information interpretation/processing, (2) purchase choice confidence, and (3) satisfaction (Arslan & Zaman, 2014).

According to research in the South African automotive industry, poor product quality contributes to customer dissatisfaction. For example, Mushavhanamadi and Xundu (2018) discovered that Ford Focus, Transit Connect, and Tourneau- have a potential risk of pressure plate cracking, resulting in a recall on March 20, 2018. These issues result in customer injuries, death, dissatisfaction, and loss of customer loyalty, which lead to purchases from competitors (Mushavhanamadi & Xundu, 2018). Toyota has also been harmed by poor product quality. Toyota responded to the poor quality of airbags supplied by Takata by recalling them in June 2015. (Akdeniz & Calantone, 2017).

4.7 INNOVATION

There are several definitions of innovation used in many fields, such as academia, industry, government, and service delivery. The accessible scholarly literature covers a wide range of topics and can span disciplinary boundaries. Taylor (2017) defines innovation as: "… the process of developing a new idea and transforming it into a brand-new item, technique, or service that increases employment, stimulates the national economy, and creates pure profit for inventive commercial business ...". To achieve uniqueness, innovation is a process that includes science, technology, economics, and management. According to Yu, Umar, and Rehman (2022), it begins with the birth of an idea and continues via its commercialisation in the form of production, trade, and consumption. Innovation is a by-product of scientific research meant to advance social activities and execute social production (Wang & Wang, 2009).

Innovation is never a one-time event; rather, it is a long and cumulative process that involves various organisational decision-making processes, from conception to implementation (Taylor, 2017). A new idea is the perception of a brand-new client requirement or a brand-new manufacturing approach. It is the result of a cumulative process of knowledge collection paired with a continually challenged entrepreneurial vision. According to the 2016 Carbon Disclosure Report, the automobile sector generates 17% of global pollution through car production processes.

Owing to the aforementioned findings, the report has recommended that the automotive industry implement strategies that reduce pollution and encourage the implementation of healthier environmental management strategies by reducing waste production during vehicle manufacturing processes (Kushwaha & Sharma, 2016). Lin, Chen and Huang (2014) describe how automobile companies have begun to develop greener products through various procedures based on the green innovation of hardware and software. Green innovation is defined by Harrington, Deltas and Khanna (2014) as "the system that influences the content and nature of the technologies adopted by a company for green initiatives." However, Silva et al. (2018) believe that implementing green innovation in the automotive industry (IGIAI) is a difficult process and requires the input of many collaborators. This complexity results in many barriers to its implementation. (Silva et al., 2018; Govindan & Hasanagic, 2018; Kushwaha & Sharma, 2016; Luthra et al., 2011; Stringham, Miller & Clark, 2015; Walker et al., 2008). Barriers to green innovation, whether internal or external, can be seen as factors that prevent improvements in the environmental performance of organisations (Silva et al., 2018). The integrated barriers to IGIAI are shown in Figure 4.2 below.

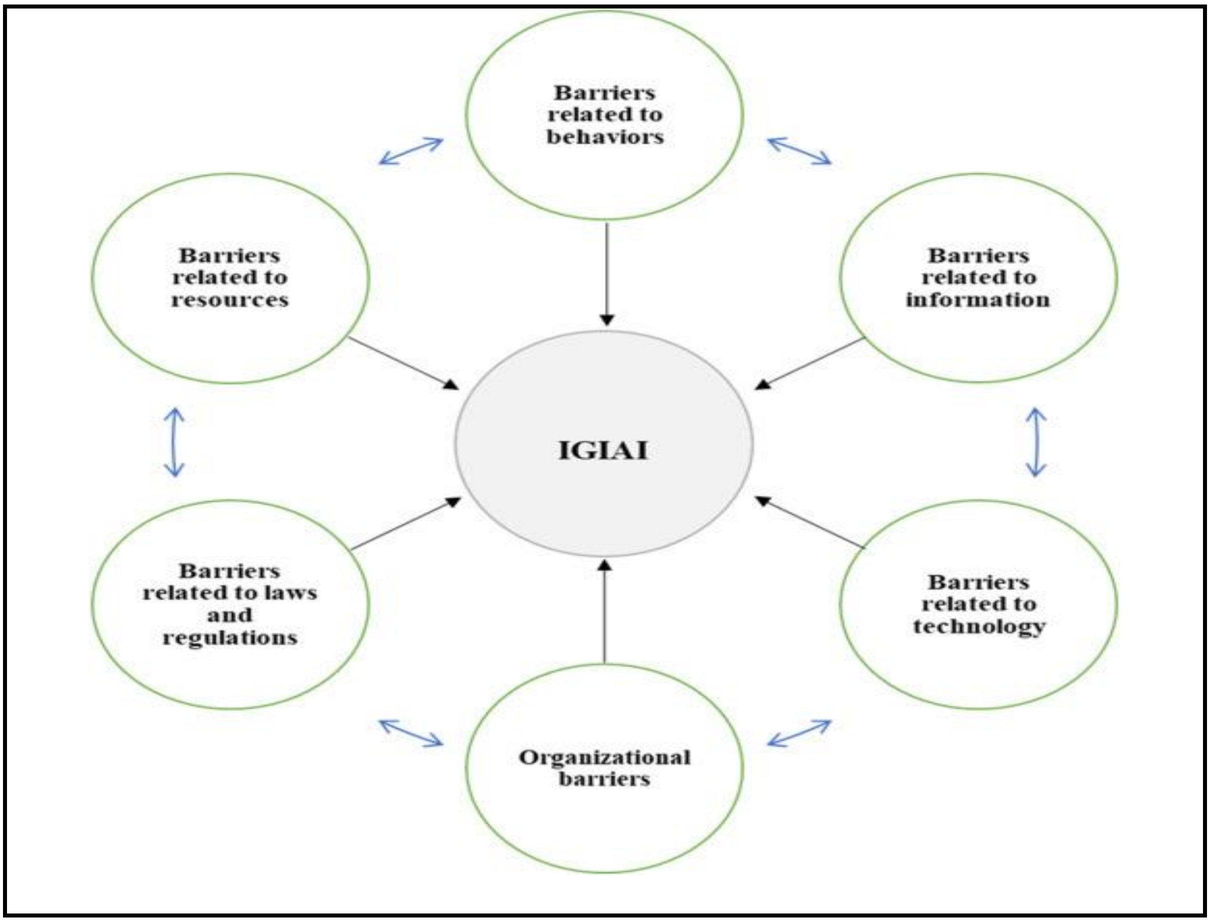

Figure 4.2: Integrated conceptual model of barriers to IGIAI

Source: Gohoungodji et al., (2020)

Note: IGIAI = Implementing Green Innovation in the Automotive Industry

4.7.1 Drivers of innovation

There is evidence to suggest that the South African automobile industry is shifting its strategic priorities away from production efficiency and toward product creation. According to current and projected economic and social developments, the variables of consumer preferences and competitive dynamics are to blame for the shift in strategic focus (Wang & Wang, 2009). Regardless of industry, innovation is currently a significant driver of competitiveness and competitive advantage (Ribeiro et al., 2022). Globalisation and international trade have increased competitiveness, which has had an impact on market demand (Yu et al. 2022). Consumer preferences and governmental demands, among other things, have an impact on the products and features offered, according to research on the evolution and transformation of innovation in the automotive repair and maintenance sector (Ribeiro et al. 2022); Taylor, 2017; Yang et al., 2018). Innovations in products and processes have wide-ranging effects on customers, businesses, and society at large.

Consumer decision-making power is growing in the market (Khan & Fasih, 2014); consumers are increasingly anticipating items that are visible and image driven, and this tendency is present everywhere. Because information is more easily accessible, global consumers have higher levels of education and knowledge. As a result, there is a growing need for more advanced technology and design(s). As a result, innovation competition is driven by the chance to meet consumer demands (Wang & Wang, 2009). This emphasises the necessity of comprehending consumer decision-making in an industry with high levels of dynamic change, such as the automotive repair and maintenance sector.

According to other research, regulatory innovation, which examines how the regulatory environment has changed and how it has affected the business climate in various markets, may encourage new solutions through protection or incentives (Alaassar, Mention & Aas, 2022). Therefore, when strategic decisions need to be made, the governing mechanisms ingrained in industries undoubtedly influence behaviour to conform with the dynamics of rules, and the focus of innovative processes will be directed or at least evaluated. According to Lopez-Fernandez, Serrano-Bedia & Gómez-López (2016), the socio-political agenda is what drives laws, particularly environmental rules, and it is multifaceted (Lopez-Fernandez et al., 2016). In the current business environment, regulations are some of the most important external variables that all businesses must address (Wang & Wang, 2009). They are becoming worse for multinational industries with considerable social impact. Considering the regulatory framework and advancements, the automotive industry is thus a highly relevant sector of the economy.

4.7.2 Outcomes of innovation

The ability to successfully exploit core competencies, such as the collective expertise inside a firm, the coordination of varied abilities, and the integration of technology, is the foundation of sustainable performance for organisations (Alaassar et al., 2022). Additionally, as technological advancement has accelerated the pace of unpredictability in the external business environment, evolving competitive dynamics across a variety of industries has favoured some sets of core capabilities while rendering others less viable or even obsolete (Drnevich & Croson, 2013). In the automotive repair and maintenance sector, digital supply chain technologies are widely used for effective communication between supply chain organisations such as dealers, OEMs, suppliers, and service providers via data. According to Gautam et al. (2017), operational digitisation in manufacturing, warehousing, and transport logistics intensifies the digital transformation of SCM. The importance of ICT in the digitalisation of the automobile sector is described by Peters, Chun, and Lanza (2016). According to Taylor (2017), there may be little difference between technology strategy and business-level strategy in the future, as businesses and industries become more digitally enabled and rely increasingly more on communication, information and connectivity technology in competing in their traditional markets. Consequently, the changing digital and technology landscape will continue to play an increasingly vital role in determining business strategy and industry structure, as business processes, functions and infrastructure become more connected with the external environment, including suppliers, customers and other stakeholders along the value chain (Ribeiro et al. 2022; Taylor, 2017; Yang et al., 2018). Additionally, Mithas and Rust (2016) consider how corporate-level strategic emphasis and investments in technology can affect organisational performance.

Several studies have shown that the automotive industry benefits from innovation. For instance, Shaikh, Kinange and Fernandes (2016) investigated the impact of consumer behaviour on automotive innovations in the automotive industry. The study revealed that consumers behave differently with each innovation and that the manufacturer tries to meet the consumer's expectations. Electronic Stability Control (ESC) is a technology introduced by many manufacturers to assist drivers in maintaining vehicle control during severe steering by keeping the car leading in the driver's expected direction even when the car approaches the limits of road traction (Ross, 2016). As a result, it is possible to conclude that innovation responds to customer expectations.

4.8 SUPPLIER RELATIONSHIPS

Supplier connections involve a broad range of tools that make it easier for a company and its trading partners to collaborate, source products, carry out transactions, and track business progress (Abdollahi et al., 2015). According to Akamp and Müller (2013), the process of planning, implementing, developing, and overseeing a company's relationship with its present and potential suppliers falls under the category of a supplier relationship. Automotive producers need hundreds of various parts to build a product that is currently quite sophisticated in terms of performance, security, comfort, and user-friendly gadgets (Ionescu Florea & Corboş, 2015). Automobile manufacturers may lack the resources or know-how to produce all spare parts in-house to have easy access to these components. As a result, they resort to specialised suppliers, resulting in the formation of an enormous network of enterprises that must provide the components (Ionescu Florea & Corboş, 2015). In the automobile business, supplier relations are crucial since bad relations may have a direct influence on earnings. According to an economic survey that measures automakers' supplier relationships and how they impact profits, Ford, General Motors, FCA, and Nissan would have lost up to $2 billion in sales in 2014. (Florea & Corbos, 2015).

4.8.1 Drivers of supplier relationships

Supplier relationships are influenced by information technology and procurement policies. Supplier relationship management combines and enhances supplier-focused supply chain processes such as design-to-source, source-to-contract, and procurement-to-pay processes by using the most current technology breakthroughs (Oghazi et al., 2016). Supplier relationship management entails optimising communication and processes between the customer and the supplier to handle these operations more effectively and efficiently (Rodriguez-Escobar & González-Benito, 2015). E-procurement is one of the technologies that is increasingly being used in the automotive industry. E-procurement is the electronic purchase, sale, and tendering of goods and services or the use of internet technology in the purchasing process (Howard Vidgen, R & Powell, 2010). The adoption of e-procurement in the automotive industry helps breakdown the technological barrier of traditional, offline procurement by utilising web-enabled technology that uses the internet for low-cost, real-time information exchange with multiple partners (Gottge et al., 2020).

To create an atmosphere that is favourable for conducting business, state corporations need to improve their strategic connections with their suppliers (Dawar, 2017). An agreement between two or more parties to pursue a set of agreed-upon goals while maintaining independent organisations is the definition of a strategic alliance (Yeniyurt, Henke & Cavusgil, 2013). The best buyer–supplier collaboration programs, according to Dawar (2017), concentrate on five factors: segmenting the supplier base (to identify suppliers who could become strategic partners); building the capabilities needed to partner effectively; finding shared incentives and benefits that can generate momentum; taking a structured approach to the program's design; and implementing and managing the program over the long term.

Material procurement policy is one of the most important management decisions in the automotive industry. The procurement policy assists the company in dealing with availability, lead time, and demand uncertainties, which are common in this industry (Yu-Chung & Min-Tsung, 2010).

4.8.2 Outcomes of Supplier Relationships

The relevance of making use of others in the growth of organisations has been demonstrated in numerous studies that adopt a business network viewpoint (Håkansson & Waluszewski, 2007). These studies have demonstrated that supplier connections can affect the positioning, development potential, and cost effectiveness of a client business (Gadde, Håkansson & Persson, 2010). Customer–supplier connections have been identified as a significant source of innovation in many studies of the industrial network tradition (Håkansson & Waluszewski, 2007). Customers' performance in terms of innovation is improved by close supplier cooperation (Schiele, 2010; Delbufalo, 2015). Additionally, supplier involvement in supplier relationships can lead to lower costs and improved quality (Sjoerdsma & van Weele, 2015).

According to studies on supplier relationships, reaping the benefits of supplier involvement depends on the parties' interaction, which is largely influenced by organisational factors on both sides and can span multiple layers of the supply chain (Sjoerdsma & Van Weele, 2015; Mazzola, Broccoleri, & Perrone, 2016). The above literature indicates that external partners are important for accessing the resources necessary for the development of a new venture.

Supplier relationships have been used in the automotive industry to align customer interests with those of manufacturers and component suppliers. For example, Volvo management recognised that separating R&D issues from production and delivery contracts had become too costly for the company's competitive advantage (Brandes, Brege & Brehmer, 2013). As a result, the creation of a partnership-based supplier strategy was intended to alter the traditional task-specific sequential culture (Ambe & Badenhorst-Wess, 2013). Supplier relationships provide a competitive advantage in the long run.

4.9 CUSTOMER RELATIONSHIP MANAGEMENT (CRM)

Customer connections, according to Naru and Jain (2020), are a marketing tactic that uses specific data routinely about present customers to anticipate market demands. Current and potential customers are mentioned in statistics. Almana et al. (2018) asserts that influencing consumer behaviour through effective communication increases customer loyalty, profitability, and retention rates. According to Naru and Jain (2020), an important organisational approach is to build relationships with customers on both internal and external levels. Relationship marketing and management produce customer relationships, thus boosting client retention (Debnath, 2016). A customer is the recipient of a good, service or product received from a supplier or a vendor for monetary or other valuable consideration.

Customer Relationship Management (CRM) is a management philosophy and set of tools that involves managing existing customers, prospective customers, and interactions at the strategic business and project levels. Additionally, the CRM philosophy and technologies can be implemented throughout the entire lifecycle of assets and have been widely accepted across various industries, such as logistics enterprises, as well as academia. According to research, automotive manufacturers and dealers place high value on CRM because it allows them to capture the greatest possible market share in a highly competitive world (Naru et al., 2020). Following the COVID-19 pandemic, automotive manufacturers and dealers are closely evaluating and implementing marketing strategies aimed at improving customer retention (Rajarshi, 2016).

4.9.1 Drivers of Customer Relationships

In a commercial partnership, success can be defined in a variety of ways. The objective and affective metrics of relationship success were divided by Naru and Jain (2020) into two categories. The number of sales that each party experiences due to the partnership serves as an objective metric for success. Affective measures, on the other hand, focus on relationship satisfaction. According to Johanesová and Vaňová (2018), there are two ways to define a business-to-business relationship's success. One approach sees the parties' overall satisfaction as the success measure of the relationship. Here, satisfaction refers to the pleasant impression one organisation has of the connection as its partner meets its expectations. The alternative strategy places greater emphasis on the reciprocal value (quantitative measure) that each party derives from the connection as a success indicator. A supplier–customer relationship that meets both parties' expectations and aims is deemed successful. The effective development of a relationship is due to the parties anticipating the fulfilment of their objectives and expectations, and their happiness motivates them to keep the connection going. Therefore, a relationship that is established and upheld over the long term by both parties could be considered successful in a supplier–customer relationship.

The drivers of supplier relationships are relationship marketing, value and relationship quality. Relationship marketing requires much more work, time, and resources from the marketer than does transaction-based marketing. As a result, the function of relationship marketing depends on the sector and type of enterprise. Relationship marketing strategies are thought to have the greatest impact on the automotive services sector. According to Johanesová and Vaňová (2020), switching costs (costs incurred when a client change suppliers) may be substantial because of factors such as high investment, the importance of the applications, and a customer's heavy reliance on the service provider.

Customers typically exercise extreme caution when selecting automobile service providers (Yan, 2016). They value doing business with suppliers on whom they can rely on and have faith. Furthermore, an increasing number of auto servicing businesses are entering the market today, providing clients with more options. As competition increases, good client ties that can be established and strengthened through relationship marketing become more important (Johanesová & Vaová, 2020).

Relationship value occurs when two people or parties embark on a relationship; they always hope for the benefits that the union will provide them. To offer various definitions of value creation in business relationships, Crespi and Zuñiga (2012) and coauthors conducted a review of the literature that has already been published. Some people have suggested that value might be considered a trade-off between advantages and disadvantages. Some have distinguished between monetary and non-monetary value in commercial partnerships, which includes competency, marketing position, and social incentives.

In the enlarged model of partnership development and success developed by Kovanoviene Romeika and Baumung (2021), relationship value was viewed as performance expectations. They asserted that these expectations are the precursors to the establishment of the partnership and that one success factor in a relationship is when performance expectations are met. In this instance, the relationship value serves as both an admission requirement for a business relationship and a condition for the relationship to last (Wagner & Benoit, 2015; El-Aldy & Eid, 2016; Yoong et al., 2017). Partnership development begins with the value of the relationship. It directly influences the trust, commitment, and satisfaction characteristics of business partnerships (relationship quality), as well as the behavioural signs of a successful connection and the readiness to grow a commercial relationship (Yoong et al., 2017).

The modern automobile industry is characterised by vertically integrated manufacturing networks coordinated by large lead assembly corporations, with a large component manufacturing outsourced to independent suppliers (Dawley, 2011). As a result, these diverse tiers of automotive enterprises contribute to value generation and value capture in the automotive repair and maintenance sector. Pavl'nek and Zenka (2016) evaluated the contributions of different levels of enterprises to value generation and capture in the automobile sector. The study's findings indicate that the automobile industry's economic impacts are mostly controlled by capital intensity and that higher-tier, primarily foreign-owned enterprises produce and capture more value than lower-tier firms do, which constitute most local suppliers.

Relationship quality refers to those specific characteristics that enhance the relationship (Balinado et al., 2021). The constructs that denote excellent relationship quality vary among studies and are not universally agreed upon. The two constructs that are mentioned the most are trust and commitment. Successful relationship marketing also relies heavily on commitment and trust as essential mediating factors.

When one side has faith in the dependability, durability, and integrity of an exchange partner, trust is said to exist. It is also understood to be the conviction that one party will act in the relationship's trusting party's best interests and result in favourable outcomes. According to prior research, Kalaja, Myshketa and Scalera (2016) defined relationship commitment as “one exchange partner's belief that a continuing relationship with another is so important as to warrant making all reasonable efforts to keep it intact." In other words, the committed party believes that the relationship is worth working on to ensure that it lasts indefinitely.

According to automotive research, there is a link between product quality and lower customer satisfaction and brand loyalty (Mushavhanamadi & Xundu, 2018). For example, cars that are deemed to have flaws that endanger customers (Akdeniz & Calantone, 2017). For example, in June 2015, Takata-supplied Toyota vehicles had poor-quality airbags, forcing the company to recall the vehicles (Akdeniz & Calantone, 2017). As a result, recalling vehicles can be viewed as a means of protecting the Toyota brand image, which is associated with high-quality products.

4.9.2 Outcomes of Customer Relationships

Every effort is being made by the car industry to retain and attract customers. Companies in the sector increasingly coordinate their efforts to deliver superior customer service, which makes customers happy. These include brand-new items, globalised services, research centres and emerging technologies. Additionally, having informed citizens who are aware of their rights and what they should expect from service providers is important. The development of new technology was required for this purpose because of how well-informed today's citizens are. This implies that businesses in the automotive repair and maintenance sector must pay attention to client needs and meet them to succeed in terms of customer relations (Johanesová & Vaňová, 2020).

Customer retention is the primary weapon for business success. Companies in the automotive industry use a variety of CRM strategies, such as informing customers about their vehicle status via a tracking sheet at the front office, resolving customer complaints in an average of three days, and greeting customers within 10 minutes of their arrival at the workshop (Sathish et al., 2013).

4.10 PREVIOUS STUDIES ON SERVICE EFFECTIVENESS

Service effectiveness has received attention in previous research efforts. The extant literature on service effectiveness has focused on several constructs related to service effectiveness (Costa et al., 2020; Andrews et al., 2022). Rangaraju et al. (2020), for example, investigated the dependability, assurance, tangibles, empathy, and responsiveness of SMEs in the automotive industry, as well as their impact on vendor satisfaction and suppliers' perceptions of the companies' supply chains. The study's findings revealed that the study's decision-making process considers the dimensions of acceptance towards sourcing products from a small number of suppliers, acceptance towards establishing clear criteria, and acceptance towards suppliers cooperating with suppliers in materials.

The effects of confidence, social benefits, and economic benefits on continuous relationship orientation in the auto maintenance and repair service sector via the mediation of service trust, service satisfaction, and customer engagement factors were investigated by Hong and Kim (2020). The findings, reveals that the benefit of trust should be increased, and professionalism or high levels of quality rendered in maintenance or repair are now the most important factors in generating customer engagement or long-term relationship continuity in the vehicle maintenance and repair industry. Studies have indicated that quality is determined by customers' perceptions and attitudes toward the service provided (Rangaraju et al., 2020). In addition, service quality is determined more by tangible items and products than by intangible services (Hong & Kim, 2020; Sendawula et al., 2020). Studies have explored the benefits of quality and established that increasing service and product quality will improve operational efficiency (Costa et al., 2019; Naumova et al., 2020). Quality rendered affects profit margins, brand equity, power and market share, perceived value ROI and profitability, and consumers' willingness to buy (Backus, 2020; Wang et al., 2021). Taylor (2017) conducted a study on innovation being applied within a social housing organisation through the application of a two-dimensional typology of social innovation; they identified innovation as being applied to new services and improvements to existing services. The findings indicated that innovation can be identified with the creation of a new product or service or an improvement of an existing product or service.

4.11 CONCEPTUAL MODEL AND HYPOTHESES DEVELOPMENT

Figure 4.3, below, shows the relationships among various constructs in environmental sustainability. These include government regulations and incentives, technology adoption, top management support, ECSR, compliance and certification, inbound logistics, and outbound logistics, and ES (mediator), and the service effectiveness dimensions (outcome), namely, productivity, innovation, supplier relationships and customer relationships.

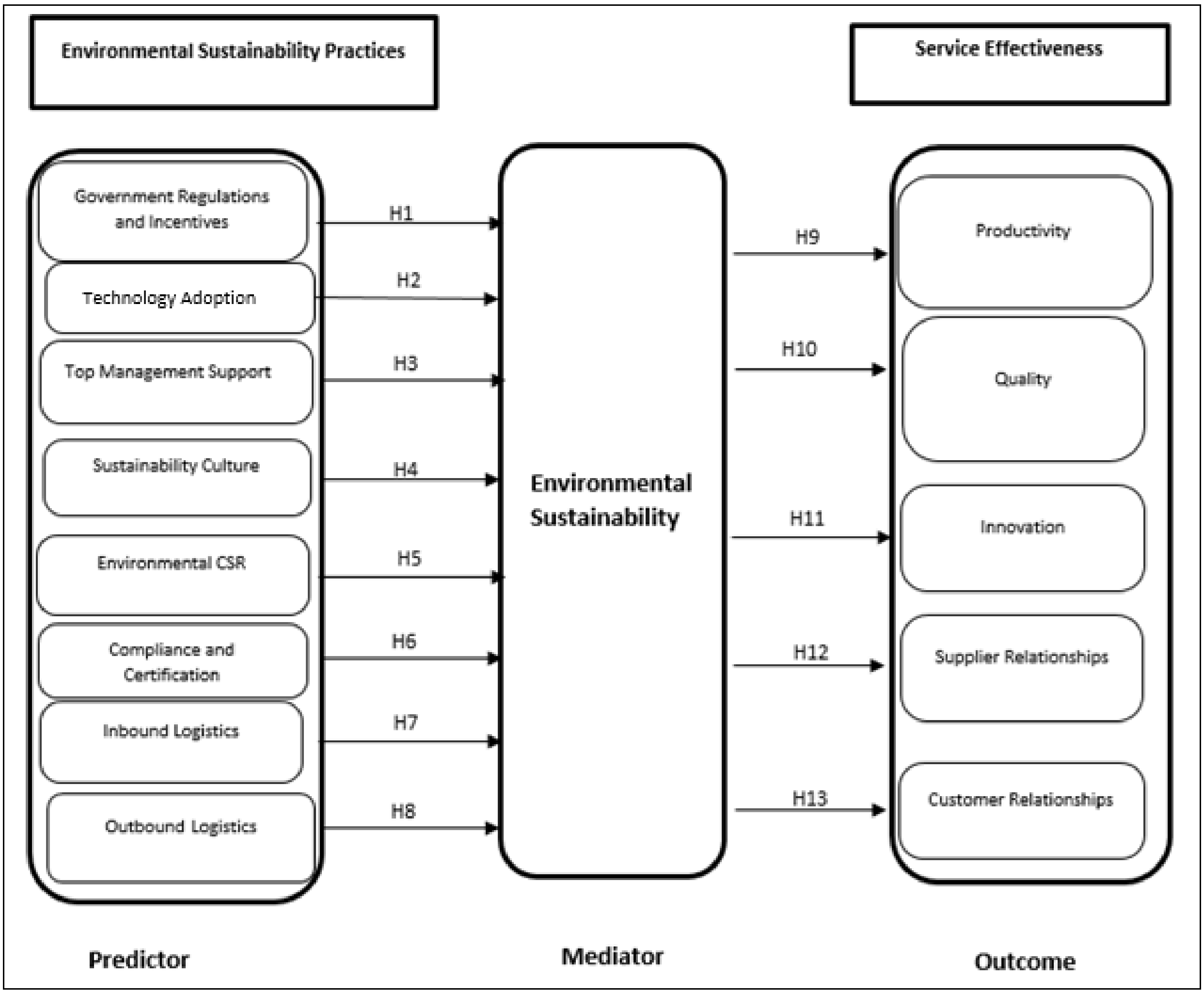

Figure 4.3: Relationships between various actors and sustainability

Source: Author's own compilation (2021)

This model proposes that ESPs (H1 to H8) directly predict ES and SE. ES, the mediating construct in turn, directly influences the outcome variable, SE (H9 to H13). This study tested these hypothesised relationships.

4.12 THE RELATIONSHIP BETWEEN GOVERNMENT REGULATIONS AND INCENTIVES AND ENVIRONMENTAL SUSTAINABILITY

The effects of climate change are worsening at an alarming rate, and voluntary action may not be enough; hence, social pressure and these "issues are compelling governments, businesses, and societies to act quickly to address social and environmental threats" (Radu, Caron, & Arroyo, 2020). Government restrictions may push businesses to adopt new technology, even if they are hesitant to accept green technologies, to ensure ecologically sustainable corporate operations. According to Richter and Medunic (2020), lawmakers pressure firms to conform to new regulations to ensure environmentally sustainable business operations; to conform with regulations, firms implement change through the modification and adaptation of products through new technologies. For example, government regulations control the trash produced by business-use computers and other ICT-related equipment (Mondragon, Mondragon & Coronado, 2017). Noncompliance may result in fines and legal repercussions, which could harm an organisation's reputation and image (Hernandez & Ona, 2016). Regulations and policies can encourage the use of green technologies by providing rewards and subsidies (Vargas-Hernández, 2020).

According to one study, government incentives and awards accelerate the adoption of green practices (Hankel et al., 2018). In Denmark, for example, businesses are required by law to provide a "green budget" in their yearly reports (Hankel et al., 2018). Businesses must continue to comply with rules while investing in energy-efficient technology to demonstrate their corporate social responsibility (Bohas & Poussing, 2016). Green ICT projects within organisations are governed by laws and regulations in South Africa. However, it is recognised that they are insufficient and ineffectively implemented to have any appreciable impact. The successful development and management of electronic waste (e-waste) policies in South Africa are hampered by the illegal import of e-waste into the country by a group of activists who are connected to the global environmental justice movement. (Lawhon, 2013).

South Africa is now struggling to ensure power availability while lowering greenhouse gas emissions. Tax breaks encourage energy customers to embrace renewable energy and EE, accelerating the transition to a greener economy. The ideal condition, according to Galpin et al. (2015), would be for everyone who contributes to a specific environmental problem to have an economic incentive to modify their conduct in favour of one that is more ecologically friendly. Section 12B of the Income Tax Act (South Africa) was revised on December 11, 2017, to include income tax incentives for renewable energy and EE to promote and assist enterprises wishing to green their offices and buildings. Regulations provide the potential for revenue growth by increasing internal productivity (Ekins & Zenghelis, 2021). A smaller environmental impact increases company sustainability and builds a competitive advantage since customers, consumers, and workers choose green enterprises and brands. Reduced capital and operating expenditures also aid in the profitability of enterprises. Environmental regulation may lower pollution emissions and stimulate more green innovation, which can eventually compensate for the expenses of regulation and even yield more profits (Todor, 2019).

Most developed-country governments, notably those in the EU, have attacked car-related petrol and diesel consumption, weakening demands for green automotive measures (Reimers, 2021). As a response, national and municipal governments throughout Europe and the rest of the globe have enacted several regulations to encourage the use of alternative fuel cars. Sixteen EU member states established a tax and/or purchasing incentive connected to vehicle engine fuel types in 2010 (ACEA, 2020). Government regulations on EVs pose a market barrier in South Africa. For example, EVs currently face a 25% import duty, whereas buses and heavy commercial vehicles are taxed at 20%, and ICEVs are taxed at 18%. (Chege et al., 2021). This leads to the following hypothesis:

This leads to the following hypothesis:

H1 – There is a significant positive relationship between government regulations and incentives and environmental sustainability.

4.13 THE RELATIONSHIP BETWEEN TECHNOLOGY ADOPTION AND ENVIRONMENTAL SUSTAINABILITY

Technology is a key tool for the automotive industry's realisation of sustainability. The four primary purposes of green technology have been generally categorised (Thiengo, Tavares & Nobre, 2019). First, technology aids in lowering the energy usage of the infrastructure supporting information systems, such as data centres. Second, the technology offers features for improving infrastructure EE, and third, it lowers greenhouse gas emissions from infrastructure and automobile systems (Ociepa-kubicka & Pachura, 2017). Finally, measures to replace carbon emissions from other corporate processes are made possible by technology (Thiengo et al., 2019). As a result, the technological dimension indicates how much businesses invest in infrastructure that is more ecologically friendly. Considerations include using renewable energy sources, virtualizing and consolidating servers, switching from older to more environmentally friendly applications and technology, and creating solutions to support corporate-wide sustainability objectives.

The preservation of the environment against pollution and resource deterioration is a major concern that necessitates the use of technology (Vial, 2019). The cost of digital transformation is borne by the sustainability triangle, namely, environmental sustainability. The adoption of technology benefits the environment, human health, and entire food chain. According to Kunkel and Matthess (2020), digital transformation has four consequences for environmental sustainability: waste management, pollution control, sustainable production, and urban sustainability. Environmental sustainability is one of the fundamental principles of sustainability, which states that the pursuit of satisfying our needs should not jeopardise the quality of the environment and that the ecosystem should be preserved for future generations (Kaswan et al., 2019).

It is anticipated that both the demand for and the use of technical infrastructure will increase. The digitalisation of economies and society's growing reliance on technology are credited with increasing demand (Thiengo et al., 2019). As a result, it is vital for technical advancements to increase EE and lower their carbon footprint since the energy consumption and environmental effects of green automotive systems are expected to continue to increase (Thiengo et al., 2019). Since the mid-1980s, the automotive industry has been in transition, with domestic industries adapting to a globalised market (Sturgeon, Van Biesebroeck & Gereffi, 2008). This integration was most visible in the buyer–supplier interaction, specifically between automakers and their suppliers (Bastin, Szklo& Rosa, 2010). Governments, such as Brazil, which developed the Brazilian vehicle registration scheme to increase the energy efficiency of new light cars, have taken initiatives to underline this relevance. Emission control legislation (hydrocarbons (HC), carbon monoxide (CO), nitrogen oxide (Nox) is in force in the United States of America (Vaz, Rauen & Lezana, 2017). The National High Technology R&D Programme (commonly known as the 863 Programme) was formed in China (Vaz et al. 2017).

This leads to the following hypothesis:

H2 – There is a significant positive relationship between technology support and environmental sustainability.

4.14 THE RELATIONSHIP BETWEEN TOP MANAGEMENT SUPPORT AND ENVIRONMENTAL SUSTAINABILITY

The importance of senior management support in attaining environmental sustainability is well understood (Chu et al., 2017). On the other hand, supplier development refers to a purchasing firm's ability and willingness to increase its capacity, which strengthens the firm's competitive advantage (Kiesnere & Baumgartner, 2019). Additionally, buyers provide companies with resources, including cash, administrative skills, and technological know-how (Mackey, 2008; Habib et al., 2020). Supplier development refers to any agreed-upon actions taken by the buyer to pinpoint, enhance, and evaluate supplier performance as well as hasten the supply chain's ongoing progress.

For any shift toward environmental sustainability, senior management support for supplier development is crucial (Dubey et al., 2019). Consequently, top management's backing is a strategic antecedent that encourages sustainable behaviours through the supplier (Tarigan, Siagan & Jie, 2020). Support from management for supplier development often aids in the development of good standards by suppliers to enhance the sustainability of the environment (Shalique et al., 2021). More specifically, senior management support proposes not only that the organisation strives for environmental excellence but also that it helps with "issue legitimation," which involves transforming the organisation's identity in favour of environmental activities (Burki et al., 2019).

Increasing economic and environmental constraints have encouraged developing nations in general and automakers in particular to explore and begin implementing green SCM (Das et al., 2023). To stimulate the implementation of current technical breakthroughs in green practices, top management commitment is essential (Burki et al., 2019), which leads to the following hypothesis:

H3 – There is a significant positive relationship between top management support and environmental sustainability.

4.15 THE RELATIONSHIP BETWEEN SUSTAINABILITY CULTURE AND ENVIRONMENTAL SUSTAINABILITY

Most daily actions are social customs that are established in larger cultural systems and customs. Sadly, this limits the possibility of bringing about significant, permanent change because psychological efforts to promote sustainability usually focus too much on individual behaviours and fall short of addressing the physical and social contexts in which individuals are entangled (Coleman & Robinson, 2018). When a company's employees share certain assumptions and views, such as the importance of finding a balance between social justice, economic effectiveness, and environmental responsibility, it is said to have a sustainable culture. Since an organisation's culture significantly influences how its employees act, change initiatives that are compatible with the current organisational culture are more likely to be successful (Hoffman & Georg, 2012; Ben-Eli, 2018).

Businesses should practice sustainability for a variety of reasons, including cost savings, employee branding, and reputation management. Sustainability must become an integral part of a company's culture if it is to be incorporated into its fundamental business practices (Franz, 2012). Businesses in the Information and Communications Technology (ICT) sector, for example, are significant contributors to sustainability issues; however, by using fewer resources, developing goods and services with sustainability in mind, granting more equitable access to goods and services, particularly for those in developing countries, and creating jobs and decent living conditions, they can address the issues of unsustainable production and consumption.

This leads to the following hypothesis:

H4 – There is a significant positive relationship between sustainability culture and environmental sustainability.

4.16 THE RELATIONSHIP BETWEEN ENVIRONMENTAL CORPORATE SOCIAL RESPONSIBILITY (ECSR) AND ENVIRONMENTAL SUSTAINABILITY

It is known that profitability and a positive corporate social responsibility image are associated (Hu & Wang, 2021). Some companies want attention to their social responsibility initiatives (Dou, Su & Wang, 2019). Businesses could present a favourable image of social responsibility and stewardship through green activities (Agus & Salas, 2017). Public pressure can assist businesses in making the move to more environmentally friendly corporate practices, such as using green ICT (Chen et al., 2018). Businesses that go above and beyond compliance frequently develop a positive public reputation and have an impact on consumer behaviour and attitudes towards brands and products (Suryawanshi and Narkhede, 2015). However, compared with industrialised countries, organisations and consumers in developing nations such as South Africa seem to place less importance on maintaining a positive public image (Slavic & Berber, 2015).

This leads to the following hypothesis:

H5 – There is a significant positive relationship between environmental CSR and environmental sustainability.

4.17 THE RELATIONSHIP BETWEEN COMPLIANCE AND CERTIFICATION AND ENVIRONMENTAL SUSTAINABILITY

Underpinned by stakeholder theory, regulatory compliance ensures that companies abide by the laws, principles, and regulations put in place by the government to support environmental conservation (Sendawula et al., 2020; Hu & Wang, 2021). In this respect, compliant automakers have a strong incentive to follow the laws in place because doing so results in environmental protection (Xing et al., 2019). These companies strive to perform neither more nor less than what the law requires. They believe that following rules is the correct thing to do, and their management places more priority on protecting the environment (Lynch-Wood & Williamson, 2014).

According to Harjoto and Salas (2017), following the law improves green development practices related to environmental sustainability. According to Goyal, Routroy & Singhal, (2019), environmental compliance certification is crucial for ensuring environmental sustainability. In contrast, Xing et al. (2019) reported in their study of the sustainable growth of Chinese manufacturing firms that environmental regulation is not positively connected with environmental performance (Malik et al., 2019). As a result, research on environmental sustainability practices and regulatory compliance yields a variety of results (Harris, Gore & Mills, 2019). This creates space for further research to support current findings in various circumstances where regulatory compliance yields diverse outcomes (Harris et al., 2019). This makes room for more research to support the current findings in different circumstances.

This leads to the following hypothesis:

H6 – There is a significant positive relationship between compliance and certification and between compliance and environmental sustainability.

4.18 THE RELATIONSHIP BETWEEN INBOUND LOGISTICS AND ENVIRONMENTAL SUSTAINABILITY

Prior studies on inbound logistics focused mostly on the production of automobiles, steel mills, and fast-moving consumer items, such as those in the dairy industry. The basic process steps in component logistics in the automotive industry, from the original call order to the return of empty containers, were detailed by Boysen et al. (2015). (Sun et al., 2014). To ensure that the final assembly lines never run out of parts, thousands of parts and suppliers, numerous different types of equipment, and hundreds of logistics personnel must be coordinated (Costa et al., 2020; Wang, et al., 2021). By revealing the hidden capacities of an integrated steel plant's raw material handling system, Mukherjee et al. (2012) provided a method for inbound logistics capacity planning (Sun et al., 2014; Ayantoyinbo & Hegelese, 2018). The connections between inbound logistics (IL) operations have been linked to organisational resilience (Costa et al., 2020). Two comprehensive case-based studies in the dairy industry have been conducted (Mukherjee et al., 2012).

Automobile manufacturers are taking steps to ensure that inbound logistics are environmentally friendly. For example, the Case Company's Bangkok plant primarily assembles and builds cabins for its UD truck brand. They also assemble buses and trucks under the Volvo brand, accounting for a small portion of the total volume processed there (Rahman, 2020). Rahman added that the case company has set a target of 30% CO_2 reduction in its transportation system by 2025. Oumer, Cheng & Tahar, (2015) presented a system dynamics simulation model for assessing green logistics practice adoption in the automotive industry. The results of the model indicated that providing an in-depth understanding of the associated environmental impacts and costs can assist decision-makers in practice (Oumer et al., 2015).

This leads to the following hypothesis:

H7 – There is a significant positive relationship between inbound logistics and environmental sustainability.

4.19 THE RELATIONSHIP BETWEEN OUTBOUND LOGISTICS AND ENVIRONMENTAL SUSTAINABILITY

Owing to the scope of this thesis, three key stages in outbound logistics are examined, namely, green transport, green packaging, and reverse logistics. (Ayantoyinbo & Gegeleso, 2018).

4.19.1 Green Transport

The construction of transportation networks, the operation of vehicles, and the disposal of vehicles are the three main sources of transportation that may have substantial environmental impacts (Nethengwe, 2022). Since many urgent difficulties have been linked to three main sources, the topic of green transportation has become contentious. For example, the most urgent issue is emissions, where delivery vehicles are implicated because of their poor fuel efficiency (Marchán & Viscidi, 2015). Additionally, the ongoing use of fossil fuels has resulted in the release of polluting pollutants such as CO_2. Therefore, organisations can rely on these three essential green transport methods to promote green logistics strategies.

Companies are urged to use multimodal transportation for product delivery in the first dimension, which addresses the modal choice of operating transport vehicles. Rail transportation is a substitute method for moving goods that is thought to reduce emissions as well as transportation costs. Using rails is seen as being more environmentally friendly than using trucks because rails use three times less energy per tonne than vehicles do (McKinnon, 2010; Abushaikha, Salhieh & Towers, 2018).

4.19.2 Green Packaging

When businesses choose to pursue sustainability in logistics, packaging has been viewed as the most difficult component (Jerzyk, 2015). Packaging can be divided into three basic categories based on its intended use: primary, secondary, and shipping packaging. While secondary packaging protects primary packaging, which is typically discarded as products are consumed, primary packaging is used to hold the product itself. When a product has been successfully delivered to clients, the exterior packaging required for transportation and storage is often removed. Companies are more inclined to convert packaging materials from conventional materials into reusable materials, such as cardboard and renewable plastics, to achieve green packaging (Smith, 2015). The actual package dimensions and form can influence how much space is used in storage facilities and by transportation methods, which in turn has an impact on the environment. If businesses are aiming for green packaging, the dependability and longevity of the packaging material are also crucial and must be carefully considered.

4.19.3 Reverse Logistics

Reverse logistics, which involves recycling, remanufacturing, refurbishment, or disposal difficulties when finished products are returned from customers to manufacturing locations, is a subset of logistics (Marchán & Viscidi, 2015). The items returned for end-of-life, end-of-use, or commercial reasons are the three main categories. The rationale for this approach is that the main factor negatively influencing the environment is product returns or losses because of packing damage during delivery (Nethengwe, 2022). The importance of developing reverse logistics decisions and policies for effective returns, reusing, and recycling of products at the end stage of the cycle is emphasised in the quest for green logistics (Zaman & Shamsuddin, 2017). It should be clear how to return items and under what circumstances they can be returned (Gan et al., 2015). The bulk of shipments have lengthy journeys, which could have an adverse effect on the environment due to increased fuel consumption and carbon emissions during return deliveries and shipments (Zaman & Shamsuddin, 2017).

According to Masoumi et al. (2019), green delivery is an important factor to consider in the automotive industry's outbound logistics. The literature emphasises the importance of delivery in SCM (Hollos, Blome& Foerstl, 2012). Delivery is a component of an SC that generates environmental waste and emits pollutant gases into the atmosphere, thereby affecting the performance of SSCM.

This leads to the following hypothesis:

H8 – There is a significant positive relationship between outbound logistics and environmental sustainability.

4.20 THE RELATIONSHIP BETWEEN ENVIRONMENTAL SUSTAINABILITY AND PRODUCTIVITY

The repercussions of not being sustainable are, to some extent, a secondary concern in individual companies' decision-making process to participate in certain strategic projects. Sustainability is a critical issue that everyone should be aware of (Wahyuni et al., 2018). Under some conditions, being more sustainable can become a preferred strategic move or shift for firms (despite the real repercussions in terms of preserving the planet's resources). This is because sustainability, eco-efficiency, and "green" issues are valued by society (Balist et al., 2016).

Environmentally friendly production methods reduce waste, the need for energy and materials, and the number of parts that go into making a product (Liu et al., 2018). According to Purba, Suparno & Suryani, (2020), less product packaging is advantageous for marketing logistics in terms of inbound and outbound shipping. By preventing pollution, expenses for disposal, mitigation, and the installation and maintenance of pollution control equipment can all be avoided. Effective environmental management also reduces the chance of losses from crises or regulation, which reduces costs (Eshikumo, & Odock, 2017).

The increased industry concern about sustainability issues has driven car and auto parts manufacturers to implement service capabilities to remain competitive while adhering to environmental rules (Bustinza, Vendrell-Herrero, & Baines, 2017). Automotive manufacturers have moved to a smart manufacturing system in which the whole supply chain, from design to customer loyalty programmes, is linked and monitored via digital technology (Vendrell-Herrero et al., 2017). A growing body of quantitative research investigates the connection between environmental sustainability and productivity. According to recent studies, firms that implement sustainability practices significantly increase their operating margins, sales growth, employment, and key performance indicators (Suarez, Cusumano & Kahl, 2013; Crozet & Milet, 2017; Sousa & da Silveira, 2017). They also appear to have a lower environmental impact (Lafuente, Vaillant, & Vendrell-Herrero, 2017).

This leads to the following hypothesis:

H9: Environmental Sustainability exerts a significant positive influence on productivity.

4.21 THE RELATIONSHIP BETWEEN ENVIRONMENTAL SUSTAINABILITY AND QUALITY

Customers' perceptions of a company's environmental sustainability practices, such as its corporate social responsibility initiatives, are crucial in determining how their intentions are formed and how they behave after making a purchase (Trang et al., 2019). Han et al. (2020), for example, reported that customer happiness and corporate/business reputation are directly correlated with how customers perceive sustainable practices. According to Perramon Oliveras-Villanueva & Llach, (2022), a company's sustainability initiatives have a significant effect on how customers perceive the firm's performance and behavioural intentions. Additionally, Nair and Choudhary (2016) reported that customers' views of a company's sustainability initiatives contribute significantly to improving their affective appraisal of its products and services by encouraging favourable feelings and attitudes toward the company. When they engage in CSR initiatives for the environment, consumers are more likely to have a positive opinion of a company's product performance (Moisescu & Gică, 2020).

In the automotive industry, the quality of environmentally friendly vehicles is regarded as a critical factor influencing consumers' purchase intentions. Coffman, Bernstein and Wee (2017) support this viewpoint by stating that vehicle ownership cost, driving range, and charging time are the most influential factors in electric vehicle adoption, which is also supported by Rajper and Albrecht (2020). According to Berkeley, Jarvis & Jones (2018) suggested that the driving range is one of the most important factors for consumers to decide whether to purchase an EV, whereas Schulz and Rode (2022) suggested that the charging time is also an important factor.

This leads to the following hypothesis:

H10: Environmental sustainability exerts a significant positive influence on quality.

4.22 THE RELATIONSHIP BETWEEN ENVIRONMENTAL SUSTAINABILITY AND INNOVATION

According to Kulangara et al. (2016), social innovation is described as shifts in a group of people's attitudes, behaviours, or perceptions that, in connection with the group's horizon of experiences, result in new and enhanced forms of collaborative action both within the group and outside of it. This is necessary since stakeholder relations regarding innovation are complicated and varied when innovation patterns are considered (Bessant & Tidd, 2007; Behnam et al., 2018). Social influences within a community have a significant effect on consumers' expectations and perceptions, which give rise to a variety of requirements (Malerba & Brusoni, 2007; Eliseeva Yu & Agafonova, 2016). A systemic change in expectations, which has pervasive and multiple effects on many stakeholders, may require economic, social and political incentives.

Digitalisation is a mega trend that affects all aspects of automotive manufacturing. Manufacturers can improve design innovation, operational efficiency, and plant productivity by utilising dedicated ICT applications. Digital solutions also foster innovation in the supply chain ecosystem. Street Scooter, an innovative EV initiative led by RWTH University in Aachen, Germany, employs a digital platform to integrate input from 30 collaborating suppliers, allowing for a crowdsourced design approach. According to the innovations highlighted in the literature, environmental sustainability is a driver of innovation in the automotive industry.

This leads to the following hypothesis:

H11: Environmental exerts a significant positive influence on innovation.

4.23 THE RELATIONSHIP BETWEEN ENVIRONMENTAL SUSTAINABILITY AND SUPPLIER RELATIONSHIPS

The impact of suppliers on company performance has been thoroughly examined in prior SCM studies (Adesanya et al., 2016; Yu et al., 2022). A focus firm's service performance, responsiveness, costs, market and sales growth, and flexibility are all significantly improved by its suppliers (Hudnurkar et al., 2014). It has become clearer in recent years that businesses should expand their sustainability initiatives beyond internal initiatives. These businesses must be accountable for their conduct throughout the entire supply chain (Sajjad, Eweje & Tappin, 2015).

Sometimes, focal companies are held accountable for the behaviour of their suppliers when it is discovered that they are acting unethically or unsustainability in their business practices. Stakeholders then put pressure on these targeted enterprises to investigate sustainability issues in their supplier chains (Ahi & Searcy, 2015). The repair and maintenance sectors involve suppliers. Maintaining supplier connections has generally been identified as a crucial aspect of a company's competitiveness (Esfahbodi, Zhang & Watson, 2016). As a result, companies cannot be sustainable if they do not address the sustainability of their suppliers (Jassim et al., 2020).

While efforts to reduce costs, waste, and energy are a focus of supplier relationship management, there is also a more important shift towards higher levels of collaboration (Esfahbodi et al. 2016). To do this, internal and external supply chain participants, such as suppliers, must evaluate goods, their packaging, their delivery procedures, and their management systems (Chu et al., 2017).

According to the existing automotive industry literature, automotive manufacturers and component suppliers prefer strategic partnerships with companies that support green initiatives (Ambe & Badenhorst-Wess, 2013; Brandes et al., 2013). Owing to these preferences, the automotive supply chain views alignment with environmental sustainability initiatives as a source of competitive advantage and brand image promotion.

This leads to the following hypothesis:

H12: Environmental sustainability exerts a significant positive influence on supplier relationships.

4.24 THE RELATIONSHIP BETWEEN ENVIRONMENTAL SUSTAINABILITY AND CUSTOMER RELATIONSHIPS

There are sustainability-oriented customer conceptions such as green consumerism and socially conscious consumer behaviour in addition to these very general concepts. In terms of the ecological dimension, someone who is a "green customer" is one whose purchasing decisions are impacted by environmental considerations (Hengboriboon et al., 2022; Kumara & Rahman, 2015). Consumers who make judgments about what to buy based at least in part on environmental considerations are said to practice green consumption (Ashby et al., 2012). Green brand image is described as a collection of consumer impressions of a brand that are connected to environmental commitments and concerns (Pohludka & Štverková, 2019). The fulfilment of a customer's enjoyable environmental need, objective, or desire is referred to as "green consumer satisfaction" (Adrodegari, Pashou & Saccani, 2017). Consumer behaviour that considers social considerations, such as labour rights and how businesses affect the communities in which they operate, is behaviour that aims to have a beneficial (or less negative) impact on others (Kumara & Rahman, 2015).

According to research, car buyers who are concerned about environmental sustainability are more likely to purchase environmentally friendly vehicles and components. Hetterich Bonnemeier and Georgiadis (2012) reported that when prospective car buyers were asked about their attitudes toward sustainable materials in a car interior, they indicated that they were willing to pay a premium price for a vehicle interior made of renewable resources. Customers' attitudes towards environmental sustainability suggest that the sustainability initiatives of automotive manufacturers and component suppliers are influenced in part by market demands.

This leads to the following hypothesis:

H13: Environmental Sustainability exerts a significant positive influence on customer relationships.

4.25 CONCLUSION

The chapter presented literature on the relationships between various aspects of environmental sustainability. The relationships that were discussed are government regulations and incentives, technology adoption, top management support, ECSR, compliance and certification, inbound logistics, and outbound logistics. In addition, the literature discusses the relationships between service effectiveness and productivity, innovation, supplier relationships and customer relationships. The literature has established that service effectiveness is determined by productivity, quality, innovation, supplier relationships, and customer relationships. Regulation, investment, competition, innovation, enterprise, and skills are drivers of productivity. Perceived service quality is influenced by intrinsic cues and extrinsic cues. In turn, brand equity, power and market share, perceived value, ROI and profitability, and consumers' willingness to buy are the outcomes of service quality. Innovation was found to be a key driver of competitiveness and competitive advantage. The literature has established that innovation is strongly linked to customer satisfaction. Supplier relationships help companies in the automotive repair and maintenance sector collaborate, source products, carry out transactions, and track business progress, whereas customer relationships help businesses achieve customer satisfaction and business success. The next chapter presents the research methodology, detailing the research process and the decisions made in conducting this study.

CHAPTER 5:
RESEARCH METHODOLOGY

5.1 INTRODUCTION

The purpose of this chapter is to discuss and how a researcher methodically organised a study to provide accurate and trustworthy results that address the research aims, objectives, and research questions (Daniel, 2021). The chapter begins by outlining the choice of deductive reasoning that was used in line with positivism. The research paradigm chosen for the study is discussed, and justifications for its use are given. The research design, research approach and research strategy used in the study are discussed, and their alignment with the postpositivist paradigm is explained. The section on population explains the target population, the sampling and the sample size for the study. The data collection methods and procedures for data collection are clarified. The chapter then outlines the data analysis methods used in the study. The validity and reliability of the study are addressed, outlining the measures that are followed. Finally, the chapter discusses the ethical guidelines that are followed and the measures taken thereof. The next section presents the research reasoning.

5.2 RESEARCH REASONING

Reasoning is the process that occurs between the moment at which reasoners attend to salient, meaningful information (linguistic or perceptual) and the point at which they derive one or more conclusions based on that information (Wills, 2022). Inductive, deductive, and abductive thinking are the three primary styles of research reasoning. Deductive reasoning is the most fundamental type of legitimate reasoning (Bradford & Weisberger, 2017). Deductive reasoning, also known as deduction, begins with a broad statement or hypothesis and explores all possible outcomes to arrive at a precise, logical conclusion. The inverse of deductive reasoning is inductive reasoning. Inductive reasoning uses individual data to build broad generalisations; it denotes drawing a conclusive statement from one or more particular facts or pieces of evidence (Blumberg et al., 2014). There are data, and conclusions are subsequently derived from them. Arguments based on experience or observation are best expressed inductively, whereas arguments based on laws, rules, or other widely accepted principles are best expressed deductively. Bellucci (2018) defines abductive reasoning as “the act of developing an explanatory hypothesis from an observation that demands an explanation.”

Abductive reasoning begins with facts, employs any specific hypothesis in mind, and is motivated by the belief that a theory is required to explain the startling facts. The purpose of abduction is to make meaning of unexpected or confusing experiences to fill gaps in our beliefs and preserve or restore their coherence (Hidayah et al., 2020).

Deductive reasoning was used in this investigation because of its benefits and suitability. Wills (2022) suggested that the deductive technique enables a study to create a theoretical observational relationship between the findings of the literature review and those of the main study. In line with the premises of deductive reasoning, several hypotheses were proposed in the current study with the expectation that a logical conclusion would be reached at the end of the research. Additionally, deductive reasoning has been used in several previous studies conducted in the automotive repair and maintenance sector. For example, Wang and Wang (2009) studied the application of the car logistics performance evaluation model. Moshikaro (2019) employed deductive reasoning in research that examined productivity increases in the sector by benchmarking data. Kelecsenyi, Nilsson & Safari (2022) employed a deductive method to assess the characteristics of electric cars that impact customers' views of electric automobiles. The study's findings demonstrated that the prominence of the selected criteria had a favourable effect on customers' attitudes toward EVs. Lopez-Vega and Moodysson (2023) investigated the usage of digital technology in the automobile sector via deductive reasoning. The study revealed that digital technologies provide the required preconditions for more radical technologies to realise their promise for industry transformation.

5.3 RESEARCH PHILOSOPHY

Research philosophy is concerned with the origin, nature, and evolution of knowledge (Aspers & Corte, 2019). Some authors (Krishna, 2024; Panya & Nyarwath, 2022) describe research philosophy as the theoretical or philosophical foundation for the study endeavour. Research philosophy is important because it enables researchers to comprehend how to approach their research studies, as well as how other previous studies were conducted (Gemma, 2018). The four philosophical standpoints considered in the current study are Positivism, Post positivism, Phenomenology and Pragmatism. Positivism is a philosophical position that holds that there is only one objective reality. To grasp reality, positivist researchers separate themselves from personal ideals (Aspers & Corte, 2019; Junjie & Yingxin, 2022). Gemma (2018) emphasises that positivists use natural science approaches to investigate social reality and do not regard the two domains as independent entities. Positivists view the world through a narrow lens, thinking that there is only one true account of an event (Kirongo & Otieno, 2020). In quantitative research, positivism is applied since positivists believe that the universe is external and that each occurrence or situation has a single objective reality, regardless of the study's perspective or belief (Killion & Fisher, 2018). As a result, positivism favours structured and regulated research methods. For example, Huang, Wang, and Zhang (2023) employed positivist philosophy to perform a bibliometric study that provides a deeper understanding that prior research in the field of automotive supply chain interruption risk management has not been thoroughly analysed.

Post-positivism is a philosophical stance that acknowledges that we cannot study the world in which we live as completely objective and disinteresting outsiders and that natural sciences do not offer the paradigm for all social research and believe that a pure truth that is unaffected by factors is impossible (McGlinchey, 2022). Post-positivists argue that a researcher can be an objective observer of the social environment (Park, Konge, & Artino, 2020). Furthermore, post-positivism contends that a researcher's views and even specific identities influence what they see and thus influence what they conclude (Varpio & MacLeod, 2020). As a result, a researcher should understand and address these biases by striving to recognise and address such biases with the ideas and information developed by theorists (McGlinchey, 2022). critical realist paradigm, as "… it exists independently of human thoughts and beliefs or knowledge of their existence but is interpreted through social conditioning …".

Phenomenology is the person's perception of the meaning of an event as opposed to the event, as it exists external to the person (Leedy & Ormrod, 2015). Phenomenologists attempt to gain better perceptions and perspectives relative to a particular context through lengthy interviews with a small sample of respondents. They reject the concept of objective research and seek to be scientific. This paradigm is associated with qualitative research projects.

The pragmatist philosophy is based on the idea that there is no single method to learn but rather many ways to comprehend reality (Maarouf, 2019). To gather knowledge about diverse realities, numerous research methodologies, including both qualitative and quantitative methods, have been applied. According to Barnes (2019), pragmatism is more concerned with the experiencing world and its various subjective and objective levels. Pragmatism acknowledges the advantages and disadvantages of each research method and gives the study a choice to select a suitable method for answering research questions. (Baŝkarada & Koronios, 2018).

The study utilised post-positivism as it is appropriate for addressing the research objectives. Post-positivism was chosen because it helps to make future predictions from the data. In addition, quantitative data provide objective information that researchers can use to make scientific assumptions (McGlinchey, 2022). Few studies have employed post-positivism in automotive research. According to Pham (2018), the post-positivism paradigm helps to predict results, scrutinise theories and unearth the relationships between the variables. He used philosophy to determine the significant relationship between the COVID-19 pandemic and the marketing efforts undertaken by marketers of the automotive industry. Another study by Majumdar and Jash (2015) investigated the advantages of e-rickshaws over the other forms of three-wheeled vehicles as well as their economic and environmental impact and the challenges faced by vehicles in India. The theory has been applied in other studies; for example, Karmjit (1997) used the post-positivist design to explore the resettlement experience of professional Asian and Indian women and the possible changes in their perceptions because of immigrating to the United States of America from India.

5.4 RESEARCH APPROACH

A research approach is a type of study that investigates and delivers deeper insights into the actual world by targeting data collection towards respondents' lived experiences (Gofe, Olana, & Debela, 2022). In contrast to quantitative research, which collects numerical data and develops and evaluates hypotheses, qualitative research aids in the development of a framework or theory (Aspers & Corte, 2019). Furthermore, qualitative research collects the experiences, attitudes, and behaviours of respondents (Moser & Korstjens, 2017). It addresses how and why rather than how many and how much (Gofe et al., 2022). Three research methodologies may be identified: qualitative research, quantitative research, and mixed-methods research.

Qualitative research is described as the gathering, analysis, and interpretation of non-numerical data such as language (Reiter, 2017; Masood, 2021). An interpretive, naturalistic method of comprehending a phenomenon is used in qualitative research (Aspers & Corte, 2019). This study explores a phenomenon in its natural surroundings, aiming to make sense of or interpret it in terms of the meanings people attribute to it (Creswell & Poth, 2017). When a study aims to understand how a person subjectively perceives and assigns meaning to their social situation, this technique is ideal (Aspers & Corte, 2019). As a result, the technique was not employed in this study because the goal of the research was to build and evaluate an environmental sustainability and service effectiveness framework guided by positivist philosophy. Opponents of the qualitative method, for example, question its suitability for producing expected outcomes (Noble & Smith, 2015). The objective is often based on the subjective aspect of the procedure, which may restrict the generalizability of the results (Coşkun, 2020).

Quantitative research is defined by Aliaga and Gunderson (2002) as explaining phenomena by collecting numerical data that are analysed via mathematically based methods, particularly statistics. The primary goal of quantitative research is to discover if a theory's predicted generalisations hold (Wisdom & Creswell, 2013). For example, the goal of this study was to build and evaluate an environmental sustainability and service effectiveness framework. Furthermore, quantitative research aims to explore causal links between variables, make predictions, and generalise the findings to a larger population (Aspers & Coerte, 2019). The statistical analysis employed in quantitative data analysis is considered scientifically objective and logical (Wisdom & Creswell, 2013). Critics of quantitative research claim that the technique approaches an issue with predetermined assumptions, limiting its capacity to allow for meaning-making that results from unanticipated encounters (Hammargerg, Kirkman & Lacey, 2016).

As previously stated, both qualitative and quantitative methodologies have limits that jeopardise data gathering and the quality of conclusions. As a result, mixed-method research was developed to address the shortcomings of qualitative and quantitative methodologies (Shorten & Smith, 2017). According to Creswell, Plano Clark (2011), mixed methods research is defined as the systematic integration of quantitative and qualitative data within a single project. Compared with employing a simple quantitative or qualitative approach, combining qualitative and quantitative methods provides more full and synergistic use of data (Shorten and Smith, 2017). Because the qualitative features described previously were not the focus of the investigation, mixed techniques were not explored in this study.

This study utilised a quantitative research approach to test objective theories by examining relationships among variables. As discussed earlier, quantitative methods are appropriate for testing and developing an environmental sustainability and service effectiveness framework. In addition, the approach was chosen because it allows for the testing of causal relationships between variables such as environmental sustainability and service effectiveness in the South African automotive industry. The extant literature on the automotive industry has used a quantitative research approach. Sierzchula et al., (2014) explored the influence of financial incentives and other socio-economic factors on electric vehicle adoption. Morton, Anable and Nelson (2016) investigated consumer preferences toward EVs via a quantitative study. Kelecsenyi et al. (2022) used an approach in which the attributes of EVs that influence consumer attitudes towards EVs were measured. Therefore, the use of a quantitative approach was ideal for this study.

5.5 RESEARCH DESIGNS

Research design is a procedure for collecting, analysing, interpreting, and reporting data in research studies (Qutoshi 2018). Schwitter & Liebe, (2025) defines research design as "the overarching approach used to combine the many components of a study consistently and logically." Descriptive, exploratory, explanatory, correlational research designs and survey research designs are the most common.

Descriptive research designs may be used in both qualitative and quantitative studies. The word "descriptive" refers to the research questions, study strategy, and data analysis used (Schwitter & Liebe, 2025). Descriptive research is concerned with determining "what is". This is accomplished by employing visual aids such as graphs and charts to assist the reader in comprehending the data distribution (Sixes, Smith, & Mitton, 2017). A descriptive research design gathers data to define a phenomenon, condition, or population methodically (Reiter, 2017). Descriptive research designs aid both qualitative and quantitative research, and aids in understanding what happened rather than how or why it happened (Creswell, 2013).

An exploratory research design is a qualitative research design that is used to study a phenomenon that is not yet completely understood (Reiter, 2017). The purpose of an exploratory investigation is to obtain deeper knowledge of the problem at hand without producing solid conclusions (Ibid). As a result, exploratory designs are designed to assist the study in developing a deeper knowledge of the subject at hand but do not offer definite conclusions (Sileyew, 2020). An explanatory research design is a qualitative design designed to analyse a phenomenon that has not been investigated previously or has not been satisfactorily explained (Masood, 2021). This study's goal in explanatory research designs is to make connections between distinct ideas and obtain deeper knowledge of their many causes, consequences, and justifications (Sileyew, 2020).

Correlational research design involves the measurement of two or more relevant variables, and an examination of their correlations with one another is central to a correlational study design (Fleurence, Naci, & Jansen, 2010). Correlational design examines the extent to which differences in one variable are associated with differences in one or more other variables (Creswell & Creswell, 2017). The goal of correlational research is to find variables that have logical relationships with one another. Correlations are a quick and easy way to identify whether there is a link between two variables that warrants further research, and a positive correlation indicates a positive relationship between research variables. They can utilise historical data, and if a link is found, it may be worth investigating why it occurs (Shamiyah, Kane, & Dickinson, 2010). Correlational studies, on the other hand, cannot provide conclusive answers concerning the origins of variations among variables (Esser & Vliegenthart, 2017). This is only conceivable with experimental study methods in which the independent variable is manipulated by the investigator (Shamiyah et al., 2010).

A survey is a means of obtaining information from a sample to provide quantitative descriptors of the occurrence. (Lampard & Pole, 2015). A survey is designed to quantify specific features of a community (Fowler, 2013). These aspects typically require an examination of the relationships among various factors (Creswell & Hirose, 2019). A subset of the population is employed in survey research, and the results are then extrapolated to the complete population (Kumar, 2014). Sileyew (2020) regarded a survey design as an appropriate tool for evaluating a study population's attitudes and orientations (Kumar, 2014). Traditionally, surveys have quantitative components, but researchers might incorporate qualitative components by asking open-ended questions (Reiter,2017). Fowler (2013) suggested that questionnaires and interviews are the two major tools applied to collect data in surveys. In tandem with that view, a questionnaire was used to collect data for the current investigation.

This study employed a mix of correlational and survey research designs based on their advantages and applicability. Objectives 1, 3 and 5 sought to determine associations between variables. For example, Research Objective 1 sought to determine the relationship between the degree of application of environmental sustainability and service effectiveness. Similarly, Research Objective 4 sought to determine the relationship between environmentally sustainable practices and service effectiveness. Hence, a correlational design was deemed applicable, as it permits the analysis of relationships among many variables in the current study.

A survey was employed for this inquiry because, as highlighted by Fowler (2013), surveys may collect data from large samples of the population that have great statistical power and are useful for gathering demographic information on the sample's composition. The current study involves the collection of data from large numbers of respondents drawn from the South African automotive repair and maintenance sector.

Several previous studies focusing on the automotive repair and maintenance sector were conducted via correlational designs. Chan et al., (2016) adopted a correlation design to investigate the influence of a green innovation strategy on corporate brand value in the automotive repair and maintenance sector. On the other hand, Grewatsch and Kleindienst (2017), and Tariq, Badir and Chonglerttham (2019) used a correlation design to explore the correlation between firm performance and Green Innovation Strategy (GIS) activities. A previous study by Saberi, Kouhizadeh, Sarkis and Shen (2019) used a correlational design to explore the relationship between Blockchain Technology (BT), communication-enabled Supply Chain Integration (SCI) and Sustainable Supply Chain Performance (SSCP) in the automotive repair and maintenance sector in India.

5.6 RESEARCH STRATEGY

Research strategy refers to the process in which a study finds a definitive answer to research questions (Creswell, 2013). Research strategies are important because they play the role of connecting conceptual research questions and empirical studies (Abosede & Onanuga, 2016). For this study, several research strategies were considered before the best strategy was determined. These approaches are as follows: survey, case study and grounded theory. A survey is a means of obtaining information from a sample to provide quantitative descriptors of the occurrence. (Lampard & Pole, 2015). A survey is designed to quantify specific features of a community (Fowler, 2013). These aspects typically require an examination of the relationships among various factors (Creswell & Hirose, 2019). A subset of the population is employed in survey research, and the results are then extrapolated to the complete population (Kumar, 2014). A survey was employed for this inquiry because, as highlighted by Fowler (2013), surveys may collect data from large samples of the population and are useful for gathering demographic information on the sample's composition. The current study involves the collection of data from large numbers of respondents drawn from the South African automotive repair and maintenance sector. A case study design concentrates on a specific research population. The case study technique allows for the examination of a phenomenon in its context while drawing on a range of data sources (Baxter & Jack, 2008). An example of a case study is research that aims to fully comprehend the recruiting and selection procedures of a single company.

Grounded theory is a research method that involves developing a comprehensive explanation of a process, activity, or interaction that is influenced by the viewpoints of many respondents. Creswell and Poth (2018) and Hameed (2020) and Charmaz and Thornberg (2021) describe grounded theory as a research method in which the inquirer develops a comprehensive explanation (a theory) of a process, activity, or interaction that is influenced by the perspectives of many respondents. Grounded theory was not used in this study, as the major focus of the study was not to develop a theory but to explain the phenomenon of recruitment strategies and their link to organisational performance.

This study used a survey strategy to achieve its aims. A survey design, according to Sileyew (2020), is an appropriate tool for evaluating a study population's attitudes and orientations (Kumar, 2014). Traditionally, surveys have quantitative components, but researchers might incorporate qualitative components by asking open-ended questions (Reiter, 2017). Fowler (2014) suggested that questionnaires and interviews are the two major tools applied to collect data in surveys. In tandem with that view, a structured self-administered questionnaire was used as the survey method to collect data for the current investigation.

5.7 TIME HORIZON

The two most common survey designs are cross-sectional designs and longitudinal designs. A longitudinal survey is conducted over time, whereas a cross-sectional survey is conducted only once (Abosede & Onanuga, 2016; Flemming, 2017). A longitudinal survey has the advantage of allowing the study to learn more about cause–and–effect linkages and create more clearly drawn links (Cresswell & Hirose, 2019). Furthermore, collecting more data over a longer period will result in more concise and superior results (Sileyew, 2020). On the other hand, cross-sectional studies are quick, straightforward, and inexpensive to undertake (Creswell & Creswell, 2017). They are typically derived from questionnaire surveys. Because respondents are questioned only once, there will be no missed opportunities for follow-up (Cresswell &

Hirose, 2019). A cross-sectional study design was employed in the present study because the research involves a comparison of all variables of interest at the same time. It is also cost-effective and acceptable because of the limited time available for completing the study (Flemming, 2017).

5.8 COLLECTION OF SECONDARY DATA

Secondary data refers to the data gathered from published sources, meaning that the data are already gathered by someone else for another reason and can also be used for other purposes in research (Taherdoost, 2021. Martins, Da Cunha and Serra (2018) define it as using information that had already been gathered by different researchers for a different purpose. A literature review is a survey of academic papers, books, and other materials related to a certain subject, field of study, or theory and provides a description, summary, and critical assessment of these works (Ramdhani, Ramdhanim, & Amin, 2014); it is intended to offer a summary of the sources you used when studying a certain issue, as well as to show your readers how your research fits into the greater area of study (Okoli & Schabram, 2010). A competent literature review collects information about a certain topic from a variety of sources. It is nicely written and lacks personal prejudices (Ramdhani et al., 2014). A literature review, on the other hand, seeks to summarise and synthesise the arguments and ideas of others without making new additions. The goal of this research's literature evaluation was to provide a theoretical framework for the primary investigation.

In this study, a comprehensive review of the literature was conducted and reported in Chapters 2, 3 and 4. Chapter 2 provided an overview of the automotive industry and environmental sustainability. Chapter 3 explored literature on environmental sustainability, and Chapter 4 was dedicated to a literature review on service effectiveness and hypothesis formulation. Table 5.1 below presents an overview of the literature review.

Table 5.1: Thematic focus of the literature review

Chapter	Main headings
Chapter 2: **Overview of the automotive industry and environmental sustainability**	• The global context of the automotive industry • Background of the automotive industry in South Africa • Major automotive industry players in South Africa • Contribution to the automotive industry • Legislative Framework for the automotive industry in South Africa • Challenges facing the automotive industry supply chain in implementing environmental sustainability practices • Previous research in the automotive repair and maintenance sector
Chapter 3: **Environmental sustainability**	• Research theories • Environmental sustainability • Environmental sustainability practices • Previous studies on environmental sustainability
Chapter 4: **A literature review on service effectiveness and hypotheses formulation**	• Service effectiveness • Productivity • Quality • Innovation • Supplier relationships • Customer relationships • Previous studies on service effectiveness • Conceptual Framework and Hypothesis Development

Source: Author's own compilation

A literature search strategy was conducted to identify articles, books and reports that focused on environmental sustainability in the sustainability automotive industry. A keyword search was performed to identify relevant articles from the database. The databases that were consulted are Science Direct: journals and books; Springer: peer-reviewed journals; EBSCOhost; Microsoft Academic; and Google Scholar. The following keywords were used to identify relevant articles: “environmental sustainability”, “automotive industry”, “sustainability”, “service performance” and “automotive supply chain”.

5.9 EMPIRICAL RESEARCH

Any study whose results are solely based on concrete, verifiable facts is classified as empirical research (Bouchrika, 2023). The phrase empirical refers to being guided by scientific experimentation and/or evidence. Similarly, research is empirical when it investigates claims via real-world evidence. This section presents the methodological procedures that culminated in the primary research findings.

5.10 SAMPLING DESIGN

Sample design refers to the plans and methods used to select a sample from the target population and the estimation technique formula for computing the sample statistics (Singh, 2019). These statistics are the estimates used to infer the population parameters. In this section, the sampling design includes the population, sample frame, sample size, sampling approach and sampling techniques.

5.10.1 Population

A population is a grouping or collection of people who have similar traits. The population can refer to the whole population of a country or city (Sharma, 2017). This full group of people shares certain features, such as demographic, geographical, and temporal traits (Thacker, 2020). The population for the current study consisted of supply chain professionals, automotive technicians, waste managers and major suppliers forming part of the aftermarket automotive workshop in South Africa.

5.10.2 Target Population

The target population refers to all people who match the criteria for a research study (Alvi, 2016). A target population is also defined as a subset of the population about which one wishes to conclude and hence a subset of the population whose features are of interest to the investigator (Asiamah, Mensah & Oteng-Abayie, 2017). The target population for this study comprised supply chain professionals, quality control professionals, automotive technicians, waste managers and major parts suppliers operating in the Provinces of Gauteng, Limpopo, Mpumalanga and the Free State automotive repair and maintenance sector.

Supply chain professionals, waste managers, automotive technicians and major parts suppliers were selected to take part in this survey because they met the inclusion criteria set out in the study, which consisted of possessing the knowledge of SCM as well as their roles as practitioners in the automotive maintenance and repair sector. The reason for this choice is that Gauteng Province was selected because it serves as the economic hub of South Africa as well as the centre of local and global businesses. The rationale behind choosing the three provinces (Limpopo, Mpumalanga and Free State) is their geographical proximity to Gauteng Province and the fact that they have several automotive maintenance and repair centres.

Table 5.2 below shows the study's target population in terms of the aftermarket automotive workshop and supply chain branches involved based on the company's classification of major suppliers.

Table 5.2: Population by units

Branches	Gauteng	Limpopo	Mpumalanga	Free State	Total
Aftermarket automotive workshop branches	70	6	12	6	94
Suppliers	350	42	72	48	512
Waste managers	70	6	12	6	94
Total units/branches	**490**	**54**	**96**	**60**	**700**

Source: Author’s own compilation

In total, the aftermarket automotive workshop has 94 branches in the targeted provinces, 70 in Gauteng Province, 6 in Limpopo Province, 12 in Mpumalanga Province and 6 in the Free State Province. In Gauteng Province, there are 350 major suppliers, 42 in Limpopo Province, 72 in Mpumalanga Province, and 48 in the Free State Province. It also has 70 waste managers in Gauteng Province, 6 in Limpopo Province, 12 in Mpumalanga Province, and 6 in the Free State Province. Among these entities, 700 managers and employees work as supply chain professionals, quality control professionals and automotive technicians.

Thus, the study population consisted of 700 supply chain professionals, waste managers, major suppliers and automotive technicians across the chosen supply chain entities.

Table 5.3: Target population by candidates

Cluster		1 Gauteng	2 Limpopo	3 Mpumalanga	4 Free State	Total
Responses (Units)	Aftermarket automotive workshop branches	70	6	12	6	94
	Suppliers	100	42	72	48	262
	Waste managers	70	6	12	6	94
Total		**240**	**54**	**96**	**60**	**450**

Source: Author's compilation

Thus, the study's target population is 450 supply chain professionals, waste managers, major suppliers and automotive technicians across the chosen supply chain entities. The sampling frame is a list containing all the sampling units. It consists of a list of items from which the sample is to be drawn.

5.10.3 Sample frame

A sampling frame is a complete and accurate list of all elements or units within the target population from which the sample is drawn (Pace, 2021). A well-defined sampling frame is essential for ensuring that every member of the target population has a known and equal chance of being selected, thereby supporting the validity of probability sampling (Alatawi, 2017).

For this study, a full sampling frame was drawn up from directories of industry associations and company records, such as the membership directory of the South African Aftermarket Association (SAAA) and the database of the Retail Motor Industry Organisation (RMI). From this frame, a comprehensive sampling frame was compiled from multiple sources to ensure complete coverage of the target population of 450 units across the four selected provinces (Gauteng, Limpopo, Mpumalanga, and Free State).

5.10.4 Sample size

A sample is a fraction or subset of a research population chosen to participate in a study and thereby represents the research population (Krieger, 2012). Similarly, Leedy & Ormrod (2015) define a sample as a subset of a population of people, another biological species, or inanimate objects; data collected from this subset are used to determine the population from which it has come. Given that the sample may reflect only a subset of the target population, the study must carefully consider how the sample size chosen meets the study's aims or hypotheses (Sharma, 2017). The Raosoft online sample size calculator was used to determine the sample size for this study. The margin of error was set at 5%, and the confidence level was 95. From a population of 450, the sample size was 392.

5.10.5 Sampling approach

The sampling design comprises two types of sampling approaches: probability or random and non-probability sampling approaches (Pace, 2021). In probability sampling, every member of the population has a known (non-zero) probability of being included in the sample, thus providing design-unbiased estimators and valid statistical inferences for finite population parameters (Alvi, 2016; Sharma, 2017; Kim et al., 2021). In contrast, respondents in non-probability sampling do not have an equal chance of participation in the investigation; on the other hand, they are unknown before the study (Chen, Li, & Wu, 2020). The study adopted a probability sampling approach since the number of units in the target population is known; probability sampling is also appropriate for quantitative research as well as for collecting data from a large sample size.

5.10.6 Sampling techniques

A sampling technique refers to a process of selecting elements in a population (Vogt, Gardner & Haeffele, 2012). Probability sampling techniques include simple random sampling, systematic sampling, stratified sampling and cluster sampling (Taherdoost, 2016). In this study, the cluster random sampling technique was utilised to select respondents because it is highly feasible when dealing with a large population and avoids reduced variation (Elfil & Negida, 2017). Lohr (2021) described cluster sampling as an aggregation of observation units in the population into smaller population units called clusters. In cluster sampling, the research context is divided into smaller units. This makes it possible for the study to make a random selection of respondents from small units when dealing with research in which data are collected from a large area. The advantage of cluster sampling is that it saves time and money, as the study focuses on smaller population units spread across different geographical areas (Elfil & Negida, 2017). Cluster random sampling combines cluster and simple random sampling techniques.

In applying cluster random sampling to identify respondents, data were collected from four provinces, namely, Gauteng, Mpumalanga, Limpopo and the Free State. One of the limitations of cluster sampling is the presence of over- or under-represented clusters (Alatawi, 2017). To address this problem, the study ensured that no cluster had fewer than 10 units, steps taken to overcome limitations of over- or under-representation of clusters as indicated in Table 5.4 below.

Table 5.4: Target population and sample size by cluster

Cluster		**1 (Gauteng)**	**2 (Mpumalanga)**	**3 (Limpopo)**	**4 (Free State)**	**Totals**
Responses (Units)	Aftermarket automotive workshop branches	70	6	12	6	94
	Suppliers	100	42	72	48	262
	Waste managers	70	6	12	6	94
Total		**240**	**54**	**96**	**60**	**450**
Sample Size						**392**
Cluster size after data collection		169	72	76	75	**392**

Source: Authors' own compilation

As indicated in Table 5.3, the target population was 450 from which respondents were chosen via cluster random sampling. The table shows the initial sample size before data collection, with large differences in population sizes between the provinces, with the smallest population size being Mpumalanga Province (n=54) and the highest being Gauteng Province (n=240). To ensure uniformity of the number of respondents across the cluster units from a sample size of 208, the study had to use the smallest population from Mpumalanga Province to determine the size of clusters for the provinces.

During data collection, the initially calculated sample size increased as more respondents from the target population participated. As a result, the final sample size increased to 392 respondents. Gauteng Province had the highest number of responses (n=169, 43.1%), followed by Limpopo Province (n=76, 19.4%). The Free State Province recorded 75 respondents (19.1%), whereas Mpumalanga Province had the lowest number, with 72 respondents (18.4%).

5.11 DATA COLLECTION INSTRUMENT

Data are defined as any information about a study, including details of methods, respondents, setting, context, interventions, outcomes, results, publications, and investigators. (Li, Higgins & Deeks, 2019). Two data collection methods were used in the study. The first is secondary data collection, which was performed for the literature review chapters. Secondary data are the data gathered from published sources, meaning that the data are already gathered by someone else for another reason and can also be used for other purposes in research (Martins et al., 2018; Taherdoost, 2021). Data were collected from different sources, such as journals, procedures, reports, magazines and brochures. Academic databases such as Science Direct, Emerald, Sabinet, Sage Research Methods EBSCOhost and Google Scholar were also consulted.

Second, data for the empirical study were collected via a survey questionnaire. A questionnaire is a research instrument used to gather information about respondents' attitudes, experiences, and views (Taherdoost, 2021). Allen (2018) considers survey research to be mainly quantitative since it proposes the use of a representative sample to provide a research overview. Survey questionnaires can be classified as structured or unstructured. A structured questionnaire is a questionnaire that has a specified number of questions and allows respondents the possibility to choose among the alternatives provided. In contrast, unstructured questionnaires are usually open-ended and attempt to probe the minds of respondents (Taherdoost, 2021). Structured questionnaire surveys were employed with closed-ended questions. According to Rassel et al. (2020), open-ended questionnaires require respondents to elaborate on their points, whereas closed-ended questionnaires limit respondents from selecting from a set of pre-defined responses, such as “Yes/No”. The rationale behind using questionnaires is to assist the study in collecting a significant quantity of data from a large sample size, conducting the study in a short period (cross-sectional study), lowering expenditures, and obtaining highly accurate data (Taherdoost, 2021).

5.11.1 Cover page of the questionnaire

A questionnaire cover page (Appendix 1) plays an important role in providing respondents with overview information about the questionnaire. It further emphasises the importance of participating in the study to encourage a high response rate (Stedman et al., 2019). A cover letter also emphasises the respondents' rights and reminds them whether they have fulfilled research requirements such as signing consent forms. Cohen et al. (2023) used a cover letter to communicate voluntary participation rights to potential respondents. The latter is therefore important in enhancing a study's ethical considerations (Karamitri, Kitsios & Talias, 2020). The cover letter included information on the title, nature, and purposes of the questionnaire and study, as well as the identities of the research stakeholders. It also collects information on respondents' preferences, especially if they prefer to obtain a copy of the research findings (Stedman et al., 2019).

5.11.2 Structure of the questionnaire

The questionnaire was written in accessible English so that respondents would have no trouble comprehending the questions. The purpose of these questions was to assist respondents in answering within the set time range, preventing them from providing information that may not be beneficial for the study. The questionnaire was divided into four sections comprising the closed-ended questions highlighted below:

Section A

This section comprises two questions that elicit gender and age information.

Section B

The construct used to assess sustainable practices included eight items measuring environmental sustainability practices, which were: government regulations and incentives, technology adoption, top management support, sustainability culture, ECSR, compliance and certification, inbound logistics and outbound logistics. The Cronbach's alpha coefficient was used to measure the internal consistency of each scale, and the values obtained ranged from 0.8 to 0.9, revealing the data's consistency and reliability (Quinlan et al., 2019). A cut-off off level of 0.7 was the recommended score to deem a scale reliable (Pallant, 2020) and 0.826 and was significant for technology adoption (Moeletsi, 2021; Tukamuhabwa, Mutebi, & Kyomuhendo, 2021). The average variance extracted (AVE) values were well above the 0.5 threshold, indicating good convergent validity. Similarly, Bag, Gupta and Luo (2020), Aziz, Memon and Ali (2020) and Keskin et al. (2021) conducted studies on SCM practices, logistics capabilities and integration, and they obtained standard alpha coefficients of 0.744, 0.726, 0.782 and 0.755, respectively.

Section C

Questions on environmental sustainability were adopted from a study by Quinlan et al. (2019). The study attained a Cronbach's alpha of 0.958. The value is above the cut-off level of 0.70, indicating a high level of reliability.

Section D

This section of the questionnaire uses five questions to elicit respondents' impressions of service effectiveness. The focus areas were productivity, quality, innovation, supplier relationships and customer relationships. Questions were adopted from studies by Chin (1998); Black, Babin and Anderson, 2010; Ghozali, 2014; and Hair et al. (2019). The studies obtained a Cronbach's alpha of 0.885 and an AVE value of 0.774, indicating acceptable reliability.

5.11.3 Adaptation of the questionnaire survey

`Changing questionnaires entailed finding a balance between making only a few modifications to maintain international comparability and resource management on the one hand and changing it to meet your strategic, national, and cultural context on the other hand (Vallejo-Medina et al., 2017). This study adapted questionnaires from previous studies, as indicated in the previous section. The questionnaires addressed three key areas of interest, namely, environmental sustainability practices, environmental sustainability and service effectiveness.

The following steps were taken in the questionnaire adaptation:

- Simplifying the language to meet the local context
- Adapting the questionnaire to the local and strategic context
- Development of new questions
- Testing the questions through a pilot study.

The most important part of adapting the questionnaire to the local context was to test the questions and the questionnaire with employees and managers in the automotive industry through a pilot study.

A pilot study helped refine the content and face validity of the research instrument. Malmqvist, et al. (2019 define a pilot study as "a procedure for testing and validating an instrument by administering it to a small number of respondents from the intended test population."

5.11.4 Response methods

The study utilised a Likert scale to weigh the responses to the questionnaire. Likert scale questions efficiently capture respondents' views on a particular topic and allow for the quantitative grading of such attitudes (Rokeman, 2024). The questionnaires were assessed via the Likert scale formula, which consists of a statement, followed by a series of six answer statements. The six-point Likert scale is less confusing and frustrating for respondents; thus, it is likely to increase the response rate. The respondents chose the option that best corresponds with how they feel about the statement or question. The Likert scale has 6 scales, namely, 1 = Strongly disagree, 2 = Disagree, 3 = Slightly disagree, 4 = Slightly agree, 5 = Agree and 6 = Strongly agree. According to Joshi et al. (2015), the Likert scale is advantageous because it is easy to construct and interpret, and each item meets an empirical test for discriminating ability.

5.11.5 Data collection procedures

The research used a self-administered survey questionnaire technique as a mode of data collection. The questionnaires were sent via online surveys to aftermarket automotive workshop branches, suppliers and waste managers across the four provinces in South Africa. An online survey method was used with respondents who were geographically dispersed in the constituencies to be covered in this study. Google Inc. was used to distribute Google Forms for a free online survey platform. Google Forms were utilised for this study because they are easy to access and use and are cost-effective (Vasantha Raju & Harinarayana, 2016). The respondents were informed in advance that they had a right to voluntarily withdraw from the study.

5.11.6 Procedures for addressing data-related problems

Two broad types of date-related challenges are measurement error and processing error. The measurement error is the variance between the actual and observed variable values (McDonald et al., 2021). The error can result from the qualities of the data collection tool, including its response categories, designs and questions/statements presented to respondents. Processing errors are related to similar differences between actual and measured values due to data management inconsistencies. These include poor data capture and verification methods (McDonald et al., 2021). Both errors can negatively affect the results, resulting in both Type I and Type II errors.

To control for measurement errors, the study ensured that the questionnaire was pilot tested for design flows that included ambiguous questions and inconsistent response categories (Allen, Mliescu & Greiff, 2022). Every single question or statement was reviewed and assessed for potential errors as part of the questionnaire design quality control (Ikart, 2019). The questionnaire was further reviewed by experienced researchers, including the supervisor. Peer reviews are effective at reducing measurement errors if performed by qualified persons (Ikart, 2019. Processing errors were minimised by cross-checking the captured data for errors and automating data analysis processes (McDonald et al., 2021). To obtain best practices, online training on data processing was obtained from reputable trainers (McDonald et al., 2021).

5.11.7 Response bias

According to Elston (2021), response bias refers to scenarios where respondents' views and options are misrepresented. It is also possible that respondents could be consciously or subconsciously driven into providing responses they believe would resonate with the study (Flinton, 2020). Among other solutions, larger, randomly selected samples reduce the effects of this balance on a dataset (Flinton, 2020). For the population size, this study used a considerably large and randomly drawn sample to minimise response biases.

5.11.8 Non-response bias

Non-response bias relates to the non-representative data collected because of specific sections of the sample opting not to take part in a study (Choumert-Nkolo, Tavera & Saxena, 2023). Non-response biases, also referred to as participation biases, are related to the collection of disproportionate data resulting from selecting a sample that has skewed underlying characteristics (Elston, 2021). The proposed solutions to this challenge lie in the research strategy design. This study applied random sampling across clusters as a way of managing non-response bias.

5.11.9 Sampling bias

Sampling bias is a situation where a selected population subset fails to statistically represent the general nature of the population of interest (Berndt, 2020). Like participation and non-participation biases, sampling bias reduces the generalisability of findings (Elston, 2021). To reduce sampling biases, the study first fully identified its population and the sub-groups in it. The subgroups were classified as clusters, and from each cluster, proportionally representative samples were extracted. Another strategy to reduce sampling bias was to have a large sample size (Berndt, 2020). The initial sample size was 208, but during data collection, more respondents participated, which is permissible and addresses the sampling bias concerns.

5.11.10 Common Method Variance (CMV)

Common Method Variance (CMV) occurs when respondents' response options reflect or are influenced by the data collection tool rather than by their perspectives and views (Kaltsonoudi, Tsigilis & Karteroliotis, 2022). The CMV affects validity, as it results in findings that do not mirror the realities in the population. Respondents might fail to recall past events required by the data collection tool (Baumgartner, Weijters & Pieters, 2021). They might also fall into a need to respond in a manner that they believe is socially acceptable. Additionally, there might be pressures to maintain a response pattern, such as choosing middle options (Kaltsonoudi, et al., 2022). To minimise CMV risk, the respondents were fully informed of their independence of choice. Furthermore, confidentiality eliminates the need to respond in a manner one thinks is socially acceptable.

5.12 PROCEDURES FOR DATA ANALYSIS

Data analysis is defined by Leedy and Ormrod (2015) as the process of cleaning, transforming, modelling and interpreting the collected data into suitable formats that facilitate the addressing of the research objectives. It validates data to ensure that it examines research questions by conducting descriptive statistics, assessing assumptions to generate and present analyses, and creating tables and figures. Data describing the sample were generated first. This was in the form of means for continuous variables (e.g., age) and frequencies for categorical data (e.g., qualifications). This was done to get to know the group that the study was interested in.

5.12.1 Data preparation

Data preparation is the process of transforming data from their original form into a representation that is more appropriate for analysis (Vassiliadis, 2009). For this study, data were captured in Microsoft Excel spreadsheets. After that, the data were exported into the Statistical Package for the Social Sciences (SPSS).

5.12.2 Data editing

Data editing involves checking the data for errors and inconsistencies. This was done once the data-capturing exercise was completed (Saunders, Lewis & Thornhill, 2014). This process primarily involved checking data entries against questionnaires as source documents and making relevant corrections where needed. Data editing is critical for enhancing research output validity and reliability (Saunders, et al., 2014).

5.12.3 Data coding

Coding is the process of identifying segments of meaning in data and labelling them with a code, which can be defined as “a word or short phrase that symbolically assigns a summative, salient, essence-capturing, and evocative attribute for a portion of language-based or visual data" (Saldaña, 2015, p. 3). The study's main responses were in Likert scale form. Coding involves assigning a number such that 1- strongly disagree, 2 - disagree, 3 - slightly disagree, 4 - slightly agree, 5 - agree and 6 - strongly agree. Coding therefore facilitates the transformation of responses into numbers that can be descriptively and inferentially analysed.

5.12.4 Data cleaning

Data cleaning is the process of reassessing data for inconsistencies and irregularities (McDonald et al., 2021). Data cleaning is performed after data have been coded to identify common irregularities such as missing or wrong entries that may have been a result of human error during the entry of data in the Excel document. The captured data were assessed in all rows to ensure that the responses were logical. Any illogical responses were investigated by returning to the questionnaire as a source document for verification.

5.13 TESTS FOR NORMALITY OF DATA

Normality tests were conducted to assess the distribution of the data. The tests that were conducted were kurtosis and skewness tests. Skewness is a measure of a distribution's deviation from symmetry; if fully symmetrical, the mean, median and mode are in the same location (Blumberg et al., 2014). The skewness value can be positive, negative, or undefined. Kurtosis is a measure that assesses the extent to which a distribution deviates from the perfect bell shape of a normal distribution. A high kurtosis (Kurt > 3) indicates greater deviation from normality, and the degree to which parametric data tests, including mean scores, cannot be relied on. Normality is important for assessing whether data can be analysed via parametric or non-parametric tests. Only normally distributed data can be analysed via methods that rely on the mean as an underlying measure, or parametric test. Data are classified as normally distributed if their skewness lies within a -2 and 2 range and a -3 and 3 range for kurtosis (Pernot & Salvin, 2018).

5.14 DESCRIPTIVE STATISTICS

Descriptive statistics refer to the collection, presentation, description, analysis and interpretation of data (Pérez-Vicente & Ruiz, 2009). Its purpose is to summarise these values from a set of values. Descriptive statistics describe the characteristics of the given data, providing crucial data for understanding the basic behaviour of the data (Shahrear, Saiki & Tareq, 2024). Statistics can be used descriptively to illustrate the characteristics of a group of observations, i.e., the raw data; these statistics are called "descriptive statistics" (Parahoo, 2006). Pérez-Vicente and Ruiz (2009) emphasise that descriptive statistics are used to organise, present, and explain the characteristics of a sample. It provides quantitative measurements of attributes, such as numerical procedures, or graphical instruments, such as bar charts, histograms, frequency polygons and pie charts (Scherbaum & Shockley, 2015). Descriptive statistics (means and standard deviations) are calculated for all the variables, namely, environmental sustainability (ESPs, environmental sustainability and service effectiveness. The specific descriptive statistics that were used in the study to evaluate the degree of application of environmental sustainability practices within the automotive industry in South Africa, assess the standard of overall environmental sustainability of the South African automotive industry and measure the service effectiveness of the South African automotive industry included the mean scores, standard deviation and skewness and kurtosis. The mean is defined as "the arithmetic average of a range of values or quantities and is computed by dividing the total of all values by the number of values" (Blumberg et al., 2014). In addition, correlation analysis was used to determine the antecedents of environmental sustainability in the South African automotive industry and establish the effect of environmental sustainability on service effectiveness in the South African automotive industry. The latest version of the statistical software SPSS was used for data analysis.

5.14.1 Frequency distribution

A frequency distribution is a data analysis and presentation method centred on measuring the number of times an observation or group of observations occur. It is a basic yet important method that helps to identify key observations and trends that can be used to independently answer research questions or initiate further tests. According to Scherbaum and Shockley (2015), frequency distribution represents a descriptive analysis that provides information about the number of observations of each observed value of a variable as well as the frequency of missing data. For the study, a frequency distribution was used to analyse the sample demographic data.

5.14.2 Mean scores

The mean is defined as the arithmetic average of a range of values or quantities, computed by dividing the total of all values by the number of values (Blumberg et al., 2014). For this study, a mean score was used for each statement across all the research constructs. This enabled an understanding and comparison of the respondents' sentiments toward these statements. The mean scores, however, work if the data are normally distributed.

5.14.3 Standard deviation

The standard deviation is a measure of how far a typical observation of the variable is likely to deviate from the mean (Lasher, 2014). Leedy and Ormrod (2015) define the standard deviation as a measure of variability in which (1) each data point is squared; (2) the sum of squares is calculated; (3) this sum is divided by the total number of data points; and (4) the square root of the obtained result is calculated. The standard deviation should then be viewed as a measure of the variation or dispersion of a set of data from its mean or expected value. A low standard deviation indicates that the data points tend to be very close to the mean, whereas a high standard deviation indicates that the data are spread out over a large range of values (Howell, 2020). For each mean score, a standard deviation was provided.

5.14.4 Inferential statistics

Inferential statistics involve the use of a sampled dataset to generalise findings to a population. Inferential statistics also test research hypotheses (Amrhein et al., 2019). The goal of inferential statistical analysis is its ability to provide answers to hypothetical questions through responses from survey questions. For this study, inferential tests were determined by the dataset quality, especially the degree of normality (Mishra et al., 2019). For this study, inferential tests included correlations that test the strengths of relationships between variables.

5.15 STRUCTURAL EQUATION MODELLING (SEM)

The hypothesised relationships were analysed using the SEM approach. The SEM is used to define and examine the relationships between two types of variables: latent (LV) and manifest (MV) variables. Latent variables (LV) cannot be observed or tested explicitly because they are abstract in nature, and manifest variables can be observed and measured. Byrne (2001) stated that the observed variables, in comparison, include empirical facts and are easier to calculate.

The application of SEM involves two phases: CFA and path analysis (PA).

Partial Least Squares Structural Equation Modelling (PLS-SEM) was selected for four primary reasons, consistent with Hair, Ringle and Sarstedt's (2019) guidelines. First, the research objective is prediction-oriented and exploratory (developing and testing a model in the novel context of the South African automotive aftermarket) rather than purely confirmatory, making PLS-SEM the appropriate choice. Second, the conceptual model is complex, comprising eight antecedent constructs, one mediating construct, and five outcome constructs (14 constructs in total), and PLS-SEM handles high model complexity without the convergence issues common in CB-SEM. Third, normality tests (Section 5.13) indicated that the data did not meet the multivariate normality assumption required for CB-SEM, whereas PLS-SEM imposes no distributional assumptions. Fourth, the final sample size ($n = 392$) is adequate for PLS-SEM but falls below the recommended threshold for CB-SEM with a model of this complexity (typically $n > 500$). Accordingly, SmartPLS 4.0 (Ringle, Wende & Becker, 2022) was used to analyse the measurement and structural models following Anderson and Gerbing's (1988) two-step approach.

5.15.1 Confirmatory Factor Analysis (CFA)

Confirmatory factor analysis (CFA) is a theory-testing procedure that is used to test the relationships between the variables of the study it also provides evidence of construct validity (Phakiti, 2018). The CFA aims to confirm a theoretical model using empirical data and is an element of the broader multivariate technique of SEM (Alavi et al., 2020). Three key tests central to the CFA procedure, namely, validity, reliability, and model fit, were employed to assess the accuracy of the measurement model.

5.15.2 Validity

Validity is defined by Sürücü and Maslakci (2020) as: "… logical or factual soundness ..." Ahmed and Ishtiaq (2021) further stress that validity is concerned with how accurate a measuring tool is in measuring what it purports to measure. In other words, it should measure what it purports to measure. In this investigation, precautions were taken to limit mistakes to a minimum. This was accomplished by using basic questions that were brief and easy for responders to understand (Sürücü & Maslakçi, 2020). A pilot survey was used to assess the questionnaire's validity. Piloting is a procedure that enables a researcher to make changes to an instrument based on feedback from a small number of individuals who complete and evaluate the instrument (Creswell, 2014). Similarly, Simkus (2022) defines a pilot study, or a feasibility study, as a small-scale preliminary study undertaken before any large-scale quantitative research to assess the possibilities for a future, full-scale project.

The pilot research was conducted on a small group of employees. Pilot research should ideally have a 10% sample size. For that purpose, 40 people were chosen for the pilot. They were briefed on the rationale for conducting the pilot research and asked whether they were willing to participate. If respondents were willing to respond to the questionnaire, they were asked which mode they preferred: hand delivery, email, or an online platform (Google Forms). A pilot study was conducted on a small group of employees with characteristics like those of actual respondents to check for inaccuracies and refine the questionnaire (Hilton & Hilton, 2020). The study concentrated on two essential areas of validity: face validity and construct validity. Construct validity is the extent to which a test measures a theoretical construct that it claims to measure (Polit & Beck, 2012; Roy et al., 2023). Face validity assesses whether each item represents the construct being studied on the surface (Roy et al., 2023). It refers to how credible results appear based on their appearance; it is a measure of whether a research project appears to be good and how representative it is at face value (Frey, 2018). Hardesty and Bearden (2004) and Nevo (1985) define face validity as the degree to which raters judge the items of an assessment instrument as appropriate to the targeted construct and assessment objectives. The face validity of the current study was unearthed by knowledgeable and experienced members of the supply chain in the automotive repair and maintenance sector, whose feedback helped clarify the questionnaire.

5.15.3 Reliability

Frey (2018) defines reliability as the consistency of the measurement to produce identical results. Reliability information will be calculated using Cronbach's alpha. Reliability is done to assess the effectiveness of the measures used to measure the constructs, and if the instrument is reliable, it will yield consistent results. Cronbach’s Alpha is a psychometric index frequently used in educational research and the behavioural sciences in general as an indicator of the internal consistency of a test (McNeish, 2018). In this study, Cronbach's alpha, a measure of internal consistency reliability, of alpha > 0.7 was regarded as a good scale (Blumberg et al., 2014). Table 5.5 below demonstrates the rule of thumb for Cronbach’s alpha.

Table 5.5: Rules of thumb for Cronbach's alpha

Cronbach's alpha coefficients	Internal consistency levels
$\alpha \leq 0.9$	Excellent
$0.9 > \alpha \geq 0.8$	Good
$0.8 > \alpha \geq 0.7$	Acceptable
$0.7 > \alpha \geq 0.6$	Questionable
$0.6 > \alpha \geq 0.5$	Poor
$0.5 > \alpha$	Unacceptable

Source: Cronbach (1951)

5.15.4 Model fit analysis

Hooper, Coughlan and Mullen (2008) describe model fit analysis as the analysis performed to determine how much of the covariance between the items would be captured by the hypothesised factor structure. Evaluating the goodness of fit of the proposed model, which reflects how well the model fits the observed data, is a critical step in CFA. Sarmento and Costa (2019) emphasise that the goodness-of-fit model is evaluated via a range of indices that assess the relationship between the observed data and the theoretical data that would be expected from the model (see Table 5.6 below). These indices can be used with hypothesis testing to reject or retain the proposed mode (Frey, 2018).

Table 5.6: Model fit analysis

	Saturated model	Estimated model
SRMR	0.066	0.114
d_ULS	4.151	12.389
d_G	1.050	1.341
Chi-square	2402.523	2855.430
NFI	0.664	0.600

Source: Research Data (2025)

The model fit analysis included standardised root mean square residual (SRMR), Unweighted Least Squares Discrepancy (d_ULS), Geodesic Discrepancy (d_G), Chisquare and Normed Fit Index (NFI). These many indicators offer insight into the model's fit, according to accepted statistical standards.

The SRMR was used to assess the discrepancies between the model's anticipated and observed correlations. According to Shi Lee & Maydeu-Olivares (2019), lower numbers indicate a superior fit, whereas larger values reflect a constrained fit. Research reveals that an SRMR < 0.08 is below the acceptable threshold, indicating a robust fit between the model and the data (Zhang & Wang, 2020).

The study also utilised the geodesic discrepancy to quantify the discrepancy between observed data and model-implied covariance matrices through geodesic distance. Research indicates that lower d_G values signify a better fit (Zhang & Wang, 2020). When the geodesic discrepancy values are interpreted, they should be combined with other fit indices to guarantee a thorough assessment. The Chi square test was used to measure how the null hypothesis that the model fits the data (Kline, 2015). According to Kline (2015), an insignificant Chi-square outcome ($p > 0.05$) indicates an adequate fit.

5.15.5 Confirmatory factor analysis (CFA) model fit indices

There are two types of CFA model fit indices: global fit, which measures the global recovery of empirical observations without considering the mean and covariance structure, and local fit, which measures model components, including but not limited to factor correlations inter-item residual covariance; and suggested model re-specification statistics (Brown, 2015). The global fit model has three categories: absolute, incremental (also known as comparative or relative), and parsimony fit indices (Hooper et al., 2008). Absolute fit indices are generated from a test statistic, and they assess overall fit to the covariance structure of the population. The Chi-square ($\chi 2$) is an example. The Chi-square fit index assesses the fit between the hypothesised model and data from a set of measurement items; its value depends on the sample size, and it is sensitive to sample size, with larger sample sizes decreasing the p value, where there may be only a small misfit (Babyak & Green, 2010).

The research used SEM analysis to report on Chi-squared; other indicators that were used to test the model fit were the goodness-of-fit index (GFI), adjusted GFI, root mean square error of approximation (RMSEA), comparative fit index (CFI) and SRMR (Steiger, 2007).

5.15.6 Path Analysis

The second phase of SEM is path analysis. It is an equation model that is used to examine the direct and indirect effects of variables that are theoretically interrelated; it allows for examination of the causal connections between two or more observed variables (Borens &

Abbot, 2011). Allen (2018) and Valenzuela and Bachmann (2017) define path analysis as a statistical technique for examining and testing relationships among a set of observed variables. It allows researchers to study the direct and indirect effects of multiple independent and dependent variables simultaneously and provides an overall GFI measure for the model. It can also be defined as "an SEM that can be utilised to examine the relationships that occur between the variables that are observed." It can be used to test different types of effects on variables, including direct, indirect and total effects, at the same time. It can also be used to obtain the overall GFI measure of the model. Baron and Kenny (1986) describe the direct effect as the direct effect of an independent variable on a dependent variable and the indirect effect as the influence of an independent variable on a dependent variable through a mediating variable. However, it is necessary to assess the model fit for the structural model and whether the model itself provides a good fit to the data before testing the hypotheses. The results from path analysis typically reveal the significance and magnitude of the connections that have been theorised between independent and dependent variables.

5.16 VALIDATING THE PROPOSED MODEL FOR ENVIRONMENTAL SUSTAINABILITY AND SERVICE PERFORMANCE

To validate the conceptual model, IT and the RBV provided the validation lenses used. One automotive company, from which respondents for the survey have been selected, was also used as the setting for validation of the proposed model in line with the IT and the RBV, with a focus on the predictor variables of environmental sustainability versus the actual data relating to service performance for the last quarter of the 2023 financial year. The choice of only one quarter was to ensure that the data were manageable and could be easily analysed, considering the limited time of the study. The metrics used to validate the model are shown on Table 5.7.

Table 5.7: Metrics used to validate the model

Predictor variables	Positive influence on outcome variable	Validation method

• Government regulations and incentives • Technology adoption • Top management support • Sustainability culture • Environmental CSR • Compliance and certification • Inbound logistics • Outbound logistics	Productivity	• Labour productivity = Total output • Input
	Quality	• The following metrics were used: Error rates • Defect rates • Retention rates
	Innovation	• The following metrics were used: • Revenue growth • Cost reduction • Time to the market
	Customer relationships	• The following metrics were used: • Customer acquisition cost, • Customer retention rate
	Supplier relationships	• The following key performance indicators were used: • Supplier satisfaction • Supplier delivery • Supplier quality • Supplier innovation

Source: Author's own compilation

Notably, owing to the complexity of the service performance variables, different validation methods were used, as indicated in Section 5.16. The next section describes how ethical considerations were addressed.

5.17 ETHICAL CONSIDERATIONS

Research ethics refers to the application of fundamental ethical principles to research activities, including research planning and execution, respect for society and individuals, resource utilisation, research outputs, scientific misconduct, and research regulation (Kumar, 2014). Ethical considerations aim to protect the research population from any unintended consequences that may arise during the research process or through the publication of the research results. When conducting research, all necessary precautions should be taken to ensure that ethical norms are adhered to. Legal codes and ethical principles were followed by obtaining permission from ethical committees at the University of South Africa (UNISA). The three key ethical considerations addressed in this study are: Informed Consent, Privacy and Confidentiality and Protection against harm.

5.17.1 Informed Consent

Informed consent is part of the ethical consideration that requires respondents to have a say in their participation in the study. Respondents must understand the aims of the study and how the research will be conducted, which enables them to participate voluntarily and to sign consent forms with their informed permission before the start of the trial (Dongre & Sankaran, 2016; Purna Singh, Vadakedath & Kandi, 2023). The explanation described the study's goal, how it would benefit the company and its employees, the function of the study, and the involvement of the participant. The respondents were advised that the data would be gathered for research reasons only and that their names would be kept confidential. Furthermore, the respondents were advised that they might withdraw from the research at any moment without penalty.

5.17.2 Privacy and Confidentiality

Individual identities are not linked to data submitted or divulged in confidentiality, whereas anonymity indicates that the participant will stay anonymous until the completion of the research. The privacy of research respondents is safeguarded by two ethical considerations: anonymity and confidentiality (Spaull & Kotze, 2015). This study guaranteed that the information gathered would not be passed on to the next individual in any way. Furthermore, respondents were not required to write their names on the survey questionnaires.

5.17.3 Protection against harm

Protection from harm refers to efforts made to guarantee that respondents are not exposed to situations that cause mental and bodily harm by taking part in the study. Harm is defined as any adverse occurrence that the research respondents are exposed to due to taking part in the study (Cohen et al., 2013; London, 2021). Measures were taken to guarantee that the respondents would not be harmed owing to their participation in the study. These included keeping respondents' identities private and using language that would not insult respondents based on race, gender, ethnicity, socio-economic position, or handicap.

5.17.4 Ethical clearance

Ethical clearance was obtained from the ethics committee at the UNISA Graduate School of Business Leadership before the data were collected. The ethical clearance Number: 2024_SBL_DBL_016_FA_2138 is attached in Appendix 2.

5.18 CONCLUSION

The chapter presented the methodological processes used to investigate the effects of the relationships among environmental sustainability practices, environmental sustainability and service effectiveness and the decisions that will be taken in the study. The research philosophy, research approach and research design were all described, and their use for the quantitative study was justified, as it aimed to investigate and explain the relationships among the research constructs under consideration. The study was correlational and adopted a survey design since it explored the correlational relationship between research variables and used questionnaires as a method of collecting data. This study used a cross-sectional design, as the data were collected over a short period. The chapter outlined the methodological procedures that were followed in the study. These include the research paradigm, research design, research approach, population and sampling, data collection and data analysis. Issues of validity and reliability were discussed, and measures taken were presented. Finally, the study indicated the ethical measures that were taken in the study. The next chapter presents the data analysis of the study, results presentation and interpretation.

CHAPTER 6:
ANALYSIS OF DATA AND RESULTS INTERPRETATION

6.1 INTRODUCTION

The preceding chapter of this quantitative study focused on the research methodologies employed. The chapter delineated the procedures and decisions implemented in this investigation, together with the rationale for these selections. This chapter emphasises the utilisation of a questionnaire as a data collection instrument and the statistical methodologies employed for data analysis, as discussed in the preceding chapter.

This chapter presents data obtained through statistical studies. The quantitative data analysis utilised the statistical software SmartPLS, created by Ringle, Wende, and Becker (2024). In accordance with standard practices in Social Science research, the analysis was performed at a 95% Confidence Interval and a 95% significant level. SmartPLS was employed to analyse the study data, from which the principal findings pertinent to the research topics were extracted. This study employed descriptive analysis, factor analysis, correlation analysis, and regression analysis. The presentation of the results commences with the response rate, followed by descriptive statistics.

6.2 RESULTS OF THE PILOT STUDY

Prior to gathering data for the primary study, a pilot study was carried out to identify any possible limitations or shortcomings in the research tool and data collection procedure (Kunselman, 2024; Leon, Davis & Kraemer, 2011). A pilot study was undertaken to familiarise the study with the methodological techniques outlined in chapter 5. In addition, the pilot test was used to collect preliminary data, evaluate the effectiveness of the questionnaire and make necessary improvements where required. The study population comprised supply chain professionals, waste managers, primary part suppliers, and automotive technicians employed at aftermarket automotive workshops and their supply chain partners in the Provinces of Gauteng, Limpopo, Mpumalanga, and the Free State. The primary study included a sample size of n=392. The pilot research sample size was determined as a proportion of the intended main study sample.

The pilot study included a sample size of 40 respondents. Viechtbauer et al. (2015) assert that a sample size of 30 or more is sufficient for establishing preliminary dependability when a pilot study evaluates the data collection instrument. The pilot test focused on language and syntax, meaning and clarity, and completion duration (Kumar, 2014; Lambert & Newman, 2023). Data were gathered through an online questionnaire, enhancing the study's reach while minimising costs and time. The questionnaire was disseminated via the complimentary edition of Google Forms offered by Google Inc. This study selected it because of its accessibility, usability, and cost-effectiveness (Vasantha Raju & Harinarayana, 2016). Respondents who consented to the pilot project were contacted through email, which included a consent letter and a link to the questionnaire. The pilot study omitted enquiries regarding the demographic information of the respondents. The outcomes are displayed in Table 6.1, below.

Table 6.1: Demographic information of the respondents

Research Construct	Sample number	Mean	Standard deviation	Average Item Total Correlation	Number of Items	Number of Items deleted	Cronbach Alpha
GRI	40	3.82	0.81	0.745	5	0	0.731
TA	40	3.95	0.85	0.752	5	0	0.739
TPS	40	3.88	0.79	0.739	5	0	0.737
ECSR	40	3.60	0.75	0.500	5	0	0.500
CC	40	4.01	0.77	0.755	5	0	0.723
IL	40	3.93	0.76	0.795	5	0	0.794
OL	40	3.89	0.74	0.787	5	0	0.782
ES	40	4.05	0.79	0.790	5	0	0.787
PR	40	3.75	0.72	0.637	4	0	0.731
QL	40	4.02	0.74	0.765	4	0	0.759
IN	40	4.11	0.71	0.925	4	0	0.812
SR	40	3.97	0.78	0.768	4	0	0.748
CR	40	4.09	0.80	0.863	4	0	0.835

GRI = Government regulation and incentives; **TA** = Technology Adoption; **TPS** = Top Management Support; **ECSR** = Environmental Corporate Social Responsibility; **CC** = Compliance and Certification; **IL** = Inbound Logistics; **OL**=Outbound Logistics; **ES** = Environmental sustainability; **PR** = Productivity; **QL** = Quality; **IN** = Innovation; **SR** = Supplier Relationships **CR** = Customer Relationships

Source: Pilot study data

The pilot study data were assessed for the internal consistency of the instrument utilising Cronbach's alpha. Taber (2018) posited that a Cronbach's alpha score of 0.70 or greater is deemed appropriate. In the pilot study, the reliability of all the constructs was assessed via Cronbach's alpha, means, standard deviations, and average item correlations. The statistics demonstrate that multiple constructs exhibited superior internal consistency, with Cronbach's alpha values exceeding ($\alpha > 0.75$). The following metrics are presented: innovation (IN) (α= 0.812), Customer Relationships (CR) (α= 0.835), Environmental Sustainability (ES) (α = 0.787), Outbound Logistics (OL) (α = 0.782), Inbound Logistics (IL) ($\alpha \geqslant 0.794$), and Quality (QL) (α = 0.759). The elevated reliability scores suggest that the items were strongly associated with and effectively measured the ideas as planned by the study.

The data provide satisfactory reliability coefficients for the following constructs: Government Regulation and Incentives (GRI) (α = 0.731), Technology Adoption (TA) (α = 0.739), Top Management Support (TMS) (α = 0.737), Compliance and Certification (CC) (α = 0.723), and Supplier Relationships (SR) (α = 0.748). The constructs with moderate to low values were Productivity (PR) (α = 0.731) and Environmental Corporate Social Responsibility (ESCR) (α = 0.500).

The average item–total correlations for all the constructs fell within the permissible range of 0.3--0.5. Field (2013) asserts that these ranges facilitate internal homogeneity. Innovation (IN) and Customer Relationships (CR) exhibited elevated item–total correlations of 0.925 and 0.863, respectively, indicating exceptional construct validity. The following section addresses the response rate of the main study.

6.3 RESPONSE RATE OF THE MAIN STUDY

In accordance with Opri et al. (2024), the response rate is calculated by dividing the total number of completed questionnaires by the number of invitations sent and then expressing the outcome as a percentage. This metric indicates participant involvement and the potential for bias in the results. A response rate of 70% is generally regarded as favourable for validating the reliability of the data (Ellis et al., 2022). This study's response rate is shown below.

Table 6.2: Response rate

Description	Frequency
Total number of questionnaires distributed	400
Total number of questionnaires returned	394
Total number of questionnaires not returned	6
Unusable responses discarded	2
Valid questionnaires retained	392
Response rate percentage	98

Source: Authors' own compilation

The study used Google Forms, an online tool for data collection. This tool facilitated the dispatch of 400 invitations to respondents. By the conclusion of the designated data collection period, 394 respondents had completed the questionnaire. The response rate (Equation 6.1) was calculated via the following formula.

$$\text{Response Rate} = \left(\frac{\text{Number of Completed Responses}}{\text{Total Number of Invitations Sent}}\right) \times 100$$

$$\text{Response Rate} = \left(\frac{394}{400}\right) \times 100 = 98.5\%$$

Equation 6.1: The calculated response rate
Source: Wu, Zhao & Fils-Aime, (2022)

Six questionnaires were not returned, constituting 1.5% of the total invitations. Only two submissions were considered unusable (0.51%). One questionnaire was incomplete, with more than 50% of the items left unanswered, which could compromise the validity of the responses (Hair et al., 2019), and the second questionnaire exhibited a straight-lining pattern, where the respondent selected the same response option, indicating a lack of attentive engagement with the questionnaire. Consequently, 392 questionnaires were retained, representing 98% of the total invitations. The demographic information of the respondents is presented in the following section.

6.4 ANALYSIS OF DEMOGRAPHIC PROFILES

This section provides an analysis of the respondents' demographic profile. The key aspects addressed are gender, age range, and the province of origin of the respondents. This demographic information is presented in the preceding sub-sections.

6.4.1 Gender Distribution

Below are a brief illustration and discussion of the sample's gender distribution. The respondents were asked to specify their gender. Figure 6.1, below, illustrates the findings.

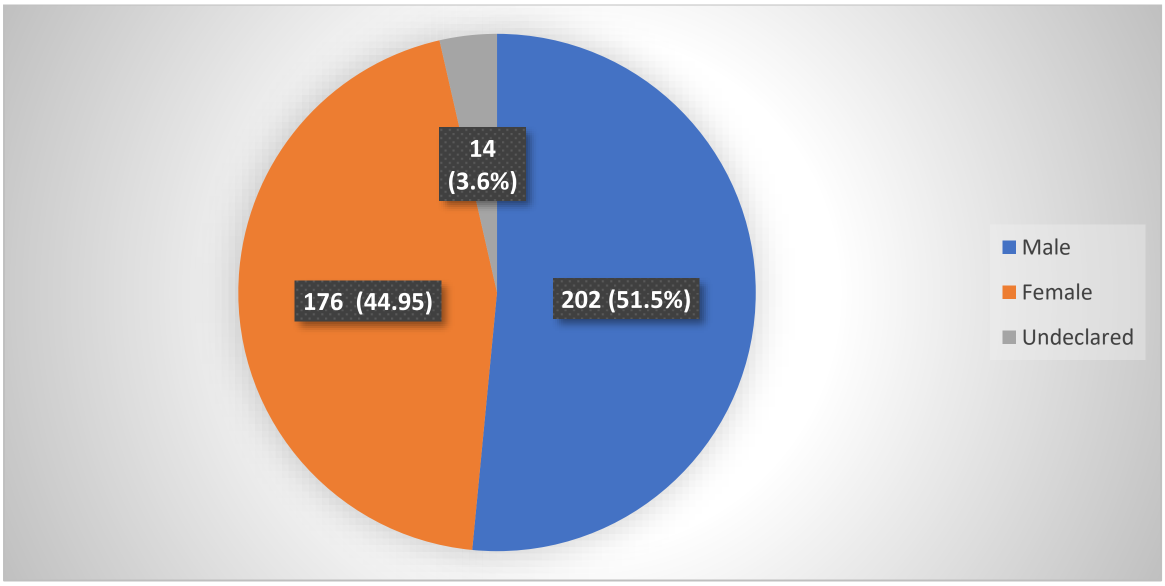

Figure 6.1: Gender distribution of the sample

Source: Authors' own compilation

Male respondents (n=202, or 51.5% of the sample) made up a slightly greater portion of the 392 respondents compared to female respondents (n=176 or 44.9%). This signifies that the predominant number of responses was male. While the gender differences may not be directly related to the results, they suggest a rather balanced sample regarding gender, indicating gender representation within the sample. Furthermore, the results are guaranteed to represent the opinions of the cross section of the automotive repair and maintenance sector with respect to sustainability practices owing to the gender-balanced sample. The subsequent demographic factor is the age of the respondents.

6.4.2 Distribution by age

The respondents were asked to indicate their age ranges on the questionnaire. In Figure 6.2, below, the age distribution of the sample is depicted and briefly discussed.

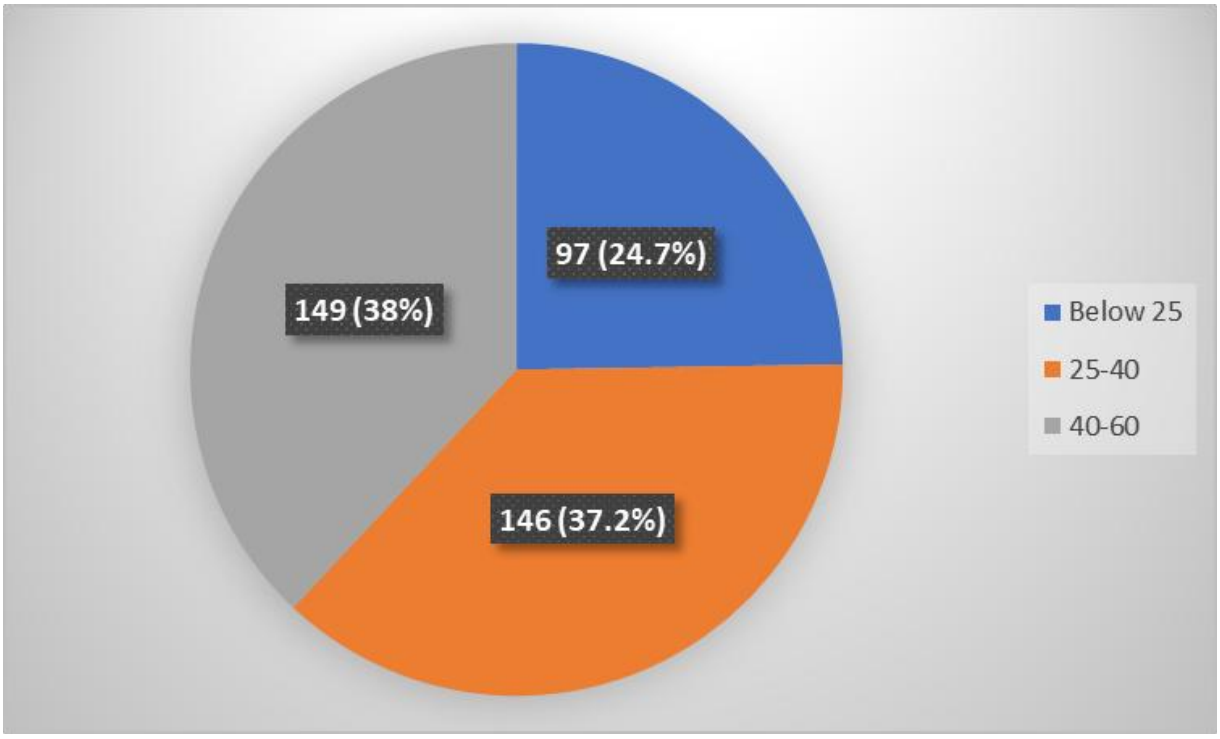

Figure 6.2: Age distribution of the respondents
Source: Authors' own compilation, (2025)

The highest proportion of respondents were 40–60 years of age (n=149, 38%). Individuals aged 25to 40 constituted 146 (37.2%) of the sample, whereas 97 (24.7%) of the respondents were under 25 years of age. This signifies that adults represent the largest proportion of respondents. Age influences respondents' general attitudes about sustainability practices and their connection to service effectiveness. The findings can be attributed to the demographic categories outlined in the study, which serve as a foundation for subsequent research or policy initiatives. The following section outlines the sample distribution by province. As indicated in chapter 5, cluster sampling was used to ensure equal sample representation.

6.4.3 Distribution by province

The respondents were asked to indicate their province. Figure 6.3 below, illustrates the provincial distribution of the sample, followed by a brief discussion. As stated in chapter 5, the respondents were drawn from four provinces: Gauteng, Free State, Limpopo, and Mpumalanga. Figure 6.3, below, shows the respondents' distribution per province.

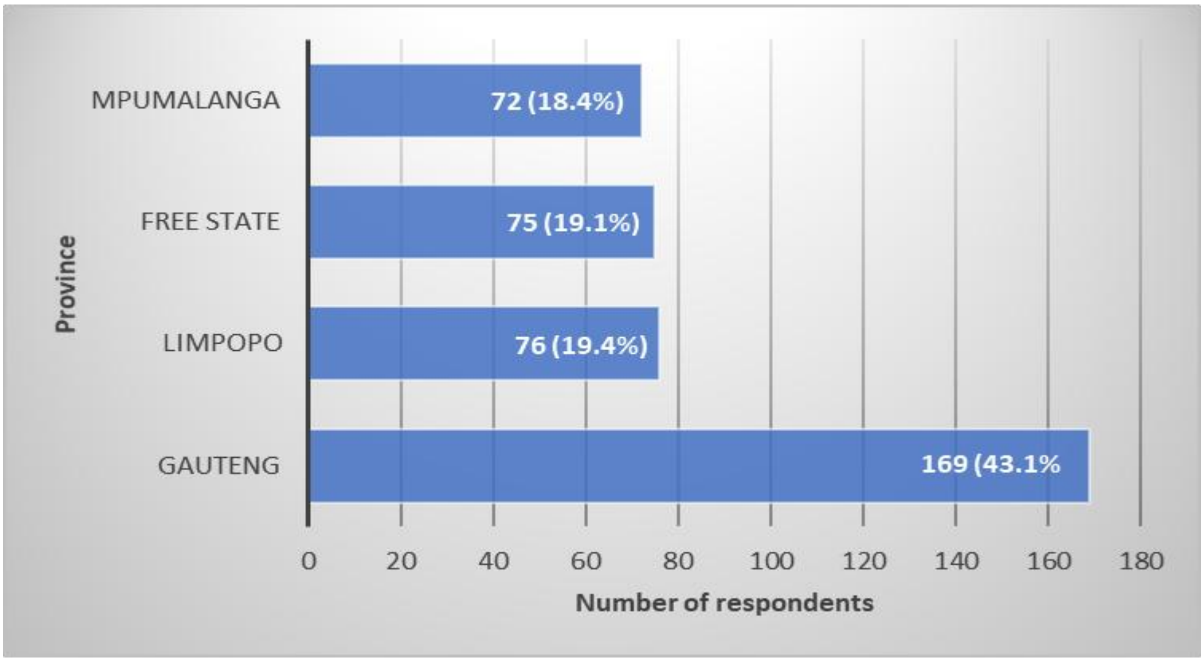

Figure 6.3: Province of respondents

Source: Authors' own compilation (2025)

Gauteng Province had the highest number of responses (n=169, 43.1%), followed by Limpopo Province (n=76, 19.4%). The Free State Province recorded 75 respondents (19.1%), whereas Mpumalanga Province had the lowest number, with 72 respondents (18.4%). The distribution of respondents reveals that Gauteng Province has a greater proportion of automotive players, whereas Mpumalanga Province has the lowest concentration. The descriptive statistics of the research constructs are presented in the following section.

6.5 DESCRIPTIVE STATISTICS OF THE RESEARCH CONSTRUCTS

The aim of the current section is to present the results from the descriptive statistical analysis of the research constructs. This section intends to address the first two secondary objectives, which are restated below:

1. To evaluate the degree of application of environmental sustainability practices within the automotive industry in South Africa.
2. To measure the service effectiveness of the South African automotive industry.

To achieve these objectives, descriptive statistics were employed in the form of mean scores, standard deviations, and minimum and maximum values. The findings are shown in Table 6.3 below.

Table 6.3: Research Constructs

Research Construct	Sample size (N)	No of items	Means	Minimum	Maximum	Standard Deviation	x̄ rank
	Predictor Variables						
GR	392	5	4.410	1	6	1.257	6
TA	392	4	4.592	1	6	1,242	2
TPS	392	3	4.451	1	6	1,216	5
SC	392	4	4.730	1	6	1,104	1
ECSR	392	3	4.484	1.8	6	,9819	4
CC	392	4	4.242	1	5.75	,8800	9
IL	392	4	4.278	1	6	,9343	8
OL	392	5	4.281	2	6	,7497	7
Mediating Variable							
ES	392	5	3.666	1	6	1,038	N/A
Outcome Variable							
PR	392	3	3.844	1	6	1.162	11
QL	392	4	3.831	1	6	1,093	12
IN	392	4	3.619	1	6	1,069	13
SR	392	3	4.512	1.5	6	1,026	3
CR	392	2	4.038	1	6	,9053	10

GR = Government regulation; **TA** = Technology Adoption; **TPS** = Top Management Support; **ECSR** = Environmental Corporate Social Responsibility; **CC** = Compliance and Certification; **IL** = Inbound Logistics; **OL**=Outbound Logistics; **ES** = Environmental sustainability; **PR** = Productivity; **QL** = Quality; **IN** = Innovation; **SR** = Supplier Relationships **CR** = Customer Relationships; SC=Sustainability Culture

Scale:

1= Strongly disagree, 2=Disagree, 3=Slightly disagree, 4= Slightly agree, 5= Agree, 6= Strongly Agree

Source: Research Data (2025)

NB: For constructs measured as averages of multiple items (e.g., CC with 4 items), the maximum observed value may be less than 6.00 if no respondent selected 'Strongly Agree' (6) for all items simultaneously. This does not indicate an error; it reflects the actual response patterns in the data

6.6 RESPONSES TOWARDS ENVIRONMENTAL SUSTAINABILITY PRACTICES

The descriptive statistics of the eight ES practices (GR, TA, TPS, SC, ECSR, CC, IL, and OL) were examined. The next subsections provide the descriptive statistics for these variables, indicating a sample of n=392 respondents.

6.6.1 Government regulation (GR)

The average score for Government Regulation (GR) was 4.410, which indicates a "slightly agree" response. This finding indicates that the items on the GR scale were accepted by the respondents. Businesses in the automotive industry have quality control systems to guarantee adherence to government regulations, have employees trained in environmental sustainability, and are responsive to government regulations regarding sustainable design in product or management systems.

Following GR in the automotive repair and maintenance sector, businesses are willing to adhere to the established standards in their operations and recognise the significance of environmental sustainability in the industry. According to Rubio-Mozos, García-Muiña and Fuentes-Moraleda (2019), this position taken by companies is expected to produce various advantages, including innovation and the implementation of sustainable practices (Wood et al., 2018). Consequently, by complying with GR, the automobile industry in SA is poised to thrive in analogous domains, resulting in advancements in corporate expansion and a competitive edge.

6.6.2 Technology adoption (TA)

With four measurement items, the descriptive statistics for Technology Adoption (TA) indicate a mean score of 4.592, signifying a generally favourable perception, with respondents inclined to agree on the adoption of technology. A standard deviation (SD = 1.242) implies moderate inconsistency in the answers, suggesting that while a significant portion of respondents concur, there are also some differing opinions. With a score of 1 at the lowest and 6 at the highest, opinions vary greatly from "Strongly Disagree" to "Strongly Agree." TA ranks second among the thirteen constructs, highlighting its significant value relative to other aspects. These findings indicate that respondents hold high regard for technology adoption, with an overall positive yet somewhat varied agreement on its relevance. This aligns with the findings of Thiengo, Tavares, and Nobre (2019), who identify four essential roles of technology adoption: decreasing energy consumption, enhancing EE, lowering greenhouse gas emissions, and facilitating carbon offsetting in business operations. Additionally, Kunkel and Matthess (2020) emphasised that digital transformation contributes to waste management, pollution mitigation, and sustainable production practices.

6.6.3 Top Management Support (TPS)

Three measurement items were used to calculate the descriptive statistics for TPS. The average score of 4.451 signifies that the respondents predominantly concurred, indicating a positive perception of senior management's support. The standard deviation (SD = 1.216) indicates moderate answer variability, implying that although numerous people demonstrate agreement, divergent perspectives exist. Responses range from a minimum score of 1 to a maximum score of 6, encompassing the full spectrum from "Strongly Disagree" to "Strongly Agree." The TPS is positioned 5th among the 13 components, indicating its moderate to high importance in the entire assessment. The results indicate that respondents view top management support well, albeit with some diversity in perspectives. Previous research has substantiated the importance of senior management assistance. Chu et al. (2017) underscore the importance of executive endorsement in attaining environmental sustainability. They contend that in the absence of this support, sustainability initiatives may have difficulty progressing.

6.6.4 Sustainability culture (SC)

The descriptive statistics for SC comprised four measurement items. The average score of 4.730 indicates a significant tendency toward agreement, highlighting a very favourable view of sustainability culture. The standard deviation (SD = 1.104) points to relatively lower response variability than other constructs, indicating greater uniformity in respondents' opinions. Responses range from a minimum score of 1 to a maximum score of 6, encompassing the complete scale from "Strongly Disagree" to "Strongly Agree," with a distinct leaning towards higher levels of agreement. Sustainability culture (SC) is ranked first among the 13 constructs, establishing it as the most important variable in this analysis. These findings imply that sustainability culture is regarded as a vital and consistently appreciated element among respondents. This shows that a culture focused on sustainability significantly impacts environmental outcomes.

The findings are in line with those of a study by Coleman and Robinson (2018) that highlighted the critical role that organisational culture plays in encouraging sustainable practices. In a similar vein, Franz (2012) emphasises that integrating sustainability culture into organisational culture is the first step towards integrating it into any business operation.

6.6.5 Environmental Corporate Social Responsibility (ECSR)

The Environmental Corporate Social Responsibility (ECSR) scores give a mean score of (X = 4.484). This indicates a prevalent favourable perception among respondents who generally concurred on the significance of ECSR. The results revealed a standard deviation of (SD = 0.982, indicating rather modest variability. The minimal standard deviation indicates that respondents' opinions were uniform. The minimum score of 1.8 and maximum score of 6 suggest a restricted range of responses relative to other constructs, where most respondents generally agreed or strongly agreed.

The ECSR ranks fourth among the 13 constructs, underscoring its significance in the overall analysis. These results suggest that respondents consider environmental CSR to be an important and consistently valued element. Agus and Salas (2017) argue that companies can enhance their reputation through green initiatives. However, the overall effect on sustainability may be lessened by local conditions, such as how aware consumers are and their willingness to adopt sustainable practices. Chen et al. (2018) noted that public pressure and green technology can drive companies toward more sustainable practices. However, in some areas, particularly in developing countries such as South Africa, there may be less consumer demand for sustainability efforts (Slavic & Berber, 2015).

6.6.6 Compliance and Certification (CC)

According to the CC descriptive statistics, the respondents' average score was 4.242, which suggests a moderate degree of agreement about the importance of compliance and certification. The standard deviation (SD = 0.880) indicates minimal differences in the responses, demonstrating considerable consistency in viewpoints. The scores range from the lowest score of 1 to a maximum of 5.75, indicating a rather narrow distribution, with responses leaning towards agreement. The CC ranks ninth among the 13 constructs, showing that it is less relevant than the other variables in the study.

This study's findings indicate that outbound logistics is a significant indicator of environmental sustainability, as evidenced by a mean agreement score of 4.281 among respondents, demonstrating robust consensus and minimal variability in responses, which ranged from "slightly agree" to "strongly agree," ranking seventh in importance among the 13 constructs in the study.

The results highlight that outbound logistics are generally considered to be significant, as respondents held a predominantly favourable view of the construct. These findings align with those of Škerlič and Muha (2020), who reported that outbound logistics, including the use of returnable transport items (RTIs) such as pallets and crates, contribute to minimising packaging waste and lowering carbon emissions throughout the supply chain. Hyder et al. (2023) emphasised that RTIs enhance product protection and safety while also decreasing overall logistical expenses.

6.6.7 Inbound logistics (IL)

According to the inbound logistics descriptive statistics, most of the respondents received a mean score of 4.278, which indicates a moderate level of agreement. This average score indicates that respondents' opinions of incoming logistics were largely favourable. The results show a standard deviation of (SD = 0.934, indicating variability in the responses. The Likert score ranges from a minimum of 1 to a maximum of 6, reflecting significant variability in responses. Inbound logistics was ranked eighth among the 13 constructs, indicating a lower middle range of relevance. The results indicate that while incoming logistics is regarded as significant, it is deemed less critical than higher-ranking components. Research on inbound logistics by Boysen et al. (2015) and Sun et al. (2014) examines automobile component logistics. The findings indicate that incoming logistics necessitate collaboration among logistics personnel to optimise the supply chain. Similarly, research by Mukherjee et al. (2012) and Ayantoyinbo and Hegelese (2018) demonstrated that efficient capacity planning was crucial in raw material management to optimise resource utilisation while minimising environmental impact.

6.6.8 Outbound logistics (OL)

This study's results indicate that outbound logistics is an essential indicator of environmental sustainability, as evidenced by a mean agreement score of 4.281 among respondents, which reflects a moderate consensus and minimal variability in responses, ranging from "slightly agree" to "strongly agree," ranking seventh in importance among the 13 constructs in the study.

The results indicate that outbound logistics is regarded as important, as respondents had a predominantly favourable assessment of the construct. These findings align with those of Škerlič and Muha (2020), who demonstrated that outbound logistics, including the use of RTIs such as pallets and crates, contribute to the reduction of packaging waste and carbon emissions throughout the supply chain. Hyder et al. (2023) asserted that RTIs improve product protection and safety while also decreasing overall logistical costs.

6.7 ANALYSIS OF DESCRIPTIVE STATISTICS FOR ENVIRONMENTAL SUSTAINABILITY (ES)

The descriptive statistics for ES are presented in the study. The findings indicate moderate agreement among the respondents. This suggests that the respondents place a moderate emphasis on the significance of environmental sustainability. The findings revealed a standard deviation of (SD = 1.038), indicating a modest degree of variability in the responses. The results revealed a minimum score of 1 and a maximum score of 6, indicating that the responses ranged from "strongly disagree" to "strongly agree." The results indicate that while environmental sustainability is significant, not all respondents prioritised it highly. These findings correspond with a study by Perramon et al. (2022), which demonstrated that ESPs significantly influence consumer perceptions of a firm's performance and their inclinations to interact with that organisation. A study by Nair and Choudhary (2016) revealed that sustainability practices foster positive emotions and attitudes, hence improving customer evaluations of products and services.

6.8 ANALYSIS OF DESCRIPTIVE STATISTICS FOR SERVICE EFFECTIVENESS (SE) PRACTICES

The five SE practices, productivity, quality, innovation, supplier relationships, and customer relationships were examined via descriptive statistics. The results for these variables are presented in the following subsections.

6.8.1 Productivity

Productivity is a crucial metric for assessing how well services are performing. The findings show an average score of 3.844, indicating that respondents generally have slight agreement with statements pertaining to productivity, reflecting a moderately favourable perception. The standard deviation (SD = 1.162) indicates significant variability in the responses, suggesting that individuals' views on productivity differ significantly. Responses range from a minimum score of 1 to a maximum score of 6, encompassing the full spectrum from "strongly disagree" to "strongly agree." Productivity (PR) is ranked 11th out of 13 constructs, indicating a lower level of significance in the overall assessment.

Productivity holds significance in the automotive repair and maintenance sector, as it directly affects operational efficiency, cost control, and overall competitiveness. A key element influencing productivity in this industry is the enhancement of SCM (Ramírez-Peña et al., 2020). In the automotive industry, where quality and accuracy are key, human factors play a critical role in productivity through expertise that provides precision in machining operations (Bícová & Melichar, 2016). Management of the assembly line, which encompasses a major part of manufacturing responsibilities, is also vital for reducing costs and enhancing efficiency (Ju & Pan, 2016). Therefore, productivity in the automotive repair and maintenance sector is crucial. Consequently, successful environmental sustainability practices contribute positively to productivity.

6.8.2 Quality

The second outcome variable examined in the study is quality. A measurement item that covers four aspects yields an average score of 3.831. This suggests that respondents generally show slight agreement with statements concerning quality, demonstrating a moderately positive perception. The standard deviation (SD = 1.093) reveals moderate variance in the responses, suggesting some differences in the respondents' assessments of quality significance. Quality (QL) is ranked 12th among the 13 characteristics, indicating its relatively low significance. The study concludes that while quality is acknowledged as significant, its value is less than that of other constructs. The results concur with those of a study by Rajper and Albrecht (2020), which revealed that product quality greatly impacts consumer purchasing intentions.

6.8.3 Innovation

The descriptive statistics for the innovation construct indicated a mean score of 3.619. This score suggests that respondents' opinions regarding the contribution of IN to ES were somewhat in accord. The results indicate a standard deviation of (SD = 1.069), underscoring the diverse responses of the respondents concerning the importance of innovation in environmental sustainability. The study concludes that although innovation is acknowledged, it is not esteemed beyond other structures. The findings parallel those of the study conducted by Berkeley et al. (2018), which determined that innovation pertaining to environmental sustainability can be interpreted as modifications in behaviours and attitudes that may promote new collaborations linked to environmental sustainability. This study concurs with prior findings that sustainability programs can influence innovation by modifying stakeholders' viewpoints (Behnam et al., 2018).

6.8.4 Supplier Relationships (SR)

The study analysed descriptive statistics for the Supplier Relationships construct. The construct serves as an outcome variable in this study and comprises three measuring items. The results show a mean score of 4.512, suggesting that respondents' perceptions of the importance of SR in affecting ES are generally positive. The findings showed that the responses varied moderately, with a standard deviation of (SD = 1.026). The scores ranged from a minimum of 1.5 to a maximum of 6, demonstrating that the responses varied from "strongly disagree" to "strongly agree," with a tendency towards the higher end of the scale.

The SR is positioned 3rd out of 13 constructs, placing it among the most important factors in the overall evaluation. These results suggest that respondents highly value supplier relationships, with a relatively strong consensus on their importance. Adesanya et al. (2016) and Yu et al. (2022) explain that suppliers significantly affect vital performance measures such as service quality, responsiveness, cost efficiency, sales growth, and adaptability. Hudnurkar et al. (2014) estimate that approximately 60% of components and services in the automotive repair and maintenance sector come from suppliers, underscoring their essential role in the supply chain. The success and long-term sustainability of a company are largely dependent on these ties.

6.8.5 Customer relationships (CR)

Customer relationships (CR) serve as the ultimate outcome variable and comprise two measurement items. With an average score of 4.038, respondents show a moderate degree of agreement and a generally positive perception of CR. The standard deviation (SD = 0.9053) indicates minimal variety in the responses, implying greater uniformity in the respondents' perspectives. Customer relationships (CR) rank 10th among the 13 characteristics, suggesting that while they are important, perceptions of their significance vary. Jassim et al. (2020) emphasise that a corporation cannot achieve complete sustainability without its suppliers implementing sustainability policies. In the automobile industry, Ambe and Badenhorst-Wess (2013) and Brandes et al. (2013) demonstrate that manufacturers and component suppliers frequently favour the formation of strategic alliances with companies that endorse ESPs.

6.9 NORMALITY OF DATA

The normality of data denotes the degree to which a dataset adheres to a normal distribution (Masum et al., 2018). A dataset that satisfies normalcy criteria is considered valid and dependable (Cain, Zhang & Yuan, 2017). Normality is evaluated via the measurement of skewness and kurtosis. The appropriate skewness range is between -2 and +2, whereas kurtosis should fall between -3 and +3 to indicate a somewhat normal distribution; values outside these ranges may indicate potential problems with data skewness or large tails in the distribution (Qu, Liu & Zhang, 2019). Adcock et al. (2015) contend that excess kurtosis quantifies the extent to which data diverge from a normal distribution (where excess kurtosis = 0). Skewness and kurtosis provide insights into the data, assisting the study in deciding whether to employ parametric or non-parametric testing. Qu et al. (2019) contend that in SEM, researchers adhere to more stringent rules. Consequently, the skewness values should fall between -3 and +3. The values of -2 and +2 are acceptable. Exceeding the specified limits may indicate significant normalcy, which impacts the results of the parametric tests. Skewness and kurtosis are essential for evaluating normality, as they indicate deviations from the conventional bell-shaped curve characteristic of a normal distribution (Staden & King, 2016). Adcock et al. (2015) assert that substantial sample sizes, exceeding 200, can mitigate the impact of fluctuations in skewness and kurtosis. Through the examination of skewness and kurtosis, researchers can validate the reliability of their findings and make informed decisions regarding the most suitable statistical approaches (Cain et al., 2017). The skewness and kurtosis results are shown in Table 6.4 below.

Table 6.4: Skewness and kurtosis of the research constructs

Research Construct	Mean	Median	Observed min	Observed max	Standard deviation	Excess kurtosis	Skewness	N statistic
CC	0.000	0.244	-3.694	1.677	1.000	0.996	-1.007	392
CR	0.000	-0.048	-2.980	1.906	1.000	-0.010	-0.561	392
ECSR	0.000	0.173	-3.528	1.441	1.000	0.345	-0.699	392
ES	0.000	0.124	-2.576	2.253	1.000	-0.139	-0.223	392
IL	0.000	0.172	-3.511	1.850	1.000	1.142	-0.897	392
IN	0.000	0.337	-2.459	2.232	1.000	-0.119	-0.527	392
PR	0.000	0.166	-2.842	2.171	1.000	-0.228	-0.339	392
QL	0.000	0.159	-2.580	1.985	1.000	-0.085	-0.416	392
SC	0.000	0.219	-3.377	1.119	1.000	-0.049	-0.712	392
SR	0.000	0.118	-3.414	1.320	1.000	-0.240	-0.580	392
TA	0.000	0.130	-2.874	1.119	1.000	-0.478	-0.578	392
TPS	0.000	0.026	-2.644	1.262	1.000	-0.663	-0.448	392
GRI = Government regulation and incentives; **TA** = Technology Adoption; **TPS** = Top Management Support; **ECSR** = Environmental Corporate Social Responsibility; **CC** = Compliance and Certification; **IL** = Inbound Logistics; **OL**=Outbound Logistics; **ES** = Environmental sustainability; **PR** = Productivity; **QL** = Quality; **IN** = Innovation; **SR** = Supplier Relationships **CR** = Customer Relationships								

Source: Smart PLS (2025)

The use of parametric statistical techniques is supported by the skewness and kurtosis metrics for the research variables, which show that the data are predominantly normally distributed. Most variables, including CR (−0.561 skewness, −0.010 kurtosis), ES (−0.223 skewness, −0.139 kurtosis), and PR (−0.339 skewness, −0.228 kurtosis), exhibit skewness and kurtosis values that are within the ideal range (between −1 and +1), indicating symmetrical distributions with minimal deviation from normality. A few variables, including CC (−1.007 skewness, 0.996 kurtosis) and IL (−0.897 skewness, 1.142 kurtosis), display slightly elevated skewness and kurtosis but remain within permissible boundaries (skewness between −2 and +2; kurtosis between −7 and +7). These small deviations are unlikely to create significant concerns, especially considering the large sample size (n = 392), which helps lessen the impact of non-normality considering the central limit theorem. In summary, the data are appropriate for parametric analyses, although variables with moderate skewness or kurtosis might benefit from robust techniques or data transformations to better align with normality assumptions. This finding is consistent with recommendations from Cain et al. (2016), which highlight that skewness and kurtosis values within these ranges are typically acceptable for most statistical applications.

6.10 SCALE ACCURACY ANALYSIS

This section presents the scale accuracy analysis, which is crucial in determining the drivers of environmental sustainability and examining the relationship between environmental sustainability practices and service effectiveness. The partial least squares (PLS) technique in SEM was used to evaluate the hypotheses and analyse the accuracy of the measurement scales. In the scale purification process, two of the research constructs were discarded. The first is a construct Government Regulations (GR), which was discarded because it had only one item, GR1, with an outer loading of 0.885. All the other four items had very low outer loadings. Similarly, construct OL (Outbound Logistics) was discarded because only item OL3 had an outer loading of 0.721, whereas the majority of the four items had very low loadings. Government Regulation (GR) was removed because the poor performance of the Government Regulation construct suggests that regulatory pressure is not perceived by automotive workshop managers as a coherent, impactful driver of environmental sustainability.

Outbound Logistics (OL) was removed because the poor performance of the Outbound Logistics construct suggests that outbound logistics is not a distinguishable practice within automotive repair and maintenance workshops. In the South African aftermarket context, most workshops outsource delivery functions such as parts delivery to customers to third-party logistics providers rather than managing these activities in-house.

In addition, in the initial tests for internal consistency via SPSS (version 28.0), four items were discarded from four of the scales because they lowered the scale reliability, as measured by the Cronbach alpha coefficient. These removed items are indicated below:

- TA1 was discarded to improve the TA scale's Cronbach alpha reliability value to 0.834
- SC1 was discarded to improve the SC scale's Cronbach alpha reliability value to 0.827
- CC1 was discarded to improve the scale's Cronbach alpha reliability value to 0.731
- IL1 was discarded to improve the scale's Cronbach alpha reliability value to 0.720.

Table 6.5 below shows the accuracy analysis results.

Table 6.5: Statistical analysis of accuracy

Research Construct		**Cronbach's test**		**Rho A**	**CR**	**AVE**	$\sqrt{\mathbf{AVE}}$	**Outer loadings**
		Item-total	α					
TA	TA1	0.312	0,835	0,863	0,888	0,666	0,816	0,765
	TA2	0.584						0,767
	TA3	0.641.						0,865
	TA4	0.656						0,861
TPS	TPS1	0.590	0.736	1.000	0.832	0.626	0.791	0.721
	TPS2	0.694						0.929
	TPS3	0.653						0.704
SC	SC1	0.572	0.812	0.925	0.871	0.629	0.793	0.746
	SC2	0.624						0.773
	SC3	0.632						0.766
	SC4	0.650						0.881
ECSR	ECSR3	0.462	0.723	0.755	0.842	0.641	0.801	0.859
	ECSR4	0.617						0.796
	ECSR5	0.578						0.742
CC	CC1	0.222	0.737	0.739	0.835	0.558	0.747	0.747
	CC2	0.502						0.775
	CC3	0.202						0.729
	CC4	0.518						0.737
IL	IL1	0.254	0.782	0.787	0.859	0.603	0.777	0.788
	IL2	0.573						0.757
	IL3	0.540						0.800
	IL4	0.607						0.761
ES	ES1	0.583	0.794	0.795	0.859	0.549	0.741	0.736
	ES2	0,586						0.743
	ES3	0.510						0.694
	ES4	0.635						0.790
	ES5	0.564						0.739
PR	PR1	0.459	0.631	0.637	0.802	0.576	0.759	0.794
	PR2	0.482						0.774
	PR3	0.497						0.705

QL	QL1	0.584	0.759	0.765	0.847	0.580	0.762	0.783
	QL2	0.540						0.718
	QL3	0.599						0.801
	QL4	0.505						0.742
IN	IN1	0.551	0.787	0.790	0.862	0.610	0.781	0.751
	IN2	0.617						0.809
	IN3	0.623						0.787
	IN4	0.585						0.773
SR	SR2	0.643	0.748	0.768	0.856	0.665	0.815	0.843
	SR3	0.625						0.862
	SR4	0.516						0.735
CR	CR2	0.536	0.500	0.500	0.800	0.667	0.816	0.824
	CR3	0.596						0.809

GRI = Government regulation and incentives; **TA** = Technology Adoption; **TPS** = Top Management Support; **ECSR** = Environmental Corporate Social Responsibility; **CC** = Compliance and Certification; **IL** = Inbound Logistics; **OL**=Outbound Logistics; **ES** = Environmental sustainability; **PR** = Productivity; **QL** = Quality; **IN** = Innovation; **SR** = Supplier Relationships **CR** = Customer Relationships

Source: Research data (2025)

6.10.1 Scale Internal Consistency

Internal consistency, indicating how well test or measurement tool items agree or are reliable as per Barchard (2010), was used to test reliability. It assesses whether the same construct or idea is consistently measured by each test item.

The results of Cronbach's alpha (α), composite reliability (CR), and AVE show a high degree of validity and reliability for the research constructs in the statistical examination of accuracy. Cronbach’s alpha scores range from 0.631 (PR) to 0.863 (TA), indicating strong to excellent internal consistency for most constructs, except for CR (0.500), which falls below the acceptable threshold of 0.7. The CR values, ranging from 0.800 (CR) to 0.888 (TA), further validate the construct reliability, since all values exceed the required threshold of 0.7. The AVE values, ranging from 0.549 (ES) to 0.666 (TA), either satisfy or surpass the minimum threshold of 0.5 for most constructs, thus affirming convergent validity. Typically, outer loadings for individual items exceed 0.7; nevertheless, certain instances (e.g., CC1, CC3, and IL1) warrant more scrutiny to confirm accurate measurement.

The results show RHO A values ranging from 0.500 (CR) to 1.000 (TPS). These results indicate that the constructs achieved reliability, with the majority surpassing 0.7. The low Rho A value of 0.637 and a Cronbach Alpha value of 0.631 suggest issues with internal consistency. This underscores the necessity for additional investigation into the enhancement of measuring items. Hamed (2016) posited that coefficients exceeding 0.6 are deemed acceptable for reliability. This study determined that the constructs exhibited robust reliability and validity since most of the measurements fell inside the suggested thresholds (Masum et al., 2018). The findings highlight the necessity for further statistical analysis, concentrating on lower reliability criteria such as CR.

6.10.2 Item–total correlations

The results show a total item correlation, which illustrates the relationship between an item's score and the test's or scale's overall score. The function of correlation is to assist in assessing the uniformity of items, ensuring that they consistently evaluate the underlying concept (Marianti et al., 2023). Karakaya and Kiliç (2021) assert that the magnitude of the correlation coefficient indicates the items' discriminatory power. Higher values suggest that the item substantially contributes to measuring the construct, whereas lower values imply that the construct is negligible (Karakaya & Kiliç, 2021). The findings reveal correlation values less than 0.3, deemed inconsequential, and values greater than 0.3 are regarded as significant and acceptable (Jansen et al., 2021).

The item–total correlations for the constructs in this study are presented in Table 6.5 above and demonstrate a satisfactory relationship between the items and their respective dimensions. The item–total correlation coefficients varied from 0.202 to 0.865, with most items above the 0.3 threshold, indicating adequate internal consistency. For example, the TA construct exhibited strong correlations for TA2 (0.584), TA3 (0.641), and TA4 (0.656), whereas TA1 (0.312) had a weaker correlation, implying that it may not be as well aligned with the overall construct. Similarly, the CC construct showed weak correlations for CC1 (0.222) and CC3 (0.202), suggesting that these items might require revision or removal to enhance the scale's reliability. In contrast, constructs like TPS and SC demonstrated consistently elevated item–total correlations, which varied from 0.572 to 0.694, indicating robust internal consistency.

The ECSR construct presented moderate to strong correlations, with ECSR4 (0.617) and ECSR5 (0.578) performing well, whereas ECSR3 (0.462) had a somewhat lower correlation. Although ECSR3 exceeds the 0.3 threshold, its moderate correlation indicates that it could be refined for better alignment with the construct. Similarly, the IL construct showed good correlations for IL2 (0.573), IL3 (0.540), and IL4 (0.607), but IL1 (0.254) revealed a weak correlation, suggesting that it may not contribute effectively to measuring the construct.

The results suggest that most items across the constructs have satisfactory item–total correlations above the 0.3 threshold. However, certain items, such as TA1, CC1, CC3, and IL1, demonstrated correlations below 0.3, indicating that they may not be evaluating the same underlying concept as the other items within the categories to which they belong. These items should be reviewed or revised to improve the scales' internal reliability. Hair et al. (2019) emphasised the significance of item–total correlations in ensuring the homogeneity and reliability of measurements.

6.11 VALIDITY

Validity refers to how closely a measure seems to be connected to a particular construct, as assessed by individuals who are not experts, such as test respondents and members of the legal system (Engellant, Holland & Piper, 2016). This section presents a discussion of the two main forms of validity ascertained in the study. These are convergent and discriminant validities.

6.11.1 Convergent validity

Convergent validity, according to Sharma and Sharma (2023), is the degree to which concepts that are conceptually connected correlate in real-world situations. Convergent validity guarantees a significant correlation between a construct's indicators. To assess convergent validity for this study, two main metrics were considered: factor outer loadings and AVE. Al-Marsomi and Al-Zwainy (2023) assert that outer loadings and the AVE factor must exceed 0.50.

Table 6.6: Construct reliability and validity

Research Construct	Cronbach's alpha	Composite reliability (Rho A)	Composite reliability (Rho C)	Average variance extracted (AVE)
CC	0.737	0.739	0.835	0.558
CR	0.500	0.500	0.800	0.667
ECSR	0.723	0.755	0.842	0.641
ES	0.794	0.795	0.859	0.549
IL	0.782	0.787	0.859	0.603
IN	0.787	0.790	0.862	0.610
PR	0.631	0.637	0.802	0.576
QL	0.759	0.765	0.847	0.580
SC	0.812	0.925	0.871	0.629
SR	0.748	0.768	0.856	0.665
TA	0.835	0.863	0.888	0.666

TPS	0.736	1.041	0.832	0.626
GRI = Government regulation and incentives; **TA** = Technology Adoption; **TPS** = Top Management Support; **ECSR** = Environmental Corporate Social Responsibility; **CC** = Compliance and Certification; **IL** = Inbound Logistics; **OL**=Outbound Logistics; **ES** = Environmental sustainability; **PR** = Productivity; **QL** = Quality; **IN** = Innovation; **SR** = Supplier Relationships **CR** = Customer Relationships				

Source: Research data (2025)

The findings shown in Table 6.6 above demonstrate the convergent validity of the constructs. The results indicate an AVE of 0.629 for cultural sustainability and 0.793 for TA. These results indicate that the measurement items effectively converged with their respective conceptions. All the constructs presented an average value of 0.50, which was sufficient to satisfy the criteria for convergent validity.

6.11.2 Discriminant Validity

According to Shin (2017), discriminant validity is crucial, as it confirms that constructs are separate and represent unique concepts. Table 6.7 below presents discriminant validity via the Fornell–Larcker criterion, which measures the significance of the Hetero-Monotrait (HTMT) Ratio.

The Fornell-Larcker criterion, which was created by Fornell and Larcker in 1981, is currently used to evaluate discriminant validity. The criterion states that each construct's AVE is greater than the correlations between it and every other construct. This ensures that, in comparison with the other constructs, each construct explains a greater amount of variance with its indicators. The discriminant validity analysis results are presented in Table 6.7 below.

Table 6.7: Analysis of discriminant validity: Fornell-Larcker criterion

	CC	CR	ECSR	ES	IL	IN	PR	QL	SC	SR	TA	TPS
CC	**0.747**											
CR	0.366	**0.816**										
ECSR	0.236	0.114	**0.801**									
ES	0.226	0.317	0.061	**0.741**								
IL	0.353	0.402	0.096	0.286	**0.777**							
IN	0.208	0.342	0.047	0.442	0.194	**0.781**						
PR	0.313	0.323	0.135	0.461	0.393	0.313	**0.759**					

QL	0.330	0.341	0.004	0.593	0.398	0.425	0.475	**0.762**				
SC	0.212	0.138	0.415	0.049	0.127	0.056	0.167	0.071	**0.793**			
SR	0.334	0.170	0.615	0.076	0.084	0.039	0.177	0.051	0.486	**0.815**		
TA	0.240	0.151	0.385	0.056	0.092	0.068	0.147	0.051	0.708	0.534	**0.816**	
TPS	0.167	0.133	0.338	0.074	0.079	0.120	0.140	0.023	0.616	0.440	0.720	**0.791**

GRI = Government regulation and incentives; **TA** = Technology Adoption; **TPS** = Top Management Support; **ECSR** = Environmental Corporate Social Responsibility; **CC** = Compliance and Certification; **IL** = Inbound Logistics; **OL**=Outbound Logistics; **ES** = Environmental sustainability; **PR** = Productivity; **QL** = Quality; **IN** = Innovation; **SR** = Supplier Relationships **CR** = Customer Relationships

Source: Research data (2025)

Table 6.7 above displays the correlations among the constructs. The results indicate that the constructs varied from 0.088 between SC and ES to 0.858 between SC and TA. In accordance with the guidelines of Hair et al. (2019), discriminant validity is established if the AVE for SC is 0.793. The correlations between SC and the other research constructs range from 0.049--0.415, which is lower than 0.793. These results correspond with the findings of Hair et al. (2019), which suggest that elevated correlations among constructs may diminish their clarity.

The HTMT ratio was used to ascertain discriminant validity. The HTMT compares the average correlations between various constructs to demonstrate discriminant validity. This is corroborated by Henseler et al. (2015), who show that acceptable discriminant validity is indicated by an HTMT value less than 0.85, as per the results in Table 6.8 below.

	CC	**CR**	**ECSR**	**ES**	**IL**	**IN**	**PR**	**QL**	**SC**	**SR**	**TA**
CC											
CR	0.604										
ECSR	0.318	0.212									
ES	0.292	0.502	0.096								
IL	0.463	0.643	0.145	0.360							
IN	0.268	0.548	0.099	0.553	0.252						
PR	0.462	0.582	0.198	0.650	0.560	0.441					
QL	0.459	0.563	0.170	0.758	0.523	0.541	0.688				
SC	0.261	0.226	0.546	0.088	0.138	0.131	0.227	0.179			
SR	0.457	0.289	0.833	0.114	0.116	0.103	0.264	0.209	0.608		
TA	0.308	0.243	0.496	0.102	0.111	0.120	0.211	0.191	0.858	0.664	

TPS	0.248	0.253	0.499	0.100	0.099	0.120	0.202	0.184	0.859	0.644	0.983
GRI = Government regulation and incentives; **TA** = Technology Adoption; **TPS** = Top Management Support; **ECSR** = Environmental Corporate Social Responsibility; **CC** = Compliance and Certification; **IL** = Inbound Logistics; **OL**=Outbound Logistics; **ES** = Environmental sustainability; **PR** = Productivity; **QL** = Quality; **IN** = Innovation; **SR** = Supplier Relationships **CR** = Customer Relationships											

Table 6.8: Heterotrait-Monotrait ratio analysis

Source: Research data (2025)

The results in Table 6.8 above demonstrate that most of the constructs presented HTMT values below the acceptable level. The HTMT value for sustainability culture and environmental corporate social responsibility was 0.546, whereas the HTMT value for technology adoption and environmental corporate social responsibility was 0.496. Furthermore, the results revealed that productivity and quality had an HR=TMT value of 0.688. The provided values substantiate discriminant validity. Conversely, the use of technology and support from top management yielded an HTMT value of 0.983, above the barrier. This signifies the absence of a link between these constructs (Henseler et al., 2015).

6.12 COLLINEARITY STATISTICS

This section presents the collinearity assessment, which ensures that the structural model can reliably determine the drivers of environmental sustainability in the South African automotive industry and the relationship between environmental sustainability practices and service effectiveness. Multicollinearity is a significant concern in SEM that can compromise the results of both the measurement (outer) and structural (inner) models. It arises when indicators or constructs exhibit strong correlations, resulting in inflated standard errors, diminished statistical significance, and unreliable estimates. The Variance Inflation Factor (VIF) is typically employed to evaluate multicollinearity, with a VIF threshold of less than 5 generally viewed as acceptable (Hair et al., 2019). Nonetheless, a more conservative threshold of VIF < 3 is frequently advised to guarantee robust results (Kock, 2015). This analysis evaluates multicollinearity in the inner and outer models via the provided VIF values and provides recommendations for resolving any possible problems. Below, Table 6.9 presents the outer model list.

Table 6.9: Outer model

Construct	Indicator	VIF
Technology Adoption (TA)	TA1	1.534
	TA2	1.774

Construct	Indicator	VIF
	TA3	2.002
	TA4	2.142
Sustainability Culture (SC)	SC1	1.590
	SC2	1.622
	SC3	1.750
	SC4	1.711
Environmental Sustainability (ES)	ES1	1.566
	ES2	1.559
	ES3	1.397
	ES4	1.698
	ES5	1.473
Innovation (IN)	IN1	1.448
	IN2	1.642
	IN3	1.683
	IN4	1.534
Inbound Logistics (IL)	IL1	1.474
	IL2	1.486
	IL3	1.626
	IL4	1.553
Quality (QL)	QL1	1.568
	QL2	1.469
	QL3	1.576
	QL4	1.385
Compliance & Certification (CC)	CC1	1.330
	CC2	1.478
	CC3	1.406
	CC4	1.454
Supplier Relationships (SR)	SR2	1.566
	SR3	1.709
	SR4	1.368
Top Management Support (TPS)	TPS1	1.379
	TPS3	1.511
	TPS5	1.510
Productivity (PR)	PR1	1.282
	PR2	1.284
	PR3	1.185
Customer Relationships (CR)	CR2	1.125
	CR3	1.125
Environmental CSR (ECSR)	ECSR3	1.481
	ECSR4	1.517
	ECSR5	1.324

Source: Research data (2025)

Multicollinearity among the indicators of each latent construct was tested by calculating the VIF in the measurement model. High multicollinearity between indicators within a construct may result in unstable measurement and estimates of the model. As can be seen from the following table, all of the indicator VIF values are far below the conservative threshold of 3, with the largest one being 2.142 for TA4. There is therefore no evidence of harmful multicollinearity within the measurement model, given that all constructs exhibit good internal consistency and are devoid of problematic redundancy among their individual indicators (Hair et al., 2022).

The multicollinearity between the latent constructs in the structural model is investigated via the inner model. Significant multicollinearity between predictor constructs may increase standard errors, diminish the statistical significance of path coefficients, and produce unreliable outcomes. Table 6.10 below, displays the inner model.

Table 6.10: Inner model

	VIF
CC -> ES	1.230
ECSR -> ES	1.265
ES -> CR	1.000
ES -> IN	1.000
ES -> PR	1.000
ES -> QL	1.000
ES -> SR	1.000
IL -> ES	1.149
SC -> ES	2.208
TA -> ES	2.774
TPS -> ES	2.187
GRI = Government regulation and incentives; **TA** = Technology Adoption; **TPS** = Top Management Support; **ECSR** = Environmental Corporate Social Responsibility; **CC** = Compliance and Certification; **IL** = Inbound Logistics; **OL**=Outbound Logistics; **ES** = Environmental sustainability; **PR** = Productivity; **QL** = Quality; **IN** = Innovation; **SR** = Supplier Relationships **CR** = Customer Relationships	

Source: Research data (2025)

This analysis reveals that most constructs in the inner model have VIF values below 3, indicating no major multicollinearity concerns. For instance, the relationships between CC and ES (1.230), ECSR and ES (1.265), and IL and ES (1.149) are all within acceptable limits.

However, some constructs display higher VIF values, approaching or exceeding the conservative threshold of 3. Specifically, SC and ES (2.208), TA and ES (2.774), and TPS and ES (2.187) suggest potential multicollinearity issues. These findings align with Kock (2015), who reported that a VIF larger than 3 may indicate multicollinearity. Therefore, the VIF values for SC, TA and TMP significantly overlap, potentially limiting the reliability of the structural model.

6.13 MODEL FIT ANALYSIS

This section presents the model fit analysis, which assesses whether the measurement and structural models are adequate for determining the drivers of environmental sustainability (Objective 3) and examining the relationship between environmental sustainability practices and service effectiveness (Objective 4). According to Kenny & Judd (2014), the analysis is a crucial statistical element in structural equation SEM. The purpose of a model fit analysis is to assess the extent to which the specified model accurately represents the data. Table 6.11, below, presents the model fit analysis.

Table 6.11: Model fit analysis

	Saturated model	Estimated model
SRMR	0.066	0.114
d_ULS	4.151	12.389
d_G	1.050	1.341
Chi-square	2402.523	2855.430
NFI	0.664	0.600

Source: Research data (2025)

According to Goretzko, Siemund and Sterner (2024), evaluating the model fit is crucial to determining the reliability and validity of a structural equation model. Conducting a model fit analysis entails evaluating multiple fit indices to assess the correspondence between the proposed model and the observed data (Goretzo et al., 2024). Table 6.11 presents the fit indices: The SRMR, d_ULS, d_G, Chi-square, and NFI. These many indicators offer insight into the model's fit, according to accepted statistical standards.

6.13.1 Standardised root mean square residual (SRMR)

According to Shi et al. (2018), the SRMR assesses the discrepancies between the model's anticipated and observed correlations. Lower numbers indicate a superior fit, whereas larger values reflect a constrained fit. Research reveals that an SRMR < 0.08 is below the acceptable threshold, indicating a robust fit between the model and the data (Goretzo et al., 2024). The study determined that the model accurately reflects the correlations between the constructs, as reflected by the negligible discrepancies between the observed and anticipated correlations. Kline (2015) highlights that Unweighted Least Squares Discrepancy (d_ULS) denotes a metric of discrepancy utilised to evaluate model fit through weighted least squares estimation. Lower d_ULS values generally signify a superior fit, whereas larger d_ULS values imply a poorer fit (Kline, 2015).

The d_ULS value was 4.151, which is near the lower threshold, suggesting that the model corresponds well with the data. The results correspond with Kline's (2015) proposal that different metrics for model fit should be utilised to assess model performance.

6.13.2 Unweighted Least Squares Discrepancy (d_ULS)

The role of geodesic discrepancy is to quantify the discrepancy between observed data and model-implied covariance matrices through geodesic distance. Like d_ULS, lower d_G values signify a better fit. In this research, the d_G value is 1.050, which is relatively low, further reinforcing the model's fit sufficiency. Like d_ULS, d_G should be interpreted in combination with other fit indices to guarantee a thorough assessment. These findings correspond with those of Hair et al. (2019), who emphasised the need to employ diverse discrepancy metrics to assess model fit.

6.13.3 Geodesic Discrepancy (d_G)

The Unweighted Least Squares Discrepancy (d_G) uses geodesic distance to quantify the difference between the observed and model-implied covariance matrices. Similar to d_ULS, reduced d_G values indicate a superior match. In this study, the d_G value is 1.050, which is rather low, hence validating the adequacy of the model's fit. Nonetheless, like d_ULS, d_G must be analysed alongside supplementary fit indices to guarantee an extensive assessment. These findings correspond with those of Hair et al. (2019), who emphasise the need to employ diverse discrepancy metrics for assessing model fit.

6.13.4 Chi-square test

The null hypothesis that the model fits the data perfectly is evaluated by the chi-square statistic. An insignificant Chi-square outcome ($p > 0.05$) indicates an adequate fit. The Chi-square test is particularly sensitive to sample size, frequently resulting in substantial Chi-square values in well-fitting models when the sample size is large (Kline, 2015). The Chi-square value in this case is 2402.523, which is probably significant considering the sample size. Although this may suggest an inadequate fit, it is essential to evaluate additional fit indices, as the Chi-square test alone may not provide a reliable assessment of model fit in large samples. This corresponds with the warnings issued by Naqvi et al. (2019) against the exclusive reliance on the Chi-square test for model assessment.

6.13.5 The Normed Fit Index (NFI)

According to Xi et al. (2024), the NFI evaluates the Chi-square statistic of the proposed model in relation to that of the null model. Values approaching 1 indicate a superior model fit. An NFI value exceeding 0.90 is deemed appropriate (Ibid). The findings of this analysis reveal an NFI value of 0.664, which falls below the acceptable threshold of 0.90.

First, the low NFI is a known limitation of PLS-SEM, particularly with complex models and smaller sample sizes. Hair et al. (2019) note that NFI tends to underestimate model fit in PLS-SEM compared to CB-SEM, and values below 0.90 are not uncommon in exploratory research with complex models such as 14 constructs in this study. Second, the low NFI must be interpreted alongside the weak R^2 values observed for several constructs, including SR (0.006) and ES (0.103). The poor NFI likely reflects that the hypothesised model does not explain all covariance in the data perfectly. This is an expected outcome given the exploratory nature of this study in a novel South African automotive aftermarket context.

Faraji et al. (2024) underscore the significance of NFI in assessing model fit. The findings of this investigation demonstrate that SRMR (0.066) and d_ULS (4.151) signify an adequate match. This indicates a reasonable fit; nonetheless, the NFI of 0.664 is below the suggested level. Hwang et al. (2020) underscore the importance of employing diverse fit indices to evaluate model fit, as demonstrated in this study.

6.14 R-SQUARED STATISTICS

This section presents the R-squared statistics, which show how much variance in service effectiveness outcomes is explained by environmental sustainability (Objective 4). The R-squared is considered a significant metric for measuring the proportion of variance in dependent (endogenous) variables that can be ascribed to independent (exogenous) variables. The R-squared provides insights into the model, focusing on how predictors account for variability in the dependent constructs. The R-squared statistics are shown in Table 6.12 below.

Table 6.12: R-squared statistics

Constructs	R-square	R-square adjusted
CR	0.101	0.098
ES	0.103	0.089
IN	0.195	0.193
PR	0.213	0.210
QL	0.351	0.350
SR	0.006	0.003

Source: Research data (2025)

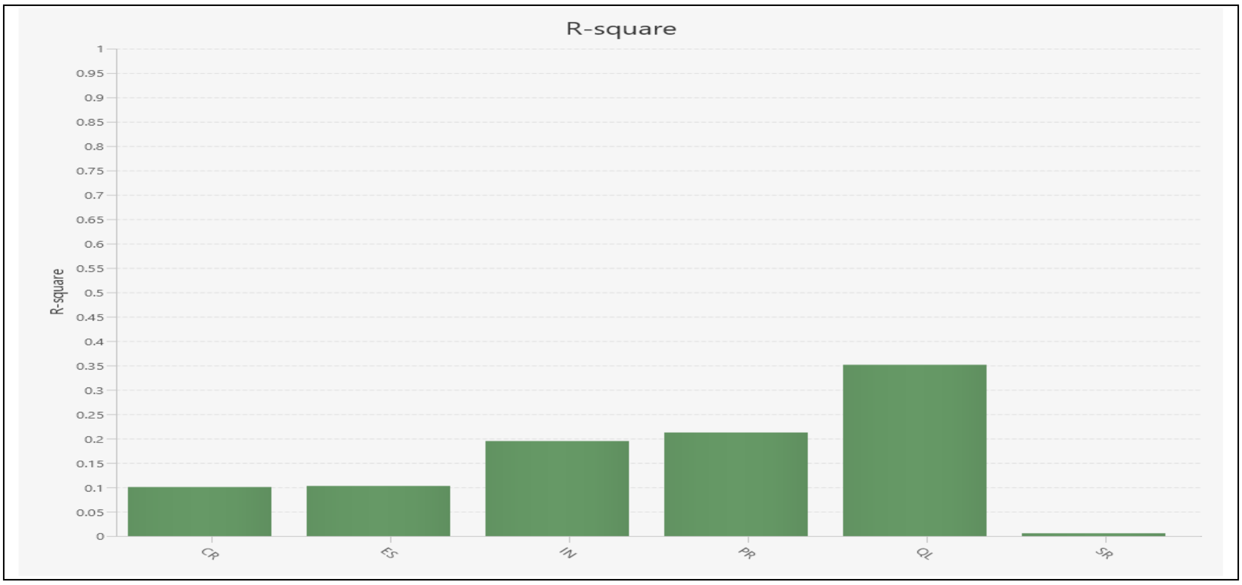

Figure 6.4: R-square chart

Source: Research data (2025)

The R-squared values range from 0.006 (Supplier Relationships) to 0.351 (Quality), indicating weak to moderate explanatory power across the five service effectiveness outcomes. According to Hair et al. (2019), an R-squared value of 0.25 indicates high explanatory power, while values below 0.10 signify weak explanatory power.

Supplier Relationships has low value ($R^2 = 0.006$) which is critically low. This finding is the most striking. Environmental sustainability explains effectively 0% of the variance in supplier relationship performance. This null finding is itself a contribution. It suggests that in the South African automotive aftermarket, supplier relationships are determined by factors entirely outside the environmental sustainability domain, including price competition, historical contracting arrangements, geographic proximity, and personal relationships between workshop owners and parts suppliers. This contradicts the RBV expectation that sustainability capabilities would enhance relational value with supply chain partners.

Environmental Sustainability which is the mediating variable, is weak ($R^2 = 0.103$). The eight antecedent practices explain only 10.3% of the variance in environmental sustainability. This indicates that significant drivers of ES are missing from the model. Omitted variables may include: firm size, access to capital, competitive intensity, customer pressure, and industry association membership. The removal of Government Regulation and Outbound Logistics during measurement assessment (see Section 6.10) further suggests that constructs validated in developed-economy studies may not transfer to this context.

Customer Relationships also has a weak value ($R^2 = 0.101$). Environmental sustainability explains only 10.1% of customer relationship variance. While the path coefficient was significant ($\beta = 0.317$, $p = 0.000$), the low R^2 suggests that other factors, such as price, convenience, and brand reputation are more important determinants of customer relationships in this context.

Although the scores for productivity ($R^2 = 0.213$) and Innovation ($R^2 = 0.195$) are moderate, they are on the weak side. These values indicate that ES explains approximately 20% of the variance in productivity and innovation. While meaningful, this leaves 80% unexplained, pointing to omitted variables such as workforce skills, management practices, and market conditions. Lastly, Quality ($R^2 = 0.351$) has a moderate value. Quality is the best-explained outcome, with ES accounting for 35.1% of variance. This suggests that the link between ES and quality is strongest in this context.

6.15 PATH ANALYSIS RESULTS

This section presents the path analysis results, which determines which practices drive environmental sustainability (Objective 3) and examines the relationship between environmental sustainability and service effectiveness (Objective 4). Path analysis, according to Mallik et al. (2021), is a statistical method used to investigate intricate causal links between several variables. Path analysis enables the study to clarify structural links within a specified model by examining the direct and indirect impacts of independent variables on the dependent variable. Hutami and Kumiawan (2019) reported that route analysis offers a more nuanced comprehension of the underlying dynamics among variables. In this study, the hypotheses were evaluated via PLS SEM, as illustrated in Figure 6.12, below.

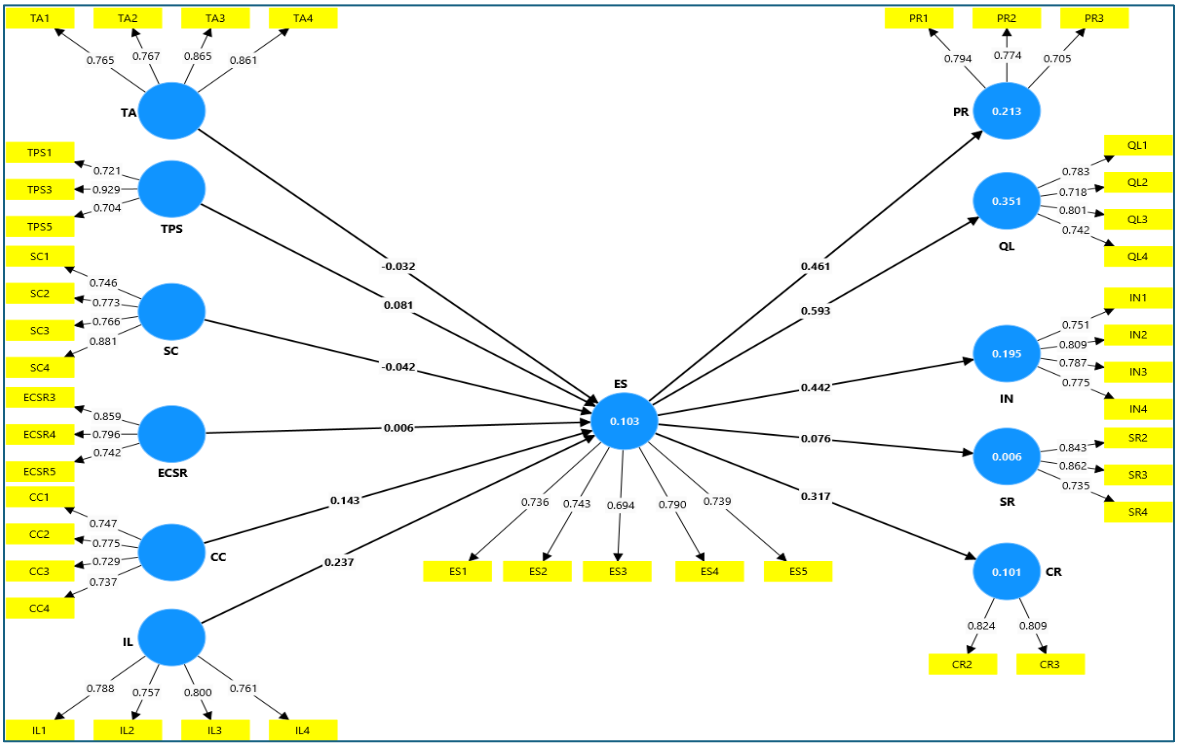

Figure 6.5: Path analysis via structural equation modelling (SEM)

Source: Research data (2025)

Table 6.13: Path coefficients, t statistics and p values

Path	Hypothesis	Path Coefficient (β)	T statistics (t)	Significance (p)	Decision
TA -> ES	H2	-0.032	0.438	0.661	Not accepted and not significant
TPS -> ES	H3	0.081	0.992	0.321	Not accepted and not significant
SC -> ES	H4	-0.042	0.626	0.532	Not accepted and not significant
ECSR -> ES	H5	0.006	0.104	0.917	Not accepted and not significant
CC -> ES	H6	0.143	2.357	0.018	Accepted and significant
IL -> ES	H7	0.237	4.333	0.000	Accepted and significant
ES -> PR	H9	0.461	10.192	0.000	Accepted and significant
ES -> QL	H10	0.593	15.154	0.000	Accepted and significant
ES -> IN	H11	0.442	8.853	0.000	Accepted and significant
ES -> SR	H12	0.076	1.336	0.182	Not accepted and not significant
ES -> CR	H13	0.317	6.348	0.000	Accepted and significant
GR = Government regulation and incentives; **TA** = Technology Adoption; **TPS** = Top Management Support; **ECSR** = Environmental Corporate Social Responsibility; **CC** = Compliance and Certification; **IL** = Inbound Logistics; **OL**=Outbound Logistics; **ES** = Environmental sustainability; **PR** = Productivity; **QL** = Quality; **IN** = Innovation; **SR** = Supplier Relationships **CR** = Customer Relationships					

Source: Research data (2025)

The results of the PLS analysis demonstrated that hypotheses H6, H7, H9, H10, H11, and H13 were supported and deemed significant. The hypotheses' p value was less than 0.05. Conversely, H2, H3, H4, H5, and H12 were unsupported and insignificant. The findings demonstrate that the impact of compliance and certification on environmental sustainability (H6) ($\beta = 0.143$; $p = 0.018$; $t = 2.357$) was substantial. This finding indicates that adherence to environmental standards fosters sustainability in the car industry. The results align with the findings of Neevedish, Karishma & Devi, (2017), emphasising that formal compliance frameworks and certification promote sustainable behaviours and adherence to environmental legislation.

Figure 6.6: Path coefficients

Source: Research data (2025)

The results for the relationship between environmental sustainability and incoming logistics (β = 0.237; p= 0.000; t = 4.333) indicate that environmental sustainability is significantly impacted by effective inbound logistics. These results align with Takita and Leite's (2019) findings, which indicate that the optimisation of logistics can reduce waste and the carbon footprint, enhance resource efficiency and promote environmental sustainability.

The findings regarding the correlation between environmental sustainability and productivity (H9) = (β = 0.461; p = 0.000; t =10.192) demonstrate that sustainable practices substantially enhance sustainability. Niedlich et al. (2020) reported that sustainability techniques, including EE mechanisms and waste reduction, optimise operations, reduce costs, and increase productivity. Similarly, Steensen (2019) highlighted that sustainable materials and processes enhance product durability, aligning with quality management principles.

The results for the correlation between quality and environmental sustainability (H10) β = 0.593; p =0.000; t = 15.154) were accepted. The results indicate that sustainable materials and methods substantially improve product and service quality. The results show that (H11:

Environmental Sustainability → Innovation) ($\beta = 0.442$; $p = 0.000$; $t = 8.853$) was accepted and significant. The results suggest that sustainability drives innovation in processes and products. Yadav et al. (2020) argued that environmental challenges stimulate creative solutions, leading to technological advancements and new business models. H13 (Environmental Sustainability → Customer Relationships) ($\beta = 0.317$; $p = 0.000$; $t = 6.348$) was supported and significant, demonstrating that sustainability strengthens customer trust and loyalty. Pohludka and Štverková (2019) demonstrated that companies with strong sustainability credentials attract and retain environmentally conscious consumers.

Hypotheses that were not accepted were not statistically significant ($p \geqslant 0.05$). H2 TA and ES ($\beta = -0.032$; $t = 0.438$; $p = 0.661$) was not accepted. This suggests that technology adoption alone does not significantly improve sustainability. This contradicts Rogers (2003), who posits that technological innovation is key to sustainability. The negative coefficient suggests that without proper training or integration, technology may even hinder progress. Although Thiengo et al. (2019) highlighted that technology can decrease emissions and energy consumption, the results indicate that automotive maintenance and repair sectors might implement technology in a superficial manner (for instance, through basic digital tools) rather than fully integrating it into their essential sustainability processes. This observation aligns with the views of Sturgeon et al. (2008) and Bastin et al. (2010), who noted that the global supply chains in the automotive maintenance and repair sector frequently fall behind in embracing advanced technologies because of their fragmented supplier networks.

H3 (Top Management Support → Environmental Sustainability) ($\beta = 0.081$; $t = 0.992$; $p = 0.321$) was not accepted. This finding indicates that leadership support alone does not guarantee sustainability outcomes. While Tarigan et al. (2020) stress the role of leadership, this result indicates that top-down commitment must be paired with actionable strategies to be effective. Although Tarigan et al. (2020) and Dubey et al. (2019) assert that leadership is crucial, they indicate that "support" might merely be a symbolic gesture. Burki et al. (2019) noted that in the absence of "issue legitimation" (integrating sustainability into the organisation's identity), directives from above are ineffective.

H4 (Sustainability Culture → Environmental Sustainability) ($\beta = -0.042$; $t = 0.626$; $p = 0.532$) was not accepted. Sustainability-oriented culture does not necessarily translate to measurable environmental benefits. The insignificant results can be linked to conflicting operational priorities. Franz (2012) emphasises that organisational culture should be in harmony with business operations, whereas Ben-Eli (2018) cautions that auto-repair shops might focus on efficiency and cost-effectiveness at the expense of sustainability, leading to a mismatch.

The results further indicate that H5 (Environmental CSR → Environmental Sustainability) ($\beta = 0.006$; $t = 0.104$; $p = 0.917$) was not accepted. This suggests that ECSR initiatives have a negligible impact on actual sustainability performance. These insignificant results may indicate that ECSR is viewed as the management of reputation. Research by Slavic and Berber (2015) and Dou et al. (2019) show that ECSR initiatives in developing countries (such as South Africa) tend to be more focused on public relations rather than being effectively integrated into operations. The results force their assertion that ECSR seldom converts into measurable sustainability. Slavic and Berber (2015) argue that ECSR fosters sustainability, but this study suggests that ECSR may be more symbolic than substantive without proper implementation.

The results of H12 indicate that (Environmental Sustainability → Supplier Relationships) ($\beta = 0.076$; $t = 1.336$; $p = 0.182$). This finding indicates that supplier relationships are not significantly improved by sustainability initiatives. This could be a result of transactional supplier dynamics. Esfahbodi et al. (2016) claim that sustainability enhances supplier relationships solely through collaborative efforts, such as the joint development of environmentally friendly practices. The results indicate that automotive maintenance and repair shops do not engage in such partnerships, which is consistent with Hudnurkar et al. (2014), who discovered that 60% of auto-supplier relationships are motivated primarily by cost considerations. Esfahbodi et al. (2016) claim that sustainability strengthens supplier ties, but this result implies that collaboration requires additional efforts beyond general sustainability practices.

6.16 OVERALL DISCUSSION ABOUT ENVIRONMENTAL SERVICE PRACTICES, ENVIRONMENTAL SUSTAINABILITY AND SERVICE EFFICACY

This study investigated the impact of ESPs on ES and, consequently, SE within South Africa's automotive industry. Consistent with institutional theory, the results indicated that inbound logistics (e.g., low-emission transportation) and regulatory compliance (e.g., certifications) significantly enhance environmental sustainability. The significance of supply chain efficiency (Rahman, 2020; Costa et al., 2020) and external pressures (Agus Harjoto & Salas, 2017; Goyal et al., 2019) in emerging markets has also been highlighted. Chu et al. (2017), Thiengo et al. (2019), and Chege et al. (2021) emphasise that internal factors such as managerial support, technology adoption, and sustainable culture have no significant impact. This is probably attributable to elevated expenses and an emphasis on immediate profits (Slavic & Berber, 2015), underscoring that in contexts with inadequate enforcement, obligatory compliance is more efficacious than discretionary environmental CSR. The findings indicate that robust environmental sustainability markedly improves service effectiveness, quality, productivity, innovation, and customer connections (Kulangra et al., 2016; Han et al., 2020; Ekins & Zenhelis, 2021). This establishes a distinct financial incentive for corporations to implement sustainable practices. The negligible effect observed on supplier relationships (Hudnurkar et al., 2014; Esfahbodi et al., 2016) underscores difficulties in partnering with environmentally conscious suppliers (Ambe & Badenhorst-Wess, 2013) and implies potential resistance or competing motivations within supply chains. This research demonstrates how the integration of the RBV (Barney, 1991) and regulatory focus theory (Malik et al., 2019) can improve sustainability efforts through regulatory compliance and logistical capabilities. For industry professionals, prioritising compliance with regulations (such as Section 12B tax incentives in South Africa), investing in green supply chain initiatives (Oumer et al., 2015), and promoting supplier collaboration (Jassim et al., 2020) represents a strategic approach to leveraging sustainability for enhanced competitive service performance.

The R-squared values presented in Section 6.14 indicate weak to moderate explanatory power for most constructs, with Environmental Sustainability (ES) having an R^2 of 0.103 and Supplier Relationships (SR) having a critically low R^2 of 0.006. These low values require explicit reconciliation with the theoretical claims of Institutional Theory (IT) and the Resource-Based View (RBV).

IT predicts that external pressures (regulatory, normative, mimetic) drive organisational behaviour. However, the weak R^2 for ES (0.103) suggests that institutional pressures in the South African automotive aftermarket are weak, fragmented, or not yet internalised. First, regarding coercive pressures (regulation), Government Regulation (GR) was removed from the model due to poor item loadings, indicating that regulatory enforcement is weak in South Africa and coercive isomorphism does not operate as predicted (Berthod, 2018). Second, regarding normative pressures (CSR and culture), Environmental CSR (ECSR) and Sustainability Culture (SC) were non-significant, suggesting that CSR is symbolic (public relations) rather than substantive, and that culture remains misaligned with operational priorities (Slavic & Berber, 2015). Third, regarding mimetic pressures (copying competitors), Compliance and Certification (CC) and Inbound Logistics (IL) were significant, demonstrating that visible, measurable practices that competitors can observe and imitate are the most effective drivers in this context (Voronov & Weber, 2020).

RBV predicts that valuable, rare, inimitable, and non-substitutable (VRIN) resources drive competitive advantage. The weak R^2 for ES (0.103) and SR (0.006) suggests that the resources measured are not yet generating expected returns in this context. Technology Adoption (TA) was non-significant, indicating that technology without complementary human resources (training) and organisational systems does not generate advantage (Holdford, 2018; Burvill et al., 2018). Top Management Support (TPS) was non-significant, suggesting that support is symbolic rather than translated into resource allocation, and is too common to be inimitable (Rotjanakorn et al., 2020). Sustainability Culture (SC) was non-significant, indicating that culture remains misaligned with operational priorities such as efficiency and cost, and is not yet institutionalised (Ben-Eli, 2018). Finally, the critically low R^2 for Supplier Relationships (0.006) demonstrates that supplier relationships in this context are driven by price and historical contracts rather than environmental sustainability, establishing a boundary condition for RBV. The weak R^2 values do not invalidate IT or RBV. They demonstrate contextual boundary conditions of weak institutional environments such as South Africa, with SME-dominated and price-sensitive markets, the mechanisms predicted by IT and RBV operate differently or are not yet mature.

6.17 MEDIATING ROLE OF ENVIRONMENTAL SUSTAINABILITY (ES) IN THE RELATIONSHIP BETWEEN ENVIRONMENTAL SUSTAINABILITY PRACTICES AND SERVICE EFFECTIVENESS

According to Madrid-Guijarro and Duréndez (2024), mediation is an intervention whereby a third variable, called the mediator, explains how an independent variable, called the predictor, affects a dependent or outcome variable. Mediation analysis enables researchers to investigate the statistical significance of direct and indirect causal pathways (Schuler et al., 2025.). The study investigated how environmental sustainability (ES) mediated the relationship between service effectiveness (SE) and environmental sustainability practices (ESPs). The results of the construct mediation analysis are presented in Table 6.14 below.

Table 6.14: Mediation analysis of the research constructs

Mediation Path	Specific Indirect Effect	T Statistics (|O/STDEV|)	P Values	Decision
IL → ES → IN	0.105	3.754	0.000	Full mediation
IL → ES → QL	0.141	3.859	0.000	Full mediation
IL → ES → PR	0.109	3.592	0.000	Full mediation
IL → ES → CR	0.075	3.116	0.002	Full mediation
CC → ES → IN	0.063	2.180	0.029	Full mediation
CC → ES → QL	0.085	2.290	0.022	Full mediation
CC → ES → PR	0.066	2.178	0.029	Full mediation
CC → ES → CR	0.046	2.000	0.046	Full mediation
ECSR → ES → IN	0.003	0.103	0.918	No mediation
ECSR → ES → PR	0.003	0.104	0.917	No mediation
ECSR → ES → QL	0.004	0.104	0.917	No mediation
ECSR → ES → CR	0.002	0.104	0.917	No mediation
ECSR → ES → SR	0.000	0.077	0.938	No mediation
SC → ES → IN	-0.018	0.615	0.538	No mediation
SC → ES → PR	-0.019	0.621	0.535	No mediation
SC → ES → QL	-0.025	0.621	0.535	No mediation
SC → ES → CR	-0.013	0.619	0.536	No mediation
SC → ES → SR	-0.003	0.463	0.643	No mediation
TA → ES → IN	-0.014	0.431	0.667	No mediation
TA → ES → PR	-0.015	0.432	0.666	No mediation
TA → ES → QL	-0.019	0.435	0.664	No mediation
TA → ES → CR	-0.010	0.430	0.667	No mediation
TA → ES → SR	-0.002	0.320	0.749	No mediation
TPS → ES → IN	0.036	0.977	0.328	No mediation
TPS → ES → PR	0.037	0.980	0.327	No mediation
TPS → ES → QL	0.048	0.985	0.325	No mediation
TPS → ES → CR	0.026	0.978	0.328	No mediation
TPS → ES → SR	0.006	0.696	0.486	No mediation
IL → ES → SR	0.018	1.261	0.207	No mediation
GR= Government regulation and incentives; **TA** = Technology Adoption; **TPS** = Top Management Support; **ECSR** = Environmental Corporate Social Responsibility; **CC** = Compliance and Certification; **IL** = Inbound Logistics; **OL**=Outbound				

Logistics; **ES** = Environmental sustainability; **PR** = Productivity; **QL** = Quality; **IN** = Innovation; **SR** = Supplier Relationships **CR** = Customer Relationships

Source: Research data (2025)

The mediation analysis results shown in Table 6.14 above provides strong evidence of how environmental sustainability practices influence service effectiveness through the intervening effects of ES. The results provide important theoretical and practical insights, which show that ES positively mediates some service effectiveness correlations while having no mediating influence on others.

The most significant results are found for CC and IL, which demonstrate complete mediation through ES across several effectiveness criteria. The pathway IL → ES → Quality (QL) demonstrates that effective logistics ($\beta = 0.141$; $t = 3.859$; $p = 0.000$) improves environmental sustainability, thereby enhancing the quality of products and services. Accordingly, green logistics techniques such as reducing packaging waste or optimising transportation pathways to reduce emissions indirectly increase quality standards (Tetteh, Owusu Kwateng & Mensah, 2024).

On the other hand, IL → ES → Innovation (IN) ($\beta = 0.105$; $t=3.754$; $p=0.000$) indicates that sustainable logistics improves innovation by increasing the sustainability of the environment, most likely through waste-to-resource initiatives or CE projects (Pacheco-López et al. 2021). As a mediator, ES is also crucial for CC, especially for quality enhancements ($\beta = 0.085$; $t=2.290$; $p = 0.022$). By integrating sustainability into organisational culture and procedures, compliance with environmental standards (such as ISO 14001) is said to improve operational outcomes.

However, there is no discernible mediation through ES in several procedures. Performance is barely impacted by environmental CSR (ECSR → ES → Innovation, for example) ($\beta=0.003$; $t=0.103$; $p=0.918$). This unexpected outcome raises the possibility that internal operational improvements may not derive from external sustainability measures. For instance, TA → ES → IN ($\beta = 0.014$; $t = -0.431$; $p = 0.667$) indicates modest, non-significant mediation between Technology Adoption (TA) and Innovation (IN). Their effects likely stem from direct processes such as leadership, cultural transformations, or digital tools rather than sustainability enhancements, thereby enhancing efficiency (Verhoef et al., 2020). These findings offer tangible evidence for ES function as a mediator between specific practices and competitive advantage, hence enhancing the RBV. The selective nature of mediation underscores the diversity of "green" solutions in their ability to enhance performance via sustainability.

6.18 LINK BETWEEN THE RESEARCH RESULTS AND THE INSTITUTIONAL THEORY

A fascinating example of how institutional forces influence the implementation and adoption of environmental sustainability efforts is provided by the South African automotive industry. The findings make use of the three main pillars of institutional theory, i.e., regulatory, normative, and cognitive-cultural (Greenwood et al., 2011), to illustrate the enabling and impeding elements that influence sustainability outcomes in the automotive supply chain. The results show that effective institutionalisation of sustainability necessitates coherence among all three pillars, whereas discrepancies or deficiencies in any one pillar may result in superficial adoption rather than genuine implementation.

At the regulative level, the strong positive relationship between Compliance and Certification (CC) and Environmental Sustainability (ES) (β=0.143, p=0.018) clearly illustrates how formal regulations and enforcement mechanisms influence organisational behaviour. According to Voronov and Weber (2020), developing economies often depend on certification frameworks as concrete evidence of adherence to global standards. However, the non-significant results for Technology Adoption (TA) (β=-0.032) and Environmental CSR (β=0.006) highlight the constraints of relying solely on regulative methods when they lack supportive normative and cognitive-cultural congruence. This finding reinforces Berthod's (2018) assertion that in emerging markets, regulatory frameworks may exist in theory but fail to be integrated into organisational practices owing to gaps in implementation.

The normative pillar is especially impactful in areas such as Inbound Logistics (IL) (β=0.237), where global supply chain benchmarks have established strong industry norms. As Miörner (2020) observes, automotive companies operating within global value chains encounter significant peer pressure to adhere to standardised environmental practices. Nevertheless, the weak results for Top Management Support (TMS) (β=0.081) and Sustainability Culture (SC) (β=-0.042) indicate that internal organisational norms frequently do not align with external industry expectations. This is in line with the findings of Wagner et al. (2022) concerning the disconnect between corporate sustainability discourse and real operational practices in developing economies.

Cognitive and cultural variables significantly underscore the downstream advantages of sustainability. The strong correlations between Environmental Sustainability (ES) and Productivity (PR) (β=0.461), Quality (QL) (β=0.593), Innovation (IN) (β=0.442), and Customer Relationships (CR) (β=0.317) demonstrate how sustainability becomes embedded in business practices when it aligns with established beliefs about success. As Ordonez-Ponce (2021) noted, these cognitive frameworks emerge through continual practice and affirmation within the marketplace. However, the insignificant finding for Supplier Relationships (SR) (β=0.076) indicates notable cognitive–cultural discrepancies that remain in value chains, corroborating Ebrahimi and Koh's (2021) observations about the fragmented institutionalisation within supply networks in emerging economies. Historical institutionalism offers essential insight into these trends.

The results can be linked to the historical institutionalism construct. The legacy of apartheid in South Africa continues to shape organisational capabilities and interactions, as indicated by Pike et al. (2018). For instance, the negative association with SC reflects the persisting cultural divisions between corporate headquarters and production locations, a remnant of this historical backdrop. Similarly, the lacklustre findings about technology adoption reveal entrenched patterns within production systems that inhibit growth, even when regulatory pressures are present. As far as policy is concerned, these observations point to the necessity of all-encompassing approaches that concurrently address the three facets of institutionalism. Improving regulatory frameworks should go hand in hand with normative efforts to create industry standards and cognitive-cultural initiatives aimed at changing organisational practices. As Burch and Crowson (2020) emphasise, effective institutional transformation depends on coordination across various levels, from formal regulations to informal norms and daily practices. Furthermore, the analysis highlights the limitations of institutional theory in confronting power disparities within value chains and organisations.

The findings demonstrate that Institutional Theory requires refinement for weak institutional environments. Coercive isomorphism in the form of government regulation did not operate as predicted, as Government Regulation (GR) was removed from the model due to poor item loadings. This suggests that in contexts where regulatory enforcement is weak, coercive pressures may not drive organisational behaviour. Normative isomorphism (CSR and culture) also did not operate as predicted, as Environmental CSR (ECSR) and Sustainability Culture (SC) were non-significant, suggesting that normative pressures are symbolic rather than substantive in this context. In contrast, mimetic isomorphism (copying competitors) appeared most relevant, as Compliance and Certification (CC) and Inbound Logistics (IL) were significant, indicating that visible, measurable practices that competitors can observe are most likely to be adopted. These findings extend Institutional Theory by specifying that in weak institutional environments, mimetic mechanisms may replace coercive and normative mechanisms as the primary drivers of sustainability adoption. Future research should test this proposition explicitly.

While the framework successfully elucidates adoption patterns and resistance, it provides fewer tools to address the structural inequalities that shape these patterns. This highlights the need to integrate institutional analysis with critical investigations of power and inequality in future research. The next section links the findings to RBT.

6.19 LINK BETWEEN THE RESEARCH RESULTS AND THE RESOURCE-BASED THEORY

The results of this study provide significant insights when evaluated through the framework of RBV. This analysis underscores how various organisational resources can either promote or hinder environmental sustainability (ES) and competitive advantage, which is consistent with the fundamental RBV principle that unique, valuable, rare, inimitable, and non-substitutable (VRIN)resources contribute to superior performance (D'Oria et al., 2021; Zhang et al., 2021).

The robust positive correlation between Inbound Logistics (IL) and Environmental Sustainability (ES) (β=0.237) illustrates how operational competencies can transform into strategic resources. Sarjana et al. (2017) discovered that optimised logistics systems, which amalgamate physical infrastructure (tangible) with process expertise (intangible), yield efficiency benefits that competitors find challenging to emulate. This finding substantiates Kumar and Rodrigues' (2020) claim that integrated resource systems provide enduring advantages. The correlation between Compliance and Certification (CC) and ES (β=0.143) illustrates how institutionalised knowledge, specifically the execution of ISO standards, transforms into an organisational capital resource. According to Sony and Aithal (2020), in their research on Industry 4.0, proficiency in certification satisfies the VRIN criteria when it integrates technical knowledge with practical experience (Chand & Tarei, 2021). The favourable effects of Environmental Sustainability (ES) on Productivity (PR) (β=0.461), Quality (QL) (β=0.593), and Innovation (IN) (β=0.442) robustly endorse the RBT paradigm, suggesting that sustainability skills can yield several competitive advantages. The results corroborate Zheng and Ge's (2022) assertion that EMS cultivate "capability bundles" that concurrently improve many performance metrics via shared knowledge and linked processes.

The adverse result related to Technology Adoption (TA) (β=-0.032) offers significant insight from an RBT perspective: simply having advanced technology does not ensure a competitive edge. As Holdford (2018) noted, technology becomes strategically advantageous only when it is paired with complementary human resources (such as training) and organisational structures (such as implementation systems), a combination seemingly lacking in these companies. This aligns with Burvill et al.'s (2018) observation that a lack of capability development may lead to less-than-optimal outcomes from technology.

The insignificant results regarding Total Management Support (TMS) (β=0.081) and Sustainability Culture (SC) (β=-0.042) likewise indicate shortcomings in the development of human capital and organisational capital. Although leadership endorsement and cultural principles are theoretically important (Suh, 2018), these results imply that they are too prevalent and easily replicable (not inimitable) to provide an advantage in South Africa's context, concurring with Rotjanakorn et al.'s (2020) argument that "soft" resources only gain strategic significance when they are uniquely institutionalised.

The findings demonstrate that the Resource-Based View requires refinement for SME-dominated, emerging-market contexts. Resource value is context-dependent: Technology Adoption (TA) and Top Management Support (TPS) did not generate competitive advantage, suggesting that resources considered valuable in developed economies may not be valuable in emerging-market SME contexts. Complementary resources are essential: the non-significance of Technology Adoption suggests that technology alone is insufficient; it must be paired with complementary human resources such as training and organisational systems such as implementation processes (Holdford, 2018). Supplier relationships as an outcome: the null finding for Environmental Sustainability leading to Supplier Relationships ($R^2 = 0.006$) establishes a boundary condition for the Resource-Based View where not all relational outcomes are driven by sustainability capabilities. In price-sensitive markets, cost and historical relationships dominate over sustainability considerations. These findings extend the Resource-Based View by specifying that resource value depends on institutional context, firm size, and the presence of complementary resources.

This RBT analysis illustrates that the competitive value of sustainability in the automotive repair and maintenance sector in South Africa fundamentally hinges on how companies combine and utilise their resources. The theory accounts for both effective implementations, where distinctive resource combinations generated advantages and failures, where resources lacked non-substitutable resource characteristics.

6.20 CHAPTER CONCLUSION

This chapter summarised the results of the quantitative data analysis on environmental sustainability practices in South Africa's automotive industry. The analysis used SEM with SmartPLS. The response rate and participant demographics; descriptive statistics pertaining to the research constructs; and assessments of data normality, reliability, and validity were among the main topics addressed. The chapter presents a comprehensive evaluation of scale accuracy, including internal consistency metrics and item–total correlations, followed by evaluations of convergent and discriminant validity.

The subsequent sections concentrated on the use of R-squared statistics to measure the structural model's explanatory power, multicollinearity assessments, and model fit analysis. The chapter concluded with route analysis to examine the postulated linkages among variables, positioned within the frameworks of IT and RBT perspectives. The analytical methodologies established a foundation for evaluating the quantitative findings of studies on sustainable practices and their impact on the automotive industry. The chapter that follows will delineate the study's results, integrate these analytical findings with broader implications, and offer practical recommendations and avenues for future research.

CHAPTER 7:

CONCLUSIONS, RECOMMENDATIONS, LIMITATIONS AND IMPLICATIONS FOR FURTHER RESEARCH

7.1 INTRODUCTION

This chapter presents a brief overview of the seven chapters that make up this thesis. The research concludes by presenting the main conclusions based on the study's results. The research focused on four key questions concerning sustainability within the South African automobile sector. The conclusions are directly correlated with the responses obtained for each question. The main problem studied was the absence of a clear model to help put environmental sustainability practices into action in South Africa's automotive repair and maintenance sector. While climate change and environmental decline are global concerns, the South African government has not set specific guidelines for implementing sustainable practices within the industry. Industry insiders also doubt whether these practices improve service quality, which is essential for business survival.

The study sought to establish and test a model that facilitates the adoption of sustainable practices in the sector while enhancing service quality. The model offers practical advice and clear steps, helping to reduce uncertainty in the sector. In addition to the conclusions, this chapter provides several recommendations. These findings offer practical solutions and advice for policymakers and industry leaders. These ideas seek to encourage the automotive industry to adopt more sustainable practices. The chapter additionally addresses the constraints of the investigation. It summarises the studies conducted and proposes avenues for future investigations. This underscores the accomplishments of this study and establishes a foundation for further research on sustainability within the automotive industry.

7.2 REVIEW OF THE CHAPTERS

The study's goal was to develop and evaluate a conceptual model that explains the connections between environmental sustainability practices, environmental sustainability, and service effectiveness in the automotive industry in South Africa. The research journey comprised seven chapters. Each chapter serves a distinct role in the research process. The thesis comprises of seven chapters, each aligning with research traditions. Each chapter is summarised in this section as follows:

Chapter 1 provided the background and introduction of the study. The chapter introduced sustainability in the automotive repair and maintenance sector, referencing the relevant literature. The introduction used recent statistics and literature to highlight the challenges limiting sustainability practices in the automotive industry. The chapter also outlined the problem statement, research questions, and objectives.

The problem statement highlighted that the automotive industry in South Africa lacked a detailed framework to help put ES practices into action and connect them to service performance. Although climate change and environmental damage are recognised as serious global problems and the industry is dedicated to being environmentally sustainable, the lack of clear instructions and uncertainty about how these practices affect service efficiency have slowed progress. Ultimately, the study aims to suggest practical strategies that help the automotive repair and maintenance sector align its environmental efforts with better service performance, benefiting both the environment and business success.

In addition, the chapter discussed the IT and the RBT, which provided the theoretical frameworks for the study. A concise literature review was subsequently provided, concentrating on the research questions. The literature review explored previous studies and identified existing gaps that warranted further study. Following the literature review, the chapter introduced 13 hypotheses that the study aimed to evaluate. The study's significance, limitations, and research delimitation were presented. The chapter highlighted the research methodology, outlining the processes and decisions implemented in the study.

Chapter 2 presented a summary of ES and the automotive industry. It began by outlining the global automotive market and subsequently examines the historical development and growth of the sector in South Africa, considering the period before and following the country's transition to democracy. The chapter identified key players in the industry, including OEMs, parts manufacturers, and car dealers, and explained their importance to the national economy.

Chapter 2 also evaluated how the industry contributed economically by supporting local businesses, creating jobs, and fostering innovation via R&D. The laws that govern this industry, such as the B-BBEE Act and the APDP, are also discussed. A significant portion discussed the obstacles encountered by the automotive supply chain in implementing sustainable practices, including supply chain constraints, industrial growth concerns, and the ongoing consequences of the COVID-19 pandemic. The chapter concluded with a review of current research and highlights the gaps that this study aims to address.

Chapter 3 provided a comprehensive review of the literature pertaining to ES, focusing on important research theories and various practices in sustainability. It began with a summary of the theoretical frameworks that underpin the research, particularly The IT and RBT shed light on how organisations embrace and carry out ES measures. The chapter then explained the idea of ES, including its definitions, key drivers, and increasing significance in modern business.

A significant portion of the chapter delved into environmental sustainability practices, such as the use of new technologies, government regulations and incentives, top management support, a sustainable culture, environmental CSR, compliance and certification, and logistics procedures for both inbound and outbound operations. This study examined these practices to understand their contributions to sustainable operations in the automotive industry.

The chapter also reviewed previous studies on environmental sustainability, summarising findings on its effects and significance for service performance, especially in sectors such as automotive. The chapter concluded by highlighting the knowledge gaps in the current research and outlining the study's potential contributions to the field of environmental sustainability in the automotive supply chain.

Chapter 4 focused on a literature review of SE, emphasising the constructs associated with improved performance. The key elements addressed include productivity, quality, innovation, supplier relationships, and customer connections. The chapter delineated patterns, problems, and deficiencies in the literature concerning service effectiveness. Following a comprehensive examination of the literature on many topic dimensions, this chapter introduced a conceptual framework for environmental sustainability within the automotive industry. Each hypothesis within the conceptual model was examined and substantiated with the pertinent literature.

Chapter 5 focused on the methodology of the research. It described the research methodologies and discussed the decisions and choices made during the study, explaining the step-by-step process followed to investigate the relationship between environmental sustainability practices and service efficacy in the automotive industry repair and maintenance sector. The introduction delineated the significance of the research and its objectives. As a result, the following important methodological aspects were covered: population, sampling, time horizon, validity and reliability, research philosophy, research methodology, research design, research strategy, and data collection and analysis techniques.

Chapter 6 presented the analysis of the quantitative data. The data analysis methodologies outlined in chapter 3 are described below, and the results are presented. The chapter presents the response rates, demographic information of the respondents, and the results derived from the primary data. After a thorough explanation of how to conduct EFA, the chapter offered descriptive data for each section. This included average scores, SDs, and other statistical figures. These statistics covered all key variables, such as government rules, technology use, support from top management, the culture of sustainability, environmental practices, and different measures of service effectiveness, such as productivity, quality, innovation, and interactions with suppliers and customers. The chapter then shared the results of CFA. This checked how reliable and valid the measurement model is. It focused on whether the scales used for each factor are consistent and accurate.

Chapter 7 presented the results of tests evaluating the model's overall fit to the data. This encompassed path analysis results, illustrating the relationships among different variables. It also reported the outcomes of hypothesis tests, which evaluated the proposed links between variables. The discussion that followed covers each hypothesis in detail. It explained whether each suggested relationship was confirmed by the data. The focus was on understanding how environmental sustainability practices relate to service effectiveness, with clear results for each hypothesis.

7.3 CONCLUSIONS BASED ON SECONDARY OBJECTIVES

The study's main objective was attained through the subsequent secondary objectives outlined in chapter 1: The study aimed to fulfil five research objectives. All the objectives were addressed in both the literature review chapters and the empirical results (see chapter 6). The following describes how each objective was addressed:

- To evaluate the degree of application of environmental sustainability practices within the automotive repair and maintenance industry in South Africa.
- To measure the service effectiveness of the South African automotive repair and maintenance industry.
- To determine the drivers of environmental sustainability in the South African repair and maintenance automotive industry.

- To examine the relationship between environmental sustainability practices and service effectiveness in the South African automotive repair and maintenance industry.
- To propose a model that can be proposed to facilitate the implementation of environmental sustainability practices and enhance service effectiveness in the automotive supply chain in the South African automotive repair and maintenance industry.

7.3.1 Conclusions regarding research objective 1

The degree of application of environmental sustainability practices within the automotive repair and maintenance industry in South Africa

The results indicate that businesses in the South African automotive industry generally demonstrate a positive commitment to environmental sustainability practices. Among the eight constructs assessed, sustainability culture, technology adoption, and top management support received the highest mean scores, suggesting that these areas are regarded as particularly important by respondents. Government regulation and environmental CSR were also viewed favourably, highlighting organisational awareness of regulatory compliance and socially responsible practices. While compliance and certification, as well as inbound and outbound logistics, showed slightly lower scores, they nonetheless reflect a moderate to strong agreement on their role in promoting sustainability. The findings suggest that environmental sustainability is increasingly embedded in organisational practices, with respondents acknowledging both the strategic and operational relevance of adopting sustainable measures across multiple facets of the automotive repair and maintenance sector.

7.3.1.1 Conclusions Regarding the Application of Government Regulations and Incentives (GRI) in the automotive repair and maintenance sector

The respondents expressed a modest level of agreement with GRI ($\bar{x}$ = 4.410). This suggests that companies in the field have quality control systems in place, train staff appropriately, and understand the significance of regulatory compliance. The results align with those of previous studies that indicate that government regulations have various advantages, including innovation and the implementation of sustainable practices (Rubio-Mozos et al., 2019; Wood et al., 2018). This research suggested that the industry recognises the fundamental framework for environmental sustainability, which serves as a vital starting point for additional sustainable development projects. It is therefore concluded that government regulations play a key role in influencing environmental sustainability practices in the automotive repair and maintenance sector.

7.3.1.2 Conclusions Regarding the Technology Adoption (TA) in the Automotive Sector

The results indicate that the automotive repair and maintenance sector has positive perceptions of the importance of TA for ES ($\bar{x}$=4.592). Businesses are therefore likely to embrace technology that increases waste management, lowers emissions, and improves EE. The results concur with previous studies on the idea that digital transformation is seen as a major facilitator of environmental sustainability, making the adoption of technology a crucial lever for increasing a sector's environmental performance (Kunkel &Matthess, 2020).

7.3.1.3 Conclusions Regarding the degree of Top Management Support (TMS) in the automotive sector

With respect to TMS, the study concludes that environmental sustainability goals are widely seen as having the backing and commitment of senior leadership ($\bar{x}$= 4.451). Thus, executive support is present, which is essential for ensuring that sustainability measures are implemented successfully and last for a long time in these organisations. According to Chu et al. (2017), top management endorsement is crucial in attaining environmental sustainability.

7.3.1.4 Conclusions Regarding the degree of Sustainability Culture (SC) in the automotive repair and maintenance sector

Regarding SC, the results showed that this construct was ranked as the most significant of all the factors, indicating a very positive perception ($\bar{x}$=4.730). This suggests that there is a deeply ingrained organisational culture that values sustainability and that it is present. The results highlight that the main and most important factor influencing sustainable practices in the South African automobile industry is a cultural shift towards environmental consciousness. This view is shared by Coleman and Robinson (2018), who suggest that organisational culture plays a role in encouraging sustainable practices.

7.3.1.5 Conclusions Regarding the Degree of Environmental Corporate Social Responsibility (ECSR) in the automotive repair and maintenance sector

With respect to ECSR, the respondents demonstrated favourable perceptions with uniform opinions ($\bar{x}$= 4.484). This suggests that businesses are taking part in green projects and understand how important it is to improve their reputation through environmental stewardship. Therefore, it can be concluded that ECSR is a well-established and continuously appreciated part of business strategy, even though external factors such as local consumer awareness may have an impact on its total impact (Agus & Salas, 2017).

7.3.1.6 Conclusions Regarding the degree of Compliance and Certification (CC) in the automotive repair and maintenance sector

With respect to CC, the mean score indicated agreement, although it was ranked as a lower-relevance variable ($\bar{x}$=4.242). This suggests that even while companies follow the required certifications and regulations, this approach is seen more as a prerequisite than as a key differentiator for environmental sustainability. The results highlight that attaining advanced environmental sustainability outcomes in the automotive repair and maintenance sector requires more than just compliance (Škerlič & Muha, 2020).

7.3.1.7 Conclusions Regarding the degree of Inbound Logistics (IL) in the automotive repair and maintenance sector

With respect to IL, respondents indicated a moderate level of agreement, although it was ranked in the lower middle range of relevance ($\bar{x}$=4.278). This suggests that although effective capacity planning and teamwork are acknowledged in SCM, they are not yet given priority as top-tier environmental sustainability practices. In alignment with the findings of previous studies, this research suggests that by increasing the strategic attention given to inbound logistics process optimisation, there is a substantial chance of improving environmental sustainability (Ayantoyinbo & Hegelese, 2018; Mukherjee et al., 2012).

7.3.1.8 Conclusions Regarding the degree of Outbound Logistics (OLs) in the automotive repair and maintenance sector

With respect to OL, the results indicated a favourable perception, with respondents agreeing on its importance ($\bar{x}$=4.281). This suggests that methods such as utilising returnable shipping items to reduce packaging waste and carbon emissions are acknowledged and appreciated. Consequently, outbound logistics is a crucial operational domain where cost-cutting and environmental advantages can be successfully combined (Škerlič & Muha, 2020).

7.3.2 Conclusions regarding research objective 2

The service effectiveness of the South African automotive repair and maintenance industry

Five key outcome variables were used to measure service effectiveness, namely: Quality, Productivity, Innovation, Supplier Relationships, and Customer Relationships.

7.3.2.1 Quality

The results relating to quality indicate a moderate degree of agreement ($\bar{x}$= 3.831), suggesting that while quality is regarded as fundamentally important, it is not perceived as the primary outcome of the sector's environmental sustainability efforts. According to this finding, there may be a mismatch between sustainable business practices and high-quality services, as not all businesses have fully grasped or operationalised this relationship. Although Rajper and Albrecht (2020) suggest that product quality strongly impacts consumer purchasing intentions, there is still no clear evidence from research on the relationship between environmental sustainability and quality.

7.3.2.2 Productivity

With respect to productivity, the study established that it was ranked as a low-relevance variable ($\bar{x}$=3.844). Although cost management and operational efficiency are acknowledged, there is a great deal of variation in how they are applied and how important they are viewed throughout industry. This result suggests that productivity is not yet a strength that is consistently prioritised, which is crucial for improvement to increase overall competitiveness and capitalise on the advantages of environmental sustainability measures. However, studies emphasise that quality and accuracy play critical roles in enhancing productivity through expertise that provides precision in machining operations (Bícová & Melichar, 2016).

7.3.2.3 Innovation

The mean score for innovation ($\bar{x}$= 3.619) showed the least amount of agreement for any construct. Accordingly, innovation, with respect to new behaviours, processes, and partnerships motivated by environmental sustainability, is not yet highly valued. Thus, although small changes might be taking place, a culture of transformative innovation that is especially focused on improving service efficacy through sustainability is still in its infancy (Ju & Pan, 2016).

7.3.2.4 Supplier relationships

The study concludes that supplier relationships are among the most significant variables, indicating a high degree of agreement with this construct ($\bar{x}$=4.512). This suggests that strategic partnerships with suppliers are highly regarded and seen as vital results for accomplishing operational and environmental objectives. The conclusion drawn from these data is that strong supplier relationships are a key component of service efficacy, facilitating enhancements in supply chain quality, responsiveness, and cost efficiency. Yu, Umar and Rehman (2022) highlight that efficient supplier relationships enhance performance measures such as service quality, responsiveness, cost efficiency, sales growth, and adaptability.

7.3.2.5 Customer relationships

As per the results, the study concludes that customer relationships were ranked as a medium-relevance variable ($\bar{x}$=4.038). This suggests that while forming strategic partnerships with clients who appreciate sustainability is acknowledged, it is not yet seen as a primary result in comparison to other elements such as supplier connections. Therefore, although customer connections are in a positive state, there is a great deal of room to strategically strengthen them by utilising environmental sustainability methods as a core value proposition (Ambe & Badenhorst-Wess, 2013; Brandes et al., 2013).

7.3.3 Conclusions regarding research objective 3

The drivers of environmental sustainability in the South African repair and maintenance automotive industry

The third research objective is to identify the antecedents of environmental sustainability within the South African automotive industry. The analysis revealed that only two of the examined factors demonstrated a statistically significant positive relationship with environmental sustainability, whereas the remaining antecedents did not yield significant results.

First, it was discovered that environmental sustainability was significantly improved by compliance and certification (CC) (β = 0.143, p = 0.018). The study concludes that the automotive industry's adoption of sustainable practices can be influenced by compliance and certification. The study revealed that inbound logistics (IL) positively impacted environmental sustainability practices (ESPs) (β = 0.237, p = 0.000). This study concludes that efficient management of inbound logistics (IL) positively contributes to environmental sustainability efforts.

7.3.3.1 Conclusion concerning the relationship between environmental sustainability practices and environmental sustainability

The fourth secondary objective sought to examine the relationship between environmental sustainability practices and environmental sustainability in the South African automotive industry. The practices considered in the study included technology adoption (TA), top management support (TMS), sustainability culture and environmental corporate social responsibility (ECSR) compliance and certification (CC) and inbound logistics (IL). To achieve this objective, the suggested hypotheses were tested via PLS-SEM, as reported in Section 6.15. The first four environmental sustainability practices, TA, TMS, SC and ECSR did not exert an influence on environmental sustainability.

7.3.3.2 Conclusions on the relationship between technology adoption and environmental sustainability

Based on the results for the relationship between technology adoption and environmental sustainability, the study concludes that there is no significant relationship between these constructs (β = -0.032; t = 0.438; p = 0.661). The results indicate that adopting technology without supporting the initiative with the necessary environment and supportive elements does not improve environmental sustainability. The mere presence of digital tools or innovations is insufficient to fulfil environmental sustainability objectives. This conclusion contrasts with Roger's (2003) diffusion of innovation theory, which centres on technology as a catalyst for technology adoption, which is motivated by perceived benefits (Thiengo et al., 2019). However, the results support recent findings that fragmented supply chains often delay the full integration of advanced technologies (Sturgeon et al., 2008).

7.3.3.3 Conclusions on the Relationship between top management support and environmental sustainability

The results related to the relationship between top management support and environmental sustainability indicate that top management support has no significant effect on environmental sustainability (β = 0.081; t = 0.992; p = 0.321). The results indicate that top management support is important but not sufficient on its own to yield measurable sustainability. As Dubey et al. (2019) reported, leadership commitment must be backed by tangible investments and strategies such as incentives for environmental sustainability initiatives and regulations.

7.3.3.4 Conclusions on the relationship between sustainability culture and environmental sustainability

Based on the results related to the relationship between SC and ES ($\beta = -0.042$; $t = 0.626$; $p = 0.532$), this study concludes that sustainability culture does not have a significant effect on environmental sustainability. This means that even if an organisation values sustainability, it does not always lead to measurable environmental improvements. In the automotive maintenance and repair sector, priorities such as efficiency and cost control can take precedence over sustainability efforts. Franz (2012) noted that sustainability culture needs to be part of daily operations to make a difference, and Ben-Eli (2018) noted that economic pressures can limit the impact of cultural commitment.

7.3.3.5 Conclusions on the relationship between environmental corporate social responsibility and environmental sustainability

The study revealed that ECSR had no significant effect on ES ($\beta = 0.006$; $t = 0.104$; $p = 0.917$). These results indicate that although ECSR initiatives may improve corporate reputation, they frequently do not lead to measurable improvements in sustainability performance. The findings suggest that in the South African automotive industry, ECSR is often implemented for symbolic legitimacy rather than to achieve substantive environmental outcomes. This aligns with previous research by Dou et al. (2019), who observed that ECSR in developing countries is oriented primarily toward public relations, and Slavić and Berber (2015), who argued that environmental corporate social responsibility must be fully integrated into operations to produce significant environmental benefits.

7.3.3.6 Conclusions on the Relationship between compliance and certification and environmental sustainability

With respect to compliance and certification, the study revealed that compliance with regulations and obtaining relevant environmental certifications greatly improved ES ($\beta = 0.143$, $p = 0.018$). This result indicates that ensuring high levels of compliance and certifications is an important contributor to sustainability levels. Accordingly, the study concludes that encouraging organised and sustainable processes in the automotive industry requires adherence to legal norms and certifications. The study revealed that compliance and certification had a significant positive relationship with environmental sustainability ($\beta = 0.143$; $t = 2.357$; $p =$

0.018). These results suggest that following environmental standards, seeking certifications, and complying with regulations drive real improvements in sustainability in the automotive sector. These measures increase accountability, lower environmental risk, and encourage sustainable practices. These findings align with those of Neevedish et al. (2017), who reported that formal compliance strengthens environmental accountability. Similarly, Testa et al. (2016) reported that ISO 14001 certification improves eco-efficiency and environmental performance.

7.3.3.7 Conclusions on the Relationship between inbound logistics and environmental sustainability

Furthermore, the research indicates that inbound logistics significantly improve environmental sustainability ($\beta = 0.237$, $p = 0.000$). In addition to lowering the waste and carbon footprints, effective inbound logistics management increases resource efficiency overall. This illustrates the vital significance that optimised logistics operations play in accomplishing industrial sustainability objectives. The results support the hypothesis that there is a significant relationship between inbound logistics and environmental sustainability ($\beta = 0.237$; $t = 4.333$; $p = 0.000$). The results imply that efficient logistics, such as reduced fuel consumption, sustainable sourcing and a reduction in waste and emissions, can increase resource efficiency in the automotive repair and maintenance sector. These results align with the results of a study conducted by Takita and Leite (2019), which reported that optimised logistics reduce the carbon footprint.

7.3.4 Conclusions regarding research objective 4

The relationship between environmental sustainability (ES) and service effectiveness (SE)

The next paragraphs discuss conclusions on the relationship between environmental sustainability and service effectiveness dimensions, namely, quality, productivity, innovation and customer relationships.

7.3.4.1 Conclusions on the relationship between environmental sustainability (ES) and quality

Quality is another outcome variable linked to productivity. The results indicate that there is a positive relationship between environmental sustainability and quality ($\beta = 0.593$; $t = 15.154$; $p = 0.000$). These results lead to the conclusion that sustainable materials, eco-friendly processes, and cleaner production methods contribute to higher product and service quality.

Research indicates that sustainability practices enhance durability, reliability and performance outputs. In the automotive sector, sustainability enhances the durability, reliability, and performance of outputs (Singh et al., 2018).

7.3.4.2 Conclusions on the relationship between environmental sustainability and productivity

In this study, productivity is an outcome variable of environmental sustainability initiatives. The results show that environmental sustainability significantly enhances productivity ($\beta = 0.461$; $t = 10.192$; $p = 0.000$). The results lead to the conclusion that sustainable practices in the automotive repair and maintenance sector, such as EE, resource optimisation, and waste reduction, streamline operations, reduce costs, and improve overall productivity. This conclusion aligns with the results of Niedlich et al. (2020), who reported that sustainable practices increase operational efficiency. Similarly, Khan et al. (2020) established that those who observed that green practices improve competitiveness and productivity in manufacturing firms.

7.3.4.3 Conclusions on the relationship between Environmental Sustainability (ES) and innovation

The results highlight that ES positively influences innovation ($\beta = 0.442$; $t = 8.853$; $p = 0.000$). As suggested by the results, the study concludes that sustainability goals and expectations encourage firms to develop new processes, technologies, and business models that reduce their environmental impact while enhancing competitiveness. Yadav et al. (2020) suggested that sustainability drives eco-innovation.

7.3.4.4 Conclusions on the relationship between Environmental Sustainability (ES) and customer relationships (CR)

Customer Relationships (CR) are another outcome variable under productivity. The results show that environmental sustainability significantly strengthens customer relationships ($\beta = 0.317$; $t = 6.348$; $p = 0.000$). This leads to the conclusion that sustainability initiatives improve customer trust, loyalty, and brand reputation. Conscious consumers are increasingly preferring organisations with strong sustainability records and practices (Pohludka & Štverková, 2019).

7.4 THE PROPOSED MODEL FOR THE AUTOMOTIVE SUPPLY CHAIN

The final objective of the study was to develop a model that may be proposed to assist the South African automotive industry's supply chain in improving service effectiveness and adopting environmental sustainability practices. This model is predicated on confirmed links found through path analysis. The objective was achieved by eliminating independent constructs that had insignificant p-values and path coefficients in their association with dependent variables. The constructs that were eliminated include corporate social responsibility, sustainability culture, top management support, and technology adoption, since they do not directly influence environmental sustainability. Without this knowledge, some automotive firms in South Africa blindly implement these practices but do not achieve environmental sustainability.

In developing the model (Figure 7.1), independent research constructs with strong statistical significance ($p < 0.05$) on their dependent constructs were retained. These include compliance and certification, inbound logistics, and environmental sustainability based on their positive effects on productivity, quality, innovation, and customer relationships. These results suggest that South Africa’s auto industry mainly depends on external rules and efficient operations to achieve environmental sustainability, whereas internal efforts, such as leadership or CSR, are less influential. Figure 7.1, below, represents the proposed practical model that was developed based on the study results.

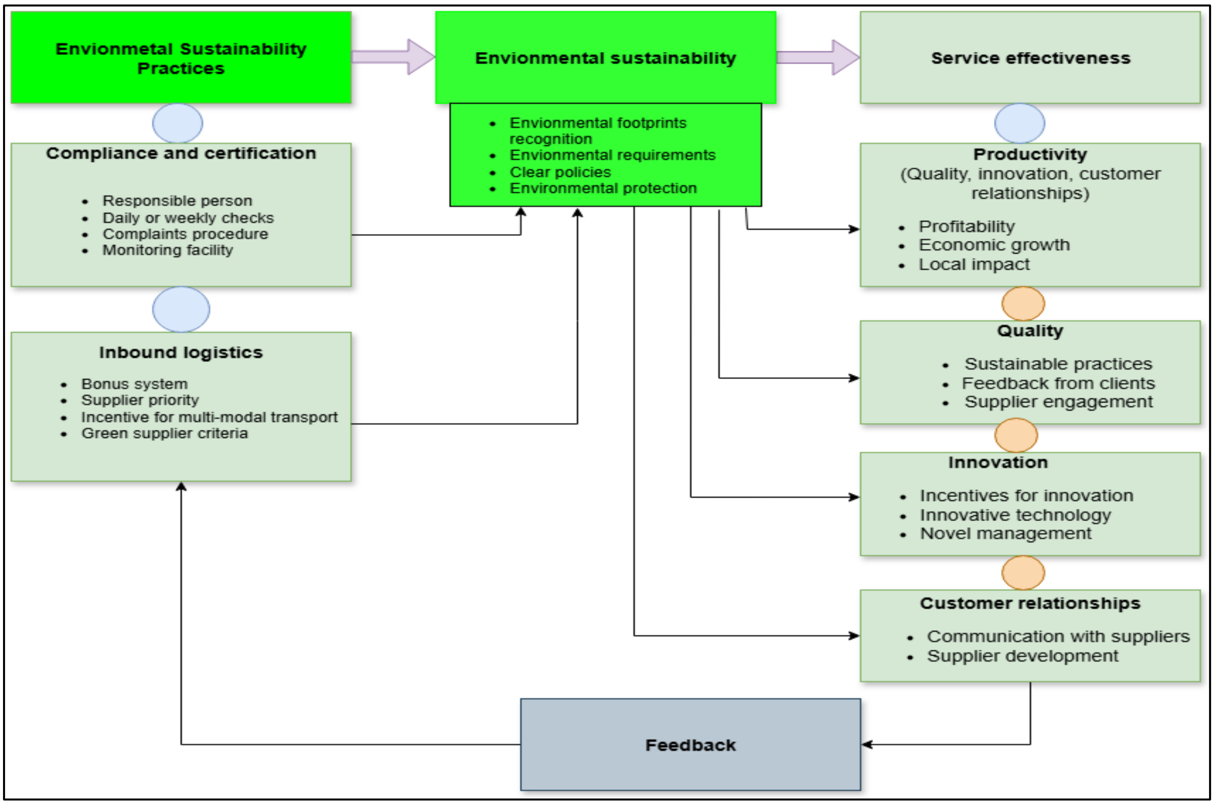

Figure 7.1: Conceptual model ESPs, ES and SE

Source: Author's own compilation

The model illustrated in Figure 7.1, above, displays only those research constructs that are statistically significant derived from the analysis. The conceptual model extends beyond envisioning correlations between research constructs, highlighting the practices and constructs that connect the relationship between environmental sustainability practices and service effectiveness. The environmental sustainability practices that play a significant role in promoting environmental sustainability in the automotive repair and maintenance sector are compliance, certification and inbound logistics.

Compliance and certification: Compliance and certification play crucial roles in promoting environmental sustainability in the South African automotive repair and maintenance sector (Asongu et al., 2017). This ensures that manufacturers, suppliers and related service providers adhere to legal, technical and ethical standards that limit harmful environmental impacts. For example, compliance with ISO 14001 environmental management certification enables automotive repair and maintenance companies to use systematic processes to reduce waste and lower emissions (Neevedish et al., 2017). Certification and regulatory compliance act as both market and legal requirements. Manufacturers and importers must meet South Africa's compulsory vehicle specifications for emissions, safety and component standards to sell vehicles locally. Without compliance, companies risk fines, exclusion from trade opportunities, reputational damage and, ultimately, loss of revenue (Takita & Leite's, 2019). Therefore, automotive companies that practice compliance and certification institutionalise knowledge so that it evolves into an organisational capital resource.

Inbound logistics have a strong influence on environmental sustainability in the automotive repair and maintenance sector. From a transport perspective, reducing distances, improving load utilisation, or shifting to lower carbon transport modes can meaningfully reduce carbon emissions. Studies in South Africa have shown that inbound logistics mechanisms such as eco-routing, better scheduling and increasing vehicle capacity are among the most feasible means to reduce road-freight (Mofokeng et al., 2025).

In packaging and material flows, the use of reusable containers or shared platforms such as what Isuzu South Africa has done. In addition, inventory and storage effects impact environmental sustainability. If inbound shipments are poorly timed, there is excessive warehousing, energy used to store items and spoilage. Supply chain transparency and data are crucial in providing insights that can be used in efforts to enhance environmental sustainability. Tracking emissions in inbound logistics allows companies in automotive repair and maintenance.

Service Effectiveness (SE)

The model presents service effectiveness as an outcome of environmental sustainability practices and environmental sustainability. These factors directly influence service effectiveness, shaping operational reliability, quality and customer satisfaction. Above all, it enhances QL, PR, IN and CR. The model reflects the notion that sustainability is not only a source of operational and strategic benefit but also a legal and ethical obligation. In a market increasingly influenced by environmental consciousness, green practices enhance output quality and consumer engagement by reducing inefficiencies, fostering creative thinking, and optimising resource utilisation.

The feedback loop in the model is significant in that actors within the environmental sustainability practices receive feedback regarding their practices from actors within the service effectiveness construct. For example, in an automotive company, a sustainability compliance officer may not know the effect of sustainability practices on service effectiveness unless there is feedback from the sales and marketing departments. This feedback helps to address gaps in environmental sustainability practices. The model outlines key factors that can aid in adopting sustainable practices and enhancing service outcomes in the South African automotive supply chain, providing a guide for practitioners and policymakers during implementation. Considering the afore-mentioned substantial and positive results among the constructs, the current model of the study posits that in the South African automotive repair and maintenance sector:

- Compliance and certification have a positive impact on environmental sustainability.
- Inbound logistics has a beneficial impact on environmental sustainability.
- Environmental sustainability has a major beneficial influence on productivity.
- Environmental sustainability has a substantial beneficial impact on quality.
- Environmental sustainability significantly enhances innovation.
- Environmental sustainability has a substantial beneficial influence on customer relationships.

Importantly, the current model allows feedback that connects sustainability practices (Compliance and Certification and Inbound logistics) with service effectiveness (Quality, Productivity, Innovation and Customer relationships). The model outlines key factors that can aid in adopting sustainable practices and enhancing service outcomes in the South African automotive supply chain, providing a guide for practitioners and policymakers during implementation.

7.5 RECOMMENDATIONS

The objective of this study was to propose a practical and comprehensive framework or model to help automotive supply chains in several South African regions adopt environmentally sustainable practices and enhance service effectiveness. The recommendations derive from the study's findings. The literature and empirical findings substantiated and confirmed this hypothesis. Nevertheless, recommendations can be derived from the results to improve the model's performance upon adoption. The recommendations pertain to environmental sustainability practices and service efficacy.

7.5.1 Recommendations on environmental sustainability practices (compliance and certification and inbound logistics)

7.5.1.1 Enforcing adherence to regulation

The government and regulatory authorities should enforce the implementation of strict emission standards for heavy-duty vehicles that release large amounts of greenhouse gases into the atmosphere because of malfunctions or key activities within a large industry.

In addition to encouraging the adoption of cleaner industrial technology, increasing government support will make South Africa more competitive in international markets. According to the South African Government news agency (2024), there are many chances for industry and economic expansion arising from the shift to sustainable practices. Furthermore, accomplishing sustainability goals will be made possible by the government's dedication to promoting collaboration between the public and private sectors. Future policy frameworks should strike a balance between immediate financial incentives and long-term investment in green innovation, taking inspiration from the MIDP experience, which effectively raised exports but lacked a long-term R&D focus (Kaggwa et al., 2007). By positioning sustainability as a strategic priority, the government can facilitate the automotive industry's evolution into a more resilient and sustainable sector. Compliant automakers have a strong incentive to follow the laws in place because doing so results in environmental protection (Xing et al., 2019). According to Agus Harjoto and Salas (2017), following the law improves green development practices related to environmental sustainability. This green innovation influences productivity and quality and builds relationships with compliant green suppliers and customers.

The government must endorse and promote environmentally friendly policies and programs, as this will increase consumer awareness of environmental challenges and the importance of eco-friendly products and services.

Firms must initiate processes to evaluate their compliance position regularly, address any noncompliance matters, and promote a compliance culture throughout the organisation. They must also ensure that compliance and procedures and policies are assessed regularly. The automotive repair and maintenance sectors should learn to handle the legal requirements arising from governmental institutions, industries, and customers to develop modifications and innovations in their supply chains.

7.5.1.2 Providing Incentives for Compliance and Certification

The government must strengthen and expand incentives for sustainable manufacturing practices to improve productivity and competitiveness. This could entail offering tax benefits, financial assistance, and research grants to companies that make investments in environmentally friendly practices and technologies.

Incentives may include tax breaks or subsidies for businesses that achieve recognised environmental certifications such as ISO 14001. Additionally, certifications can be incorporated as selection criteria for vendors or suppliers bidding for government projects, thereby creating a market-based motivation for compliance. This approach ensures that only certified suppliers are eligible for public sector contracts, rewarding sustainable practices with tangible business opportunities.

Automotive firms must adopt eco-innovation because the aim of its implementation is to lessen adverse environmental impacts such as pollution and other environmental threats caused by the use of natural resources. Government support plays a crucial role in spearheading eco-process innovation by generating an environment in which companies are incentivised to lessen their environmental footprint while sustaining a competitive edge. One way in which the government can support this process is by increasing the human resource capacity for knowledge and technology improvement. This, subsequently, contributes to total ecological sustainability.

The government should advocate innovation by providing funding and collaborative innovation hubs and promoting technological innovation. Additionally, the government can offer resources and environmental support to manufacturers. Policymakers should consider offering incentives, funding, and R&D support to motivate businesses to embrace eco-innovation.

7.5.1.3 Supplier Relationship Management

Firms should encourage strong supplier relationships; a trusting relationship between a buyer and its suppliers allows both parties to share critical resources and strategic information freely. As a result, these partners may be able to obtain notable output resources that may boost the operational performance of their suppliers in terms of responsiveness, reliability and effectiveness in strategic problem resolution.

Firms should also partner with suppliers, as such partnerships can reduce their environmental impact by purchasing green and recyclable materials from them. Additionally, firms should set realistic, attainable goals and objectives that are understood by the buyer and their suppliers and communicate consistently and clearly right from the beginning, as clear communication will alleviate unnecessary problems. Active responsiveness to supplier concerns and transparency in addressing issues will instil trust between the two parties and make the supplier feel at home. Other efforts could also be directed towards generating efficient control mechanisms to address weaknesses, risks and vulnerabilities within the supply chain network.

A final recommendation would be to form a strategic joint venture with suppliers. The relationships with different stakeholders of the supply chain should be built on trust and should include the active engagement of supply chain members in sharing resources and distributing risks and benefits. Sharing risk and rewards is necessary for a successful alliance.

7.5.1.4 Reduction of Carbon emissions

Strong policy frameworks and increased government backing are essential for enhancing South Africa's auto industry's adoption of sustainable practices. The adoption of EVs and lowering carbon emissions are two major obstacles facing the automobile industry as it moves toward more sustainable practices; this is due to inadequate charging stations and dependence on non-renewable electricity sources for charging, as well as high purchase costs of EVs (Tongwane & Moeletsi, 2021). To overcome obstacles of inadequate charging stations, non-renewable electricity sources, and high EV purchase costs, the government should enforce robust policies, incentives, smart grid development, renewable energy adoption, and better public awareness to accelerate electric vehicle adoption and lower overall carbon emissions.

Government programs should concentrate on offering targeted subsidies, incentives, and policy assistance that promote the adoption of ecologically friendly practices to address these issues. The foundation offered by the Electric Vehicle White Paper is encouraging, but a more all-encompassing strategy is needed, one that includes tax breaks for green innovation, subsidies for sustainable manufacturing technology, and assistance in developing EV infrastructure (Boateng & Klopp, 2024; Pillay & Dall-Orsoletta, 2024). Automotive businesses will also be guaranteed the ability to connect their operations with national and international sustainability goals if clear regulatory guidelines and compliance criteria are established.

Systematic carbon footprint tracking is essential for lowering the carbon footprint of the South African automobile sector. Integrating carbon footprint tracking tools, like Carbon Footprint Tracking Apps, into daily operations is an efficient strategy. This recommendation is supported by Lasarov et al. (2024), who demonstrated that cutting-edge information technology can make a substantial contribution to global climate targets, particularly when goal-oriented appeals and feedback systems are used.

This study promotes the utilisation of low-carbon materials in the automobile sector. This recommendation is reinforced by Rüdele and Wolf (2022), who assert that the utilisation of low-carbon materials can aid in diminishing the PCF of automotive parts.

7.5.1.5 Regulation of vehicle emissions

This study recommends the regulation of vehicle emissions. Vehicle emissions are referred to in terms of Euro emission standard equivalents; the most recent emission standard is Euro 6/VI, which controls NOx, PM, CO and hydrocarbon (HC) emissions. The reinforcement of Euro 6/VI adoption in the South African automotive sector is limited by the economic impact. A cost–benefit study conducted by the ICCT revealed that the societal health benefits of adopting Euro VI emission standards outweigh the costs of the transition (Xie, Posada & Sen, 2022). Furthermore, this adoption may stimulate the growth of local green and clean technology markets in South Africa.

Stakeholders are encouraged to engage with vehicle manufacturers, vehicle parts manufacturers and fleet companies to prepare and assist the automotive industry in the transition process. This move will create job opportunities in the green transport value chain. Most Global South countries have made notable progress in the adoption of strict vehicle emission standards. China, Brazil, Mexico and India have already adopted Euro IV-equivalent standards for new vehicle sales and registrations. In contrast to the progress made internationally, South African vehicle emission regulations have remained unchanged at the Euro II level for nearly two decades.

7.5.1.6 Recommendation on Inbound logistics

The automotive industry should implement the LSS method, which is a combination of the Six Sigma methodology and lean philosophies. Six Sigma concentrates on quality improvement and the reduction of part defects, whereas the lean approach centres around waste and speed in all workshop processes. The simultaneous application of the two structures ensures that the process speed, product or service quality and customer satisfaction can be increased while maintaining costs. Its application further promotes waste reduction and smooth, sustainable workflow in automotive maintenance and repair workshops. The supply of faulty parts lengthens the shipment and supply process and affects inventory planning within the scope of inbound logistics. Faulty parts, if fitted on the car accidentally, may result in the whole vehicle being repaired or scrapped.

The connections between IL operations have been linked to organisational resilience (Costa et al., 2020). Automotive repair and maintenance workshops need to keep abreast of their competitors so that they can work with competent suppliers who will supply the correct quality parts timeously. To that end, a resilient organisation strives to improve product quality, enhance productivity and is innovative. This competitive advantage helps it to build customer and supplier relationships.

The government, through the Department of Forestry, Fisheries and Environment, should ascertain that companies that are working on environmental logistics perform regular checks of their carbon footprints. The establishment of a standardised method for tracking carbon footprints in the sector would lead to reduced carbon emissions in the supply chain. Standardisation would help to monitor and improve the environmental impact of both incoming and leaving logistics.

The department of transport should consider moving towards rail transport for long-distance, dense corridors might yield environmental, financial and social benefits. Most road transport in South Africa is responsible for freight transportation from different production sources to different destinations where the products are being sold and processed (Van der Merwe, Van Eeden & Simpson, 2023). Most freight transport uses a single-trip transport method from the loading point to the delivery destination without a return load, resulting in an empty running time. Using the two trips-to-one load ratios, an assumption that 50% of trips are empty loads contributes significantly to the kilometres travelled, fuel consumption and carbon emissions.

The study recommends the implementation of carbon tracking applications. This approach may have positive effects on other aspects, such as heating and housework, in addition to lowering emissions in particular areas, such as energy use and transportation. Custom tracking systems deliver prompt feedback and promote environmentally sustainable behaviours across the automotive supply chain. This study promotes the utilisation of low-carbon materials in the automobile sector. This recommendation is consistent with Rüdele and Wolf (2022), who assert that the utilisation of low-carbon materials can aid in diminishing the product carbon footprint (PCF) of automotive parts.

7.5.1.7 Recommendations regarding the effectiveness of services (quality, innovation, productivity, and customer relationships)

The findings of the study suggest that a greater emphasis on environmental sustainability may lead to greater gains in overall productivity. These results imply that sustainable practices, such as conserving energy and cutting waste, improving business operations and lowering expenses, may increase productivity. The automotive industry needs to focus more on the latest and most advanced production technologies, stringent safety regulations, and improved environmental protection laws to survive enormous challenges such as hyper-competition and other challenges that are common in today's globally competitive world. This is because productivity pertains to the efficient utilisation of resources (inputs) in the production of goods and/or services (output).

The study indicates that delivering high-quality service and parts in the automotive repair and maintenance sector improves customer retention, attracts new clients through word-of-mouth promotion, increases productivity, and results in increased market share. Exceptional quality products alone are insufficient to contend with fierce competition in a dynamic market; rather, a diverse product range is essential (Senarath Gunarathne & Fernando, 2020). Given these findings, stakeholders in the automotive repair and maintenance sector in selected regions of South Africa should assess their quality management models to ensure conformity with the identified success drivers. Through the implementation of these managerial implications, the automotive industry can aim for excellence in supply chain performance, resulting in a stronger competitive position both locally and globally.

This study recommends that businesses include sustainable practices in their strategy for innovation. They can employ environmentally sustainable technology, sustainable materials, and green manufacturing practices. These practices could result in environmental advantages and enhancements in service quality. Additionally, the study suggests that innovation and sustainability be integrated. Braidy, Pokharel & ElMekkawy, (2024) substantiate this viewpoint, emphasising that the innovation potential of the automotive repair and maintenance sector is influenced by organisational culture, resource availability, and primary business focus. By integrating sustainability initiatives with innovation goals, automotive manufacturers can comply with environmental regulations while creating value through enhanced products, processes, and market positioning. This integrated strategy can provide a competitive edge, particularly as international markets increasingly prioritise sustainable credentials. The report indicates an increased implementation of digital transformation. Acciarini et al. (2022) assert that digital transformation can facilitate the development of sustainable business models by allowing enterprises to adjust to changing environmental requirements and market needs. Digital tools can enhance EE, minimise waste, and expedite innovation processes in sustainability projects. Maier et al. (2020) assert that integrating innovation with sustainability can promote advancements focused on environmental sustainability.

The study highlighted the significance of customer relationships in advancing environmental sustainability. Customer relationship management (CRM) is a service strategy that emphasises the cultivation of enduring and durable customer connections while enhancing value for both the client and the company (Pohludka & Štverková, 2019). Companies should prioritise enduring collaborations with clients whose environmental values align with their own. Supply chain management (SCM) involves coordinating and collaborating on the flow of information and resources among diverse channel partners, suppliers, and customers. Establishing collaborations that promote eco-friendly practices and initiatives is crucial, fostering a collective dedication to sustainability across the supply chain. Strategic supplier connections enhance innovation and operational efficiency using external knowledge and resources. The connection between suppliers and customers is crucial for fostering supply chain innovation, as indicated by Modungwa et al. (2021). Automotive repair and maintenance workshops must rigorously comply with customer specifications, provide high-quality service, and ensure timely delivery. According to the study, including suppliers can greatly increase productivity and innovation results, particularly in the pre-innovation stage. The lack of early supplier involvement, which represents an unrealised opportunity for automakers, is one of the difficulties the report also finds. Structured collaboration frameworks that support early engagement and co-creation in innovation processes are necessary to address these issues.

Furthermore, developing strategic supplier alliances can improve the automotive industry's ability to adjust to changing environmental regulations. Vendor relationships in sustainable supply chains greatly improve productivity, risk management, and profitability, according to Achal and Vijaya (2023). By creating partnership models that promote the collaborative development of green technology and sustainable production techniques, the South African automotive repair and maintenance sector can benefit from a similar strategy. Furthermore, the government should consider implementing regulations that encourage collaboration focused on sustainable innovation, drawing inspiration from the production asset allowance (PAA) program, which has a favourable effect on industry investment (Kaggwa et al., 2007). The industry can create more robust and flexible supply chains that serve long-term sustainability objectives while preserving global competitiveness by encouraging customer collaboration. By leveraging the knowledge, assets, and networks of numerous stakeholders, cross-sectoral collaborations (CSCs), as explored by Aliyeva et al. (2024), benefit internal collaboration in external partnerships. Through the creation of synergies between corporate, public, and non-profit groups, this method can support the sustainable supply development initiatives of automotive firms. According to Ba et al. (2024), departments must be flexible, technologically savvy, and strategically aligned to be collaboration ready. To create robust and sustainable processes that ultimately spur innovation and long-term competitiveness, automotive companies should encourage cross-departmental and cross-sectoral collaboration.

7.6 STRENGTHS AND LIMITATIONS OF THE STUDY

The key strength of this research is its empirically driven approach to model development. By utilising PLS-SEM, the study was able to rigorously test the hypotheses and refine its initial conceptual framework. This resulted in an actionable model that distinguishes between influential and non-influential sustainability practices.

One of the study's limitations, especially when collecting data in private organisations, is the respondents' hesitancy to commit to participating and responding to the questionnaire. According to studies examining the causes of resplendent hesitancy (Cycyota & Harrison, 2006; Baruch & Holtom, 2008), private company employees may be hesitant to participate in research studies because they are concerned about the confidentiality of their responses and the potential for private information to be disclosed. Employees may fear that their participation could jeopardise their job security or lead to negative consequences within the organisation (Baruch & Holtom, 2008). In addition, employees in private organisations often have demanding workloads and limited time to devote to activities outside of their core job responsibilities. Participating in a research study may be perceived as an additional burden that they cannot accommodate (Baruch & Holtom, 2008).

The study’s cross-sectional design is also a limitation because such designs cannot establish cause-and-effect relationships and lack the ability to analyse trends over time. The study is restricted to automotive maintenance and repair workshops in South Africa and is limited to four provinces, namely, Gauteng, Free State, Limpopo and Mpumalanga, hence limiting the geographic scope of the study. A cross-country study could be explored, which would provide a comprehensive plan for a broader perspective and a deeper understanding of knowledge-based supply chains. Since the sampling design was susceptible to include bias, this was mitigated by selecting respondents based on their knowledge of supply chain management and involved in supply chain activities.

7.7 SUGGESTIONS FOR FUTURE RESEARCH

Future research could explore ways to address these limitations and broaden the focus to other areas or industries, thereby creating a more comprehensive understanding of how sustainability relates to service efficiency. Future studies should investigate variables that have not had a positive impact on environmental sustainability; this will assist in testing studies in these fields and support multi-country studies. These variables include government regulations, technology adoption, top management support, sustainability culture, environmental corporate social responsibility, and outbound logistics. Additionally, it is acknowledged that numerous frameworks exist that propose different drivers of environmental sustainability. Examples include frameworks mentioned by Hossain et al. (2022), Oke et al. (2023) and Alinda et al. (2024), among others. Future research endeavours should then consider such frameworks and test their dimensions within the automotive industry, as performed in the current study.

The study's geographic breadth was limited by its focus on the four South African provinces; subsequent research could include more provinces to enable the findings to be more broadly applied. Although the proposed model is a helpful reference for industry professionals, further research and continuous refinement are recommended to achieve improved outcomes. Furthermore, although this study focuses on automotive repair and maintenance workshops in the four provinces of South Africa, other studies may investigate how the proposed model can be applied to other industries.

The cross-sectional design of this study captures relationships at a single point in time but cannot establish causality or track changes over time. Future research should conduct longitudinal studies tracking ES adoption and service effectiveness outcomes over 3–5 years to determine whether non-significant constructs such as TPS and SC become significant as sustainability matures in the sector. Future research should also consider adopting a mixed-method study to ensure that lived experiences of the stakeholders in the automotive repair and maintenance sector are captured and compared with quantitative data.

7.8 THEORETICAL AND PRACTICAL CONTRIBUTIONS OF THE STUDY

This section highlights the theoretical and practical contributions of the study. A theoretical contribution enhances knowledge by creating or refining theories and proposing new models or frameworks to explain various phenomena. A practical contribution refers to the extent to which a study's results provide actionable insights and solutions that can be implemented in real-life settings beyond the academic environment (Lim & Bowman, 2023).

7.8.1 Theoretical contribution

This study contributes to the literature on sustainability and service operations in the automotive maintenance and repair sector. The results challenge established hierarchies of sustainability drivers, where culturally driven factors, such as top management support, sustainability culture, and technology adoption, are seen as the primary drivers of environmental sustainability. This study, however, reveals that the most critical drivers are not internal factors but external governance and operational efficiency, specifically compliance and certification, as well as inbound logistics. This result challenges the universal applicability of dominant theories and suggests that, in developing, fragmented industries, the path to sustainability is more structurally enforced than technologically led. This contributes to a vital refinement of existing theories, such as institutional theory and RBV by highlighting the value of different sustainability drivers.

The study provides insights that validate the service effectiveness payoff of sustainability. While the results show a positive relationship between sustainability and performance from a theoretical perspective, this study provides robust, empirical evidence within a specific industrial context. This finding demonstrates that ES is a significant direct antecedent to multiple dimensions of service effectiveness. This moves the concepts from theoretical propositions to a measurable reality. The study uniquely explores the need to combine Environmental sustainability practices (compliance and certification) and environmental sustainability to produce higher service effectiveness and competitive advantage through productivity, quality, innovation and customer relationships.

A key theoretical contribution of the study is the development and validation of a model to assist the South African automotive industry's supply chain in enhancing service effectiveness and adopting ES practices. The model, which retains only the statistically significant constructs, goes beyond a concept to an actionable framework. The model highlights that effective sustainability guidelines in certain contexts can be focused on and practical, focusing on the core of high-impact, verifiable practices that directly lead to both environmental and service delivery gains.

7.8.2 Practical contribution

The study's practical contributions are outlined from the perspectives of different stakeholders, including automotive maintenance and repair industry managers, policymakers, and supply chain partners.

7.8.2.1 For automotive repair and maintenance managers

The results of the study provide clear insights for managers to achieve environmental sustainability, prioritise investments in inbound logistics and supplier collaboration and strengthen compliance and certification systems. This prevents the manipulation of limited resources into practices such as standalone technology adoption. The study provides managers with a compelling business case, offering empirically proven links between environmental sustainability and improved quality, productivity, and customer relationships. Managers can use these insights to justify sustainability initiatives, not solely on ethical grounds but also as strategic investments that enhance core operational performance and profitability.

In addition, the finding that sustainability drives innovation encourages managers to channel their creative efforts toward developing new processes and business models that reduce environmental impact, thereby positioning their firms for long-term competitiveness.

7.8.2.2 For policy makers and regulatory bodies

The study's results validate the effectiveness of environmental sustainability regulatory instruments. The significant positive relationship between compliance and certification strongly validates the role of government regulation and standards. Policy makers should be confident that developing and enforcing clear environmental standards for the automotive aftermarket sector is an effective strategy for driving tangible environmental improvements.

This study provides insights into how green logistics infrastructure can be achieved. Given the powerful role of inbound logistics, policymakers can amplify sustainability outcomes by incentivising green logistics infrastructure, such as supporting technologies that optimise freight movement and promote low-carbon transport modes.

7.8.2.3 For supply chain partners

The study's results set the basis for collaborative improvements. The importance of inbound logistics highlights that environmental sustainability is a shared responsibility. Automotive companies should engage their suppliers in collaborative efforts to green their supply chain. This can be achieved by focusing on joint initiatives in transportation, packaging, and inventory management.

7.9 FINAL REMARKS

This concluding chapter presents the final synthesis of a study that aimed to address a practical problem within the South African automotive repair and maintenance industry by developing a model to guide the implementation of environmental sustainability practices. The research went beyond theoretical postulations to provide empirically validated, actionable insights. Through a quantitative investigation, the research identified key drivers of environmental sustainability and demonstrated its influence on service effectiveness. The results reveal that in the South African automotive repair and maintenance sector, environmental sustainability is not driven solely by often-cited internal factors such as top management support or technology but is most powerfully driven by external factors, including compliance and certification, as well as inbound logistics. Most importantly, the study establishes a robust, causal link between environmental sustainability and enhanced service effectiveness. This proves that sustainable practices directly and significantly improve productivity, quality, innovation and customer relationships. The results transform sustainability from a perceived cost centre into a veritable strategic lever for competitive advantage.

REFERENCES

Abdollahi, M., Arvan, M. & Razmi, J. 2015. An integrated approach for supplier portfolio selection: Lean or agile? *Expert Systems with Applications*, 42:679-690.

Abdul Wahab, A.H. 2021. *Private Communication: Professor of Agriculture.* Arabian Gulf University, Kingdom of Bahrain.

Aboal, D. & Garda, P. 2016. Technological and non-technological innovation and productivity in services vis-à-vis manufacturing sectors. *Economics of Innovation and New Technology*, 25(5):435-454.

Aboal, D. & Tacsir, E. 2018. Innovation and productivity in services and manufacturing: The role of ICT. *Industrial and Corporate Change*, 27(2)2: 21-241.

Abolhassani, A. & Jaridi, M. 2016. Productivity enhancement in North American automotive industry: Strategies and techniques to reduce hours-per-vehicle. *International Journal of Productivity and Performance Management,* 65(8):1112-1136.

Abosede, A.J. & Onanuga, A.T. 2016. Research design: A review of features and emerging developments. *European Journal of Business and Management,* 8(11):113-118.

Abushaikha, I., Salhieh, L. & Towers, N. 2018. Improving distribution and business performance through lean warehousing. *International Journal of Retail & Distribution Managemen*t, 46(8):780-800.

Acciarini, C., Borelli, F., Capo, F., Cappa, F. & Sarrocco, C. 2022. Can digitalization favour the emergence of innovative and sustainable business models? A qualitative exploration in the automotive sector. *Journal of Strategy and Management*, 15(3):335-352.

Adam, P., Ovseiko, P.V., Grant, J., Graham, K.E., Boukhris, O.F., Dowd, A.M., Balling, G. V., Christensen, R.N., Pollitt, A., Taylor, M. & Sued, O. 2018. ISRIA statement: Ten-point guidelines for an effective process of research impact assessment. *Health Research Policy and Systems*, 16(1):1-16.

Adams, C., Muir, S. & Hoque, Z. 2014. Measurement of sustainability performance in the public sector. *Sustainability Accounting, Management and Policy Journal*, 5(1):46-67.

Adcock, C., Eling, M. & Loperfido, N. 2015. Skewed distributions in finance and actuarial science: a review. *The European Journal of Finance*, 21(13-14):1253-1281.

Adesanya, A., Yang, B., Bin Iqdara, F.W. & Yang, Y. 2020. Improving sustainability performance through supplier relationship management in the tobacco industry. *Supply Chain Management: An International Journal,* 25(4):413-426.

Adhikari, S.P., Meng, S., Wu, Y.J., Mao, Y.P., Ye, R.X., Wang, Q.Z., Sun, C., Sylvia, S., Rozelle, S., Raat, H. & Zhou, H., 2020. Epidemiology, causes, clinical manifestation and diagnosis, prevention and control of coronavirus disease (COVID-19) during the early outbreak period: a scoping review. *Infectious diseases of poverty*, 9(1):29.

Adrodegari, F. Bonetti, D., & Saccani, N. 2017. *A framework to assess the level of customer centricity in manufacturing companies* [Online]. Available at: https://www.researchgate.net/publication/320081732_a_framework_to_assess_the_level_of_customer_centricity_in_manufacturing_companies/citation/download (Accessed 27 March 2022).

Afzal, F. & Lim, B. 2022. Organizational factors influencing the sustainability performance of construction organizations. *Sustainability*, 14(16):1-17.

Agar, J. 2020. What is technology? Technology: Critical History of a Concept. *Annals of Science*, 77(3):377–382.

Agarwal, B. 2018. Capacity Building and Empowerment of Women in Climate Adaptation: A Key to Resilient Communities. *Environmental Research and Sustainability,* 12:214-230.

Aghion, P., Akcigit, U. & Howitt, P. 2014. What do we learn from Schumpeterian growth theory? In *Handbook of economic growth*, 2:515-563.

Agus Harjoto, M. & Salas, J. 2017. Strategic and institutional sustainability: Corporate social responsibility, brand value, and Interbrand listing. *Journal of Product & Brand Management,* 26(6):545-558

Ahi, P. & Searcy, C. 2015. Assessing sustainability in the supply chain: A triple bottom line approach. *Applied Mathematical Modelling,* 39:2882-2896.

Ahi, P., Jaber, M.Y. & Searcy, C. 2016. A comprehensive multidimensional framework for assessing the performance of sustainable supply chains. *Applied Mathematical Modelling*, 40:10153-10166.

Ah-Lian, K., Eric, R., Karl, A., Jari, P. & Georges, J-P. 2019. Education in Green ICT and Control of Smart Systems: A First-Hand Experience from the International PERCCOM Masters Programme, *IFAC-PapersOnLine*, 52(9):1-8.

Ahmed, I. & Ishtiaq, S. 2021. Reliability and validity: Importance in Medical Research. *Journal of Pakistan Medical Association,* 71(10):2401-2406.

Ahmed, M.N. 2017. Impact of outbound logistics in purchase decision of small electronic home appliance traders in Chittagong. *International Journal of Applied Logistics,* 7(2):52–62.

Ahmed, P.K. & Shepherd, C.D. 2012. *Innovation management: context, strategies, systems and processes*. Larlow: Pearson Education.

Ahuja, S.P. & Muthiah, K. 2021, Advances in Green Cloud Computing. *in Research Anthology on Architectures, Frameworks, and Integration Strategies for Distributed and Cloud Computing*. IGI Global: 2651-2662.

Akdeniz, M.B. & Calantone, R.J. 2017. A longitudinal examination of the impact of quality perception gap on brand performance in the US automotive industry. *Marketing Letters*, 28(1):43-57.

Akinlabi, S.A. & Mbohwa, C. 2016. Evaluating operational challenges of road freight system. *In Proceedings of the World Congress on Engineering and Computer Science,* 2:1-5.

Alaassar, A., Mention, A. L. & Aas, T.H. 2022. Facilitating innovation in FinTech: A review and research agenda. *Review of Managerial Science*, 17(1):33-66.

Al-Ansari, T., Korre, A., Nie, Z. & Shah, N. 2017. Integration of greenhouse gas control technologies within the energy, water and food nexus to enhance the environmental performance of food production systems. *Journal of Cleaner Production*, 162:1592-1606.

Alatawi, M.A. 2017. Overcoming the limitation of cluster samples with a simplified sampling method. *International Journal of Research in Management & Social Science*, 10:7-11

Alavi, M., Visentin, D.C., Thapa, D.K., Hunt, G.E., Watson, R. & Cleary, M. 2020. Exploratory factor analysis and principal component analysis in clinical studies: Which one should you use. *Journal of advanced nursing,* 76(8):1886-1889.

Al-Doori, J.A. 2019. The impact of supply chain collaboration on performance in automotive industry: Empirical evidence. *Journal of Industrial Engineering and Management*, 12(2):241-253.

Alhadid, AY. & Aburumman, A. 2014. The Impact of Green Innovation on Organizational Performance, Environmental Management Behavior as a Moderate Variable: An Analytical Study on Nuqul Group in Jordan. *International Journal of Biometrics,* 9(7):51-57.

Aliaga, M. & Gunderson, B. 2002. *Interactive statistics*. 2nd ed., New Jersey: Prentice-Hall.

Alinda, K., Tumwine, S., Nalukenge, I., Kaawaase, T. K., Sserwanga, A. & Navrud, S. 2024. Institutional pressures and sustainability practices of manufacturing firms in Uganda. *Sustainable Development,* 32(1):940-958.

Aliyeva, A., Balciunaite, U., Kamau, S. & Völler, C. 2024. Effective cross-sectoral collaboration for strategic sustainable development (master's dissertation). Blekinge Institute of Technology.

Allen, A. 2018. The SAGE Encyclopedia of Communication Research Methods. Chapter Title: "Survey Response Rates". SAGE Publications, Inc. [Online]. Available from: https://dx.doi.org/10.4135/9781483381411. [Accessed: 29 November 2021].

Allen, M.S., Iliescu, D. & Greiff, S. 2022. Single item measures in psychological science. *European Journal of Psychological Assessment.*38(1):1-5

Almana, L.O., Utu, L., Mustakim, A. & Halisu, L. 2018. Effects of satisfaction, trust and commitment on customer loyalty. *International Journal of Scientific & Engineering Research,* 9(2):269-276.

Al-Marsomi, N. & Al-Zwainy, F. 2023. Assessing convergent validity in structural equation modelling: A practical guide. *Journal of Applied Measurement,* 24(2):23-135.

Almquist, E., Senior, J. & Bloch, N. 2016. The elements of value: measuring-and delivering-what consumers really want. *Harvard Business Review*, 94(9):47-53.

Alotaibi, M.A. & Eltamaly, A.M. 2022. Upgrading Conventional Power System for Accommodating Electric Vehicle through Demand Side Management and V2G Concepts. *Energies*, 15(18):6541.

Alshehhi, A., Nobanee, H. & Khare, N. 2018. The impact of sustainability practices on corporate financial performance: Literature trends and future research potential. *Sustainability*, 10:494.

Alvi, M. 2016. A manual for selecting sampling techniques in research. *Munich Personal RePEc Archive.*

Ambe, I.M. & Badenhorst-Wess, J.A. 2013. An exploration of supply chain practices in the South African automotive industry. *African Journal of Business Management, 7(31*):3094-3101.

Ambe, I.M. & Nkosi, R. 2017. Factors influencing green supply chain management in the South African public sector. *Journal of Transport and Supply Chain Management,* 11(1):1-9.

Amighini, A. & Sanfilippo, M. 2014. Impact of South–South FDI and Trade on the Export Upgrading of African Economies- World Development, *Elsevier*, 64(C):1-17.

Amrhein, V., Trafimow, D. & Greenland, S. 2019. Inferential Statistics as Descriptive Statistics: There Is No Replication Crisis if We Don't Expect Replication. *The American Statistician*, 73:262–270.

Ansara, D. & Davids, M. 2018. *Motor Industry Skills of the Future: Research Project to Investigate the Relevance of Occupations and Skills for the South African Motor Industry* [Online]. Available at: https://www.merseta.org.za/wp-content/uploads/2021/05/merSETA-Motor-Industry-Skills-of-the-Future-Research-Report.pdf (Accessed 12 February 2023).

Anthony, B., Majid, M. & Romli, A. 2018. Heterogeneous agent-enabled decision system for evaluating Green IT performance in industrial environments. *Journal of Decision Systems*, 27(1):37-62.

Anwar, M., Khattak, M. S., Popp, J., Meyer, D. F., & Mátė, D. (2020). The nexus of government incentives and sustainable development goals: is the management of resources the solution to non-profit organisations? *Technological and Economic Development of Economy*, *26*(6):1284-1310.

Anzolin, G. Andreoni, A. & Zanfei, A. 2020. Robot adoption and FDI driven transformation in the automotive industry. *International Journal of Automotive Technology and Management,* 20(2):215-237.

Arbib, J. and Seba, T. (2017) Rethinking Transportation 2020-2030. A RethinkX Sector Disruption Report [Online]. Available at: https://static1.squarespace.com/static/585c3439be65942f022bbf9b/t/591a2e4be6f2e1c13df930c5/1494888038959/Rethink+Report_051517.pdf (Accessed 16 February 2023).

Arinze, C.A., Agho, M.O., Eyo-Udo, N.L., Abbey, A.B.N. & Onukwulu, E.C. 2025. AI-Driven Transport and Distribution Optimization Model (TDOM) for the downstream petroleum sector: enhancing SME supply chains and sustainability. *Magna Scientia Advanced Research and Reviews,* 13(1):137-153.

Asadi, S., Hussin, A.R.C. & A. Saedi. 2016. *Decision makers intention for adoption of Green Information Technology, 3rd International Conference on Computer and Information Sciences (ICCOINS),* Kuala Lumpur, Malaysia: 91-96.

Asiamah, N., Mensah, H.K., & Oteng-Abayie, E.F. 2017. General, Target, and Accessible Population: Demystifying the Concepts for Effective Sampling. *The Qualitative Report*, 22:1607-1622.

Asongu, S. A., Le Roux, S., & Biekpe, N. 2017. Environmental degradation, ICT and inclusive development in Sub-Saharan Africa. *Energy policy*, 111:353-361.

Aspers, P. & Corte, U. 2019.What is Qualitative in Qualitative Research. *Qualitative Sociology,* 42:139–160.

Atkin, B. & Brooks, A. 2014. Total facility management (4th ed.). John Wiley & Sons.

Autokunbo. 2025. *How many cars are there in the world 2025* [Online]. Available at: https://autokunbo.com/number-of-cars-in-the-world-2025-key-stats-figures/ (Accessed 8 January 2025).

Ayantoyinbo, B.B. & Adepoju, O.O. 2018. Analysis of Solid Waste Management Logistics and Its Attendant Challenges in Lagos Metropolis. *Logistics*, 2(2):11.

Aziz, A., Memon, J.A. & Ali, S. 2020. Logistics capability, logistics outsourcing and firm performance in manufacturing companies in Pakistan. *Journal of Asian Finance, Economics and Business*, 7(8):435-444.

Babbie, E. R. 2020. *The practice of social research*. Boston: Cengage.

Babyak, M.A. & Green, S.B. 2010. Confirmatory factor analysis: An introduction for psychosomatic medicine researchers. *Psychosomatic Medicine*, 72(6):587-597.

Backus, M. 2020. Why is productivity correlated with competition? *Econometrical*, 88(6): 2415-2444.

Baffour-Awuah, E. 2018. Service quality in the motor vehicle maintenance and repair industry: A documentary review. *International Journal of Engineering and Modern Technology*, 4(1): 14-34.

Bag, S., Gupta, S. & Luo, Z. 2020. Examining the role of logistics 4.0 enabled dynamic capabilities on firm performance. *The international journal of logistics management*, 31(3): 607-628.

Bai, C. & Satir, A. 2020. Barriers for green supplier development programs in manufacturing industry. Resources, Conservation and Recycling, 158:04756.

Bain, A. 2016. 15. Suburban creativity and innovation. Handbook on the Geographies of Innovation.

Balatsky, E.V. & Ekimova, N.A. 2019. Russia in the world system of labour productivity. *The World of New Economy*, 13(3):14-28.

Balinado, J.R., Prasetyo, Y.T., Young, M.N., Persada, S.F., Miraja, B.A. & Redi, A.A.N.P. 2021. The effect of service quality on customer satisfaction in an automotive after-sales service. *Journal of Open Innovation: Technology, Market, and Complexity,* 7(2):116.

Balist, J., Sargazi, E., Hoveidi, H. & Faryadi, S. 2016. Environmental Management System and Green Productivity (EMS_GP) Implementation in Kurdistan Cement Plant. *International Journal of Business and Management Invention*, *5*(4):1-7.

Banerjee, S.B., Iyer, E.S. & Kashyap, R.K. 2003. Corporate environmentalism: Antecedents and influence of industry type. *Journal of marketing*, 67(2):106-122.

Barchard, K. 2010. Internal consistency reliability. *Encyclopedia of research design*, 1:615-619.

Barnes, J, Black, A, Comrie, D. & Hartogh, T. 2017. Phase 4 report - South African Automotive Masterplan to 2035. Compiled for the South African national government's Department of Trade and Industry.

Barnes, J. & Kaplinsky, R. 2000. Globalization and the death of the local firm? The automobile components sector in South Africa. *Regional studies*, 34(9):797-812.

Barnes, J. 2013. Capital structure of the South African automotive industry: Historical perspectives and development implications. *Transformation: Critical Perspectives on Southern Africa*, 81(1):236-259.

Barnes, J. 2020. Covid-19: The South African auto industry. Trade and industry Policy Strategies, Policy Brief, 6/2020.

Barnes, J., Black, A. & Monaco, L. 2018, July. State–business bargaining, localisation and supply chain development in the South African auto industry. *In 4th annual competition and economic development (ACER) conference Johannesburg, South Africa* (pp. 19-20). Johannesburg.

Barney, J. 1991. Firm resources and sustained competitive advantage. *Journal of Management*, 17(1):99-120.

Barney, J.B., Ketchen Jr, D.J. & Wright, M. 2021. Resource-based theory and the value creation framework. *Journal of Management*, 47(7):1936-1955.

Baron, R.M. & Kenny, D.A. 1986. The moderator–mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of personality and social psychology*, 51(6):1173-1182

Baruch, Y. & Holtom, B.C. 2008. Survey response rate levels and trends in organizational research. *Human Relations*, 61(8):1139–1160.

Bask, A., Rajahonka, M., Laari, S., Solakivi, T., Töyli, J. & Ojala, L. 2018. Environmental sustainability in shipper-LSP relationships. *Journal of Cleaner Production,* 172:2986-2998.

Bastin, C., Szklo, A. & Rosa, L.P. 2010. Diffusion of new automotive technologies for improving energy efficiency in Brazil's light vehicle fleet. *Energy Policy*, 38(7):3586-3597.

Bauer, G.R., Churchill, S.M., Mahendran, M., Walwyn, C., Lizotte, D. & Villa-Rueda, A.A. 2021. Intersectionality in quantitative research: A systematic review of its emergence and applications of theory and methods. *SSM-population health*, 14:100798.

Baumgartner, H., Weijters, B. & Pieters, R., 2021. The biasing effect of common method variance: Some clarifications. *Journal of the Academy of Marketing Science*, 49(2):221-235.

Baxter, P. & Jack, S. 2008. Qualitative Case Study Methodology: Study Design and Implementation for Novice Researchers. *The Qualitative Report*, 13:544-559.

Begeny, C.T., Ryan, M.K., Moss-Racusin, C.A. & Ravetz, G. 2020. In some professions, women have become well represented, yet gender bias persists - Perpetuated by those who think it is not happening. *Science Advances*, 6(26):1-10

Behnam, S., Cagliano, R. & Grijalvo, M. 2018. How should firms reconcile their open innovation capabilities for incorporating external actors in innovations aimed at sustainable development? *Journal of Cleaner. Production,*170:950–965.

Bell, E., Bryman, A. & Harley, B. 2018. *Business Research Methods*. 5th ed. Oxford: Oxford University Press.

Bellucci, F. 2018. Eco and Peirce on abduction. *European Journal of Pragmatism and American Philosophy*, X-(1):1–20.

Belucio, M., Rodrigues, C., Antunes, C.H., Freire, F. & Dias, L.C. 2021. Eco-efficiency in early design decisions: a multimethodology approach. *Journal of Cleaner Production*, 283: 124630.

Bender, S., Bloom, N., Card, D., Van Reenen, J.& Wolter, S. 2018. Management practices, workforce selection, and productivity. *Journal of Labor Economics*, 36(1):371-409.

Ben-Eli, M.U. 2018. Sustainability: definition and five core principles, a systems perspective. *Sustainability Science*, 13(5):1337-1343.

Berkeley, N., Jarvis, D. & Jones, A. 2018. Analysing the take up of battery electric vehicles: An investigation of barriers amongst drivers in the UK. *Transportation Research Part D: Transport and Environment*, 63:466-481.

Berndt, A.E. 2020. Sampling methods. *Journal of Human Lactation,* 36(2):224-226.

Berthod, O. 2018. *Institutional Theory of Organizations*. Cham: Springer.

Bessant, J. & Tidd, J. 2007. *Innovation and Entrepreneurship*; John Wiley & Sons Ltd.: Hoboken, NJ, USA.

Bhandari, P. 2020. *An Introduction to Quantitative Research* [Online]. Available at: https://www.scribbr.com/methodology/quantitative-research (Accessed 22 March 2021).

Bícová, K. & Melichar, M. 2016, January. Influence on the shift the product precision of machining process and eligibility. *In Proceedings of the 26th DAAAM International Symposium*: 0508-0512.

Black, A., Barnes, J. & Monaco, L. 2018. *Structural Transformation in the Auto Sector: Industrial Policy, State-Business. Bargaining and Supply Chain Development. Johannesburg: Centre for Competition, Regulation and Economic Development*, Dissertation. University of Johannesburg.

Black, A.H., Makundi, B. & McLennan, T. 2017. *Africa's Automotive Industry: Potential and Challenges. Working Paper Series N° 282, African Development Bank, Abidjan, Côte d'Ivoire* [Online]. Available at: https://www.semanticscholar.org/paper/Africa-%E2%80%99-s-Automotive-Industry-%3A-Potential-and-Black-Makundi/9e6cc07beb6ba27ce95460dbaec57bd7110f35a1 (Accessed (13 January 2023).

Blanco-Novoa, Ó., Fernández-Caramés, T.M., Fraga-Lamas, P. & Vilar-Montesinos, M.A. 2018. A practical evaluation of commercial industrial augmented reality systems in an Industry 4.0 shipyard, IEEE Access, vol. 6, pp. 8201–8218. https://doi.org/10.48550/arXiv.2402.00925.

Bloom, N, Propper C, Seiler S. &Van Reenen J. 2015. 'The Impact of competition on management quality: evidence from public hospitals'. *The Review of Economic Studies,* 82(2): 457-489.

Blumberg, B., Cooper, D. & Schindler, P. 2014. *EBOOK: Business Research Methods*. McGraw Hill.

Boakye, D. 2018. *The Relationship between Environmental Management Quality and Financial Performance of AIM listed Firms*. Ph.D. Thesis. Bournemouth University; Bournemouth, UK.

Boateng, F.G. & Klopp, J.M. 2024. The electric vehicle transition: A blessing or a curse for improving extractive industries and mineral supply chains*? Energy Research & Social Science*, 113:103541.

Boggia, A., Massei, G., Paolotti, L., Rocchi, L. & Schiavi, F. 2018. A model for measuring the environmental sustainability of events. *Journal of Environmental Management,* 206:836-845.

Bohas, A. & Poussing, N. 2016. An empirical exploration of the role of strategic and responsive corporate social responsibility in the adoption of different Green IT strategies. *Journal of Cleaner Production*, 122:240-251.

Bonges, H.A. & Lusk, A.C. 2016. Addressing Electric Vehicle (EV) Sales and Range Anxiety through Parking Layout, Policy and Regulation. *Transportation Research Part A: Policy and Practice,* 83:63-73.

Borens. S. K. & Abbot, B. B. 2011. *Research design and methods*: *A process approach*. 8^{th} ed. McGraw-Hill, New York.

Boschma, R. 2011. *Regional branching and regional innovation policy, in: K. Kourtit, P. Nijkamp and R.R. Stough (eds.) Drivers of Innovation, Entrepreneurship and Regional Dynamics*. Verlag, Berlin/Heidelberg: Springer: 359-368.

Bossle, M.B., De Barcellos, M.D. & Vieira, L.M. 2016. Why food companies go green? The determinant factors to adopt eco-innovations. British. *Food Journal*, 118 (6):1317–1333.

Botnar, O.V., Naumchik, K.A. & Shilova, N. N. 2017. Automation of business processes as a factor in increasing labour productivity. Scientific Community of Students of the 21^{st} century. *Economic Sciences*, 4(52):20-26.

Bouchrika, I. 2023. How to Write a Research Question. Types, steps, and examples [Online]. Available at https://research.com/research/how-to-write-aresearch-question (Accessed 25 April 2023).

Bowden, J.A. & Green, P.J. 2019. Writing with integrity. *In Playing the PhD Game with Integrity: Connecting Research, Professional Practice and Educational Context*. Singapore: Springer:163-197.

Boysen, N., Emde, S., Hoeck, M. & Kauderer, M. 2015. Part logistics in the automotive industry: Decision problems literature review and research agenda. *European Journal of Operational Research,* 242 (1):107-120

Braathen, N.A. 2007. Instrument mixes for environmental policy: How many stones should be used to kill a bird, *International Review of Environmental and Resource Economics* 1(2):185-235.

Bradford, A. & Weisberger, M. 2017. Deductive reasoning vs. inductive reasoning. *Live Science.* 1:1-7.

Brahmbhatt, M. 2014. Criticizing green stimulus. *Wiley Interdisciplinary Reviews: Climate Change*, 5(1):15–21.

Braidy, A., Pokharel, S. & ElMekkawy, T.Y. 2025. Research perspectives on innovation in the automotive repair and maintenance sector. *Sustainability*, 17(7): 2795.

Brand South Africa. 2025. South Africa's automotive industry gears up for Festival of Motoring 2025. Available at: https://brandsouthafrica.com/179948/news-facts/south-africas-automotive-industry-gears-up-for-festival-of-motoring-2025 (Accessed 24 May 2026)

Brandes, O., Brege, S. & Brehmer, P. 2013. The Strategic Importance of Supplier Relationships in the Automotive Industry. *International Journal of Engineering Business Management*, 5(17):1-9.

Brown, T. A. (2015). Confirmatory Factor Analysis for Applied Research. 2nd ed., New York: The Guilford Press.

Brückmann, G., Willibald, F. & Blanco, V. 2021. Battery Electric Vehicle adoption in regions without strong policies. *Transportation Research Part D: Transport and Environment*, 90: 102615.

Brunow, S., Hammer, A. & McCann, P. 2020. The Impact of KIBS Location on their Innovation Behaviour, *Regional Studies*, 54(9):289-1303.

Bryman, A. 2016. *Social research methods*: Oxford: Oxford University Press.

Bryman, A., Bell, E., Hirschsohn, A., Dos Santos, A., Du Toit, J. & Masenge, A. 2014. *Research methodology: Business and management contexts*. Cape Town: Oxford University Press.

Burawat, P. 2019. The relationships among transformational leadership, sustainable leadership, lean manufacturing and sustainability performance in Thai SMEs manufacturing industry. *International Journal of Quality & Reliability Management*, 36(6):1014-1036.

Burch, P. & Crowson, R.L. 2020. Local schooling and organizational change: New insights from the perspective of institutional theory. *Peabody Journal of Education*, 95(4):331-335.

Burki, U., Ersoy, P. & Dahlstrom, R. 2018. Achieving triple bottom line performance in manufacturer customer supply chains: evidence from an emerging economy. *Journal of Cleaner Production,* 197:1307-1316.

Burki, U.; Ersoy, P & Najam, U. 2019. Top management, green innovations, and the mediating effect of customer cooperation in green supply chains. *Sustainability*, 11:1031.

Burvill, S.M., Jones-Evans, D. & Rowlands, H. 2018. Reconceptualising the principles of Penrose's (1959) theory and the resource-based view of the firm: The generation of a new conceptual framework. *Journal of Small Business and Enterprise Development*, 25(6):930-959.

Business Victoria. 2016. Increase profitability and staff retention with an innovative culture, State Government of Victoria, Melbourne.

Busse, C. 2016. Doing Well by Doing Good? The Self-Interest of Buying Firms and Sustainable Supply Chain Management. *Journal of Supply Chain Management*, 52: 28-47.

Bustinza, O.F., Vendrell-Herrero, F. & Baines, T. 2017. Service implementation in manufacturing: An organisational transformation perspective. *International Journal of Production Economics*, *192*:1-8.

Butler, A. H., Seidel, D. J., Hardiman, S. C., Butchart, N., Birner, T. & Match, A. 2015. Defining sudden stratospheric warmings, *American Meteorological Sociology*, 96:1913–1928.

Byrne, B.M. 2001. *Structural equation modelling with AMOS: Basic Concepts, Applications, and Programming*, Mahwah: New Jersey.

Cai, W.G. & Zhou, X.L.2014. On the drivers of eco-innovation: empirical evidence from China. *Journal of Cleaner Production,* 79:239-248.

Cain, M.K., Zhang, Z. & Yuan, K.H. 2017. Univariate and multivariate skewness and kurtosis for measuring nonnormality: Prevalence, influence and estimation. *Behaviour research methods*, 49(5):1716-1735.

Camilleri, M.A. 2022. The rationale for ISO 14001 certification: A systematic review and a cost–benefit analysis. *Corporate Social Responsibility and Environmental Management,* 29(4): 1067-1083.

Cantore, N., Nussbaumer, P., Wei, M. & Kammen, D.M. 2017. Promoting renewable energy and energy efficiency in Africa: a framework to evaluate employment generation and cost effectiveness. *Environmental Research Letters*, 12(3):1-10.

Cârstea, V. 2017. Environmental regulations and the automotive industry. *Romanian Economic and Business Review,* 12(2):72-79.

Carter, C.R. & Liane Easton, P. 2011. Sustainable supply chain management: evolution and future directions. *International journal of physical distribution & logistics management*, 41(1):46-62.

Chan, H.K., Yee, R.W., Dai, J. & Lim, M.K. 2016. The moderating effect of environmental dynamism on green product innovation and performance. *International Journal of Production Economics*, 181:384-391.

Chand, P. & Tarei, P.K. 2021. Do the barriers of multi-tier sustainable supply chain interact? A multi-sector examination using resource-based theory and resource-dependence theory. *Journal of Purchasing and Supply Management*, 27(5):100722.

Charmaz, K. & Thornberg, R. 2021. The pursuit of quality in grounded theory. *Qualitative Research in Psychology*, 18(3):305–327.

Chege, C.G.K., Wanyama, R., Lundy, M., Nguru, W. & Jäger, M. 2021. Does retail food diversity in urban food environments influence consumer diets? *Sustainability*, 13(14):115.

Chen, S. & Ji, Y. 2022. Do corporate social responsibility categories distinctly influence innovation? A Resource-Based Theory Perspective. *Sustainability*, 14(6):3154.

Chen, X., Huang, R., Yang, Z. & Dube, L. 2018. CSR types and the moderating role of corporate competence. *European Journal of Marketing*, 52(7):1358-1386.

Cheng, H., Hu, X. & Zhou, R. 2019. How firms select environmental behaviours in China: The framework of environmental motivations and performance. *Journal of Cleaner Production*, 208:132-141.

Chin, W.W. 1998. The partial least squares approach to structural equation modeling. *In Modern methods for business research.* Psychology Press:295-336.

Choumert-Nkolo, J., Santana Tavera, G. & Saxena, P. 2023. Addressing non-response bias in surveys of wealthy households in low-and middle-income countries: strategies and implementation. *The Journal of Development Studies*, 59(9):1427-1442.

Chu, S., Yang H., Lee, M. & Park, S. 2017. The impact of institutional pressures on green supply chain management and firm performance: top management roles and social capital. *Sustainability*, 9(5):1-21.

Chuang, S., Chen, K.S. & Tsai, M.T. 2015. Exploring the antecedents that influence middle management employees' knowledge-sharing intentions in the context of total quality management implementations. *Total Quality Management and Business Excellence*, 26(1-2): 108-122.

Cici, C. & D'Isanto, D. 2017. Integrating sustainability into core business. *Symphonya. Emerging Issues in Management*, (1):50-65.

City of Johannesburg. 2021. *Air Pollution Control By-law,* 2021. Johannesburg.

Coffman, M., Bernstein, P. & Wee, S. 2017. Electric vehicles revisited: a review of factors that affect adoption. *Transport Reviews,* 37(1):79-93.

Cohen, A.G., Tal, Y., Hersh, D., Vinker, S., Merzon, E., Green, I., Israel, A. & Tuval, A. 2023. Perceptions of Experienced Primary Care Physicians on Telemedicine: Treatment Convenience affects more than Treatment Quality-A Questionnaire-based Study.

Cohen, L., Manion, L. & Morrison, K. 2013. *Research Methods in Education*. 7th ed. London: Routledge.

Coleman, S. & Robinson, J.B. 2018. Introducing the qualitative performance gap: Stories about a sustainable building. *Building Research & Information*, 46(5):485-500.

Cook, L.D. & Kamalodeen, J.V. 2019. *Mixed methods case study research* [Online]. Available at: https://www.ualberta.ca/en/international-institute-for-qualitative-methodology/media-library/international-institute-of-qualitative-methods/webinars/mixed-methods/2019/cook-kamalodeen-webinar-final.pdf (Accessed 18 April 2022).

Correia, M.S. 2019. Sustainability: An Overview of the Triple Bottom Line and Sustainability Implementation. *International Journal of Strategic Engineering*, 2(1):29-38

Coşkun, K. 2020. A new explanation for the conflict between constructivist and objectivist grounded theory. *International Journal of Qualitative Methods*, 19:1-5.

Costa, F.H.D.O., Da Silva, A.L., Pereira, C.R., Pereira, S.C.F. & Gómez Paredes, F.J. 2020. Achieving organisational resilience through inbound logistics effort. *British Food Journal*, 122(2):432-447.

Costantini, V., Crespi, F., Marin, G. & Paglialunga, E. 2017. Eco Innovation, Sustainable Supply Chains and Environmental Performance in European Industries. *Journal of Cleaner Production*,155:141–154.

Council, A.I.E., 2020. Automotive Export Manual. Pretoria: Automotive Industry Export Council

Council, A.I.E.2019. Automotive Export Manual. Pretoria: Automotive Industry Export Council.

Coyle, D. & Lu, S. 2020. Trust and productivity growth – an empirical analysis. Bennett Institute working paper. Bennett Institute for Public Policy, Cambridge.

Coyle, D. 2021. The idea of productivity, Working Papers 003, The Productivity Institute.

Coyle, J.J., Langley, C.J., Novack, A.R., & Gibson, J. B. 2017. Supply Chain Management - A Logistics Perspective. Boston: Cengage Learning.

Crespi, G. & Zuñiga, P. 2012. Innovation and productivity: Evidence from six Latin American countries. *World Development*, 40(2):273-290.

Creswell, J. & Poth, C. 2017. *Qualitative Inquiry and Research Design: Choosing among Five Approaches.* Sage, London.

Creswell, J.W. & Creswell, J.D. 2017. *Research design: Qualitative, quantitative, and mixed methods approaches*. Sage publications. Los Angeles.

Creswell, J.W. & Hirose, M. 2019. Mixed methods and survey research in family medicine and community health. *Family medicine and community health,* 7(2): e000086.

Creswell, J.W. & Plano Clark, V.L. 2011. Designing and Conducting Mixed Methods Research. 2nd Ed., Sage Publications, Los Angeles.

Creswell, J.W. 2013. *Research design: qualitative, quantitative, and mixed methods approaches*. 4th ed., Thousand Oaks: Sage Publications.

Crozet, M. & Milet, E. 2017. Should everybody be in services? The effect of servitization on manufacturing firm performance. *Journal of Economics & Management Strategy,* 26(4):820-841.

Cycyota, C.S. & Harrison, D.A. 2006. What (Not) to Expect When Surveying Executives: A Meta-Analysis of Top Manager Response Rates and Techniques Over Time. *Organizational Research Methods,* 9(2):133–160.

D'Oria, L., Crook, T.R., Ketchen Jr, D.J., Sirmon, D.G. & Wright, M. 2021. The evolution of resource-based inquiry: A review and meta-analytic integration of the strategic resources–actions–performance pathway. *Journal of Management*, 47(6):1383-1429.

Daniel, B.K. 2021. The Role of Research Methodology in Enhancing Postgraduate Students Research Experience. *The Electronic Journal of Business Research Methods*, 20(1):34-48.

Das, G., Li, S., Tunio, R.A., Jamali, R.H., Ullah, I. & Fernando, K.W.T.M., 2023. The implementation of green supply chain management (GSCM) and environmental management system (EMS) practices and its impact on market competitiveness during COVID-19. *Environmental Science and Pollution Research*, 30(26):68387-68402.

Davies-Sramek, B., Omar. A. & Germaine, R. 2017. Leveraging supply chain orientation for global supplier responsiveness: The impact of institutional distance. *The international journal of logistics management,* 30(1):39-56.

Dawar, K. 2017. The role of public procurement policy in driving industrial development. Vienna: united Nations Industrial Development Organization.

Dawley, S. 2010. Transnational corporations and local and regional development. *In Handbook of local and regional development* (pp. 394-412). Routledge.

De Loecker, J., Eeckhout, J. & Unger, G. 2020. The Rise of Market Power and the Macroeconomic Implications. *The Quarterly Journal of Economics*, 135(2): 561-644.

Debnath, R.B.D. 2016. Customer Relationship Management Theory and Research in the new Millennium: Direction for future research. *Journal of Relationship Marketing*, 15(4):1-28.

Decker, R., Haltiwanger, J., Jarmin, R., & Miranda, J. 2020. Changing Business Dynamism and Productivity: Shocks versus Responsiveness. *American Economic Review*, 110(12):3952-3990.

Delbufalo, E. 2015. The influence of supply network structure on firm's multiple innovation capabilities: a longitudinal study in the fashion industry. *Management Decision*, 53(10):2457-2476.

Delmas, M.A. & Pekovic, S. 2013. Environmental standards and labour productivity: understanding the mechanisms that sustain sustainability. *Journal of Organizational Behaviour*, 34 (2):230-252

Deloitte. 2016. *Deloitte Africa Automotive Insights: Navigating the African Automotive Sector: Ethiopia, Kenya and Nigeria* [Online]. Available at: https://www2.deloitte.com/ content/ dam/Deloitte/za/Documents/deloitteafrica/ZA_Deloitte-Africa-automotive-insights-Ethiopia-Kenya-Nigeria-Apr16-2017.pdf (Accessed 13 January 2023)

Deloitte. 2019. *Rooting South Africa. Strengthening the local automotive industry* [Online]. Available at https://www2.deloitte.com/content/dam/Deloitte/za/Documents/Consumer_ Industrial_Products/ZA-Deloitte-Rooting-SA-Strengthening-the-local-automotive-industry-2019.pdf (Accessed 12 January 2023)

Denning, P.J. & Lewis, T.G. 2020. Technology adoption. *Communications of the ACM*, 63(6): 27-29.

Department of Trade and Industry (DTI). 2013. Broad-Based Black Economic Empowerment (B-BBEE) Codes of Good Practice. http://www.thedtic.gov.za/financial-and-non-financial-support/b-bbee/broad-based-black-economic-empowerment.

Department of Trade and Industry (DTI). 2016. *Presentation to the Portfolio Committee on Trade and Industry: Automotive Production and Development Programme (APDP) 2014/15 Review* [Online]. Available at: https://pmg.org.za/files/160216APDP.ppt (Accessed 23 June 2022).

Dezdar, S. 2017. An integrative model for realising benefits from enterprise resource planning implementation. *International Journal of Business Information Systems,* 24(4):423-451.

Di Maggio, P.J. & Powell, W.W. 1983. The iron cage revisited: Institutional isomorphism and collective rationality in organizational fields. *American sociological review*, 148:47-160.

Di Pillo, F., Gastaldi, M., Levialdi, N. & Miliacca. M.2017. Environmental Performance Versus Economic-financial Performance: Evidence from Italian Firms. *International Journal of Energy and Economic Policy*, 7 (2): 98-108.

Dobrovnik, M., Herold, D.M., Fürst, E., & Kummer, S. 2018. Blockchain for and in Logistics: What to Adopt and Where to Start. *Logistics*, 2(3):18.

Doleski, O.D. 2015. *Integrated Business model: Applying the St Gallen management concept to Business models.* Wiesbaden: Springer.

Dongre, A.R. & Sankaran, R. 2016. Ethical issues in qualitative research: Challenges and options. *International Journal of Medical Science and Public Health*, 5(6): 1187-1194.

Dou, J., Su, E. & Wang, S. 2019. When does family ownership promote proactive environmental strategy? The role of the firm's long-term orientation. *Journal of Business Ethics*, 158 (1):81-95.

Dou, X., Su, C., & Wang, J. 2019. Corporate social responsibility and sustainability in emerging markets: Evidence from China. *Journal of Cleaner Production,* 235(1):963–971.

Driffield, N., Du, J., Godsell, J., Hart, M., Lavoratori, K., Roper, S., Surdu, I. & Zhang, W. 2021. *Understanding productivity: Organisational Capital perspectives* (No. 013).

Drnevich, P.L.& Croson, D.C. 2013. Information technology and business-level strategy: Toward an integrated theoretical perspective. *MIS quarterly*, 37:483-509.

Du Plooy-Cilliers, F., Davis, C. & Bezuidenhout, R.M. (eds). *Research Matters*. Cape Town: Juta and Company.

Du, Q. & Kang, J.T. 2016. Tentative ideas on the reform of exercising state ownership of natural resources: Preliminary thoughts on establishing a state-owned natural resources supervision and administration commission. *Jiangxi Social Science*, 6:160.

Dubey, R., Bag, S., Ali, S.S., & Venkatesh, V.G. 2013. Green purchasing is key to superior performance: an empirical study. *International Journal of Procurement Management*. 6 (2):187-210.

Dubey, R., Gunasekaran, A. & Samar Ali, S. 2015. Exploring the relationship between leadership, operational practices, institutional pressures and environmental performance: A framework for green supply chain. *International Journal of Production Economics*, 160:120-132.

Dubey, R., Gunasekaran, A., Childe, S.J., Papadopoulos, T. & Helo, P. 2019. Supplier relationship management for circular economy: Influence of external pressures and top management commitment. *Management Decision,* 57(4):767-790.

Dubey, R., Gunasekaran, A., Childe, S.J., Papadopoulos, T., Hazen, B., Giannakis, M.& Roubaud, D.2017. Examining the effect of external pressures and organizational culture on shaping performance measurement systems (PMS) for sustainability benchmarking: Some empirical findings. *International Journal of Production Economics*, 193:63-76.

Dunn, J. 2022. Floods hit auto production in South Africa. Automotive Logistics [Online]. Available at: https://www.automotivelogistics.media/middle-east-and-africa/floods-hit-auto-production-and-supply-in-south-africa/43073.article (Accessed 16 February 2023).

Dunne, R., Desai, D., Sadiku, R. & Jayaramudu, J. 2016. A review of natural fibres, their sustainability and automotive applications. *Journal of Reinforced Plastic & Composites,*35(13):1041-1050.

Durand, R., & Thornton, P. 2018. Categorizing institutional logics, institutionalizing categories: A review of two literatures. *Academy of Management Annals*, 12(2): 631- 658.

Ebrahimi, S.M. & Koh, L. 2021 Manufacturing sustainability: Institutional theory and life cycle thinking. *Journal of Cleaner Production*, 298:126787.

Edgeman, R. 2018. *Performance Management and Enterprise Excellence Through Sustainable Business Models.* In *Sustainable Business Models*: *Innovation, Implementation and Success*. Cham: Springer:317-359.

Egbue, O. & Long, S. 2012. Barriers to Widespread Adoption of Electric Vehicles: An Analysis of Consumer Attitudes and Perceptions. *Energy Policy*, 48:717-729.

Egnér, F. & Trosvik, L. 2018. Electric vehicle adoption in Sweden and the impact of local policy instruments. *Energy Policy*, 121:584-596.

Ekins, P. & Zenghelis, D. 2021. The costs and benefits of environmental sustainability. *Sustainability Science,* 16(3):949-965.

Elfil, M. & Negida, M. 2017. Sampling Methods in Clinical Research. An Educational Review. *Emergency*, 5: e52.

Eliseeva, Yu. V. & Agafonova, O.V. 2016. The impact of innovation on organizational performance. *Actual Problems of the Agro-industrial Complex*, 9(2): 93-96.

Ellis, L., Pomare, C., Churruca, K., Carrigan, A., Meulenbroeks, I., Saba, M. & Braithwaite, J. 2022. Predictors of response rates of safety culture questionnaires in healthcare: a systematic review and analysis. *BMJ Open,* 12(9):1-6.

Elston, D.M. 2021. Participation bias, self-selection bias, and response bias. *Journal of the American Academy of Dermatology.* 1.

Engellant, K.A., Holland, D.D. & Piper, R.T. 2016. Assessing convergent and discriminant validity of the motivation construct for the technology integration education (TIE) model. *Journal of Higher Education Theory & Practice*, 16(1):37-47

Esfahbodi, A., Zhang, Y. & Watson, G. 2016. Sustainable supply chain management in emerging economies: Trade-offs between environmental and cost performance. *International journal of production economics*, 181:350-366.

Eshikumo, S.M. & Odock, S.O. 2017. Green manufacturing and operational performance of a firm: Case of cement manufacturing in Kenya. *International Journal of Business and Social Science,* 8(4):106-120.

Esser, F. & Vliegenthart, R. 2017. Comparative research methods. *The International Encyclopedia of Communication Research Methods*, 1:1-22.

Essletzbichler, J. 2015. Relatedness, industrial branching and technological cohesion in US metropolitan areas. *Regional Studies,* 49(5):752-766.

European Automobile Manufacturers Association (ACEA). 2020. *The automotive industry pocket guide 2020/2021* [Online]. Available at: https://www.acea.auto/publication/ automobile-industry-pocket-guide-2020-2021/ (Accessed 22 January 2023).

European Automobile Manufacturers Association (ACEA). 2017. *Passenger car fleet by fuel type 2015-2016* [Online]. Available at: http://www.acea.be/statistics/tag/ category/passenger-car-fleet-by-fuel-type (Accessed 22 January 2023).

Eurostat Publishing, 2019. *Europe in figures – Product Statistical Books* [Online]. Available at: https://ec.europa.eu/eurostat/web/products-statistical-books/-/ks-cd-09-001 (Accessed 11 December 2022).

Faggio, G., Salvanes, K.G.& Van Reenen, J. 2010. The evolution of inequality in productivity and wages: panel data evidence. *Industrial and Corporate Change*, 19(6):1919-1951.

Faraji, H., Akbarzadeh, I., Yaseri, M., Sahraian, M.A. & Nikfar, S. 2024. Psychometric validation of the Persian version of the CarerQol-7D instrument on caregivers of patients with multiple sclerosis. *Current Journal of Neurology*, 23(1):59.

Fernandes, A.C., Sampaio, P., Sameiro, M. & Truong, H.Q. 2017. Supply chain management and quality management integration: A conceptual model proposal. *International Journal of Quality & Reliability Management,* 34(1):53-67.

Fernando, Y., Bee, P.S., Jabbour, C.J.C. & Thomé, A.M.T. 2018. Understanding the effects of energy management practices on renewable energy supply chains: implications for energy policy in emerging economies. *Energy Policy*, 118:418-428.

Field, A. 2013. Discovering Statistics Using IBM SPSS Statistics: And Sex and Drugs and Rock "N" Roll, 4th Edition, Sage, Los Angeles, London, New Delhi.

Firli, A., Priminia, I., Kaltum, U., Oesman, Y.M., Herwany, A., Azis, Y. & Yunani, A. 2017. CAPEX efficiency and service quality improvement view tower sharing in the Indonesian telecommunication industry: optimization model using comparison of genetic algorithm and simulated annealing methods, *International Journal of Services, Economics and Management,* 8(1-2):90–108.

Flatters, F. & Netshitomboni, N. 2006. *Trade and Poverty in South Africa: Motor Industry Case Study* [Online]. Available at: https://www.tips.org.za/files/trade_flattersnetshitomboni.pdf (Accessed 13 January 2023).

Flemming, Z. 2017. Methodologies, methods and ethical considerations for conducting research in work integrated learning. *International Journal of Work Integrated*, 19(3):223-235.

Fleurence, RL., Naci, H. & Jansen, J.P. 2010. The critical role of observational evidence in comparative effectiveness research. *Health affairs (Project Hope*), 29(10):1826-1833.

Flinton, D.M., 2020. Sampling errors, bias, and objectivity. *In Medical imaging and radiotherapy Research: Skills and strategies* (pp. 149-165). Cham: Springer.

Florea, A.I.I. & Corbos, R.A. 2015. Supplier relationship strategies in the automotive industry: An international comparative analysis. *Revista de Management Comparat International*, 16(4): 451-460.

Foerstl, K., Azadegan, A., Leppelt, T. & Hartmann, E. 2015. Drivers of supplier sustainability: Moving beyond compliance to commitment. *Journal of Supply Chain Management*, 51(1): 67-92.

Ford, R. & Hardy, J. 2020.Are we seeing clearly? The need for aligned vision and supporting strategies to deliver net-zero electricity systems. *Energy Policy*, 147:111902.

Forman, C., Goldfarb, A. & Greenstein, S. 2018. *Technology Adoption. In: Augier, M., Teece, D.J. (eds) The Palgrave Encyclopedia of Strategic Management*. London: Palgrave Macmillan. https://protect.checkpoint.com/v2/___https://doi.org/10.1057/978-1-137-00772-8_379___.YzJlOnVuaXNhbW9iaWxlOmM6bzo3M2VjZjA1ODBkOGQ1NjQzNTY5NWQ3ZjU4NTgwOWU0Mzo2OjM5YTY6ZDAzMDBlYWEwMTIyYzY0YmQ4MTAzOGI0MGJlNDk1ODI5NTVmODhhY2M2MDRlYzllMDdmN2U1ZGY4MjgwNzQ0ODpwOkY

Fornell, C. & Larcker, D.F. 1981. Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research*, 18(1): 39-50.

Fowler Jr, F.J. 2013. *Survey research methods*. Sage publications.

Franco, A.C. & Franco, L.S. 2022. An institutional theory investigation: analysis of the main trends in innovation. *Brazilian Journal of Management and Innovation*, 9(2):126-144.

Franz, H.W. 2012. Sustainability and organizational culture: An integrative framework. *Journal of Organizational Change Management, 25*(4):573-589.

Franz, R.S. 2012. Role of business: a portfolio model of corporate social responsibility. *Journal of Global Responsibility*, 3(1):83-110.

Freight Waves, 2018. BiTA welcomes Daimler Trucks North America as newest member — Freight Waves. Retrieved January 8, 2019, from https://www.freightwaves.com/news/daimler-trucksnorth-america-joins-bita.

Frey, B. 2018. *The Sage Encyclopedia of educational research, measurement, and evaluation*. (Vols. 1-4). Thousand Oaks, CA: Sage Publications.

Fried, H.O., Lovell, C.A.K. & Schmidt, S.S. 2008. Efficiency and Productivity. Oxford University Press: New York.

Fuchs, M., Dannenberg, P., Lopez Ayala. T., Wiedemann, C. & Riedler, T. 2023. Location-specific labour control strategies in online retail. *ZWF- Advances in Economic Geography,* 67(4):189-201.

Gadde, L.E., Håkansson, H. & Persson, G. 2010. Supply network strategies. John Wiley & Sons.

Galpin, T., Whitttington, J.L. & Bell, G. 2015. Is your sustainability strategy sustainable? Creating a culture of sustainability. *Corporate Governance*, 15(1):1-17.

Gan, Z., Henao, R., Carlson, D. & Carin, L., 2015. Learning deep sigmoid belief networks with data augmentation. In *Artificial Intelligence and Statistics,* 1:268-276.

Gandhi, S.K., Sachdeva, A. & Gupta, A. 2017. Treat employees like customers for an achievement culture: an intrinsic service quality perspective from Indian SMEs. *Journal of Industrial Engineering and Advances,* 2(3):1-10.

Gang, L. 2020. *Impacts of Institutional Change on Industrial Economy: A China's automobile industry perspective*. Doctoral dissertation. ISCTE-Instituto Universitario de Lisboa (Portugal)).

García-Muiña, F.E., Medina-Salgado, M.S., Ferrari, A.M. & Cucchi, M. 2020. Sustainability transition in industry 4.0 and smart manufacturing with the triple-layered business model canvas. *Sustainability*, 12 (6):2364.

Gautam, R., Singh, A., Karthik, K., Pandey, S., Scrimgeour, F. & Tiwari, M.K. 2017. Traceability using RFID and its formulation for a kiwifruit supply chain. *Computers & Industrial Engineering*, 103:46-58

Gemma, R. 2018. Introduction to positivism, interpretivism and critical theory. *Nurse Researcher,* 25(4):41-49.

Ghosh, S. & Sarkar, B. 2025. Consumer adoption intention towards electric vehicles: Insights from Bangalore, India. *Transportation Letters*, 1:1-17.

Ghozali, I. 2014. An efficiency determinant of banking industry in Indonesia. *Research Journal of Finance and Accounting,* 5(3):18-26.

Giampieri, A., Ling-Chin, J., Taylor, W., Smallbone, A. & Roskilly, A.P. 2019. Moving towards low-carbon manufacturing in the UK automotive industry. *Energy Procedia,* 158: 3381-3386.https://protect.checkpoint.com/v2/___https://doi.org/10.1016/j.egypro.2019.01.946___.YzJlOnVuaXNhbW9iaWxlOmM6bzo3M2VjZjA1ODBkOGQ1NjQzNTY5NWQ3ZjU4NTgwOWU0Mzo2OjQ2OGI6ZDU0OGZiODQxYjIzYzViNjkyMDZjNTA2MDJiNjkxMGVjNDFmYmZhZDIwYzkyMDE2MjBlMmY3NzI1NDI3YTIxOTpwOkY

Glanz, K. 2017. *Social and behavioural theories. Office of Behavioural and Social Sciences Research (OBSSR), US National Institutes of Health* [Online]. Available at: https://obssr. od. nih. gov/sites/obssr/files/Social-and-Behavioral-Theories. pdf (Accessed on 7 December 2022).

Goel, R.R., Painter, M.M., Apostolidis, S.A. Matthew, D. 2021. mRNA Vaccines Induce Durable Immune Memory to SARS-CoV-2 and Variants of Concern. *Science*, 374: abm0829.

Gofe, T.E., Olana, D.R. & Debela, K.L. 2022. A Critical Review of Qualitative Research Methods: Collecting evidence, crafting analysis, communicating impact. *Science Research*,10 (5):114-120.

Gohoungodji, P., N'Dri, A.B., Latulippe, J.M. & Matos, A.L.B. 2020. What is stopping the automotive industry from going green? A systematic review of barriers to green innovation in the automotive industry. *Journal of Cleaner Production*, 277:123524.

Gollin, D., Jedwab, R. & Vollrath, D. 2016. Urbanization with and without industrialization. *Journal of Economic Growth,* 21**:**35–70.

Gondlekar, M.S. & Kamat, M.S. 2016. Effect of organizational climate on psychological wellbeing: A study of Vedanta Ltd. *The International Journal of Indian Psychology*, 3(3): 182-195.

Goretzko, D., Siemund, K. &Sterner, P. 2024. Evaluating model fit of measurement models in confirmatory factor analysis. *Educational and Psychological Measurement,* 84(1):123-144.

Goswami, M., De, A., Habibi, M.K.K, & Daultani, Y. 2020. Examining freight performance of third-party logistics providers within the automotive industry in India: an environmental sustainability perspective. *International Journal of Production Research*, 58(24):7565-7592.https://protect.checkpoint.com/v2/___https://doi.org/10.1080/00207543.2020.1756504___.YzJlOnVuaXNhbW9iaWxlOmM6bzo3M2VjZjA1ODBkOGQ1NjQzNTY5NWQ3ZjU4NTgwOWU0Mzo2OmM0Y2M6NDk2M2UzZjA1MzRiMzljNzlhOGQzZGJmNjdmZmUxNjg2NGU0ZTQ5ZDM1MGRiYzQ2MjBiYTQ0OGVhMjZhMTcyYzpwOkY

Gottge, S., Menzel, T. & Forslund, H. 2020. Industry 4.0 technologies in the purchasing process. *Industrial Management & Data Systems,* 120(4):730-748.

Govindan, K. & Hasanagic, M. 2018. A systematic review on drivers, barriers, and practices towards circular economy: a supply chain perspective. *International Journal of Production Research,* 56(1-2):278-311.

Goyal, S., Routroy, S.& Singhal, A. 2019. Analysing environment sustainability enablers using fuzzy DEMATEL for an Indian steel manufacturing company, *Journal of Engineering, Design and Technology,* 17(2):300-329.

Grant, C. & Osanloo, A. 2014. Understanding, selecting, and integrating a theoretical framework in dissertation research: Creating the blueprint for your "house". *Administrative Issues Journal*, 4:12-26.

Grant, R.M. 1991. The resource-based theory of competitive advantage: implications for strategy formulation. *California management review*, 33(3):114-135.

Greenwood, R., Raynard, M., Kodeih, F., Micelotta, E.R. & Lounsbury, M. 2011. Institutional complexity and organizational responses. *Academy of Management annals*, 5(1):317-371.

Grewatsch, S. & Kleindienst, I. 2017. When does it pay to be good? Moderators and mediators in the corporate sustainability–corporate financial performance relationship: A critical review. *Journal of Business Ethics,* 145(2):383-416.

Guatam, R.K. 2014. Purchase decision of Indian customers: the factors of attraction while purchasing car, *Studies in Business and Economic*, 9(1):29-42.

Gunawan, J., Permatasari, P. & Sharma, U. 2022. Exploring sustainability and green banking disclosures: a study of banking sector. *Environment, Development and Sustainability*, 24(9):11153-11194.

Gunduz, M. & Abu-Hijleh, A. 2020. Assessment of human productivity drivers for construction labour through importance rating and risk mapping. *Sustainability*, 12(8614):1-18.

Gupta, A.K. & Gupta, N. 2020. Effect of corporate environmental sustainability on dimensions of firm performance–Towards sustainable development: *Evidence from India. Journal of cleaner production,* 253:119948.

Gupta, S. & Palsule-Desai, O.D. 2011. Sustainable supply chain management: Review and research opportunities. *IIMB Management review*, 23(4):234-245.

Gupta, S. & Vijayvargy, L. 2021, Selection of green supplier in automotive industry: an expert choice methodology. *In IOP Conference Series: Earth and Environmental Science,* 795(1):012036.

Habib, A. Bao, Y, & Ilmudeen, A. 2020. The impact of green entrepreneurial orientation, market orientation and green supply chain management practices on sustainable firm performance. *Cogent Business & Management*, 7(1):1-26.

Hagtvedt, H. & Brasel, S.A. 2017. Color saturation increases perceived product size. *Journal of Consumer Research,* 44(2):396-413.

Haidar, B. & Aguilar Rojas, M.T.A. 2022. The relationship between public charging infrastructure deployment and other socio-economic factors and electric vehicle adoption in France. *Research in Transportation Economics,* 95:101208.

Hair, J.F., Risher, J.J., Sarstedt, M., Ringle, C.M. 2019. When to use and how to report the results of PLS-SEM. *European Business Review*, 31(1): 2–24.

Håkansson, H. & Waluszewski, A. 2007. Interaction: the only means to create use. In *Knowledge and innovation in business and industry.* Routledge:147-167.

Hakim, I.M., Zaqiah, R.O. & Teuku, Y.M.Z. 2018. Optimization of inbound logistics cost in automotive industry. In *MATEC Web of Conferences - EDP Sciences,* 204:02007.

Hamed, K.H. 2016. The distribution of Spearman's rho trend statistic for persistent hydrologic data. *Hydrological Sciences Journal*, 61(1):214-223.

Hameed, S. 2020. Political Economy of Rentierism in the Middle East and Disruptions from the Digital Space. *Contemporary Review of the Middle East*, 7:54-89.

Hammargerg, K., Kirkman, M. & Lacey, S. 2016. Qualitative research methods: when to use them and how to judge them. *Human Reproduction,* 31(3):498-501.

Han, H., Al-Ansi, A., Chi, X., Baek, H. & Lee, K.S. 2020. Impact of environmental CSR, service quality, emotional attachment, and price perception on word-of-mouth for full-service airlines. *Sustainability*, 12(10):3974.

Hankel, A., Heimeriks, G. & Lago, P. 2018. A systematic literature review of the factors of influence on the environmental impact of ICT. *Technologies*, 6(3):85.

Hardesty, D.M. & Bearden, W.O. 2004. The use of expert judges in scale development: Implications for improving face validity of measures of unobservable constructs. *Journal of business research,* 57(2):98-107.

Harrington, D.R., Deltas, G. & Khanna, M. 2014. Does pollution prevention reduce toxic releases? A dynamic panel data model. *Land Economics,* 90(2):199-221.

Harris, L., Gore, M.& Mills, M. 2019. Compliance with ivory trade regulations in the United Kingdom among traders. *Conservation Biology.* 33(4):906-916.

Harrison, G. & Thiel, C. 2017. An exploratory policy analysis of electric vehicle sales competition and sensitivity to infrastructure in Europe, *Technological Forecasting and Social Change,*114:165-178.

Hartzenberg, T. & Marudzikwa, S. 2002. *Transfer of technology for successful integration into the global economy: A Case study of the South African automotive industry. Working paper: Best practices in the transfer of technology*. New York: United Nations.

Heizer, J., Render, B., Munson, C.L. & Griffin, P. 2020. *Operations management: Sustainability and supply chain management.* 14th ed. Pearson Education.

Hengboriboon, L., Sayut, T., Srisathan, W.A.& Naruetharadhol, P. 2022. Strengthening a company–customer relationship from sustainable practices: A case study of petrotrade in Laos. *Cogent Social Sciences,* 8(1):2038355.

Henseler, J., Ringle, C.M.& Sarstedt, M. 2015. A new criterion for assessing discriminant validity in variance-based structural equation modelling. *Journal of the Academy of Marketing Science*, 43(1):115-135.

Hernandez, A.A. & Ona, S.E. 2016. Green IT adoption: lessons from the Philippines business process outsourcing industry. *International Journal of Social Ecology and Sustainable Development (IJSESD)*, 7(1):1-34.

Heskett, J. L., Sasser, W. E., & Schlesinger, L. A. 2015. *What Great Service Leaders Know and Do: Creating Breakthroughs in Service Firms*. Oakland, CA: Berrett-Koehler.

Hetterich, J., Bonnemeier, S. & Georgiadis, A. 2012. Ecological sustainability-a customer requirement? Evidence from the automotive industry. *Journal of environmental Planning and Management,* 55(9):1111.

Hidalgo, C.A. & Hausmann, R. 2008. A network view of economic development. *Developing alternatives*, 12(1):5-10.

Hidayah, I.N., Sa'dijah, C., Subanji, & Sudirman. 2020. Characteristics of Students' Abductive Reasoning in Solving Algebra Problems. *Journal on Mathematics Education*, 11(3):347-362.

Higueras-Castillo, E., Kalinic, Z., Marinkovic, V. & Liébana-Cabanillas, F.J. 2020. A mixed analysis of perceptions of electric and hybrid vehicles. *Energy Policy*, 136:111076.

Hilton, A. & Hilton, G. 2020. *Learning to Research and Researching to Learn: An Educator's Guide.* Cambridge University Press.

Hoffman, A.J. & Georg, S. 2012. A history of research on business and the natural environment: Conversations from the field. *Business and the environment: Critical perspectives in business and management*, 1:1-58.

Holdford, D.A. 2018. Resource-based theory of competitive advantage - a framework for pharmacy practice innovation research. *Pharmacy Practice*, 16(3):1351-1351.https://protect.checkpoint.com/v2/___https://doi.org/10.18549/PharmPract.2018.03.1351___.YzJlOnVuaXNhbW9iaWxlOmM6bzo3M2VjZjA1ODBkOGQ1NjQzNTY5NWQ3ZjU4NTgwOWU0Mzo2OmVkMTA6OWEyMGYyYTQ5YThmNTNiYTVhMGRjYWQxMDcxN2JjZGUwYTQ4ZWE1YjcyODI3YmRiM2IwOWI4MjY3ZjJhMjFkZTpwOkY

Hollos, D., Blome, C. & Foerstl, K. 2012. Does sustainable supplier co-operation affect performance? Examining implications for the triple bottom line. *International Journal of Production Research*, 50(11):2968-2986.

Holtskog, H. 2017. Forms of innovation—Insights from product development. *Journal of the Knowledge Economy*, 8(1):63-76.

Hong, J.& Kim, B. 2020. Service quality, relationship benefit and experience value in the auto repair services sector. *Journal of Open Innovation: Technology, Market, and Complexity*, 6(2): 30.

Hooks, D., Davis, Z., Agrawal, V. & Li, Z. 2022. Exploring factors influencing technology adoption rate at the macro level: A predictive model. *Technology in Society*, 68:101826.

Hooper, D., Coughlan, J. & Mullen, M.R. 2008. Structural equation modelling: Guidelines for determining model fit. *Electronic Journal of Business Research Methods*, 6(1):53-60.

Hopkins, J. & Hawking, P. 2018. Big Data Analytics and IoT in logistics: a case study. *The International Journal of Logistics Management*, 29(2):575-591.

Hossain, M. I., Ong, T. S., Tabash, M. I., Siow, M. L. & Said, R. M. 2022. Systematic literature review and future research directions: drivers of environmental sustainability practices in small and medium-sized enterprises. *International Journal of Sustainable Economy*, 14(3):269-293.

Hourneaux Jr, F., Gabriel, M.L.d.S. & Gallardo-Vázquez, D.A. 2018. Triple bottom line and sustainable performance measurement in industrial companies. *Revista de Gestão,* 25(4): 413-429.

Howard, M., Vidgen, R & Powell, P. 2010. Strategies for e-procurement: auto industry hubs re-examined. Information, Decisions & Operations School of Management, University of Bath

Howell, D.C. 2020. *Fundamental statistics for the behavioural sciences*. 9th ed., Cengage.

Hu, S. & Wang, X. 2021. The Origin of Proactive Environmental Corporate Social Responsibility (ECSR) of Large Firms: Institutional Embeddedness—Driven, Family Involvement-Promoted, or Resource-Dependent? *Economic and Business Aspects of Sustainability*, 13(3):1197.

Huang, C. 2012. *Developing circular economy capability: antecedents, mechanisms, and outcomes in Chinese manufacturing industry*. Dissertation. University of Toledo.

Huang, K., Wang, J. & Zhang, J. 2023. Automotive Supply Chain Disruption Risk Management: A Visualization Analysis Based on Bibliometric. *Processes Engineering,*11(3):710.

Hudnurkar, M., Jakhar, S. & Rathod S. 2014. Factors affecting collaboration in supply chain: a literature review. *Procedia-Social and Behavioural Sciences*, 133:189-202.

Hunter, J.J. 2015. Shayle R. Searle: Pioneer in Linear Modelling. *Australian & New Zealand Journal of Statistics*, 57(1):1-14.

Hutami, L.T.H., & Kurniawan, I.S. 2019. The Analysis of Marketing performance in Yogyakarta SMEs. HOLISTICA. *Journal of Business and Public Administration*, 10(3):170-180.

Hwang, A., Yen, C., Liao, H., Chi, W., Liou, T., Chang, B., & Bedell, G. 2020. Structural validity of an ICF-based measure of activity and participation for children in Taiwan's disability eligibility determination system. *International Journal of Environmental Research and Public Health*, 17(17):6134.

Hyder, A., Uddin, B., Siddiqui, H., Naeem, M. & Waheed, A. 2023. Mediation of reverse logistics in sustainable resources and organizational performance. *South Asian Journal of Operations and Logistics,* 2(1):11-27.

Ikart, E.M. 2019. Survey questionnaire survey pretesting method: An evaluation of survey questionnaire via expert reviews technique. *Asian Journal of Social Science Studies*, 4(2):1.

Ikome, J.M., Laseinde, O.T. & Katumba, M.G. 2022. The Future of the Automotive Manufacturing Industry in Developing Nations: A Case Study of its Sustainability Based on South Africa's Paradigm. *Procedia Computer Science*, 200:1165-1173.

In'nami, Y. & Koizumi, R. 2013. Review of sample size for structural equation models in second language testing and learning research: A Monte Carlo approach*. International Journal of Testing*, 13(1):329-353.

Intarakumnerd, P. 2021. Technological upgrading and challenges in the Thai automotive industry. *Journal of Southeast Asian Economies,* 38(2):207–222.

Ionescu Florea, A.I. & Corboş, R. 2015. Supplier relationship strategies in the automotive industry*: an international comparative analysis. Review of International Comparative Management,* 16(4): 451-460

Jaca, C., Prieto-Sandoval, V., Psomas, E.L.& Ormazabal, M. 2018. What should consumer organizations do to drive environmental sustainability? *Journal of Cleaner Production*, 181: 201-208.

Jain, M., Khalil, S., Johnston, W.J. & Cheng, J.M.S. 2014. The performance implications of power-trust relationship: The moderating role of commitment in the supplier-retailer relationship. *Industrial Marketing Management*, 43:312-321.

James, B., Katie, G., Jitendra, M., & Bharat, M. 2015. "The Big Idea" The Sustainable Economy and the TBL (triple bottom line). *Advances in Management*, 8(1): 1-8.

Jansen, S.E.M., Doornebosch, A.J., de Waal, M.W.M., Wattel, E.M., Visser, M., Spek, B., & Smit, J.H. 2021. Item-total correlations in the assessment of scale reliability. *Journal of Applied Measurement*, 22(3):245-252.

Jassim, S., AL-Mubarak, M & Hamdan, A. 2020.The impact of green supply chain management on firm's performance. *Journal of Information & Knowledge Management*, 19(1):1-16.

Jerzyk, E. 2015. Sustainable packaging as a determinant of the process of making purchase decisions from the perspective of Polish and French young consumers*. Journal of Agribusiness and Rural Development,* 37(3):437-445.

Jiang, J. 2012. *Sustainable Manufacturing -A study of the business context and eco-efficiency practices in Chinese microelectronics firms*. Masters' dissertation, Brunel University.

Johanesová, V. & Vaňová, J. 2020. What is Relationship Marketing and How to Use it to Connect with Your Customers. *Research Papers Faculty of Materials Science and Technology Slovak University of Technology*, 28(46):29-35.https://protect.checkpoint.com/v2/___https://doi.org/10.2478/rput-2020-

0004___.YzJlOnVuaXNhbW9iaWxlOmM6bzo3M2VjZjA1ODBkOGQ1NjQzNTY5NWQ3ZjU4NTgwOWU0Mzo2OjNiM2Y6NjRmOTExNGMzMTkyNzdiYzAyMzY4NWJiZmQ2NjYwOGFkYjI1NGEyZGVmNWIyMmU5ZWYwMWQyNDM5MDJmODM5NTpwOkY

Johnson, J. 2018. *Chaos report: decision latency theory: it is all about the interval*. USA: Standish Group.

José, P., Lim, B. Kim., S. & Bryant, F. 2018. *Savouring as a mediator of relationships between explanatory style & mood outcomes* [Online]. Available at: https://www.research gate.net/publication/325186849_Jose_Lim_Kim_Bryant_2018savoring_as_a_mediator_of_relationships_between_explanatory_style_mood_outcomes/citation/download (Accessed 11 December 2022).

Joshi, A., Kale, S., Chandel, S., & Pal, D. 2015. Likert Scale: Explored and explained. *British Journal of Applied Science & Technology* 7(4):396-403.

Ju, Q. & Pan, F. 2016. Performance comprehensive assessment system for the manufacturing system of automotive assembly line. *Proceedings of the 28th Chinese Control and Decision Conference* (2016 CCDC): 4672-4676.

Junjie, M & Yingxin, M. 2022. The Discussions of Positivism and Interpretivism. *Global Academic Journal of Humanities and Social Sciences*, 4(1):10-14.

Jurevicius, O. 2013. *Resource based view. Retrieved from strategic management insight* [Online]. Available at: http://strategicmanagementinsight. com/topics/resource-based-view (Accessed 7 December 2022).

Kadam, M., Teli, N.S. & Gaikwad, L.M. 2015. A review on Quality certification in Automobile Industry. *International Journal on Recent Technologies in Mechanical and Electrical Engineering (IJRMEE) ISSN*: 2349-7947, 2 (1): 1-6.

Kaggwa, M., Pouris, A. & Steyn. J.L. 2007. South Africa government's support of the automotive industry: prospects of the productive asset allowance. *Development Southern Africa*, 24(5):681-691.

Kalaitzandonakes, N.G., Bredahl, M.E. & Gehrke, B. 2019. Competitive pressure, productivity growth, and competitiveness. *Competitiveness in International Food Markets*, 23(2):169-187.https://protect.checkpoint.com/v2/___https://doi.org/10.1201/9780429037597-9___.YzJlOnVuaXNhbW9iaWxlOmM6bzo3M2VjZjA1ODBkOGQ1NjQzNTY5NWQ3ZjU4NTgwOWU0Mzo2OjgyYjU6NjczYTMwYTY1ZDdkMjIzZjExMjY4MzZhODgxYmY4ZjMxOTUzY2QxNTJlYTZlNWU5NjRlNGM5OWE3YWM0YmIwNjpwOkY

Kalaja, R.; Myshketa, R. & Scalera, F. 2016. Service quality assessment in health care sector: The case of Durres public hospital. Procedia: *Social and Behavioural Sciences*, 235:557-565.

Kaltsonoudi, K., Tsigilis, N. & Karteroliotis, K. 2022. Critical review of the literature and current tendencies of the common method variance in sport management research. *Measurement in Physical Education and Exercise Science*, 26(2):103-115.

Kamilaris, A., Neovino, J., Kondepudi, S. & Kalluri, B. 2015. A case study on the individual energy use of personal computers in an office setting and assessment of various feedback types toward energy savings. *Energy and Buildings*, 104:73-86.

Kannangara, B., Kuruppuarachchi, J. & Madurapperuma, B. 2025. Assessing climate change literacy among university students in Sri Lanka: implications for future mitigation strategies. *International Journal of Sustainability in Higher Education*, 1:1-28.

Kannegiesser, M. & Günther, H.O. 2014. Sustainable development of global supply chains—part 1: sustainability optimization framework. *Flex Service Manufacturing Journal,* 26:24-47.

Karakaya, İ., & Kiliç, M. 2021. The role of item-total correlations in scale development. Educational Sciences: *Theory & Practice*, 21(2):45-58.

Karamitri, I., Kitsios, F.& Talias, M.A. 2020. Development and validation of a knowledge management questionnaire for hospitals and other healthcare organizations. *Sustainability*, 12(7):2730.

Karmjit, S. 1997. A post-positivist study exploring the resettlement experience of professional Asian Indian women. Theses Digitization Project.

Kaswan, V., Choudhary, M., Kumar, P., Kaswan, S. & Bajya, P. 2019. Green production strategies. *Encyclopedia of Food Security and Sustainability,* Ferranti, P., Berry, E., Jock, A., Eds, 492-500.

Kato, T. 2021. Factors of loyalty across corporate brand images, products, dealers, sales staff, and after-sales services in the automotive industry. *Procedia Computer Science*, 192:1411-1421.

Kelecsenyi, M., Nilsson, J. & Safari, H. 2022. *The electric upswing: A quantitative study of electric vehicle attributes and consumer attitudes influence on purchase intent in Sweden*. Dissertation. Mälardalen University. Västerås: Sweden.

Kenny, D.A. & Judd, C.M. 2014. Power anomalies in testing mediation. *Psychological science*, 25(2):334-339.

Keskin, H., Ayar Şentürk, H., Tatoglu, E., Gölgeci, I., Kalaycioglu, O. & Etlioglu, H.T. 2021. The simultaneous effect of firm capabilities and competitive strategies on export performance: the role of competitive advantages and competitive intensity. *International Marketing Review*, 38(6):1242-1266.

Ketprapakorn, N., & Kantabutra, S. 2022. Toward an organizational theory of sustainability culture. *Sustainable Production and Consumption*, 32:638-654.https://protect.checkpoint.com/v2/___https://doi.org/10.1016/j.spc.2022.05.020___.YzJlOnVuaXNhbW9iaWxlOmM6bzo3M2VjZjA1ODBkOGQ1NjQzNTY5NWQ3ZjU4NTgwOWU0Mzo2OjYyN2U6YzBmOTBhMjJkOWE4ZTI1NDdlYzVkODNlODQwYjk4NDkxZTg5MWU0MGYxMDI3YTZlZDBhM2U5MmM5ODM3MzljNzpwOkY

Khan, S.A.R., Zhang, Y., Kumar, A., Zavadskas, E.K., & Streimikiene, D. 2020. Measuring the impact of renewable energy, public health expenditure, logistics, and environmental performance on sustainable productivity growth. *Sustainable Development,* 28(4): 832-843.

Kiesnere, A.L. & Baumgartner, R.J. 2019. Top management involvement and role in sustainable development of companies. In Leal Filho, W., Azul, A., Brandli, L., Özuyar, P., Wall, T. (eds), *Responsible consumption and production,* in *Encyclopaedia of the UN Sustainable Development Goals* series. Cham: Springer: 827-839.

Killion, L. & Fisher, R. 2018. Ontology, epistemology: Paradigms and parameters for qualitative approaches to tourism research. *CQ University*, 82:1-28.

Kim, H. & Lee, C.W. 2018. The effects of customer perception and participation in sustainable supply chain management: *A smartphone industry stud. Sustainability*, 10(7):2271.

Kim, J.K., Park S., Chen, Y. & Wu C. 2021. Combining non-probability and probability survey samples through mass imputation. *Journal of the Royal Statistical Society Series*, 184:1-23.

Kindström, D. & Kowalkowski, C. 2014. Service innovation in product-centric firms: a multidimensional business model perspective*, Journal of Business & Industrial Marketing*, 29 (2):96-111.

Kiron, D., Unruh, G., Reeves, M., Kruschwitz, N., Rubel, H. & ZumFelde, A.M. 2017. Corporate sustainability at a crossroads: Progress Toward Our Common Future in Uncertain Times, MIT *Sloan Management Review*, 58(4).

Kirongo, A. & Odoyo, C. 2020. Research philosophy design and methodologies: A systematic review of research paradigms in information technology. *Global Scientific Journal,* 8(5):33-38.

Klewitz, J.; Zeyen, A. & Hansen, E.G. 2012. Intermediaries driving eco-innovation in SMEs: A qualitative investigation. *European Journal of Innovation Management*, 15:442-467

Klier, T.H. & Rubenstein, J. 2007. *Whose part is it? —Measuring domestic content of vehicles.* Chicago Fed Letter*, (243), October. Federal Reserve Bank of Chicago* [Online]. Available at: https://www.chicagofed.org/publications/chicago-fed-letter/2007/october-243#:~:text=There%20is%20more%20than%20one,lies%20with%20the%20parts%20producer. (Accessed 12 May 2022).

Kline, R. B. 2015. *Principles and Practice of Structural Equation Modeling*. Guildford Press.

Klumpp, M. & Heragu, S. 2019. *Outbound Logistics and Distribution Management. Operations, Logistics and Supply Chain Management*, 1st ed., Springer: 305-330.

Kock, N. 2015. Common Method Bias in PLS-SEM: A Full Collinearity Assessment Approach. *International Journal of e-Collaboration (IJeC*), 11:1-10.

Koers, M. 2014. *Industry and Politics. Politics also Basis profitable Washstands in der Automobile industry*. In B. Ebel, & M. B. Hofer (Eds.) *Automotive Management Strategy and Marketing in the Automobile sector*. 2nd ed. Berlin: Springer:177-188.

Kolinski, A., Dujak, D. & Golinska-Dawson, P. 2020. *Integration of Information Flow for Greening Supply Chain Management.* 1st ed., Cham: Springer.

Kotler, P. & Keller, K. 2009. Marketing Management, 12th ed., Prentice Hall International Inc., New Jersey.

Kovanoviene, V., Romeika, G., & Baumung, W. 2021. Creating Value for the Consumer Through Marketing Communication Tools. *Journal of Competitiveness*, 13(1):59-75.

Krieger, N. 2012. Who and what is a population. Historical debates, current controversies, and implications for understanding "Population health" and rectifying health inequities. The Milbank Quarterly*: A multidisciplinary journal of population Health and Health Policy*, 90 (4):634-681.

Krishna, V.V. 2024. *The Indian Science Community: Historical and Sociological Studies*. 1st ed., India: Routledge.

Kulangara, N.P. Jackson, S.A. & Prater, E. 2016. Examining the impact of socialization and information sharing and the mediating effect of trust on innovation capability. *International Journal of Operations & Production Management*,36(11):1601-1624.

Kumar, A. & Ayedee, N. 2019. Sustainable development in SMEs through social media channels. *International Journal of Management, Technology and Engineering*, 9(6):1066-1075.

Kumar, A., Mangla, S.K., Luthra, S. & Ishizaka, A. 2019. Evaluating the human resource related soft dimensions in green supply chain management implementation. *Production Planning & Control*, 30(9):699-715.

Kumar, M. & Rodrigues, V.S. 2020. Synergetic effect of lean and green on innovation: A resource-based perspective. *International Journal of Production Economics*, 219:469-479.

Kumar, N. & Das, D. 2017. Fibrous biocomposites from nettle (*Girardinia diversifolia*) and poly (lactic acid) fibers for automotive dashboard panel applications. *Composites Part B*, 130:54–63.

Kumar, R. 2014. The history of doing: *An illustrated account of movements for women's rights and feminism in India*, 1800-1990. Zubaan.

Kumar, S., Luthra, S., Haleem, A. & Garg, D. 2014. *Significance of knowledge management in operations management. XVIII Annual International Conference of the Society of Operations Management Theme: Operations Management in Digital Economy,* [Online]. Available at: https://www.researchgate.net/publication/269921850_Significance_of_knowledge_management_in_operations_management (Accessed 14 March 2022).

Kumara, D. & Rahman, Z. 2015. Sustainability adoption through buyer supplier relationship across supply chain: A literature review and conceptual framework. *International Strategic Review Management,* 3:110-127.

Kumari, N. and Chahal, H., 2017. Mediating role of consumer perceived value, consumer satisfaction and consumer loyalty in the service-performance framework. *NICE Journal of Business*, 12(2):37-56.

Kunkel, S. & Matthess, M. 2020. Digital transformation and environmental sustainability in industry: Putting expectations in Asian and African policies into perspective. *Environmental science & policy*, 112:318-329.

Kunselman, A.R. 2024. A brief overview of pilot studies and their sample size justification. *Fertility and sterility*, 121(6):899-901.

Kupczyk, A., Mączyńska-Sęczek, J., Golisz, E. & Borowski, P.F. 2020. Renewable energy sources in transport on the example of methyl esters and bioethanol. *Processes*, 8(12):1610.

Kushwaha, G.S. & Sharma, N.K. 2016. Green initiatives: a step towards sustainable development and firm's performance in the automobile industry. *Journal of cleaner production*, 121:116-129.

Lafuente, E., Vaillant, Y. & Vendrell-Herrero, F. 2017. Territorial servitization: Exploring the virtuous circle connecting knowledge-intensive services and new manufacturing businesses. *International Journal of Production Economics*, 192:19-28.

Lambert, L.S. & Newman, D.A. 2023. Construct development and validation in three practical steps: Recommendations for reviewers, editors, and authors. *Organizational Research Methods*, 26(4):574-607.

Lampard, R. & Pole, C. 2015. *Practical social investigation: Qualitative and quantitative methods in social research.* London: Routledge.

Langbroek, J.H., Franklin, J.P. & Susilo, Y.O. 2016. The effect of policy incentives on electric vehicle adoption. *Energy Policy,* 94:94-103.

Langton, I., Mafini, C. & Maotoawe, N. 2023. Financial performance and green supply chain management in a South African national electrical energy provider. *Southern African Business Review*, 27:1-22.

Lasarov, W., Hoffmann, S., Mai, R. & Schleich, J. 2024. Carbon footprint tracking apps: The spillover effects of feedback and goal-activating appeals. *Ecological Economics,* 226:108354.

Laseinde, OT. & Kanakana, G.M.2017. Interventions to skills development in the automotive manufacturing sector of South Africa. *In Skills Development for Sustainable Manufacturing. IntechOpen.*

Lawhon, M., 2013. Dumping ground or country-in-transition? Discourses of e-waste in South Africa. Environment and Planning C: *Government and Policy,* 31(4):700-715.

Leedy, P.D. & Ormrod, J.E. 2015. *Practical research*. UK: Pearson Education.

Leon, A.C., Davis, L.L. & Kraemer, H.C. 2011. The role and interpretation of pilot studies in clinical research. *Journal of Psychiatric Research,* 45(5):626-629.

Li, H., Du, G., Qamri, G.M. & Li, S. 2024. Green innovation and natural resource efficiency: The role of environmental regulations and resource endowment in Chinese cities. *Journal of Environmental Management*, 370:122338.

Li, T., Higgins, J.P. & Deeks, J.J. 2019. Collecting data. Cochrane handbook for systematic: A macro, micro, and congruence perspective. *Journal of Purchasing and Supply Management*, 28(1):100723.

Liddell, H.G., Scott, R. & Berry, G.R. 2007. *Greek English Lexicon, Abridged*. USA. Follett.

Lim, W.M. & Bowman, C. 2023. How to establish practical contributions and convey practical implications? Guidelines on locating practice gaps and making recommendations for practice. *Activities, adaptation & aging*, 47(3):263-282.

Lin, F. & Tang, H.C. 2013 Exporting and Innovation: Theory and Firm-Level Evidence from the People's Republic of China. *International Journal of applied Economics*, 10(2): 52-76.

Linnenluecke, M.K. Russell, S.V. & Griffiths, A. 2009. Subcultures and sustainability practices: the impact on understanding corporate sustainability. *Business strategy and environment*, 18(7):32-452.

Lioui, A. & Sharma, Z. 2012. Environmental corporate social responsibility and financial performance: Disentangling direct and indirect effects. *Ecological Economics*, 78:100-111.

Liu, C., Rouse, W.B. & Hanawalt, E.S. 2017. Adoption of Powertrain Technologies in Automobiles - A System Dynamics Model of Technology Diffusion in the American Market. *IEEE Transactions on Vehicular Technology*, 67(7):5621-5634.

Liu, G, Shi P, Hai F, Zhang Y. & Li X. 2018. Study on Measurement of Green Productivity of Tourism in the Yangtze River Economic Zone, China. *Sustainability*, 10(8):2786.

Liu, J., Liu, Y. & Yang, L. 2020. Uncovering the influence mechanism between top management support and green procurement: The effect of green training. *Journal of Cleaner Production,* 251:119674.

Lohr, S.L. 2021. *Sampling: design and analysis*. Chapman and Hall/CRC.

London, A.J. 2021. *For the common good: philosophical foundations of research ethics.* Oxford: Oxford University Press.

Lopez-Fernandez, M.C., Serrano-Bedia, A.M. & Gómez-López, R. 2016. Determinants of innovation decision in small and medium-sized family enterprises. *Journal of Small Business and Enterprise Development*, 23 (2):408-427.

Lopez-Vega, H. & Moodysson, J. 2023. Digital transformation of the Automotive Industry: An integrating framework to analyse technological novelty and breadth. *Industry and Innovation*, 30(1): 67-102.

Luedeke-Freund, F. Gold, S. & Bocken, N. 2019. A review and typology of circular economy business model patterns. *Journal of Industrial Ecology*, 23:36-61.

Lundfall, K, Grosso, P, Lago, P. & Procaccianti, G. 2015, The Green Practitioner: A Decision-Making Tool for Green ICT. in V Kvist Johannsen, S Jensen, V Wohlgemuth, C Preist & E Eriksson (eds), *EnviroInfo and ICT4S 2015. Advances in Computer Science Research*, *Atlantis Press*, 74-81.

Luthra, S., Kumar, V., Kumar, S. & Haleem, A. 2011. Barriers to implement green supply chain management in automobile industry using interpretive structural modelling technique: An Indian perspective. *Journal of Industrial Engineering and Management (JIEM),* 4(2):231-257.

Lynch-Wood, G. & Williamson, D. 2014. Understanding SME responses to environmental regulation. *Journal of Environmental Planning and Management*, 57(8):1220-1239.https://protect.checkpoint.com/v2/___https://doi.org/10.3390/su13052928___.YzJlOnVuaXNhbW9iaWxlOmM6bzo3M2VjZjA1ODBkOGQ1NjQzNTY5NWQ3ZjU4NTgwOWU0Mzo2OmM0MTM6NzRhYzRiYWVlN2Y4ZjQ5NDZhYjdjYzA5ODE1ZGJiMzdhZjcwZDE2NzAwOWZmNTY0MDE0MTNhMmNmOWY3OWVlNTpwOkY

Maarouf, H. 2019. Pragmatism as a supportive paradigm for the mixed research approach: Conceptualizing the Ontological, Epistemological, and Axiological stances of Pragmatism. *International Business Research,* 12 (9):1-12

Mackey, A. 2008. The effect of CEOs on firm performance. *Strategic Management Journal*, 29(12):1357-1367.

Madrid-Guijarro, A.& Duréndez, A, 2024. Sustainable development barriers and pressures in SMEs: The mediating effect of management commitment to environmental practices. *Business Strategy and the Environment*, 33(2):949-967.

Maier, D., Buzatu, A., Costache, C. & Maier, A. 2018 The creativity role in the innovation management. *In proceedings of the 32nd International Business Information Management Association Conference*, IBIMA.

Maier, D., Maier, A., Aşchilean, I., Anastasiu, L., & Gavriş, O. (2020). The relationship between innovation and sustainability: A bibliometric review of the literature. *Sustainability*, 12(10):4083.

Majumdar, D. & Jash, T. 2015. Merits and challenges of e-rickshaw as an alternative form of public road transport system: a case study in the state of West Bengal in India. *Energy Procedia,* 79:307-314.

Makhloufi, L., Laghouag, A.A., Meirun, T.& Belaid, F. 2022. Impact of green entrepreneurship orientation on environmental performance: The natural resource-based view and environmental policy perspective. *Business Strategy and the Environment*, 31(1):425-444.

Makita, R. 2016. A role of Fair-Trade certification for environmental sustainability. *Journal of Agricultural and Environmental Ethics*, 29:185–201. https://doi.org/10.1007/s10806-016-9604-0

Malerba, F. & Brusoni, S. 2007. *Perspectives on Innovation*. Cambridge University Press, Cambridge.https://protect.checkpoint.com/v2/___https://doi.org/10.1017/CBO9780511618390___.YzJlOnVuaXNhbW9iaWxlOmM6bzo3M2VjZjA1ODBkOGQ1NjQzNTY5NWQ3ZjU4NTgwOWU0Mzo2OmFkNTE6MjRjOTUyODE3MGVkMDMxYTljYzhiNWFkMDEwZDYxYWM4ZDc0NzNlMGUzOTdkZDY5MTM2ODlkYjEzYzM5MzM5OTpwOkY

Malhotra, N.K., Nunan, D. & Birks, B.F. 2017. *Marketing research and applied approach*. 5th ed. Harlow, UK: Pearson Education.

Malik, M.I., Nawaz Mir, F., Hussain, S., Hyder, S., Anwar, A., Khan, Z.U., Nawab, N., Shah, S.F.A. & Waseem, M. 2019. Contradictory results on environmental concern while re-visiting green purchase awareness and behaviour. *Asia Pacific Journal of Innovation and Entrepreneurship*, 13(1):17-28.

Mallik, S., Bhowmik, T., Mishra, U. and Paul, N., 2021. Local scale groundwater vulnerability assessment with an improved DRASTIC model. *Natural Resources Research*, 30(3):2145-2160.

Malmqvist, J., Hellberg, K., Möllås, G., Rose, R. & Shevlin, M. 2019. Conducting the pilot study: a neglected part of the research process? Methodological findings supporting the importance of piloting in qualitative research studies. *International Journal of Qualitative Methods*, 18:1–11.

Mandl, U., Dierx, A. & Ilzkovitz, F. 2008. *The effectiveness and efficiency of public spending* (No. 301). Directorate General Economic and Financial Affairs (DG ECFIN), European Commission.

Manyika, J., Lund, S., Chui, M., Bughin, J., Woetzel, J., Batra, P., Ko, R. & Sanghvi, S. 2017. Jobs lost, jobs gained: Workforce transitions in a time of automation. *McKinsey Global Institute*, 150(1):1-148.

Marchán, E. & Viscidi, L. 2015. Green transportation: the outlook for electric vehicles in Latin America. *Energy (Working Paper)*, 1:1-15.

Marianti, S., Rufaida, S., Hasanah, U., & Nuryanti, L. 2023. Assessing homogeneity in measurement scales: A practical guide. *Journal of Psychometric Research*, 15(1):78-92.

Marshall, D., McCarthy, L., McGarth, P., & Claudy, M.C. 2015. Going above and beyond: How sustainability culture and entrepreneurial orientation drive social sustainability supply chain practice adoption. *Supply Chain Management International Journal,*20:434–454.

Martelo-Landroguez, S.; Albort-Morant, G.; Leal-Rodríguez, A., & Ribeiro-Soriano, B. 2018. The Effect of Absorptive Capacity on Green Customer Capital under an Organizational Unlearning Context. *Sustainability*, 10(1):265.

Martins, F.S., da Cunha, J.A.C. & Serra, F.A.R. 2018. Secondary data in research–uses and opportunities. PODIUM *sport, leisure and tourism review*, 17(4): 1-4.

Abe, M. & Linghe, Y. 2013. Building Resilient Supply Chains against Natural Disasters: The Cases of Japan and Thailand. *Global Business Review*. 14:567-586.

Mashhoodi, B. & van der Blij, N. 2021. Drivers' range anxiety and cost of new EV chargers in Amsterdam: a scenario-based optimization approach. *Annals of GIS*, 27(1):87-98.

Mashilo, A.M. 2019. *Auto production in South Africa and components manufacturing in Gauteng Province* (No. 58). Global Labour University Working Paper.

Masocha, R. 2018. Sustainable marketing practices and sustainable consumer behaviour of tertiary Students in South Africa. *Journal of Economics and Behavioural Studies*, 10:248-257.

Masocha, R.& Fatoki, O. 2018. The role of mimicry isomorphism in sustainable development operationalisation by SMEs in South Africa. *Sustainability*, 10(4):1264.

Mason, A.D., & Shetty, S. 2019. Sustaining productivity growth. A Resurgent East Asia: *Navigating a Changing World*, 13(2):55-89.

Masood, Y.2021. *SHAMIL: British South Asian recruitment into Mental Health Research in the UK.* PhD Thesis, University of Manchester: United Kingdom.https://protect.checkpoint.com/v2/___https://doi.org/10.1596/978-1-4648-1333-7_ch2___.YzJlOnVuaXNhbW9iaWxlOmM6bzo3M2VjZjA1ODBkOGQ1NjQzNTY5NWQ3ZjU4NTgwOWU0Mzo2OmRlZmU6MmI0NGU1ZWVmMWM5NGM1ZTJhYjBmMjM4ZjFjMjRkZmM5M2M3YjBjYzY3YmFmNjk0NDE3ZGE5NDY4NjlkZDBiMjpwOkY

Masoumi, S., Kazemi, N. & Abdul-Rashid, S. 2019. Sustainable supply chain management in the automotive industry. *Sustainability,* 11(14):55-70.

Masum, H., Chattopadhyay, S., Ray, R. & Bhaumik, S. 2018. Measurement of walking speed from gait data using kurtosis and skewness based approximate and detailed coefficients. *Iet Science Measurement & Technology*, 12(4): 521-527.

Mathivathanan, D.& Haq, A.N. 2017. Comparisons of sustainable supply chain management practices in the automotive sector. *International Journal of Business Performance and Supply Chain Modelling,* 9(1):18-27.

Mazzola, E., Bruccoleri, M. & Perrone, G. 2016. Open innovation and firms' performance: State of the art and empirical evidence from the bio-pharmaceutical industry. *International Journal of Technology Management,* 70(2-3):109-134.

McDonald, K., Callahan, R., Wec, A., Mory, B., Pranschke, L., Grau, E. & Markesich, J. 2021. National Beneficiary Survey—General Waves Round 7: Data Cleaning and Identification of Data Problems. *Washington, DC: Mathematica*, 2(3).

McGlinchey, S. 2022. *Foundations of International Relations*. London: Bloomsbury.

McKinnon, A. 2010. *Environmental sustainability. Green logistics: improving the environmental sustainability of logistics*. London. Kogan Page.

McKinsey and company. 2020. *The importance of customer service in the automotive industry* [Online]. Available at: https://www.doxee.com/blog/customer-experience/the-importance-of-customer-service-in-the-automotive-industry/ [Accessed: 20 July 2021].

McNeish, D. 2018. Thanks coefficient alpha, we'll take it from here. *Psychological methods*, 23(3):412.

Mealy, P. & Teytelboym, A. 2017. *Economic Complexity and the Green Economy* [Online]. Available at SSRN: https://ssrn.com/abstract=3111644 or http://dx.doi.org/10.2139/ssrn.3111644. (Accessed 23 May 2023).

Meekaewkunchorn, N., Szczepańska-Woszczyna, K., Muangmee, C., Kassakorn, N. & Khalid, B. 2021. Entrepreneurial orientation and SME performance: The mediating role of learning orientation. *Economics & Sociology*, 14(2):294-312.

Mensah, J. & Casadevall, S. 2019. Sustainable development: Meaning, history, principles, pillars, and implications for human action: Literature review. *Cogent Social Sciences*, 5(1):1-15.

Mertens, D.M. 2019. *Research and evaluation in education and psychology: Integrating diversity with quantitative, qualitative, and mixed methods*. Sage publications.

Meyer, J.W. & Rowan, B. 1977. Institutionalized Organizations: Formal Structure as Myth and Ceremony. *American Journal of Sociology*, 83(2):340-363.

Miguel, S.R.D. & Alejandro, J. 2019. Environmental Responsibility in Mexico. *Espacios*, 40(30):18-26.

Mihaiu, D.M., Şerban, R.A., Opreana, A., Ţichindelean, M., Brătian, V. & Barbu, L. 2021. The Impact of Mergers and Acquisitions and Sustainability on Company Performance in the Pharmaceutical Sector. Sustainability, 13(12):6525.

Miörner, J. 2020. The road towards autonomous driving – A differentiated view of institutional agency in path transformation, Norsk Geografisk Tidsskrift. *Norwegian Journal of Geography*, 74(5):283-295.

Mishra, P., Pandey, C.M., Singh, U., Gupta, A., Sahu, C. & Keshri, A. 2019. Descriptive statistics and normality tests for statistical data. *Annals of cardiac anaesthesia*, 22(1):67-72.

Mithas, S. & Rust, R.T. 2016. How information technology strategy and investments influence firm performance. *Mis Quarterly,* 40(1): 223-246.

Modungwa, M., Rinke, M., Agigi, A. &Mocke, K. 2021. The role of strategic supplier relationships in enhancing supply chain innovation: A qualitative study in the South African automotive manufacturing industry. *African Journal of Science, Technology, Innovation and Development,* 13(1):1-14.

Moeletsi, M.E. 2021. Future policy and technological advancement recommendations for enhanced adoption of electric vehicles in South Africa: A survey and review. *Sustainability*, 13(22):12535.

Mofokeng, S., Ramolobe, K.S., Bogopa, D. & Bambo, T.L. 2025. Fiscal Sustainability in Coalition-Governed South African Municipalities: A Systematic Literature Review. *Journal of Public Administration and Development Alternatives*, 10(si1):18-36.

Moisescu, O.I.& Gică, O.A. 2020. The impact of environmental and social responsibility on customer loyalty: A multigroup analysis among generations x and y. *International Journal of Environmental Research and Public Health,* 17(18):6466.

Moktadir, M.A., Paul, S.K., Bai, C., & Santibanez Gonzalez, E.D. 2025. The current and future states of MCDM methods in sustainable supply chain risk assessment. *Environment, Development and Sustainability*, *27*(3):7435-7480.https://protect.checkpoint.com/v2/___https://doi.org/10.3390/ijerph17186466___.YzJlOnVuaXNhbW9iaWxlOmM6bzo3M2VjZjA1ODBkOGQ1NjQzNTY5NWQ3ZjU4NTgwOWU0Mzo2OjQyOGQ6OGE2N2VlMTVjNzE2ODJiZWE4ZTNlMzIyOWY3NTU5NmU0MGMyMTNmOGRiZGU3Zjk2NjU2NDkwNTVlYTQ1N2IwOTpwOkY

Mondragon, A.E.C., Mondragon, C.E.C. & Coronado, E.S. 2017. ICT adoption in multimodal transport sites: Investigating institutional-related influences in international seaports terminals. Transportation Research Part A: *Policy and Practice,* 97(3):69-88.

Moos, M & Sambo, W. 2018. An exploratory study of challenges faced by small automotive businesses in townships: the case of Garankuwa, South Africa. *Journal of Contemporary Management*, 15(1): 467-494.

Morelli, J. 2011. Environmental Sustainability: A Definition for Environmental Professionals. *Journal of Environmental Sustainability*, 1(1):2-16.

Mori Junior, R., Franks, D.M. & Ali, S.H. 2016. Sustainability certification schemes: Evaluating their effectiveness and adaptability. *Corporate Governance*, 16(3):579-592.

Morton, C., Anable, J. & Nelson, J. D. 2016. Exploring consumer preferences towards electric vehicles: The influence of consumer innovativeness. *Research in transportation business & management,* 18:18-28.

Moser, A. & Korstjens, I. 2017. Series: Practical guidance to qualitative research. Part 1: Introduction. *The European journal of general practice*, 23(1):271–273.

Moshikaro, L. 2019. *Benchmarking and productivity analysis in South Africa's automotive industry*. Master's Dissertation, University of Cape Town: Cape Town.

Moyano-Fuentes, J., Maqueira-Marín, J.M. & Bruque-Cámara, S. 2018. Process innovation and environmental sustainability engagement: an application on technological firms. *Journal of Cleaner Production*, 171:844-856.https://protect.checkpoint.com/v2/___https://doi.org/10.1016/j.jclepro.2017.10.067___.YzJlOnVuaXNhbW9iaWxlOmM6bzo3M2VjZjA1ODBkOGQ1NjQzNTY5NWQ3ZjU4NTgwOWU0Mzo2OjBiNWU6YjM2YjI5MDRhMzM5NjI1N2RmNjhkZDcxNzNmYWEyODFmMmY1MTMzM2QzMjBmZWE5YzQ4MjY3OTFkOTVhNmUyNzpwOkY

Mukherjee, A., Som, A., Adak, A., Raj, P. & Kirtania, S. 2012. *Augmenting an inbound raw material handling system of a steel plant by uncovering hidden logistics capacity.* In *Proceedings of the 2012 Winter Simulation Conference* (WSC), IEEE: 1-12.

Mukhopadhyay, K. 2006. 360-degree appraisal–A performance assessment tool. *Journal of Management & Allied Sciences,* 2:19-25.

Mukondeleli, G., Kanakana, K & Laseinde, O.T 2016. Assessment of Automotive Industry Component Supplier's Competitiveness in South Africa. Proceedings - *International Conference on Industrial Engineering and Operations Management, Kuala Lumpur*: .2345-2357.

Munodawafa, R.T. & Johl, S.K. 2019. A systematic review of eco-innovation and performance from the resource-based and stakeholder perspectives. *Sustainability*, 11(21):6067.

Murakwani, S., Nyirenda, G. & Fokoya, M. 2017. Governance of corporate social responsibility and return on assets in the South African mining firms. *African Journal of Public Affairs*, 9(5):137-153.

Murphy, P.R.& Knemeyer, A.M. 2018. *Contemporary Logistics*, 12th ed.; Pearson Education Limited: New York. USA.

Murugan, M. & Marisamynathan, S. 2022. Analysis of barriers to adopt electric vehicles in India using fuzzy DEMATEL and Relative importance Index approaches. *Case Studies on Transport Policy,*10(2):795-810.

Musabayana, G.T. & Mutambara, E. 2022. The Implementation of the Broad-Based Black Economic Empowerment (B-BBEE) Policy in South Africa: a Myth or a Reality in SMEs? *Australasian Accounting, Business and Finance Journal*, 16(1):73-84.

Mushavhanamadi, K. & Xundu, L. 2018, September. The Impact of poor quality in South African automobile manufacturing industry leading to customer dissatisfaction. *In Proceedings of the International Conference on Industrial Engineering and Operations Management* (Vol. 2018, No. SEP, pp. 1712-1721).

Mustajoki, H. & Mustajoki, A. 2017. *A new approach to research ethics: Using guided dialogue to strengthen research communities (*p. 254). Taylor & Francis.

Mutasa, F.C., 2017. *Gender equality and corporate social responsibility in the workplace: a case study of Anglo-American Platinum Mine and Impala Platinum Mines Rustenburg, South Africa* (Doctoral dissertation).

Mutumi, P.P.J. & Simatele, D.2017. Can the motor vehicle manufacturing industry be sustainable? Exploring the relationships between profitability, the green economy and environmental sustainability in South Africa. *International Journal of Sustainable Development*, 20(3-4):285-305.

Nair, G.K.& Choudhary, N.2016. The impact of service quality on business performance in Qatar-based hotels: An empirical study. *The Journal of Hospitality Financial Management*, 24(1):47-67.

Naqvi, A.A., AlShayban, D.M., Ghori, S.A., Mahmoud, M.A., Haseeb, A., Faidah, H.S. & Hassali, M.A. 2019. Validation of the general medication adherence scale in Saudi patients with chronic diseases. *Frontiers in pharmacology,* 10:633.

Naru, R. & Jain, A.K. 2020. The role of customer relationship m7nagement in auto car industry in building customer relationship in after sales department. *Journal of Critical Reviews* ,7(11): 1-9.

Naude, M.J. & Badenhorst-Weiss, J.A. 2011. Supply chain management problems at South African automotive component manufacturers. *Southern African Business Review*, 15(1):71-99.

Naude, M.J. 2013. Capital structure of the South African automotive industry: Historical perspectives and development implications. *Transformation: Critical Perspectives on Southern Africa,* 81(1): 236-259.

Naude, M.J. 2013. Supply chain challenges in the South African automotive sector: do location, size and age matter? *South African Journal of Economic and Management Sciences*, 16(4): 407-417.

Naumova, O.A., Berbasova, L.V. & Panteleeva, Y.A. 2020. Trends of labour productivity increase of car components manufacturers*. European Proceedings of Social and Behavioural Sciences.*

Nawawi, H.H. 2016. The effect of investment to value added production, employment adoption, productivity, and employees' economic welfare in manufacturing industry sector in West Kalimatan province. Procedia - *Social and Behavioural Sciences*, 219:387-393.

Neevedish, S., Wijethilake, C. & Ekanayake, A. 2017. Environmental compliance and firm performance: Evidence from manufacturing SMEs. *Journal of Cleaner Production, 142:*4424-4433.

Neeveditah, P.M., Karishma, A. & Devi, R.N. 2017. Environmental management systems and financial performance: The case of listed companies in Mauritius. *Theoretical Economics Letters,* 7(7):2054-2069.

Nethengwe, N.S. 2022. Transport Modes and the Green Economy. *Green Economy in the Transport Sector.* Cham: Springer.

Nevo, B. 1985. Face validity revisited. *Journal of Educational Measurement*, 22(4):287-293.

Niedlich, S., Bauer, M., Doni, F. & Schrader, U. 2020. Sustainable productivity: Conceptualization and measurement. *Journal of Cleaner Production,* 252:119792.

Niedlich, S., Kummer, B., Bauer, M., Rieckmann, M. & Bormann, I. 2020. Cultures of sustainability governance in higher education institutions: a multi-case study of dimensions and implications. *Higher Education Quarterly*,74: 373-390.

Noble, H. & Smith, J. 2015. Issues of validity and reliability in qualitative research. *Evidence based nursing*, 18(2):34-35.

Nomadolo, L. 2021. Gender-Based discrimination in the workplace in South Africa. *The Thinker*, 73:72-76.

Nunkoo, R., Teeroovengadum, V., Ringle, C.M. & Sunnassee, V. 2020. Service quality and customer satisfaction: The moderating effects of hotel star rating. *International Journal of Hospitality Management,* 91:102414.

Nykvist, B. & Nilsson, M. 2015. Rapidly falling costs of battery packs for electric vehicles. *Nature climate change*, 5(4):329-332.

Ociepa-Kubicka, A. & Pachura, P. 2017. Eco-innovations in the functioning of companies. *Environmental research*, 156:284-290.

Oghazi, P., Rad, F.F., Zaefarian, G., Beheshti, H.M. & Mortazavi, S.2016. Unity is strength: A study of supplier relationship management integration. *Journal of business research*, 69(11): 4804-4810.

International Organization of Motor Vehicles Manufacturers (OICA). 2017. Production Statistics [Online]. Available at: http://www.oica.net/category/production-statistics/2017-statistics/. (Accessed 3 February 2019).

Oke, A.E., Aliu, J., Odia, O.A., Aigbavboa, C.O., Jamir Singh, P.S., Awuzie, B.O. & Samsurijan, M.S. 2023. A quantitative assessment of key drivers for environmental economic practices adoption for sustainable development. *Sustainable Development,* 31(5), 3579-3594.

Okoli, C. & Schabram, K. 2010. A guide to conducting a systematic literature review of information systems research. sprouts: *Working papers on information systems*, 10(26):1-16

Opri, F., Opri, R., Zaffanello, M. & Rigotti, E. 2024. Assessing Response Rates and Sleep Disorder Prevalence: Insights from a Propranolol Treatment Study for Infantile Haemangiomas. *Children*, 11(9):1086.

Ordonez-Ponce, E. 2021. The role of institutional context for sustainability cross-sector partnerships. An exploratory analysis of European cities. *Sustainability,* 13(17): 9497.https://protect.checkpoint.com/v2/___https://doi.org/10.3390/su13179497___.YzJlOnVuaXNhbW9iaWxlOmM6bzo3M2VjZjA1ODBkOGQ1NjQzNTY5NWQ3ZjU4NTgwOWU0Mzo2OjRhNmM6MzdkZjBlNDVkYjZjZGI5ZWZmYTQ3ZmVhMTQ3NTljNjA3OTlhNWY0Zjk3MmU1Y2Q5NjEyOTM2NTI1YTMyMTkxZTpwOkY

Orsato, R.J. & Wells, P. 2007. The automobile industry & sustainability. *Journal of cleaner production*, 15(11-12): 989-993.

Oumer, A.J., Cheng, J.K. & Tahar, R.M. 2015, August. Green manufacturing and logistics in automotive industry: A simulation model. In 2015 9th *International Conference on IT in Asia* (CITA):1-6.

Pace, D.S. 2021. Probability and non-probability sampling-an entry point for undergraduate researchers. *International journal of quantitative and qualitative research methods*, 9(2):1-15.

Pacheco-López, A., Somoza-Tornos, A., Graells, M. & Espuña, A. 2021. Synthesis and assessment of waste-to-resource routes for circular economy. *Computers & Chemical Engineering,* 153:107439.

Paipa-Sanabria, E.G., Gonzales Montoya, D. & Coronado Hernandez, J. 2025. Understanding eco-innovation: a critical examination of theories and tools for achieving societal sustainability. *Journal of Sustainability Research*, 7(1): e250013.

Pallant, J. 2020. *SPSS survival manual: A step-by-step guide to data analysis using IBM SPSS*. United Kingdom: McGraw-Hill education.

Panya, K.O. & Nyarwath, O. 2022. Demystifying philosophies and paradigms underpinning scientific research. *The Strategic Journal of Business & Change Management*, 9 (4):1367 - 1382.

Papadopoulos, T., Baltas, K.N. & Balta, M.E. 2020. The use of digital technologies by small and medium enterprises during COVID-19: Implications for theory and practice. *International journal of information management,* 55:102192.

Parahoo K. 2006. Nursing research principles, processes and issues. 2nd ed. Basingstoke: Palgrave Macmillan.

Park, S.Y. & Baek, Y.M. 2018. Two faces of social comparison on Facebook: The interplay between social comparison orientation, emotions, and psychological well-being. *Computers in Human Behavior*, *79*:83-93.

Park, Y.S., Konge, L. & Artino Jr, A.R. 2020. The positivism paradigm of research. *Academic medicine,* 95(5):690-694.

Parliamentary Monitoring Group. 2014. Report of the Portfolio Committee on Trade and Industry on the implementation of the Industrial Policy Action Plan with specific reference to the state of the manufacturing sector. Available from: https://static.pmg.org.za/141028pctradereport.htm (Accessed May 2024).

Pereira, A.C. & Romero, F.2017. A review of the meanings and the implications of the industry 4.0 concept. *Procedia Manufacturing*, 13:06-1214.

Pérez-Vicente, S. & Ruiz, M.E. 2009. Descriptive statistics. *Allergologia et immunopathologia*, 37(6):314-320.

Pernot, P. & Savin, A. 2018. Probabilistic performance estimators for computational chemistry methods: The empirical cumulative distribution function of absolute errors. *The Journal of Chemical Physics,* 148(24):41707.

Perramon, J., Oliveras-Villanueva, M. & Llach, J. 2022. Impact of service quality and environmental practices on hotel companies: An empirical approach. *International Journal of Hospitality Management,*107:103307.

Peters, S., Chun, J.H. & Lanza, G. 2016. Digitalization of automotive industry – scenarios for future manufacturing, Manufacturing Review.

Phakiti, A. 2018. Confirmatory factor analysis and structural equation modelling. In A. Phakiti, P. De Costa, L. Plonsky, & S. Starfield (Eds.), *The Palgrave handbook of applied linguistics research methodology*. London: Palgrave Macmillan.

Pham, L.T.M. 2018. A review of key paradigms: Positivism, interpretivism & critical enquiry, school of education. *University of Adelaide,* 6:34-37.

Pike, A., Puchert, J. & Chinyamurindi, W.T. 2018. Analysing the future of Broad-Based Black Economic Empowerment through the lens of small and medium enterprises. *Acta Commercii,* 18(1):1-10.

Pillay, N.S., & Dall-Orsoletta, A. 2024. Electric vehicle adoption: Implications for employment in South Africa's automotive component industry. *World Electric Vehicle Journal,* 15(10): 471.

Pischinger, S. & Seiffert, U. 2016. *Vieweg Handbook of Automotive Engineering*. 8th ed., Springer.

Pohludka, M. & Štverková, H. 2019. The best practice of CRM implementation for small and medium-sized enterprises, *Administrative Sciences*, 9(1):2-17.

Pohludka, M. & Štverková, H. 2019. The role of business sustainability in customer relationships: Evidence from SMEs. *Sustainability*, 11(18): 4988.

Polit, D.F. and Beck, C.T. 2012. *Nursing Research: Generating and Assessing Evidence for Nursing Practice.* 9th ed., Lippincott, Williams & Wilkins, Philadelphia.

Porter, M. 1991, America's Green Strategy. *Scientific American*, 264(4): 168.

Portney, K. 2015. Taking sustainable cities seriously: economic development, the environment and quality of life in American cities. *Journal of Environmental Studies and Sciences*, 6(3): 1-22.

Priyono, A., Moin, A. & Putri, V.N.A.O. 2020. Identifying Digital Transformation Paths in the Business Model of SMEs during the COVID-19 Pandemic. *Journal of Open Innovation: Technology, Market and Complexity*, 6(104):1-22.

Purba, F., Suparno, O.& Suryani, A. 2020. Green productivity in the Indonesian leather-tanning industry. *Revista de Pielarie Incaltaminte*, 20(3):245-266.

Purna Singh, A., Vadakedath, S. & Kandi, V. 2023 Clinical Research: A Review of Study Designs, Hypotheses, Errors, Sampling Types, Ethics, and Informed Consent. *Cureus*,15(1): e3337

Pusavec, F., Kramar, D., Krajnik, P. & Kopac, J. 2010. Transitioning to sustainable production–part II: evaluation of sustainable machining technologies. *Journal of Cleaner Production,* 18(12):1211-1221.

Qu, W., Liu, H. & Zhang, Z. 2019. A method of generating multivariate non-normal random numbers with desired multivariate skewness and kurtosis. *Behaviour Research Methods,* 52(3): 939-946.

Quinlan, C., Babin, B.J., Carr, J.C., Griffin, M. & Zikmund, W.G. 2019. *Business research methods.* Hampshire: Cengage Learning, EMEA.

Qutoshi, S.B. 2018. Phenomenology: A philosophy and method of inquiry. *Journal of education and educational development*, 5(1):215-222.

Radu, C., Caron, M.A. & Arroyo, P. 2020. Integration of carbon and environmental strategies within corporate disclosures*. Journal of cleaner Production*, 244:118681.

Radu, L.D. 2018. Barriers to green ICT adoption in Romania. *Academic Journal of Economic Studies*, 4(4):28–33.

Rae, J.B. & Binder, A.K. 2017. A*utomotive Industry*. *Encyclopedia Britannica* [Online]. Available at: https://www.britannica.com/technology/automotive-industry (Accessed 21 March 2021).

Ragland, G.J., Egan, S.P., Feder, J.L., Berlocher, S.H. & Hahn, D.A. 2011. Developmental trajectories of gene expression reveal candidates for diapause termination: a key life-history transition in the apple maggot fly Rhagoletis pomonella. *Journal of Experimental Biology*, 214(23):3948-3960.

Rahaman, M.M., Abdullah, M. & Rahman, A. 2011. Measuring service quality using SERVQUAL model: A Study on PCBs (Private Commercial Banks) in Bangladesh. *Business Management Dynamics,* 1(1):1-11.

Rahman, M. 2020. Reducing CO2 *Emission for Inbound Logistics: Redesigning inbound logistical operations for environmental sustainability-A case study from Volvo Group* [Online]. Available at: (Dissertation). Retrieved from https://urn.kb.se/resolve?urn=urn:nbn:se:hj:diva-50925</div>> (Accessed 22 March 2022).

Rahman, S. 2011. Evaluation of definitions: ten dimensions of corporate social responsibility. *World review of business research,* 1(1):166-176.

Rajahonka, M. & Bask, A. 2016. The development of outbound logistics services in the automotive industry A logistics service provider's view. *Development of Outbound Logistics Service,* 27(3):707-737.

Rajarshi, D, B. D. 2016. Customer relationship management theory and research in the new millennium: Direction for future research. *Journal of Relationship Marketing*, 15(4):299-325.

Rajper, S.Z. & Albrecht, J. 2020. Prospects of electric vehicles in the developing countries: a literature review. *Sustainability*, 12(5):1906.

Ramdhani, A., Ramdhani, M.A. & Amin, A.S. 2014. Writing a literature review research paper: A step-by-step approach. *International Journal of Basic and Applied Science*, 3(1):47-56

Ramírez-Peña, M., Mayuet, P., Vázquez, J., & Batista, M. 2020. Sustainability in the aerospace, naval, and automotive supply chain 4.0: descriptive review. *Materials*, 13(24):5625.

Rangaraju, K. Nedunchezhian, V. R. & Kumar, S.P. K. 2020. Effectiveness of Quality of Service towards Commitment of Suppliers with Reference to SMEs in Automobile Industry. *International Journal of Management, Technology, and Social Sciences (IJMTS*), 5(2):216-232.

Rashida, N.R.N., Khalidb, S.A.K. & Rahman, I.A. 2015. Environmental corporate social responsibility (ECSR): Exploring its influence on customer loyalty. *Procedia Economics and Finance* 31:705 -713.

Rassel, G., Leland, S., Mohr, Z. & O'Sullivan, E. 2020. *Research methods for public administrators*. Routledge.

Rathilall, R. & Singh, S. 2011. Improving quality and productivity at an automotive component manufacturing organisation in Durban-South Africa*. African Journal of Business Management*, 5(22):8854.

Raza, S.A., Jawaid, S.T. & Hassan, A. 2015. Internet banking and customer satisfaction in Pakistan. *Qualitative Research in Financial Markets*, 7(1):24-36.

Rehman, K. 1990. Introduction to research paradigms. *Alharthi International Journal of Educational Investigations*, 3 (8):51-59.

Rehman, M. A., Seth, D. & Shrivastava, R. 2016. Impact of green manufacturing practices on organisational performance in Indian context: An empirical study. *Journal of Cleaner Production*, 137: 427-448.

Reichheld, F.F. & Sasser, W.E. 1990. Zero defections: Quality comes to services. *Harvard Business Review*,56(5):105-111.

Reimers, P. 2021. The subsidized green revolution: the impact of public incentives on the automotive industry to promote alternative fuel vehicles (AFVs) in the period from 2010 to 2018. *Energies*, 14(18):5765.

Reiter. B. 2017. Theory and methodology of exploratory social science research. University of South Florida.

Republic of South Africa. 1998. *The Atmospheric Pollution Prevention Act,* 1965. Pretoria. Government Printers.

Republic of South Africa. 1998. *The National Environmental Management Act (NEMA)*, 1998. Pretoria. Government Printers.

Republic of South Africa. 1998. *The National Road Traffic Act,* 1996. Pretoria. Government Printers.

Reyes-Rodríguez, J.F., Ulhøi, J.P. & Madsen, H. 2016. Corporate environmental sustainability in Danish SMEs: A longitudinal study of motivators, initiatives, and strategic effects. *Corporate Social Responsibility and Environmental Management,* 23(4):193-212.

Rezvani, Z., Jansson, J. & Bodin, J., 2015. Advances in consumer electric vehicle adoption research: A review and research agenda. *Transportation research part D: transport and environment*, 34:122-136.

Ribeiro, J.L., Junior, J.A.V.A., da Silva, D.O., da Silva, W.D. & Sellitto, M.A. 2022. Driving innovation initiatives in a multinational company subsidiary: A case study and conceptual framework for further application. *Journal of Open Innovation: Technology, Market, and Complexity*, 8(4):187.

Richter, T. & Medunic, A. 2020. *Sustainability and change in the automotive industry: How regulations on environmental sustainability are implemented in companies and leading to change* [Online]. Available at: https://urn.kb.se/resolve?urn=urn:nbn:se:hh:diva-42272</div> (Accessed 18 March 2022).

Ringle, C.M., Wende, S. & Becker, J.M. 2024. *SmartPLS 4.* SmartPLS [Online]. Available at: https://www.smartpls.com (Accessed 12 February 2025).

RMB. 2021. *Localisation essential to transform SA's automotive sector* [Online]. Available at: https://www.rmb.co.za/news/localisation-essential-to-transform-sas-automotive-sector (Accessed 12 May 2022).

Rodrigues, V.C., Rauenm, T.R. & Álvaro, G.R. 2017. Sustainability and Innovation in the automotive repair and maintenance sector: A Structured Content Analysis. *Sustainability*, 9(6):880

Rodríguez-Escobar, J.A. & González-Benito, J. 2015. The role of information technology in purchasing function", *Journal of Business & Industrial Marketing*, 30(5):498-510.https://protect.checkpoint.com/v2/___https://doi.org/10.1108/JBIM-06-2012-0106___.YzJlOnVuaXNhbW9iaWxlOmM6bzo3M2VjZjA1ODBkOGQ1NjQzNTY5NWQ3ZjU4NTgwOWU0Mzo2OmQ1NDg6OWExNDNiNThmYjZlZjZiYzdhNDM4ODllNWExNzQ5MmY5YjY0ZmYyNWI4ZjAzMWZmNjhhMzlmODM2MzQwMTQ2YzpwOkY

Rogers, E. M. 2003. *Diffusion of innovations*, 5th ed., New York: Free Press.

Rokadiya, S. Yang, Z. & Bandivadekar, A. 2019. Incentivizing electric vehicles to meet fuel consumption standards for passenger cars in India. *The International Council on Clean Transportation (ICCT)* [Online]. Available at: https://theicct.org/publication/incentivizing-electric-vehicles-to-meet-fuel-consumption-standards-for-passenger-cars-in-india/ (Accessed 22 April 2022).

Rokeman, N.R.M. 2024. Likert measurement scale in education and social sciences: explored and explained. *EDUCATUM Journal of Social Sciences*, 10(1):77-88.

Roscoe, S., Subramanian, N., Jabbour, C.J. & Chong, T. 2019. Green human resource management and the enablers of green organisational culture: Enhancing a firm's environmental performance for sustainable development. Business Strategy and the Environment, 28(5):737-749.

Rose, S. Spinks, N. & Canhoto, A. I. 2014. *Management Research: Applying the Principles*. New York: Routledge.

Rotjanakorn, A., Sadangharn, P. & Na-Nan, K. 2020. Development of dynamic capabilities for automotive industry performance under disruptive innovation. *Journal of Open Innovation: Technology, Market, and Complexity*, 6(4):2-19.

Roy, R., Sukumar, G.M., Philip, M. & Gopalakrishna, G. 2023. Face, content, criterion and construct validity assessment of a newly developed tool to assess and classify work–related stress (TAWS–16). *Plos one*, 18(1): e0280189.

Rubio-Mozos, E., García-Muiña, F. E. & Fuentes-Moraleda, L. 2019. Rethinking 21st-century businesses: An approach to fourth sector SMEs in their transition to a sustainable model committed to SDGs. *Sustainability*, 11(20):5569.

Rüdele, K. & Wolf, M. 2023. Identification and reduction of product carbon footprints: Case studies from the Austrian Automotive Supplier Industry. *Sustainability*, 15:14911.

Rüdisüli, M., Romano, E., Eggimann, S., & Patel, M.K. 2022. Decarbonization strategies for Switzerland considering embedded greenhouse gas emissions in electricity imports. *Energy Policy*, 162:112794.

SA Fact. 2022. List of automotive component manufacturers in South Africa. https://safacts. co.za /list-of-automotive-component-manufacturers-in-south-africa.

Sabadka, D. 2016. New trends and challenges in automotive industry logistics operations. Acta Logistica - *International Scientific Journal about Logistics*, 2(1):15-19.

Saberi, S., Kouhizadeh, M., Sarkis, J. & Shen, L. 2019. Blockchain technology and its relationships to sustainable supply chain management. *International Journal of Production Research*, 57(7):2117-2135

Sajjad, A., Eweje, G. & Tappin. D. 2015. Sustainable Supply Chain Management: Motivators and Barriers. *Business Environment and the Environment,* 24(7):643-655.

Salvioni, D.M., Franzoni, S. & Cassano, R. 2017. Sustainability in the higher education system: An opportunity to improve quality and image. *Sustainability*, 9(6):914.

Sanders, S. & Karmowska, J. 2020. Voluntary flexible working arrangements and their effects on managers and employees. *Harvard Deusto Business Research,* IX (2*):197-220.*

Saritas, O., Meissner, D. & Sokolov, A. 2019. A transition management roadmap for fuel cell electric vehicles (FCEVs). *Journal of the Knowledge Economy*, 10:1183-1203.

Sarjana, S., Kartini, D., Rufaidah, P., & Yunizar, A. 2017. Resource based view as a strengthening of industry's capabilities to improve competitive strategies. *International Journal of Advanced Research*, 5(7):2195-2204.

Sarkis, J., Zhu, Q. & Lai, K.H. 2011. An organizational theoretic review of green supply chain management literature. International journal of production economics, 130(1):1-15.

Sarmento, R.P. & Costa, V. 2019. Confirmatory factor analysis--a case study. *arXiv:1905.05598v1,* 1-2.

Sathasivam, K., Che Hashim, R. & Abu Bakar, R. 2021. Automobile industry managers' views on their roles in environmental sustainability: a qualitative study. Management of Environmental Quality: *An International Journal*, 32(5):844-862.https://protect.checkpoint.com/v2/___https://doi.org/10.1108/MEQ-09-2020-0194___.YzJlOnVuaXNhbW9iaWxlOmM6bzo3M2VjZjA1ODBkOGQ1NjQzNTY5NWQ3ZjU4NTgwOWU0Mzo2OmMyNDg6ZWE0MjE0MDNiY2Y4YzhkZGEwMjE0OWMxNzhhY2I3Y2U1NjUzZTlkMmI2YzE1YzVmMTI2ODZmMTY3ZDU5N2EyNzpwOkY

Sathish, M., Balamurugan, R.N., Sharma, S.N. & Karthikeyan, P. 2013. Customer Relationship Management in Car Service Industry with Reference to Car Dealers in Coimbatore. *Journal of Business Management & Social Sciences Research,* 2(6):44-49.

Saunders, M., Lewis, P. & Thornhill, A. 2014. *Research Methods for Business Students*. 7th ed. Essex: Pearson Education Limited.

Scherbaum, C.A. & Shockley, K.M. 2015. Analysing quantitative data for business and management students. *Google Scholar*, 1-184.

Schiele, H. 2010. Early supplier integration: the dual role of purchasing in new product development. *R&d Management*, 40(2):138-153.

Schönborn, G., Berlin, C., Pinzone, M., Hanisch, C., Georgoulias, K. & Lanz, M. 2019. Why social sustainability counts: The impact of corporate social sustainability culture on financial success. *Sustainable Production and Consumption*, 17:1-10.

Schuler, M.S., Coffman, D.L., Stuart, E.A., Nguyen, T.Q., Vegetabile, B. & McCaffrey, D.F. 2025. Practical challenges in mediation analysis: a guide for applied researchers. *Health Services & Outcomes Research Methodology*, 25:57–84.

Schulz, F., & Rode, J. 2022. Public charging infrastructure and electric vehicles in Norway. *Energy Policy,* 160:112660.

Schwitter, N. & Liebe, U. 2025. Sometimes, a descriptive figure is worth more than a thousand model coefficients: the importance of data description in social research. *International Journal of Social Research Methodology*, 1:1–6.

Scott, M. 2023. *Supply Chain Mapping for Emergency Management Decision-Making. (Report No. IHS/CR-2023-1027). The Sam Houston State University Institute for Homeland Security* [Online]. Available at: https://hdl.handle.net/20.500.11875/4254 (Accessed 13 December 2023).

Senarath, B.T.D.N., Gunarathne, G.C.I. & Fernando, T.S.S. 2020. Impact of total quality management on operational performance. *Peradeniya management review,* 2(1):99-127.

Sendawula, K., Bagire, V., Mbidde, C.I. &Turyakira, P. 2020. Environmental commitment and environmental sustainability practices of manufacturing small and medium enterprises in Uganda. *Journal of Enterprising Communities: People and Places in the Global Economy*, 15(4):588-607.

Severo, E.A., de Guimarães, J.C.F. & Dorion, E.C.H. 2017. Cleaner production and environmental management as sustainable product innovation antecedents: a survey in Brazilian industries. *Journal of Cleaner Production,* 142:87-97.

Shahrear, P., Saiki, M.F.H. & Tareq, M.T.N. 2024. Analysis of Covid-19 Data Based on Modelling and Descriptive Statistical Approach. *Pre-prints,* 1-22.

Shaikh, A., Kinange, U. & Fernandes, A. 2016. Innovations in automotive industry and its influence on consumer behaviour. *Tactful Management,* 4(12):1-9

Shalique, M.S., Padhi, S.S., Jayaram, J. & Pati, R.K. 2022. Adoption of symbolic versus substantive sustainability practices by lower-tier suppliers: a behavioural view. *International Journal of Production Research*, 60(15):4817-4844.

Shamiyah, T., Kane, R.L. & Dickinson, S. 2010. A systematic review of tools used to assess the quality of observational studies that examine incidence or prevalence and risk factors for diseases. *Journal of clinical epidemiology*, 63(10):1061-1070.

Sharma, G. 2017. Pros and cons of different sampling techniques. *International Journal of Applied Research*. 3(7):749-752.

Sharma, P., Aggarwal, R., Mittal, N., Chougule, D., Bhalla, R., Kapoor, D., Chauhan, K.K., Singh, P. & Singh, M.K. 2023. A cross-sectional survey to assess awareness and perception to clinical research: Unbox research. *Journal of Clinical and Preventive Cardiology*, 12(4):118-123.

Sharma, R., & Sharma, P. 2023. Understanding convergent validity in research: A theoretical perspective. *Journal of Research Methods*, 12(3):78-92.

Sharma, S. & Gandhi, P.J. 2017. Scope and Impact of Implementing Lean Principles & Practices in Shipbuilding. *Procedia Engineering*, 194:232-240.

Sharma, S. & Vredenburg, H. 1998. Proactive corporate environmental strategy and the development of competitively valuable organizational capabilities. *Strategic Management Journal,* 19(8):729-753.

Shava, E. 2016. Black Economic Empowerment in South Africa: Challenges and Prospects. *Journal of Economics and Behavioural Studies*, 8(6):161-170

Sheller, M. &Urry, J. 2016. Mobilizing the new mobilities paradigm. *Applied Mobilities*, 1(1): 10-25.

Shi, D., Lee, T & Maydeu-Olivares, A. 2019. Understanding the model size effect on SEM fit indices. *Educational and psychological measurement*, 79(2):310-334.

Shin, D. 2017. The role of affordance in the experience of virtual reality learning: Technological and affective affordances in virtual reality. *Telematics and Informatics,* 34(8): 1826-1836.

Shokouhyar, S. Shokoohyar, S. & Safari, S. 2020. Research on the influence of after-sales service quality factors on customer satisfaction. *Journal of Retailing and Consumer Services*, 56:102139.

Shorten, A. & Smith, J. 2017. Mixed methods research: expanding the evidence base. *Evidence based nursing*, 20(3):74-75.

Shukla, O.P. & Garg, S.K. 2017. Perception of faculty members on factors affecting quality education and employability skills in technical education sector: an empirical analysis, *International Journal of Services, Economics and Management,* 8 (1-2):109-131.

Sibanda, M. & Straus, J. 2020. The intellectual property system as a catalyst for socioeconomic development for middle income countries – Lessons from South Africa. *European Intellectual Property Review*, 42(11):738-750.

Sierzchula, W., Bakker, S., Maat, K. & van Wee, B. 2015. Alliance formation in the automobile sector during an era of ferment. *Creativity and Innovation Management*, 24(1):109-122.

Sileyew, K.J., 2020. Research design and Methodology. *Cyberspace*, 1:27-37.

Silva, F.C.D., Shibao, F.Y., Barbieri, J.C., Librantz, A.F.H. & Santos, M.R.D. 2018. Barriers to green supply chain management in the automotive industry. *Revista de Administração de Empresas*, 58:149-162.

Simandan, D. 2020. *Industrialisation. International Encyclopaedia of Human Geography*. Elsevier Ltd.

Simkus, J. 2022. *Cluster sampling: definition, method and examples* [Online] Available at: www.simplypsychology.org/cluster-sampling.html (Accessed 23 April 2024).

Singh, F.P. 2019. Sampling design and techniques in research. *International Journal of Management, Technology and Engineering,* 11(1):94-103.

Singh, M. & Sahu, G.P. 2020. Towards adoption of Green IS: a literature review using classification methodology. *International Journal of Information Management*, 10(3):1-14.

Sixes, V., Smith, N. & Mitton, C. 2017.The qualitative descriptive approach in international comparative studies: Using online qualitative studies. *International journal of heath policy and management*, 7(9):778-779.

Škerlič, S. & Muha, R. 2020. A model for managing packaging in the product life cycle in the automotive industry. *Sustainability,* 12(22):1-19.

Slavić, A. & Berber, N. 2015. The Role of HRM in CSR and Sustainable Development: Findings from *V4 Countries and Serbia*, 64(4):56-59.

Slavić, A. & Berber, N. 2015. The impact of corporate social responsibility on sustainable business practices: Evidence from Serbia. *Management: Journal of Sustainable Business and Management Solutions in Emerging Economies, 20*(77):25-36.

Smith, M.M. 2015. *Impact of environmentally friendly packaging on consumers' attitudes and patronage intentions towards apparel retail brands* [Online]. Available at: https://www.semanticscholar.org/paper/Impact-of-environmentally-friendly-packaging-on-and-Smith/a00381b00fba95b794fdd288a821163987f10226#:~:text=Impact%20of%20environmentally%20friendly%20packaging,intentions%20toward%20apparel%20retail%20brands. (Accessed 17 May 2022).

Sony, M. & Aithal, P. S. 2020. A Resource-Based View and Institutional Theory-based analysis of Industry 4.0 Implementation in the Indian Engineering Industry. *International Journal of Management, Technology, and Social Sciences* (IJMTS), 5(2):154-166.

Sony, M. 2018. Industry 4.0 and lean management: a proposed integration model and research propositions. *Production & Manufacturing Res*earch ,6 (1):416-432.

Sousa, R. & da Silveira, G.J. 2017. Capability antecedents and performance outcomes of servitization: Differences between basic and advanced services. *International Journal of Operations & Production Management*, 37(4):444-467.

South Africa Country Commercial Guide (SACCG). 2021. *Market conditions, opportunities, regulations, and business conditions in South Africa* [Online]. Available at: https://www.trade.gov/country-commercial-guides/south-africa-automotive. (Accessed: 12 May 2021).

South Africa Revenue Service (SARS) 2019. SARS Media Release 2019. Available at: chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.sars.gov.za/wp-content/uploads/Docs/TradeStats/2019/May/Media-Release-May-2019.pdf (Accessed 24 May 2024).

Sparkman, G. & Walton, G.M. 2017. Dynamic norms promote sustainable behaviour, even if it is counternormative. *Psychological science*, 28(11):1663-1674.

Spaull, N. & Kotze, J. 2015. Starting behind and staying behind in South Africa: The Case of Insurmountable Learning Deficits in Mathematics. *International Journal of Educational Development*, 41:13-24.

Sperling, D. 2018. *Three revolutions: Steering automated, shared, and electric vehicles to a better future.* Island Press.

Staden, V. & King, R. 2016. Kurtosis of the logistic-exponential survival distribution. Communication in Statistics- *Theory and Methods*, 45(23):6891-6899.

Stedman, R.C., Connelly, N.A., Heberlein, T.A., Decker, D.J. & Allred, S.B. 2019. The end of the research world as we know it. *Understanding and coping with declining response rates to mail surveys. Society & Natural Resources*, 32(10):1139-1154.

Steensen, N.K. 2019. *The role of self-regulation in environmental behaviour change,* PhD Series. Copenhagen Business School (CBS), Frederiksberg,

Steiger, J. H. 2007. Understanding the limitations of global fit assessment in structural equation modeling. *Personality and individual differences*, 42(5):893-898.

Stringham, E.P., Miller, J.K. & Clark, J.R. 2015. Overcoming barriers to entry in an established industry: Tesla Motors. *California Management Review*, 57(4):85-103.

Sturgeon, T. J., Van Biesebroeck, J. & Gereffi, G. 2008. Value chains, networks and clusters: Reframing the global automotive industry. *Journal of Economic Geography,* 8(3): 297-321.

Stylidis, K., Wickman, C. & Söderberg, R. 2015. Defining perceived quality in the automotive industry: An engineering approach. *Procedia CIRP*, 36:165-170.

Suarez, F.F.; Cusumano, M.A. & Kahl, S. 2013. Services and the business models of product firms: An empirical analysis of the software industry. *Management. Science*, 59: 420-435.

Suh, J.T. 2018. *Strategies for Used Car Dealership Owners to Sustain Business in a Competitive Environment.* PHD thesis. Walden University.https://protect.checkpoint.com/v2/___https://scholarworks.waldenu.edu/cgi/viewcontent.cgi?article=7228&context=dissertations___.YzJlOnVuaXNhbW9iaWxlOmM6bzo3M2VjZjA1ODBkOGQ1NjQzNTY5NWQ3ZjU4NTgwOWU0Mzo2OmIwNjM6MjRiMzhlOTZmYTlhOGVmZjdiNDhiYjkzMzc4MjJkZTg4ODI4N2U0ZTdhMjM5NGZjNzQzMzE2ZjViOTYwYzE4NDpwOkY

Suhi, S.A., Enayet, R.R., Haque, T., Ali, M., Moktadir, A. & Kumar, S.P. 2019. Environ-mental sustainability assessment in supply chain: An emerging economy context. *Environmental Impact Assessment Review,* 79:106306

Sürücü, L. & Maslakci, A.2020. Validity and reliability in quantitative research. Business & Management Studies: *An International Journal*, 8(3):2694-2726.

Suryawanshi, K. & Narkhede, S. 2015. Green ICT for sustainable development: A higher education perspective. *Procedia Computer Science,* 70:701-707.

Taber, K.S. 2018. The Use of Cronbach's Alpha When Developing and Reporting Research Instruments in Science Education. *Research in Science Education*, 48:1273-1296.

Tahanisaz, S. & Shokuhyar, S. 2020. Evaluation of passenger satisfaction with service quality: A consecutive method applied to the airline industry. *Journal of Air Transport Management,* 83(2):101764.

Taherdoost, H. 2016. Sampling methods in research methodology; how to choose a sampling technique for research. *International journal of academic research in management* (*IJARM),* 5(2):18-27.

Taherdoost, H. 2021. Data collection methods and tools for research: a step-by-step guide to choose data collection technique for academic and business research projects. *International Journal of Academic Research in Management*, 10(1):10–38.

Takita, A. K. & Leite, P.R. 2019. Sustainable logistics and supply chain management: A Brazilian automotive case study. *International Journal of Logistics Management,* 30(2): 485-504.

Takita, A.M.V. & Leite, J.C. 2019. Inbound logistics: A case study. *Business management dynamics,* 8(12):13-21.

Tao, F. 2014. Customer Relationship management based on Increasing Customer Satisfaction. *International Journal of Business and Social Science*, 5:256–263.

Tapscott, D. & Tapscott, A. 2016. *Blockchain revolution: how the technology behind bitcoin is changing money, business, and the world*. Penguin.

Tarigan, Z.J.H., Siagian, H & Jie, F. 2020. The role of top management commitment to enhancing competitive advantage through ERP integration and purchasing strategy. *International Journal of Enterprise Information Systems*, 16(1):53-68.

Tariq, A., Badir, Y. & Chonglerttham, S. 2019. Green innovation and performance: moderation analyses from Thailand. *European Journal of Innovation Management*, 22(3):446-467.

Taruna, S., Singh, P. & Joshi, S. 2014. Green computing in developed and developing countries. *arXiv preprint arXiv:1406.2773*.

Taylor, S.P. 2017. What is innovation? A study of the definitions, academic models and applicability of innovation to an example of social housing in England. *Open Journal of Social Sciences,* 5(11):128-146.

Testa, F., Rizzi, F., Daddi, T. & Frey, M. 2016. Effectiveness of EMAS and ISO 14001 in improving environmental performance: A comparison of two industrial districts in Italy. *Journal of Cleaner Production,* 114:153-163.

Tetteh, F.K., Owusu Kwateng, K. & Mensah, J. 2024. Green logistics practices: A bibliometric and systematic methodological review and future research opportunities. *Journal of Cleaner Production*, 476(3):143735.

Thacker, L.R. 2020. What is the big deal about populations in research? *Progress in transplantation*, 30(1):3-3.

Thiel, M. 2015. Unlocking the social domain in sustainable development. World J. Science. *Technology and Sustainable Development*, 12:183-193.

Thiengo, H., Tavares, E. & Nobre, G.C. 2019. Organisational readiness evaluation on sustainable IT management in the Brazilian context. *International Journal of Innovation and Sustainable Development,* 13(3-4):314-332.

Todor, A. 2019. Correction: Willing to pay to save the planet? Evaluating support for increased spending on sustainable development and environmentally friendly policies in five countries. *PLOS ONE*, 14(5): e0216571.

Tongwane, M.I. & Moeletsi, M.E. 2021. Status of electric vehicles in South Africa and their carbon mitigation potential. *Scientific African*, 14:1-9.

Toni, M., Renzi, M.F., Pasca, M.G., Guglielmetti Mugion, R., di Pietro, L. & Ungaro, V. 2021. Industry 4.0 an empirical analysis of users' intention in the automotiverepair and maintenance sector. *International Journal of Quality and Service Sciences*, 13(4):563–584.https://protect.checkpoint.com/v2/___https://doi.org/10.1108/IJQSS-04-2020-0062___.YzJlOnVuaXNhbW9iaWxlOmM6bzo3M2VjZjA1ODBkOGQ1NjQzNTY5NWQ3ZjU4NTgwOWU0Mzo2OjllMTU6MWMzYmQ1YzBkNzMwYzNlMWQ1ZDM0M2YxZjdjYzYwYWQwOGUxN2VkYzQzYTM3MmFmOTZhNjM3ZmEzODFkM2YxYzpwOkY

Touboulic, A, Walker, H. 2015. A relational, transformative and engaged approach to sustainable supply chain management: The potential of action research. *Human Relations,* 69(2):301-343.

Trang, H.L.T., Lee, J.S. & Han, H. 2019. How do green attributes elicit pro-environmental behaviors in guests? The case of green hotels in Vietnam. *Journal of Travel & Tourism Marketing*, 36(1):14-28.

Treiman, D.J. 2014. *Quantitative Data Analysis: Doing Social Research to Test Ideas,* New York: John Wiley & Sons.

Trumpp. C. & Guanther, T. 2017. Too little or too much? Exploring U-shaped relationship between corporate environmental performance and financial performance. *Business Strategy and the Environment*, 26:49-68.

Tuczek, F., Castka, P. & Wakolbinger, T. 2018. A review of management theories in the context of quality, environmental and social responsibility voluntary standards. *Journal of cleaner production*, 176:399-416.

Tukamuhabwa, B., Mutebi, H. & Kyomuhendo, R. 2023. Competitive advantage in SMEs: effect of supply chain management practices, logistics capabilities and logistics integration in a developing country. *Journal of Business and Socio-Economic Development*, 3(4):353-371.

Valenzuela, S. & Bachmann, I. 2017. Path Analysis. In J. Matthes, S. C. Davies, & F. R. Potter, *The international encyclopedia of communication research methods*, (pp. 1-9). Wiley-Blackwell.

Vallejo-Medina, P., Gómez-Lugo, M., Marchal-Bertrand, L., Saavedra-Roa, A., Soler, F. & Morales, A. 2017. Developing guidelines for adapting questionnaires into the same language in another culture. *Terapia Psicológica,* 35(2):181-194.

Van der Merwe, D., Van Eeden, J. & Simpson, Z. 2023. Developing a toolkit to assist in the decision-making process of logistics service providers to shift to the use of bimodal transport in South Africa. *Research in Transportation Business & Management*, 48:100817.

Van Weele, A.J. 2017. *Purchasing and supply management* (5th ed.) Essex: Cengage Learning.

Vantamay, S. 2007. Understanding of perceived product quality: Reviews and recommendations. *BU Academic Review,* 6(1):110-117.

Vargas-Hernández, J.G. 2020. Strategic transformational transition of green economy, green growth and sustainable development: An institutional approach. *International Journal of Environmental Sustainability and Green Technologies* (IJESGT), 11(1):34-56.

Varpio, L. & MacLeod, A. 2020. Philosophy of science series: harnessing the multi-disciplinary edge effect by exploring paradigms, ontologies, epistemologies, axiologies, and methodologies. *Academic Medicine,* 95(5):686-689.

Vasanth, V., Selvam M., Lingaraja K., Miencha I.O. & Raja M. 2015. Testing Environmental Kuznets Curve Hypothesis at firm level in India. *Journal of Sustainable Development*, 8:201-212.

Vasantha Raju, N.N.S.H. & Harinarayana, N.S. 2016, January. Online survey tools: A case study of Google Forms. *In National conference on scientific, computational & information research trends in engineering*, *GSSS-IETW* [Online]. Available at: https://www.scirp.org/reference/referencespapers?referenceid=3435511. (Accessed 13 December 2022).

Vassiliadis, P. 2009. A survey of extract–transform–load technology. *International Journal of data warehousing and mining* (IJDWM), 5(3):1-27.

Vaz, C.R., Rauen, T.R.S. & Lezana, A.G.R. 2017. Sustainability and Innovation in the automotive repair and maintenance sector: A Structured Content Analysis. *Sustainability* 9(6): 880.

Vendrell-Herrero, F.; Bustinza, O.F.; Parry, G. & Georgantzis, N. 2017. *Servitization, digitization and supply chain interdependency. Industrial. Marketing. Management,* 60:69-81.

Venkatesh, V. & Davis, F.D. 2000. A theoretical extension of the technology acceptance model: four longitudinal field studies. *Management Science*, 46(2):186-204.

Venske, E. 2016. Learning to leave a legacy: corporate social responsibility in South African business event tourism curricula. *African Journal of Hospitality, Tourism and Leisure*, 5(3):2-19.

Verdecchia, R., Lago, P., Ebert, C. & De Vries, C. 2021. Green IT and green software. *IEEE software*, *38*(6):7-15.

Verhoef, P. C., Broekhuizen, T., Bart, Y., Bhattacharya, A., Qi Dong, J., Fabian, N. & Haenlein, M. 2020. Digital transformation: A multidisciplinary reflection and research agenda. *Journal of Business Research*, 122:889-901.

Versey, H. S. 2021. Missing pieces in the discussion on climate change and risk: Inter-sectionality and compounded vulnerability. *Policy Insights from the Behavioural and Brain Sciences*, 8(1):67-75.

Vesal, M., Siahtiri, V. & O' Cass, A. 2021. Strengthening b2b brands by signalling environmental sustainability and managing customer relationships. *Industrial Marketing Management,* 92:321-331.https://protect.checkpoint.com/v2/___https://doi.org/10.1016/j.indmarman.2020.02.024___.YzJlOnVuaXNhbW9iaWxlOmM6bzo3M2VjZjA1ODBkOGQ1NjQzNTY5NWQ3ZjU4NTgwOWU0Mzo2OjM4OTY6OThjNjk2NWUwMTdlNTcwNzA0MDBlN2EyNTI3ZDBlNDBjOThlMjY4Yjk2NDg0MzExODJjZjNmMGQzOTIwMTRkNjpwOkY

Vial, G. 2019. Understanding digital transformation: A review and a research agenda. *The Journal of Strategic Information Systems,*28(2):118-144.

Viechtbauer, W., Smits, L., Kotz, D., Budé, L., Spigt, M., Serroyen, J. & Crutzen, R. 2015.A simple formula for the calculation of sample size in pilot studies. *Journal of Clinical Epidemiology,* 68(11):1375- 1379.

Vogt, W.P., Gardner, D.C. & Haeffele, L.M. 2012. *When to use what research design*. New York: The Guilford Press.

Volvo Cars. 2018. Annual Report 2018, Gothenburg, Sweden: s.n.

Volvo Cars. 2019. Annual Report 2019, Gothenburg, Sweden: s.n.

Voronov, M. & Weber, 2020. People, actors, and the humanizing of institutional theory. *Journal of Management Studies*,57(4):873-884.

Wagner, J. & Benoit, S. 2015. Creating value in retail buyer–vendor relationships: A service-centred model. *Industrial Marketing Management*, 44:166-179

Wagner, R., Huemann, M. & Radukkov, M. 2022. An institutional theory perspective on the role of project management associations projectification of society: the case of Germany. *International Journal of Managing Projects in Business*, 15(8):1-22.

Wahyuni, D., Tambunan, M., Panjaitan, N. & Budiman, I. 2018. Re-designing illumination level in printing working area. In I*OP Conference Series: Materials Science and Engineering*, 309(1):012058.

Wang, G. & Gunasekaran, A. 2017. Modeling and analysis of sustainable supply chain dynamics. *Annals of Operations Research,* 250(2):521-536.

Wang, J., Yin, J., Khan, R.U., Wang, S.& Zheng, T. 2021. A study of inbound logistics mode based on JIT production in cruise ship construction. *Sustainability,* 13(3):1-18.

Wang, W.-T. & Wang, C.-C. 2009. An empirical study of instructor adoption of web-based learning systems. *Computers & Education, 53*(3), 761–774.

Wang, Y.G. & Chiou, S.C. 2018. An analysis of the sustainable development of environmental education provided by museums. *Sustainability*,10(11):1-19.

Warokka, A., Subekti, P., Mindarta, E.K., Pambudi, Y.S. & Idris, I. 2020. Asia automotive industry: global and country scenario. *International Journal of Psychosocial Rehabilitation*, 24 (1):1127-1138.

Wellbrock, W., Ludin, D., Röhrle, L. & Gerstlberger, W. 2020. Sustainability in the automotive industry, importance of and impact on automobile interior–insights from an empirical survey. *International Journal of Corporate Social Responsibility*, 5(1):10.

Wewerinke-Singh, M. 2019. *Media of State Responsibility, Climate Change and Human Rights under International Law. London:* Bloomsbury Publishing: London.

Whipple, J.M., Wiedmer, R. & Boyer, K.K. 2015. A Dyadic investigation of collaborative competence, social capital, and performance in buyer-supplier relationships. *Journal of Supply Chain Management,* 51(2):3-21

Willis, K. A., Serra-Gonçalves, C., Richardson, K., Schuyler, Q. A., Pedersen, H., Anderson, K., Stark, J. S., Vince, J., Hardesty, B. D., Wilcox, C., Nowak, B. F., Lavers, J. L., Semmens, J. M., Greeno, D., MacLeod, C., Frederiksen, N. P. O. & Puskic, P. S. 2022. Cleaner seas: reducing marine pollution. *Reviews in fish biology and fisheries*, 32(1):145–160.

Wills, M. W. 2022. Inductive or deductive reasoning in the narrative of the introduction of a scientific article: a logical and sequential ordering. *Journal of Clinical and Medical Research and Studies*, 1–3.

Wisdom, J. & Creswell, J.W. 2013. Mixed methods: integrating quantitative and qualitative data collection and analysis while studying patient-centred medical home models. *Rockville: Agency for Healthcare Research and Quality*, 13:1-5.

Wood, S.L., Jones, S.K., Johnson, J.A., Brauman, K.A., Chaplin-Kramer, R., Fremier, A., Girvetz, E., Gordon, L.J., Kappel, C.V., Mandle, L. & Mulligan, M. 2018. Distilling the role of ecosystem services in the Sustainable Development Goals. *Ecosystem services*, 29:70-82.

Wu, M.J., Zhao, K. & Fils-Aime, F., 2022. Response rates of online surveys in published research: A meta-analysis. *Computers in Human Behaviour Reports,* 7(2):1-10

Wu, S.I. & Chen, Y.J. 2014. The Impact of Green Marketing and Perceived Innovation on Purchase Intention for Green Products. *International Journal of Marketing Studies*, 6(5):81.

Xie, Y., Posada, F. & Sen, A. 2022. *Soot-free road transport in South Africa: A cost-benefit analysis of Euro VI heavy-duty vehicle standards* [Online] Available at: https://theicct.org/wp-content/uploads/2022/12/Soot-working-paper-26-A4-v4.pdf. (Accessed 22 May 2025).

Xing, X., Liu, T., Wang, J., Shen, L. & Zhu, Y. 2019. Environmental regulation, environmental commitment, sustainability exploration/exploitation innovation, and firm sustainable development. *Sustainability,* 11(21):1-20

Xue, C., Zhou, H., Wu, Q., Wu, X. & Xu X. 2021. Impact of Incentive Policies and Other Socio-Economic Factors on Electric Vehicle Market Share: A Panel Data Analysis from the 20 Countries. *Sustainability*, 13(5):1-12.

Yadav, G., Kumar, A., Luthra, S., Garza-Reyes, J.A., Kumar, V. & Batista, L 2020. A framework to achieve sustainability in manufacturing organisations of developing economies using industry 4.0 technologies' enablers. *Computers in industry,* 122:1-32.

Yadav, G., Luthra, S., Jakhar, S.K., Mangla, S.K. & Rai, D.P. 2020. A framework to overcome sustainable supply chain challenges through solution measures of industry 4.0 and circular economy: An automotive case. *Journal of Cleaner Production,* 254:1-13.

Yan, T.P. 2016. January. Analysis and innovative research of Automobile marketing model. In 2016 *International Forum on Management, Education and Information Technology Application* (pp. 853-856). Atlantis Press.

Yang, D., Wang, A. X., Zhou, K. Z., & Jiang, W. 2019. Environmental strategy, institutional force, and innovation capability: A managerial cognition perspective. *Journal of Business Ethics,* 159(4): 1147-1161.

Yang, S., Song, Y., & Tong, S. 2017. Sustainable Retailing in the Fashion Industry: A Systematic Literature Review. *Sustainability*, 9(7):1-19.

Yang, Y., Lau, A. K.W., Lee, P.K.C., Yeung, A.C.L. & Cheng, T.C.E. 2019. Efficacy of China's strategic environmental management in its institutional environment. *International Journal of Operations and Production Management,* 39(1):138-163.

Yeniyurt, S., Henke Jr, J.W. & Cavusgil, E. 2013. Integrating global and local procurement for superior supplier working relations. *International Business Review*, 22(2):351-362.

Yoong, L., Lian, S. & Subramaniam, M. 2017. Relationship Value and Relationship Quality: An Exploration of Its Antecedents on Customer Loyalty. *Asian Social Science* 13 (12):51-62.https://protect.checkpoint.com/v2/___https://doi.org/10.5539/ass.v13n12p5___.YzJlOnVuaXNhbW9iaWxlOmM6bzo3M2VjZjA1ODBkOGQ1NjQzNTY5NWQ3ZjU4NTgwOWU0Mzo2OjdhNzk6YmIxZTc1MWZmY2VjNzRkNTcxOGVmMTUyZmUyY2NlMTU4YjdkOGI3MWIwZjA4ODVlOWQwZTVlNGFlZTU4NTVhNzpwOkY

Yu, C., Wang, Y., Li, T. & Lin, C. 2022. Do top management teams' expectations and support drive management innovation in small and medium-sized enterprises? *Journal of Business Research*, 142:88-99.

Yu, H.C. & Tsai, B.Y. 2018. Environmental policy and sustainable development: An empirical study on carbon reduction among Chinese enterprises. *Corporate Social Responsibility and Environmental Management,* 25(5):1019-1026.

Yu, Y., Zhang, M. & Huo, B. 2019. The impact of supply chain quality integration on green supply chain management and environmental performance. *Total Quality Management & Business Excellence*, 30(9-10):1110-1125.

Yu, Z., Umar, M. & Rehman, S.A., 2022. Adoption of technological innovation and recycling practices in automobile sector: under the Covid-19 pandemic. *Operations Management Research,* 15(1):298-306.https://protect.checkpoint.com/v2/___https://doi.org/10.1007/s12063-022-00263-x___.YzJlOnVuaXNhbW9iaWxlOmM6bzo3M2VjZjA1ODBkOGQ1NjQzNTY5NWQ3ZjU4NTgwOWU0Mzo2OjAwNDY6NDM1YjFmNjJmODVhYzY5NjY2NDQzM2EwZWNjZWEyMzkzN2M0OWVmNjZkNWIxODI2M2MxZjhiYjhlOTEyY2UzZTpwOkY

Zahraee, S.M., Mamizadeh, F. & Vafaei, S.A. 2018. Greening assessment of suppliers in automotive supply chain: an empirical survey of the automotive industry in Iran. *Global Journal of Flexible Systems Management,* 19(3):225-238.https://protect.checkpoint.com/v2/___https://doi.org/10.1007/s40171-018-0189-5___.YzJlOnVuaXNhbW9iaWxlOmM6bzo3M2VjZjA1ODBkOGQ1NjQzNTY5NWQ3ZjU4NTgwOWU0Mzo2OjExNmI6M2RlZjU3NThiNjNmOTE0YjViNDk5MDQzM2I1ZWVjYjBhNzQwNDgzMzZiMGQ2M2NlMDViZmViNDY2NDg0OGRiNTpwOkY

Zaman, K. & Shamsuddin, S. 2017. Green logistics and national scale economic indicators: Evidence from a panel of selected European countries. *Journal of Cleaner Production*, 143: 51-63.

Zhang, M. & Huo, B. 2013. The impact of dependence and trust on supply chain integration. *International Journal of Physical Distribution & Logistics Management*, 43(7):544-563.

Zhang, X., & Wang, J. 2020. On the sequential hierarchical cognitive diagnostic model. *Frontiers in Psychology*, 11:1-13.

Zhang, Y., Sun, YJ., Yang, Z. & Wang, Y. 2020. Critical success factors of green innovation: technology, organization and environment readiness. *Journal of Cleaner Production*, 264(4): 121701.

Zhang, Y., Wei, Y. & Zhou, G. 2018. Promoting firms' energy-saving behaviour: the role of institutional pressures, top management support and financial slack. *Energy Policy*, 115:230-238.

Zhao, H., Teng, H. & Wu, Q. 2018. The effect of corporate culture on firm performance: Evidence from China. *China Journal of Accounting Research,* 11(1): 1-19.

Zheng, H. & Ge, L. 2022. Carbon emissions reduction effects of sustainable development policy in resource-based cities from the perspective of resource dependence: theory and Chinese experience. *Resources Policy*, 78:1-11.

Zhou, Y.; Levin, T. & Plotkin, S.E. 2016. Plug-In Electric Vehicle Policy Effectiveness: Literature Review; Energy Systems Division, Argonne National Laboratory: Lemont, IL, USA

Zhu, J.F., Yu, P.L. & Shi, J.G. 2015. A study on the relationship between green technology innovation, environmental performance, economic performance and government rewards and penalties—based on an integrated supply chain perspective. *Forecasting*, 34:61–66.

Ziegler, M., Anton, A., Klein, S.G., Rädecker, N., Geraldi, N.R., Schmidt-Roach, S., Saderne, V., Mumby, P.J., Cziesielski, M.J., Martin, C. & Frölicher, T.L. 2021. Integrating environmental variability to broaden the research on coral responses to future ocean conditions. *Global Change Biology*, 27(21):5532-5546.

APPENDICES

APPENDIX 1: QUESTIONNAIRE SURVEY

Project's Title
A STRATEGIC MODEL FOR ADVANCING ENVIRONMENTAL SUSTAINABILITY AND SERVICE EFFECTIVENESS IN THE AUTOMOTIVE SUPPLY CHAIN IN SOUTH AFRICA
Confidentiality
Kindly note that this project is purely academic, and the data collected will be treated with discretion and will not be disclosed to the public or any other unauthorised person.
Duration to complete the Questionnaire
Please note that the questionnaire will take approximately 30 minutes to complete.
Timeframe
You are kindly required to submit your responses within two weeks of receipt of the questionnaire.
Communication
Researcher's name: Prisca Raesetse Mphahlele Contact number: (082) -2939991 E-mail address: priscam@vodamail.co.za Research Supervisor's Name: Prof. C. Mafini. Contact details. Mobile: 083 – 642 9215 Work: 016 – 950 9520 E-mail address: chengedzaim@vut.ac.za

This study is designed to implement environmental sustainability practices, evaluate the role of the environmental sustainability framework in developing and strengthening sustainability practices and determine the level of the supply chain practices in the South African automotive industry.

This questionnaire relates to your experiences as supply chain professionals, quality control professionals and senior automotive technicians in Bosch supply chain entities. Completing the questionnaire is anonymous, and your willingness to assist is highly appreciated. Should you have any inquiries about this survey, please feel free to contact the study.

Instructions: You are kindly required to complete the questionnaire by placing “X” in the appropriate box.

Please note that the study relies on your participation and input to complete the project.

SECTION A: DEMOGRAPHICS PROFILE OF RESPONDENTS

Gender:

Male		01
Female		02
Other		03

Age:

Below 25		01
Between 25 – 40		02
Between 40 – 60		03

Indicate your province (Please choose)

Gauteng	1	Free State	3
Mpumalanga	2	Limpopo	4

SECTION B: ENVIRONMENTAL SUSTAINABILITY PRACTICES

Please indicate the level of agreement with each of the statements. Please choose the extent to which environmental sustainability practices are implemented in your company, using a six-point Likert scale anchored by the following scale: (1 - strongly disagree; 2 - disagree; 3 - slightly disagree; 4- slightly agree; 5 - agree; and 6 - strongly agree).

Item Code	**Item Description**	**1**	**2**	**3**	**4**	**5**	**6**
Government regulations and incentives							
GRI1	Our firm is responsive to government regulations about sustainable design in product or management systems.						
GRI2	Our firm has a definite responsible person for environmental problems.						
GRI3	Our firm has a quality control system that enforces government regulations on sustainable manufacturing.						
GRI4	Our firm uses sustainable design standards or similar government legislation in decision-making.						
GRI5	Our firm received interrelated training or consultation regarding government regulations on sustainable manufacturing.						
Technology adoption							
TA1	Our firm invests in new technology for environmental protection and sustainable product design.						
TA2	Our firm is satisfied with the income of energy-saving and environmentally friendly products.						
TA3	Our firm frequently and innovatively updates manufacturing processes to prevent contaminations.						

TA4	Our firm frequently and innovatively updates manufacturing processes to adhere to environmental law standards.						
TA5	Our firm frequently utilises innovative technologies in manufacturing processes to conserve the environment.						
Top management support							
TPS1	Our firm's high-level managers think about regular environmental problems and the risks and chances the company faces.						
TPS2	Management is committed to an open, participatory process of continuous evaluation and improvement focused on the firm's long-term economic performance.						
TPS3	Our firm's management provides employee training and development opportunities on sustainable manufacturing.						
TPS4	Our firm's management provides incentives for employee innovation on sustainable manufacturing systems.						
TPS5	Our managers actively support environmentally sustainable manufacturing activities by the employees and the firm.						
Sustainability culture							
SC1	Our firm provides employees with opportunities to learn sustainable manufacturing values.						
SC2	Our firm's management and employees' activities promote environmental accountability.						

SC3	Our firm's management practices promote a sustainability culture.						
SC4	Our management listens to employees regarding their innovations and views on sustainable manufacturing.						
SC5	Our firm promotes teamwork around environmentally friendly manufacturing practices.						
Environmental corporate social responsibility							
ECSR1	The company has environmental corporate social responsibility, responsible management person						
ECSR2	The company publishes an environmental CSR/Sustainability Report that aligns with globally accepted standards.						
ECSR3	The company has a code of conduct that outlines responsibilities for employees and the company.						
ECSR4	Management organises training sessions to enhance the understanding of environmental CSR.						
ECSR5	The company participates in voluntary environmental CSR initiatives.						
Compliance and certification							
CC1	The company has a Person responsible for compliance management.						
CC2	Our firm conducts daily or weekly checks to ensure that correct procedures are followed to protect the environment.						
CC3	Our firm has an environmental action plan informed by the government's environmental laws and policies.						

CC4	Our firm has a procedure for dealing with complaints from the public, regulatory authorities, or staff regarding environmental issues.						
CC5	Our firm has a monitoring and evaluation facility that targets the firm's compliance with environmental regulations.						
Inbound logistics							
IL1	Our firm has a bonus system that encourages inbound logistics players to take initiatives for green behaviour practices.						
IL2	Our firm prioritises dealing with suppliers who provide environmental effort reports.						
IL3	Our firm provides incentives for the use of multimodal transport.						
IL4	Our management promotes transport collaboration initiatives among suppliers.						
IL5	Our firm has green supplier criteria.						
Outbound logistics							
OL1	Our firm has put in place automatic warehousing systems.						
OL2	Our firm has clean material handling equipment.						
OL3	Our firm conducts carbon footprint assessments periodically.						
OL4	Our firm takes initiatives towards distribution consolidation.						
OL5	Our firm has implemented an environmental management system.						

SECTION C: ENVIRONMENTAL SUSTAINABILITY

Please indicate the level of agreement with each of the statements on environmental sustainability in your company, using a six-point scale anchored by (1 - Strongly Disagree; 2 - Disagree; 3 - Slightly Disagree; 4- Slightly Agree; 5 - Agree; 6 - Strongly Agree).

Environmental sustainability								
Item Code	Item Description	1	2	3	4	5	6
ES1	Our firm recognises the environmental footprints of its operations.						
ES2	Our firm recognises the environmental requirements of the external stakeholders.						
ES3	Our firm has clear policies promoting environmental awareness in all functional areas.						
ES4	Our firm takes the initiative to ensure employees realise the importance of natural environment protection.						
ES5	Our firm identifies environmental protection as its corporate responsibility.						

SECTION D: SERVICE EFFECTIVENESS

Please indicate the service effectiveness of your company, using a five-point scale anchored by the following scale: (1 - Strongly Disagree; 2 - Disagree; 3 - Slightly Disagree; 4- Slightly Agree; 5 - Agree; 6 - Strongly Agree).

Item Code	Item Description	1	2	3	4	5	6
Productivity							
P1	With government incentives for sustainable manufacturing practices, auto component manufacturing in SA is competitive and profitable.						
P2	SA is a cost-competitive location for automotive manufacturing, even without government incentives						
P3	Government policies and legislation on environmental sustainability have positively impacted the economic growth and profitability of the auto component manufacturing ring.						

P4	Tariffs on sustainable manufacturing have increased the importation of products in the local market						
Quality							
Q1	Our firm regularly communicates with clients about the quality of sustainable practices.						
Q2	Our firm periodically seeks feedback from clients regarding their satisfaction with the firm's sustainable practices.						
Q3	Our management is responsive to complaints by clients regarding the quality of sustainability practices.						
Q4	Our firm frequently engages suppliers on sustainable practices and service quality.						
Innovation							
I1	Our firm provides incentives for innovation that enhance productivity and service effectiveness.						
I2	Our firm frequently emphasises developing new eco-products using innovative technologies to improve their package.						
I3	Our firm's management frequently redefines operation and production processes to ensure internal efficiency that can help to implement green practices.						
I4	Our firm's management frequently uses novel management systems to manage eco-innovation.						
Supplier relationships							
SR1	Our firm communicates with its suppliers promptly and regularly on sustainability-related issues.						
SR2	Our firm chooses to develop instead of abandoning suppliers if they fail to meet environmental standards.						
SR3	Our firm Engages the supplier to participate in our green product design and development process.						
SR4	Our firm provides the supplier's employees with environmental training (i.e., Eco-design, Recycling/Reuse and LCA).						
Customer relationships							

CR1	Our firm's sustainable manufacturing practices meet customer expectations.						
CR2	Our firm's customers are satisfied with our sustainable manufacturing policies.						
CR3	Our firm maintains an effective communication flow of information with customers.						
CR4	Management is open to criticism from customers regarding environmental sustainability.						

SECTION E –FURTHER INFORMATION

In the spaces below, feel free to add any additional information you would like to provide with regard to any of the statements mentioned above.

____

____

Thank you for taking the time to complete this questionnaire. Your views are much appreciated.

APPENDIX 2: ETHICAL CLEARANCE

UNISA University of South Africa

Graduate School of Business Leadership_RERC

Date: 22/07/2024

Dear: Mrs Raesetse Prisca Mphahlele

Decision: Ethics Approval from July 2024 to June 2027

Ref #:2024_SBL_DBL_016_FA_ 2138
Name: Mrs Raesetse Prisca Mphahlele
Student #: 7722540

Date: 22/07/2024

Temba Auto Clinic Unit 7 Midrand Junxion 940 Old Pretoria Road Halfway House

MIDRAND

priscam@vodamail.co.za 0822939991

Supervisor: Professor Chengedzai Mafini, chengedzaim@vut.ac.za

An Environmental Sustainability and Service Performance Model for the Automotive Supply Chain in selected regions of South Africa

Qualification: Doctor of Business Leadership Degree

Thank you for the application for research ethics clearance by the Graduate School of Business Leadership_RERC for the abovementioned research study Ethics approval is granted for three years.

Page 1 of 2

The low-risk application was reviewed by Graduate School of Business Leadership_RERC on 19 July 2024 in compliance with the Unisa Policy on Research Ethics and the Standard Operating Procedure on. Research Ethics Risk Assessment.

The proposed research may now commence with the provisions that:

the study(s) will ensure that the research project adheres to the values and principles expressed in the UNISA Policy on Research Ethics.

Any adverse circumstance arising in the undertaking of the research project that is relevant to the ethicality of the study should be communicated in writing to the Graduate School of Business Leadership_RERC.

the study(s) will conduct the study according to the methods and procedures set out in the approved application.

Any changes that can affect the study-related risks for the research respondents, particularly in terms of assurances made with regards to the protection of respondents' privacy and the confidentiality of the data, should be reported to the Committee in writing, accompanied by a progress report.

the study will ensure that the research project adheres to any applicable national legislation, professional codes of conduct, institutional guidelines and scientific standards relevant to the specific field of study. Adherence to the following South African legislation is important, if applicable: Protection of Personal Information Act, no 4 of 2013; Children's act no 38 of 2005 and the National Health Act, no 61 of 2003.

Only de-identified research data may be used for secondary research purposes in future on condition that the research objectives are similar to those of the original research. Secondary use of identifiable human research data requires additional ethics clearance, No field work activities may continue after the expiry date (June 2027). Submission of a completed research ethics progress report will constitute an application for renewal, for Ethics Research Committee approval.

Additional Conditions

1. Disclosure of data to third parties is prohibited without explicit consent from Unisa.

De-identified data must be safely stored on password protected PCs.

Care should be taken by the study when publishing the results to protect the confidentiality and privacy of the university.

Adherence to the National Statement on Ethical Research and Publication practices, principle 7 referring to Social awareness, must be ensured: "Researchers and institutions must be sensitive to the potential impact of their research on society, marginal groups or individuals, and must consider these when weighing the benefits of the research against any harmful effects, with a view to minimising or avoiding the latter where possible." Unisa will not be liable for any failure to comply with this principle.

Note

The reference number 2024_SBL_DBL_016_FA-2138 should be clearly indicated on all forms of communication with the intended research respondents, as well as with the Committee.

Kind regards,

NBWMlitwa

Prof N Mlitwa

Chair of Graduate School of Business Leadership_RERC E-mail: wiltonb@unisa.ac.za

Prof P Msweli

Executive Dean / By delegation from the Executive Dean of Graduate School of Business Leadership_RERC E-mail: mswelp@unisa.ac.za

APPENDIX 3: LETTER OF EDITING

B SQUARE SYNERGY CONSULTANTS
EST.2019

B-Square Synergy Consultants

Tax no: 93 087 48 228

Idea.Concept.Product

LETTER FOR EDITING OF A THESIS OF BY RAESETSE PRISCA MPHAHLELE

A STRATEGIC MODEL FOR ADVANCING ENVIRONMENTAL SUSTAINABILITY AND SERVICE EFFECTIVENESS IN THE AUTOMOTIVE SUPPLY CHAIN IN SOUTH AFRICA

Submitted in accordance with the requirements
for the degree of:
DOCTOR OF BUSINESS LEADERSHIP

in the subject: Supply Chain Management
at the
UNIVERSITY OF SOUTH AFRICA (UNISA)

To whom it may concern

I have edited the thesis of Raesetse Prisca Mphahlele for her thesis and I have sent her and her Promotor my comments/suggestions.

Declaration of professional editing: This document certifies that the thesis listed above was edited by an Editor of B Square Synergy Consultants in accordance with the instruction of the Author.

This letter may be verified by Dr. Liesl Brown, at liesl.brown@gmail.com. Neither the research content nor the Author's intentions were altered in any way during the editing process. Documents receiving this Letter of Editing should be English-ready for publication; however, the Author has the ability (and discretion) to accept, reject, change, or amend the suggestions, changes, and edits of the Editor.

This edited document of the Author is protected under the Copyright Act 98 of 1978 and the Editor cannot share or distribute any document(s) without the permission of the Author. Upon request, the edited document(s) may be shared, by the Editor, to a third party, only if the Author has granted the necessary permission to do so.

Take notice that no edits on the merits of (structure, substance, arguments, or content) of the work was made in a co-author capacity. The proofreading and editing of the work did not include any guidance, amendments or edits on the merits, structure, substance, arguments, or the content of the work. The proofreading and editing are strictly limited to the Editor's capacity as a Language and Style Editor.

Kind regards

Dr. Liesl Brown, PhD
Managing Director: B Square Synergy Consultants©

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liesl.brown@gmail.com

APPENDIX 4: TURNITIN REPORT

P MPHAHLELE DBL THESIS TURNITIN

by PRISCA MPHAHLELE

Submission date: 16-Jan-2026 10:09AM (UTC+0200)
Submission ID: 2193785781
File name: P_Mphahlele_DBL_Thesis_for_Examination.docx (2.26M)
Word count: 101987
Character count: 628682

P MPHAHLELE DBL THESIS TURNITIN

ORIGINALITY REPORT

3%	2%	2%	3%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

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4	Ambe, Intaher Marcus. "Determining Supply Chain Practices and Strategies of Light Vehicle Manufacturers in South Africa", University of South Africa (South Africa) Publication	1%

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