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An exploration of the adoption of eco-innovations in the automotive
industry: A closer look at ABC Motors in South Africa

Declaration

I, Georgina Eulylia van den Heever (16001448), declare that the Research Report submitted for the BCom Honours in Management degree to The Independent Institute of Education is my own work and has not been previously submitted to another University or Higher Education Institution for degree purposes.

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21 October 2020

Abstract

In the research report provided, the researcher seeks to understand the importance of eco-innovation in the automotive industry as well as explore the different eco-innovations adopted by ABC Motors in South Africa and the impact thereof. With the automotive industry posing a tremendous negative effect on the environment, it is crucial to generate knowledge surrounding the topic researched.

This is a qualitative study with the aim to gain an in-depth understanding of the opinions regarding the adoption of eco-innovations from the employees at ABC Motors in South Africa. Three semi-structured interviews were conducted in order to gather data from the participants to obtain a logical understanding of the different points of view.

A qualitative data analysis software, QDA Miner Lite, was used to analyse each transcription where it was indicated by all the participants that the adoption of eco-innovation has not only presented ABC Motors with a competitive advantage and opened doors to new markets, but also decreased the environmental impact that they have. Further, participants indicated that eco-innovations have an impact on the Corporate Social Responsibility (CSR) of the company with an efficient human resource base as well as operational cost savings. Overall, a better understanding was gained as to why eco-innovations play a significant role in the future of automotive companies.

Key words: Eco-innovation, Corporate Social Responsibility (CSR), competitive advantage, new markets

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1. Introduction

This research report aims to gain an in-depth understanding of the adoption of eco-innovations in the automotive industry, specifically looking at ABC Motors in South Africa. The report focuses on the types of eco-innovations adopted and these innovations in practice.

A problem statement was provided in this study, followed by a set of research goals and a research question. Following the research question, a set of research objectives were provided along with the theoretical framework for this study. A literature review identifying and discussing the main themes, as well as subthemes, related to the research question and objectives has been presented and used as a framework for the qualitative study at which it was aimed. Conceptualisation also forms part of this study.

The research question, problem and objectives have been addressed and discussed further in context of the findings resulting from the interviews conducted. Finally, the ethical considerations and limitations of the study are discussed with a description of the anticipated contributions of the research study.

1.1 Background

In order for countries, such as South Africa, to move towards becoming a more environmentally friendly and developing society, promoting innovation is key because it enables firms to research and discover different ways of addressing current and future environmental issues. In return, this helps to reduce energy and resource consumption, while at the same time developing sustainable economic activity. This innovation is commonly known as eco-innovation (Islam, 2018). An important definition of eco-innovation to look at is one provided by Kemp and Pearson (2007), “the production, assimilation or exploitation of a product, production process, service or management or business method that is novel to the organisation (developing or adopting it) and which results, throughout its life cycle, in a reduction of environmental risk, pollution and other negative impacts of resources use (including energy use) compared to relevant alternatives.”

The focus of this research report is the investigation of the environmental impact that the automotive industry poses – specifically through carbon dioxide emissions, waste and fossil fuel dependence. Further, this research report is an attempt to improve the understanding of adopting eco-innovations in the automotive industry, specifically ABC Motors in South Africa, in order to tackle the pressing environmental issues which they face. This study will add to the body of knowledge and create understanding of eco-innovations and the perceived influence they have on reducing environmental impact. This research report further investigates the perception that ABC Motors in South Africa continues their commitment to address environmental issues by introducing new innovations.

2. Research Rationale

Eco-innovation is the term for the type of innovation which contributes to an improved environment as well as a good economic exchange. This can be considered as the type of innovation where the innovator/entrepreneur is expecting a good market diffusion, with good profit, and at the same time contributes to an improved environment (Calza, 2017). This study is worth conducting because protecting the environment is of utmost importance to ensure that future generations will be able to meet their needs. When specifically looking at the automotive industry, the manufacturing process of automobiles will play a big role in the sustainability of the planet and the organisation, due to various environmental issues revealed. The automotive industry specifically, needs to pay close attention to reducing greenhouse gas emissions, cleaner production and other environmental impacts (Rodrigues Vaz, Rauhen & Lezana, 2017). An automotive company that owns several plants across the globe, for example, needs to constantly focus their attention on their environmental impact. The adoption of eco-innovations will assist in this regard.

3. Problem Statement

One of the current problems of the global system is environmental pollution caused by industrial production (Spirko, Spirkova, Caganova & Bawa, 2016). Nowadays, there are many advanced materials and production methods utilised in the automotive industry however, when focusing on such innovations, the environment is often forgotten. This can possibly cause problems when looking at the sustainability of a motor company and the environment as a whole. The problem to be addressed in this research report is to find out whether the automotive industry in South Africa is directing its attention to the environmental issues posed by the industry they operate in and if they are continuously introducing eco-innovations to assist with this.

4. Research Purpose

The overall objective of this study is to generate knowledge regarding the adoption of eco-innovations in the automotive and transport industry, specifically ABC Motors in South Africa. One purpose is to gain an in-depth understanding of why eco-innovations are vital in the automotive industry and the different types of eco-innovations that are then adopted to target environmental issues. Another purpose is to further understand eco-innovation policies in South Africa and describe how this influences the adoption of eco-innovations in a motor company, specifically at ABC Motors.

4.1 Primary Research Question

What influence does the adoption of an eco-innovation have on ABC Motors in South Africa during the manufacturing processes of their automobiles?

4.2 Research Objectives

- To determine what kinds of eco-innovations are currently adopted by ABC Motors in South Africa.
- To determine if eco-innovations adopted internationally by ABC Motors are in line with the eco-innovations adopted by ABC Motors in South Africa.
- To determine the environmental impact by ABC Motors in South Africa following the adoption of eco-innovations.
- To determine whether the eco-innovations adopted have an influence on the manufacturing process or procedures of ABC Motors in South Africa.

4.3 Theoretical Foundation

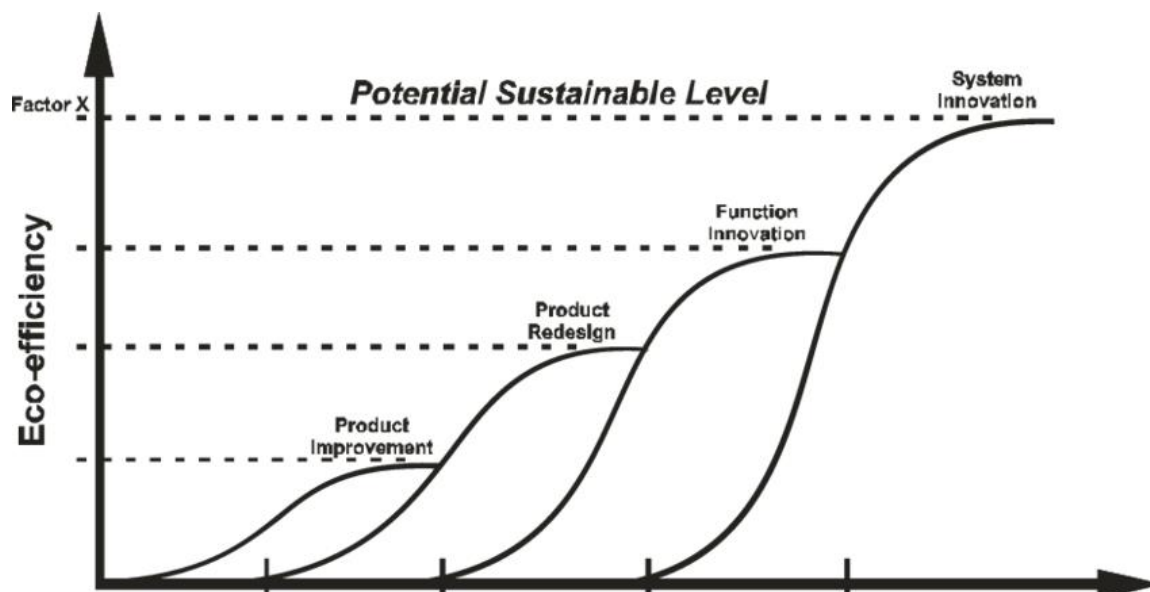


Figure 1: The Brezet Model for environmental innovations.

The theory chosen for this study is Brezet's environmental innovation classification system. Brezet's studies resulted in four different types of eco-innovations, which vary in terms of eco-efficiency:

- 1) Product improvement,
- 2) Product re-design,
- 3) Function innovation, and
- 4) System innovation.

The four types of innovations are all environmentally driven, but have different qualities and characteristics (Halila, 2007).

Further, Figure 1 illustrates levels of eco-efficiency for a given innovation applied on a product against a sustainability degree. Accordingly, environmental improvements are

classified into four categories in regards to different levels of eco-efficiency. A potential sustainable level can be achieved by systemic innovations, where new scenarios are proposed to meet sustainable lifestyles (Factor X) (Alves, Silva, Reis, Ferrão & Freitas, 2011).

Halila (2007) explains the four different types of innovations in detail:

- **Product improvement**

This first type of environmental innovation involves the improvement of products from the perspective of pollution prevention and environmental care. Both the product and the production technique will generally remain the same.

- **Product re-design**

With this type of environmental innovation, the product concept remains the same, but parts of the product are improved or replaced, for the purpose of using non-toxic materials, recycling and disassembly, improved distribution and energy-use reduction with respect to all components over the product life cycle.

- **Functional innovation**

This environmental innovation relates to the function of the current product. In this case, the way in which the product fulfils the function is changed. The general shift from physical products to dematerialised services belongs to this category.

- **System innovation**

With this last environmental innovation, the entire technological system (product, production chain and associated infrastructure and institutional structure) is replaced. System innovation tends to create a new system; for example, consumption is organised in such a way that the environment does not suffer as a result and other economic rules and principles are applied.

Each of these four can be linked to the automotive industry and explored in terms of ABC Motors in South Africa.

4.4 Application to the Study

Brezet's environmental innovation classification system applies to the study as it outlines four different types of eco-innovations, each which can be applied to ABC Motors in South Africa. The theory provides a foundation for the study as it indicates the levels of eco-efficiency against a sustainability degree. Further, it will indicate ABC Motors in South Africa's sustainable level depending on the type of eco-innovation they apply during the manufacturing process.

5. Literature Review

5.1 Eco-innovation Policies in South Africa

Many governments in the present regard eco-innovation as part of their growth strategy. In light of the big global challenges such as economic downturn, environmental deterioration and resource scarcity, eco-innovation is seen as a way to reunite economic and environmental priorities, and further open new sustainable pathways for industries (Machiba, 2012).

In South Africa's mission to integrate its first and second economies, it is committed to two objectives. Firstly, to be a competitive player in global markets, and secondly to transform its economy away from its former dependence on primary resource production and associated commodity-based industries (OECD, 2007). Therefore, promoting eco-innovation capabilities is key to the sustained improvement of living standards, green economic development and to the preservation of natural resources.

In South Africa terms such as, "environmentally sound technology", "green technology," "environmentally friendly" products and services, or "cleaner production," "pollution prevention" and "cleaner technology," are used more often than "eco-innovation." (Commission for Sustainable Development (CSD), 2010).

The South African emphasis on eco-innovation is three tiered (Jacobs, Meissner & Ntombela, 2011):

- 1) Innovation in the research and development of technologies or techniques for environmental protection;
- 2) Innovation in regulatory approaches and standards; and
- 3) Focus on the impact of eco-innovation mechanisms as reflected in the national priority of sustainable development.

South Africa does not have a specific national act, policy or strategy for eco-innovation. However, there are a number of governmental departments, universities, parastatals, and other public entities support eco-innovation, often at different levels and with varying degrees of coordination. A few of the major examples include, the Council for Scientific and Industrial Research (CSIR), the Department of Science and Technology (DST), Department of Agriculture, Forestry and Fisheries (DAFF) and the Department of Trade and Industry (the dti) (Jacobs, et al., 2011).

Following the first National Waste Management Summit, and the publication of the Polokwane Declaration (aimed at mapping South Africa's transition towards zero waste) in 2001, there has been growth of a local waste recycling economy, driven by (Oelofse & Strydom, 2010):

1. industry efforts to pre-empt possible government regulatory action, on the belief that it could develop and implement more effective, sustainable and lower cost solutions than government-imposed regulations;
2. voluntary investment by producers and manufacturers; and
3. economics, as a competitive response to other materials

In 2008, the National Environmental Management (NEM): Waste Act (Act 59 of 2008) was brought into effect which created the motivation for a wave of regulations between 2008 and 2017, including the NEM: Waste Amendment Act (Act 26 of 2014) (Godfrey & Oelofse, 2017).

The South African private sector has contributed major investments in eco-innovation. For example, waste water treatment technology, some of which hold worldwide patents; cleaner production and especially clean coal production; and energy efficiency. In the energy sector, significant progress has been made regarding electricity, clean coal technology and future energy supply and demand (Commission for Sustainable Development (CSD), 2010).

Maximising the potential to attract sustained private sector investment in eco-innovation is critically important if long-term term capacity is to be developed. This requires commitment from multiple sectors and a diversity of private sector institutions.

5.2 Types of Eco-innovations

There are different types of eco-innovations that tackle environmental problems and also offer competitiveness for businesses. Five different types of eco-innovations have been identified (Islam, 2018):

- 1) **Add-on eco-innovation** (Pollution and resource handling technologies and services): This type of product, service or artefact aims to improve the environmental performance of the customer. The product does not necessarily need to be environmentally friendly. Instead, they deal with an environmental solution such as at the sink side, which are technologies or services that clean up, dilute, recycle, control, measure and transport emissions as well as at the source side, which is the extraction and the supply of natural resources and energy. These technologies and services are typically added on to current production and consumption practice which have limited systematic effect, this being very cost effective.
- 2) **Integrated eco-innovations** (Cleaner technological processes and cleaner products): These are integrated innovations because they introduce either a production process or a product that is more eco-efficient, or “cleaner”, compared to similar/ conventional processes or products. Companies who have chosen to invest in integrated innovations can increase their competitive advantage as the environmental performance, or even the environmental impact, of the products or processes appear to be more eco-efficient than their competitors. These integrated

innovations provide solutions to the environmental problem of the organisation within the company or other organisations, such as public institutions, because they enable energy and resource efficiency, enhance recycling or enable the substitutions of toxic materials. Such innovations are normally technical but can also be organisational when there are changes in the organisation of production and management, for example. The greenness of the product is stressed under this category.

- 3) **Alternative product eco-innovation** (New technological paths): These are innovations that represent a radical technological discontinuity. Meaning, they are different in nature, rather than cleaner compared to similar products. These can be considered radical product innovations because they have wide systemic effects: they are built on new theories, capabilities and practices and may demand a change of both production and consumption patterns. The environmental dimension of these innovations lies in the product or production design alone, which is supposedly greener than the alternative. Examples of this type of innovation is organic farming, instead of conventional farming.
- 4) **Macro-organisational eco-innovations** (New organisational structures): These innovations entail radical new solutions in terms of the efficient organisation of society as a whole; this implies new ways of organising production and consumption at a more systemic level and entails new functional interplays between organisations, workplaces and families. An example of this type of innovation is urban ecology, which is a new way of organising cities and their technical infrastructure. These innovations are organisational but may include technical innovations as well. Further, they emphasize the importance of the spatial dimension for eco-innovation as well as the need for organisational and institutional change.
- 5) **General purpose eco-innovations**: These innovations pose a major impact on the economy and the innovation process as they feed into a range of other technological innovations. More specifically, these technologies define the dominating techno-economic paradigm at any given time. Changes in these innovations are so fundamental that they will have major effect on eco-innovations and special attention should therefore be given to developments within these. The positive and negative impacts technologies such as biotechnology might have on eco-innovation deserves further scrutiny.

5.3 The Emergence of Eco-innovation as a Field worth Studying

Eco-innovation is applied across the business from the strategy and business model through to operational activities such as design, production, purchasing and marketing. For a company to be truly successful, eco-innovation must be embedded in the culture and working practices of the company. Whilst a significant investment in terms of time,

resources and effort needs to be made, by a company, to implement eco-innovation the long-term cost savings and increased efficiency is worth the investment (OECD, 2007).

The National Cleaner Production Centre (2011) identifies five ways eco-innovation adds value to businesses:

- 1) Access to new and expanding markets - there could be opportunities in segments of entirely new markets that impose stringent sustainable procurement policies and standards.
- 2) Increase profitability along the value chain – examples include, modifying processes to reduce environmental impacts, designing products to allow easier recovery and the reuse of materials.
- 3) Stay ahead of standards and regulations – although it may be costly, it is a necessity for businesses to abide by environmental legislation. This could however, lead to competitive advantage if changes in legislation create new market opportunities.
- 4) Attract investments – public funds are attainable to a business if they prove significant commitment to sustainability as part of the funding proposal. Smaller companies who participate in eco-innovation also attract investment from larger companies, especially when it is difficult to find suppliers.
- 5) Increase productivity and technical capacity – environmentally responsible companies attract, recruit and retain skilled, innovative employees. Further, because the eco-innovation process requires a new set of skills and competencies, investing in relevant training will lead to a significant pay-off in terms of working practices and even greater innovation.

The importance of eco-innovation is understated. Once a coordinated set of modifications or novel solutions to goods and services, processes, market approach and organisational structure have been implemented, eco-innovation leads to enhanced performance and competitiveness.

5.4 Multilevel Framework of Eco-innovation Drivers

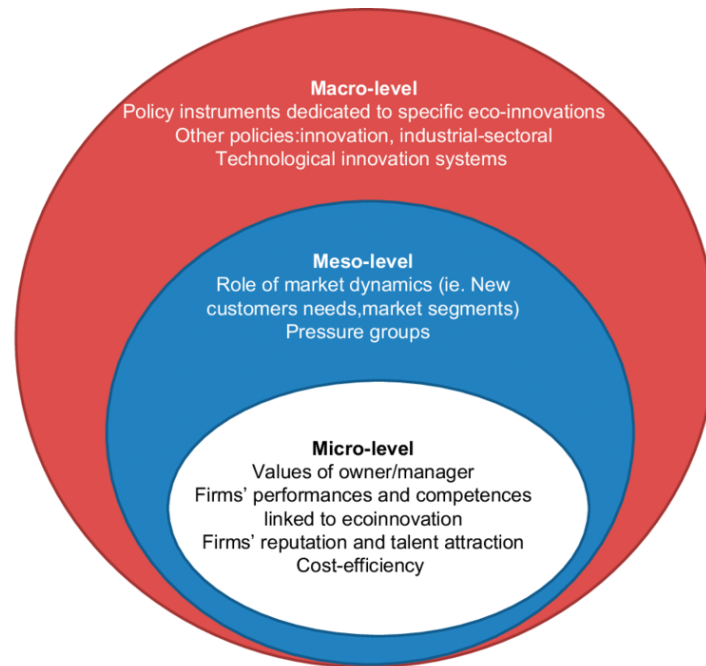


Figure 2: Multilevel framework of eco-innovation drivers

As “drivers of eco-innovation” is a recurrent theme in literature, Figure 2 demonstrates a multilevel framework to understand the impact of different drivers of eco-innovation and classifies them in three levels: micro, meso and macro. Each of these will be explained in detail.

5.4.1 Macro-level Drivers

Regulation drives eco-innovation and helps its diffusion. Porter’s hypothesis assumes that environmental regulation stimulates innovation and then leads to a win-win situation where pollution is reduced at the same time that the competitiveness of the firm increases (Díaz-García, González Moreno & Saez-Martinez, 2015).

When looking at policy instruments, softer forms of regulatory governance as well as direct regulation are effective at inducing eco-innovations, as firms behave differently when confronted with particular forms of regulation (Williamson & Lynch-Wood, 2012). Further, regulation might affect some types of eco-innovation more than others, for example reducing air, water or noise emissions, avoiding hazardous substances and increasing recyclability of products (Horbach, Rammer & Rennings, 2012).

Within this level, country context and regional factors are also taken into account. For example, in transition economies there are several factors that constitute significant obstacles to adopting competitive environmental strategies. These factors include: predominance of competitive advantages based on low labour costs, high potential of increasing labour productivity, deficient environmental and industrial policies, and lack of

awareness in both business and policy environment as to the beneficial role of eco-innovation in resource productivity. Horbach (2014) further emphasises that, within current literature analysing eco-innovation determinants, there is a lack of adequate data therefore regional and location factors are neglected and rarely included. Eco-innovation also introduces a chance for under-developed regions looking for new business opportunities as rurality is described as very important for eco-innovation, due to their closeness to the impacts of climate change and firms' visibility within their local communities (Martin, et al., 2013).

Lastly, technological innovation is directly linked to the success of eco-innovation as current eco-innovations focus mostly on technological development. Innovation density, knowledge spill overs and externalities are present in industrial districts so if the firm is located in such a district it is advantageous as it drives the fostering of eco-innovations (Díaz-García, et al., 2015).

5.4.2 Meso-level Drivers

At the meso level, factors affecting environmental orientation adopted by firms are identified: availability of financing, market demand, pressure groups or industry characteristics (Díaz-García, et al., 2015). Changes in market trends are usually related to opportunities for eco-innovation. Suppliers and customers enhance the development of this type of innovation, also customers' perception or requirements can explain a firm's decision to engage in eco-innovation (Horbach, et al., 2012).

Pressure groups or stakeholders have been pointed out as another force influencing firms' engagement in eco-innovation practices. In addition, networking with other firms and institutions –authorities, research institutes – is also important for eco-innovation adoption (Klewitz & Hansen, 2014). In this sense, it is observed that having a network with diverse competencies will encourage eco-innovators. A final note is that eco-innovative activities require more external sources of knowledge and information, and R&D cooperation seems to be key (Díaz-García, et al., 2015).

At the meso level, another important factor is the industry in which the firms operate. The automotive industry is frequently analysed for its potential regarding product-design and eco-innovation (Sierzchula, et al., 2012). However, there is minimal literature with regards to services with a link to eco-innovation in this industry.

5.4.3 Micro-level Drivers

Here, structural characteristics of firms (e.g. size, age), their strategy and business logic (e.g. cost savings, market expansion) or to their technological competences (e.g. R&D, qualification of staff and management, cooperation and participation in networks) are explained. When looking at the structural factor the following is observed - on one hand, firm size is not found to have any effect on the probability of a firm carrying out environmental product or process innovations. On the other hand, it is assumed that

SMEs have been reluctant when it comes to the adoption of eco-innovation, as they have not gained competitive advantage from green initiatives (Díaz-García, et al., 2015).

With regards to a firm's strategy and its business logic, the importance of visionary management in adopting and implementing environmental orientation is emphasized. As proposed by Wagner and Llerena (2011), the development of eco-innovation is often an activity originated at the operational level it requires simultaneous integration of environmental aspects with the overall corporate strategy. In conclusion, firms are more aware of the consequences of their activities and try to be socially responsible through their Corporate Social Responsibility (CSR) programs (Cainelli, Mazzanti & Zoboli, 2011).

Regarding the basis for a competitive strategy, literature reveals that eco-innovation is found in the roots of both cost-leadership and differentiation competitive strategies (Díaz-García, et al., 2015). Also, the adoption of differentiation strategies is linked to eco-innovation as differentiation is considered a motivation related to the adoption of these innovation initiatives (Triguero Cano, Córcoles & Cuerva, 2014). Additionally, obtaining a greater market share is also linked to the development of eco-innovations, especially eco-products.

A firm's resources and capabilities are another micro level factor that has relevance for achieving a successful eco-innovation. Both managerial and organisational capabilities and the actions of the company related to training, information and dissemination in order to improve the absorptive capacity of human resources are found to encourage and stimulate the development of eco-innovations (Díaz-García, et al., 2015).

6. Conceptualisation

- Innovation – Joe Tidd and John Bessant (2014, p.3) define innovation simply as, “the process of creating value from ideas.” And continue on to say that there are differences in the novelty of changes that can be put in place. For example, a car with an entirely new concept such as an electric engine and new composite materials, is different to simply updating the style of a car. Innovation can plainly be seen as doing something different and also be explained as a new idea, product, device or novelty. It is a mind-set, a way of thinking beyond the present and into the future (Stenberg, 2017).
- Eco-innovation – A type of innovation that has recently received increasing attention consists of innovations that contribute to sustainable development: Eco-innovation (environmental innovation, green innovation or sustainable innovation) is the term for the type of innovation which contributes to an improved environment as well as a good economic exchange (Halila, 2007). This can be considered as the type of innovation where the innovator/entrepreneur is expecting a good market diffusion, with good profit, and at the same time contributes to an improved environment.

- Environmental technology (Envirotech) – Environmental technology is the implementation of one or more environmental sciences, green chemistries, environmental monitoring and electronic devices to monitor, model and conserve the natural environment and resources, in order to curb the negative effects of human involvement. The term is also a way of describing sustainable energy generation technologies (Pradeep, Rao, Subrahmanyam, Budithi, Kumar & Ayyanna, 2015).
- Sustainability/ Sustainable development – Professor Jansen van Rensburg (2019) breaks down the definition of sustainable development, the development that satisfies the needs of the present without taking away the ability of future generations to meet their needs, into two key concepts:
 - The concept of **needs**, particularly looking at the essential needs of the world's poor, to which priority should be given.
 - The idea of **limitations** foisted by technology and social organisation on the environment's ability to meet present as well as future needs.

Sustainable development covers numerous areas. Sustainability is highlighted as the notion of environmental, economic and social progress and equity, within the limitations of natural resources worldwide (Erasmus, Strydom & Rudansky-Kloppers, 2014: 158).

- Entrepreneurship – Entrepreneurship is an individual or even a group who discover an opportunity and attempt to exploit it, despite the risk (Tidd & Bessant, 2014). Innovation is the specific tool of entrepreneurs, the means by which they exploit change as an opportunity for a different business or a different service. Further, Entrepreneurs need to search purposefully for the sources of innovation, the changes and their symptoms that indicate opportunities for successful innovation (Lee Swanson, 2017).
- Corporate Social Responsibility (CSR) – CSR can be defined as a management concept whereby organisations integrate social and environmental concerns in their business operations as well as interactions with their stakeholders (UNIDO, 2020). Further, CSR can be seen as a company's commitment to manage their social, environmental and economic effects (Triple Bottom Line) to be in line with public expectations (BDC, 2020). If CSR is implemented properly then an organisation will gain a competitive advantage by enhanced access to markets, increased sales and profit, operational cost saving, improved productivity and quality, efficient human resource base, improved brand image and reputation, greater customer loyalty, better decision making and risk management processes (UNIDO, 2020).

7. Research Paradigm

The chosen paradigm for the study is interpretivism as this research tradition aims to understand and describe meaningful social action and experiences with a further aim of telling a story to create in-depth understating of the topic, being the adoption of eco-innovations at ABC Motors in South Africa. Also, to explain a phenomenon which entails obtaining answers to research questions. Further, interpretivism addresses the reaction to the shortcomings and limitations of positivism (du Plooy-Cilliers, Davis & Bezuidenhout, 2014: 27).

This is also a qualitative, exploratory study done on ABC Motors in South Africa, aiming to obtain new insights and confirm assumptions with regard to eco-innovations adopted to address their environmental footprint. The aim of interpretivists is to gain an in-depth understanding of multiple realities as mentioned, therefore qualitative research is depended on and can be described as a research strategy emphasizing words, not numbers throughout the collection and analysis of data (du Plooy-Cilliers, et al., 2014, p. 30).

The ontological position of interpretivism sees reality as subjective, created by human interaction. The epistemological position of interpretivism entails looking at facts as fluid and embedded within a meaning system. Interpretivists accept that truth is dependent on people's interpretation of facts, they do not generalise their results beyond the context in which the study was conducted. The axiological position of interpretivism looks at openly discussing the values that shape interpretivists' research, which includes their own interpretations and those of the participants (du Plooy-Cilliers, et al., 2014, p. 28).

Positivism as a research paradigm will not be effective in this study as it is only objective and explained through scientific laws – there is a single truth (Maree, 2016, p. 22). It includes putting variables in a controlled environment and observing the results.

8. Research Design

As mentioned, this is a qualitative study. The core property of qualitative research is that it examines the way people make sense out of their own concrete real-life experiences in their own minds and in their own words. This information is usually expressed in everyday language using everyday concepts. Qualitative research thus contrasts with quantitative research, which focuses on the way the world is understood in researchers' minds, usually using abstract scientific concepts and terminology (Cropley, 2019).

Semi-structured interviews with an interview schedule was utilised. Open-ended questions were asked, followed by further probing and clarification. The study is cross-sectional, meaning data collection is performed in a short time frame and the researcher has direct observation. There is no need to follow-up and this is a more cost-effective design type (Zangirolami-Raimundo, de Oliveira & Leone, 2018). This also assists to create an overall picture of the phenomenon at that point in time. A “photograph” and not a “movie”, so to speak.

This is an exploratory case study which explores situations in which the intervention being evaluated has no clear, single set of outcomes (Maree, 2016, p. 82). It explores the research questions and does not intend to offer final and conclusive solutions to existing problems. Explanatory case studies, on the other hand, explain the presumed causal links between real-life interventions and can relate more towards quantitative studies

9. Population

9.1 Target and Accessible Population

- Target population: Between *15 and 20 employees* at different levels (different ages) at ABC Motors in South Africa.
- Accessible population: Between *3 and 5 employees* of different ages at ABC Motors in South Africa.

9.2 Population Parameters

- ABC Motors employees in South Africa.
- Men and Woman (different age groups)
- Working in various departments
- Employed for 6 months or more

10. Sampling

Non-probability sampling is best suited for this study as it is a qualitative study. The researcher did not make use of random selection of population elements. This sampling method is advantageous in this case study due to limitations faced, such as time and financial resources (Maree, 2016, p. 197). The sample chosen was based on accessibility and personal judgement of the researcher. Non-probability sampling also goes hand in hand with the semi-structured interviews that will be conducted. It is also best suited for exploratory stages of studies (du Plooy-Cilliers, et al., 2014, p. 137).

Purposive sampling is a type of non-probability sampling and was utilised in this study, this ensured the population parameters described above were met. Purposive sampling is a sampling technique that qualitative researchers use to recruit participants who can provide in-depth and detailed information about the phenomenon under investigation (Palinkas, 2015). It is done at the discretion of the researcher and the sample is chosen based on characteristics of the population as well as the objective of the study.

The unit of analysis in this research study is the employees of ABC Motors in South Africa, men and women. The study further required at least three respondents because the purposive sampling method is utilised, focusing on a more specific group of individuals in

accordance with the parameters of the study. The responses of the participants were captured in order to gain in-depth information. Respondents' answers to the transcriptions were analysed through QDA Miner Lite software, based on answers given during the semi-structured interviews conducted.

11. Data Collection Methods

In-depth, semi-structured interviews were conducted via a conferencing application, Cisco Webex. This was due to the COVID-19 pandemic, which caused restrictions on conducting face-to-face interviews. However, the interviews were recorded and transcribed by the researcher as usual. Permission to conduct the interviews was acquired by the researcher with a sample of three employees at ABC Motors in South Africa.

This qualitative collection method allows for questions to participants with the aim of learning more about the participants' views, opinions and beliefs about a specific phenomenon (du Plooy-Cilliers, et al., 2014). Open and close-ended questions were utilised. Ethical clearance was received by the Independent Institution of Education (IIE), and e-mails were sent out to the employees to inform them of their interview date and time. Respondents were then provided with consent forms, which gave the researcher permission to use the responses given during the interviews for this study. This also gave the researcher permission to record the interviews. An interview schedule was utilised as well (Appendix B).

The researcher aimed to collect responses surrounding the themes found in the literature review conducted for the purpose of this study. Each interview took approximately 10 to 20 minutes and each one was recorded so that information could be transcribed. Questions asked were linked to the research question and objectives, as well as the themes collected. Interviews allow for more open-ended questions, as opposed to questionnaires, and the researcher was able to follow-up on ideas and gain in-depth insight from the respondents regarding the eco-innovations adopted at ABC Motors in South Africa.

12. Data Analysis Methods

Responses were recorded and then transcribed and filed by the researcher using Microsoft Word. These files were stored in a password-protected folder. Transcriptions were then loaded onto QDA Miner Lite, with unparalleled computer-assisted coding, analysis and report writing capabilities. QDA Miner is an easy-to-use qualitative data analysis software package used for coding textual data and graphical, annotating, retrieving and reviewing coded data and documents (LaPan, 2013). The software does a qualitative text analysis on each transcription and generates results on connected terms or phrases used to describe identified themes. Based on the respondents' answers given during their interviews, more commonly found themes were revealed.

QDA Miner organises data easily, making the coding and analysis process straightforward; provides dedicated tools that help you create and manage your codebook in a creative way; code text segments and images with an intuitive qualitative tagging process; code your documents more quickly and more reliably with seven text search and retrieval tools; quickly identify patterns and trends, explore data, describe, compare, and test; it is the most powerful geotagging qualitative tool on the market; dedicated functions make collaboration an easy task; track changes and lastly, export and share results (Provalis Research, 2018).

The following eight steps in the process of qualitative content analysis were used: preparing the data; defining the coding unit to be analysed; developing categories and a coding scheme; testing of the coding scheme; text was coded; coding consistency was assessed; data was interpreted (conclusions drawn); and finally, all methods and findings were reported (du Plooy-Cilliers, et al., 2014, p. 235).

Content analysis was utilised to gather and analyse textual data when the recordings from the interviews were analysed. Textual analysis was used when the information received from the participants was transcribed.

This study also made use of the coding method; participants remained anonymous and categorised by the codes allocated to them, as such:

ABCM: ABC Motors

Coding scheme:

ABCM1: Participant 1

ABCM2: Participant 2

ABCM3: Participant 3

13. Trustworthiness

There are four criteria in order for a study to be trustworthy: credibility, transferability, dependability and confirmability. Each were adhered to in this research report as explained below.

Credibility

Credibility deals with the congruency of the findings with reality and the belief of the findings. To ensure credibility well-established research methods must be adopted, the research design should fit the research question, having a theoretical underpinning that is in line with the research question and methods (Maree, 2016, p. 123). In more simple terms, credibility refers to the accuracy with which the researcher interpreted the data that was provided by the respondents (du Plooy-Cilliers, et al., 2014, p. 258).

Enough time was spent with the participants to gain a better insight on the topic at hand and to be able to sound out initial understandings with them so that interpretations from the researcher's side is verified. Written consent was also received prior to conducting the interviews.

Transferability

This refers to the rejection of generalisation and the aim to draw randomly selected samples. It is the ability of findings to be applied to a similar situation and deliver similar results (du Plooy-Cilliers, et al., 2014, p. 258).

To increase transferability, the researcher focused on how typical the participants are to the context being studied and the context to which the findings were applied (providing a complete understanding of the context being studied) (Maree, 2016, p. 124). The researcher painted a full picture of the context which allows the reader to determine if the research is transferable to its context. Thick descriptions have been utilised as well as purposeful sampling which also increases transferability.

Dependability

Dependability is shown through the research design and its implementation, the operational detail of data gathering and the reflective appraisal of the study. The analysis process should be documented so that another individual can examine the decisions you made, how you went about the analysis and how you came about the interpretations (Maree, 2016, p. 124). It is the quality of the process related to the data collection method, data analysis and the theory generated from the data (du Plooy-Cilliers, et al., 2014, p. 259).

QDA Miner Lite was utilised to transcribe and code the data, this ensured objectivity and minimised human error. The researcher remained consistent throughout the study, including the data collection method, data analysis and the theory generated. Consent was received from IIE and then from the participants, which increased the dependability of the study.

Confirmability

This refers to the neutrality of the study, how findings are not shaped by researcher bias, motivation or interest. It requires the researcher to have described the research process in detail to assist others in scrutinising the research design (du Plooy-Cilliers, et al., 2014, p. 259).

To increase confirmability, the researcher admitted to predispositions. Relationships were not developed with the participants and an audit trail allowed any reader or observer to trace the course of the research step by step via the decisions made and procedures described (Maree, 2016, p. 125). The researcher's own interpretation was not forced on the answers given by participants.

14. Presentation of Findings

Following the data collection and data analysis, the researcher presented the findings of this study which compared three employees of ABC Motors. These have been categorised into two main themes as well as their sub-themes.

(The following visual graph and tables are not for statistical purposes, nor have the number of instances been ranked, as this is a qualitative study, it is mainly used to assist the researcher in observing and further explaining the occurrence of each main theme and the relative sub-themes mentioned by the participants.)

Category (Main theme)	Code (Sub-themes)	Count (Coding frequency)
Drivers of Eco-innovation	Eco-innovation policies in South Africa	11 mentions
	Types of Eco-innovations	18 mentions
	The emergence of Eco-innovation as a field worth studying	13 mentions
	Multilevel framework of Eco-innovation drivers	19 mentions

Table 1: Theme 1 – Number of mentions of each sub-theme related to Drivers of Eco-Innovation as the Main Theme.

When looking at **Table 1**, it appears that *Multilevel framework of Eco-innovation drivers* was mentioned most, subsequently *Types of Eco-innovations* and then *the Emergence of Eco-innovation as a field worth studying*. *Eco-innovation policies in South Africa* was mentioned least as a sub-theme for **Drivers of Eco-innovation** as the Main theme.

Category (Main theme)	Code (Sub-themes)	Count (Coding frequency)
Consequences of Eco-innovation	Cost	5 mentions
	Internationalisation	6 mentions
	Short-lived competitive advantage	4 mentions

Table 2: Theme 2 – Number of mentions of each sub-theme related to Consequences of Eco-Innovation as the Main Theme.

When looking at **Table 2**, it appears that *Internationalisation* was mentioned most, followed by *Cost* and then *Short-lived competitive advantage* with the least amount of mentions when analysing sub-themes based on **Consequences of Eco-innovations** as the Main theme.

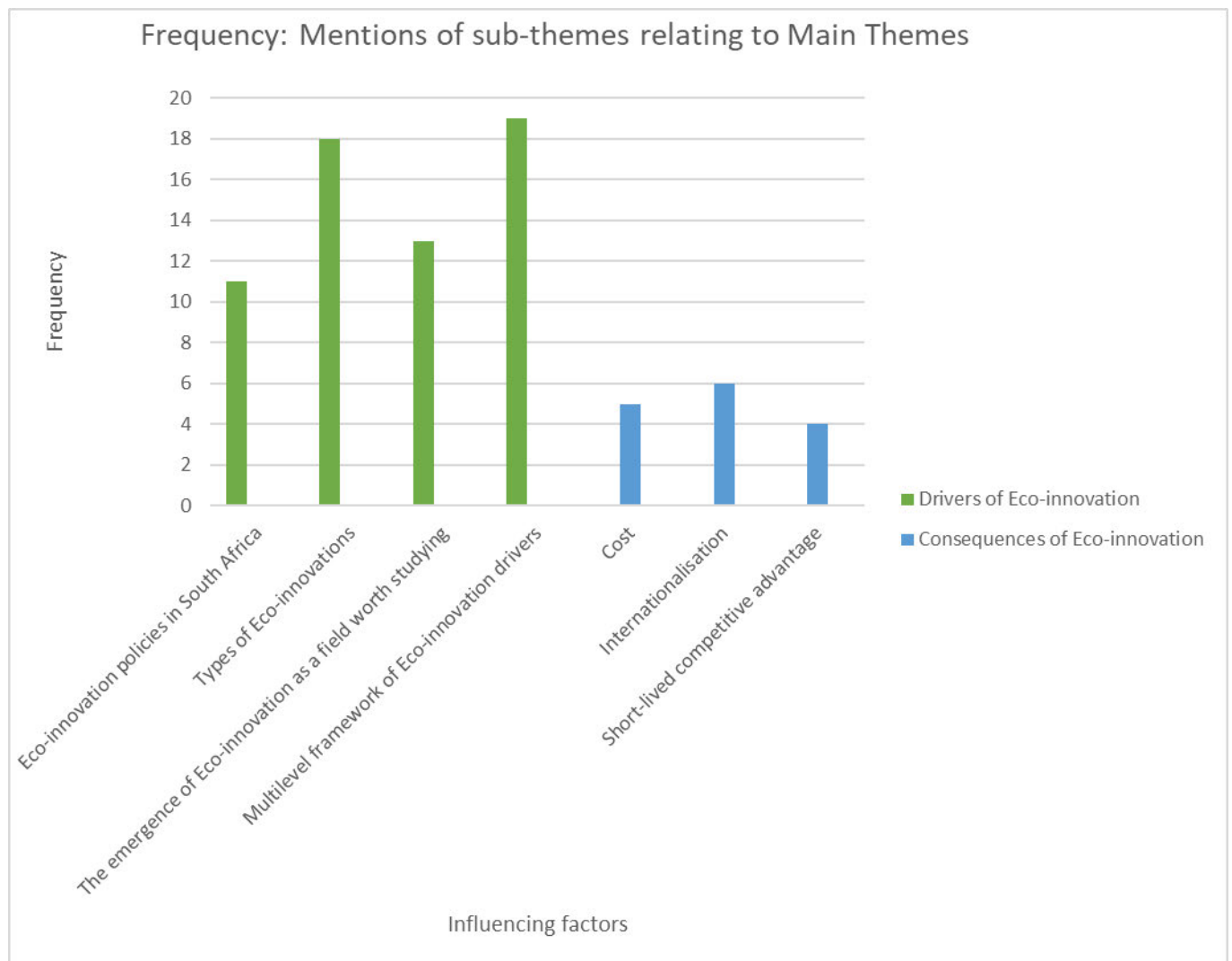


Figure 3: Bar graph – Frequency: Mentions of sub-themes relating to Main Themes

15. Interpretation of Findings

All themes and sub-themes appeared in the responses collected by the researcher in the following ways:

15.1 Drivers of Eco-innovation

According to Cai & Li (2018), the focus on eco-innovation in organisations provides customer and business value while contributing to sustainable development and decreasing environmental costs and impacts. Eco-innovations therefore have an influence on consumer perceptions and the well-being of an organisation, as well as the environment. When analysing the adoption of eco-innovation, it is evident that eco-innovative behaviour can enhance a firm's environmental performance and through this, benefit from an indirect impact on its economic performance (Cai & Li, 2018). The following is an exploration of the findings for this study.

As depicted in Figure 3, *multilevel framework of eco-innovation drivers* was the most mentioned sub-theme while the *types of eco-innovations* did not fall far behind.

Multilevel framework of Eco-innovation drivers comprises of Macro, Meso and Micro-level drivers where Macro-level drivers were specifically mentioned most. This can be represented in the quotes below:

ABCM1: *reduction of landfill*

ABCM2: *we have a responsibility with regards to things like uhm the environment and uhm pollution*

ABCM3: *we're also in a drive at the moment to do zero waste landfill*

Landfilling of general and hazardous waste remains the dominant technology solution in South Africa, with an estimated 90 per cent of all waste generated in South Africa disposed of to landfill (Department of Environmental Affairs, 2012). Numerous environmental and human health concerns associated with landfills has prompted South African Government to develop a policy and regulations aimed at improving the way in which landfills have been designed and operated (Godfrey & Oelofse, 2017). It can be recognised that ABC Motors is doing what they can to reduce their waste to landfill.

Further, *types of eco-innovations* was also mentioned by all three participants mainly looking at add-on eco-innovations, integrated eco-innovations and alternative product eco-innovation. This can be depicted in the following quotes:

ABCM1: *what this entails is uhm reducing one of the volatile contents of paint*

This is an Integrated eco-innovation as the production process and product itself is eco-efficient and "cleaner."

ABCM2: *the best thing that I can imagine to explain to you today from an eco-innovation type of deal is the connected vehicle drive*

This is considered to be an alternative product eco-innovation as it is a new technological path built on new practices.

ABCM3: *the drive to stop possible ground contamination, planting trees, water saving ideas*

These are add-on eco-innovations as they are pollution and resource handling technologies.

Macro-organisational eco-innovations as well as general purpose eco-innovations were not mentioned by any of the participants. Therefore, when interpreting the findings, it can be deduced that ABC Motors do not implement radical eco-innovations but rather focus more on the consumer and product itself then adopt an eco-innovation accordingly.

The other sub-themes, the emergence of Eco-innovation as a field worth studying and Eco-innovation policies in South Africa were also mentioned at least once by each participant.

The emergence of eco-innovation as a field worth studying, is linked to the five ways eco-innovation adds value to an organisation, as identified by the National Cleaner Production Centre of South Africa (2011) and mentioned in the literature review. Those five being: access to new markets and expanding markets, increased profitability along the value chain, staying ahead of standards and regulations, attracting investments and increased productivity and technical capacity. This is expressed by the participants as illustrated below:

ABCM1: *for us to be able to sell certain vehicles into certain countries is with certain environmental requirements we've got to meet from a legislation perspective*

ABCM2: *collaboration between for instance companies that do telecommunications because we need the data transfer and uhm the accessibility to their systems*

The above two quotes are linked to the access to new and expanding markets.

ABCM3: *these innovations allow us to spend cash in other areas of the business such as our people development and we also streamline our manufacturing processes*

This is linked to increased profitability along the value chain as well as increased productivity and technical capacity as processes are modified and employees are trained to gain relevant and new skills accordingly.

When interpreting these findings, it can be deduced that accessing new and expanding markets is important as the automotive industry is a competitive one. ABC Motors in South Africa benefits from increased profitability along the value chain as well as increased productivity (with streamlined manufacturing processes) and technical capacity, with the capability of spending more money on people development. Further, they are doing their utmost best to keep waste to a minimum, especially regarding landfills. They are also taking advantage of the new markets they access, such as the telecommunications industry.

Eco-innovation policies in South Africa was mentioned least as a sub-theme of *drivers of eco-innovation*. This sub-theme has to do with the private sector making major investments in eco-innovation, as South Africa has yet to implement a national act or policy for eco-innovation. The following quotes by the participants relate to this:

ABCM1: *our drive to improve vehicles is driven also by legislation in countries*

ABCM2: *we can implement that to have ongoing... quality improvements for our next generation of vehicles*

ABCM3: *we've got more focus on protecting the environment, we are saving our scarce resources such as water*

Improvements are constantly needed to ensure that the customer is happy, customers' satisfaction is part of their rights. As illustrated above, ABC Motors in South Africa invests quite a bit in eco-innovation – from utilising rain water to planting trees. Though there is no specific eco-innovation legislation in the long-term these initiatives are vital to support sustainable development.

15.2 Consequences of Eco-innovation

Some companies could avoid the adoption of eco-innovations due to the initial investment that needs to be made, or have the expectation that such an innovation will be expensive. The three sub-themes are: cost, internationalisation and short-lived competitive advantage.

When looking at internationalisation it can be argued that national regulations stimulating environmental innovation have to be properly set and need to comply with international markets, demand and regulations in order for international doors to be opened (Hojn, 2017). Internationalisation was mentioned most as a sub-theme under Consequences of Eco-innovations and is demonstrated below:

ABCM1: *Europe is very environmentally friendly and there is a lot of requirements that we need to meet in order to export into that country*

ABCM2: *it sometimes only lacks a little bit in timing because as you can imagine, especially with things like uhm, internet connectivity and those kinds of things uhm, the uhm, you know it's not always replicable or reproducible uhm, in other markets the same as it would be in the United States for instances*

ABCM3: *the designing occurs in Australia*

There is an increasing number of companies who are pursuing foreign markets to look for opportunities and to increase their competitiveness. Internationalisation pushes companies to learn and implement eco-innovation through two channels of influence (Hojn, 2017). Taken from the findings above, there is a delay in the timing of the implementation of eco-innovations in South Africa compared to other countries. There are a few influencing factors such as internet connectivity and country requirements.

Cost is another sub-theme of Consequences of Eco-innovation and was mentioned a total of five times amongst all three participants. Although cost is a concern for most organisations at first, the long-term cost savings and increased efficiency makes the initial investment well worth it (National Cleaner Production Centre of South Africa, 2011). Cost as a consequence in the adoption of eco-innovations is illustrated in the below quotes:

ABCM1: *one of the biggest pillars is environmental so continuously we drive and we spend a huge amount of money in making sure that's all a reality*

ABCM2: *it includes investing a massive amount of money in, every year in developing, and staying ahead of the curve*

The third participant did not mention cost throughout the interview. Nonetheless, from the above quotes it can be depicted that a large sum of money is spent by ABC Motors in South Africa in order to support the adoption of eco-innovations.

The last sub-theme, short-lived competitive advantage, was mentioned least by the participants. The third participant did not mention this sub-theme whatsoever. The consequence of a short-lived competitive advantage is due to the imitation by competition, this requires an organisation to protect the innovation by means of intellectual property to slow down the erosion of competitive advantage (Hojn, 2017). The automotive industry is highly competitive. This can be depicted from the following:

ABCM1: *it is definitely something that we have to continuously work on in order to be able to have export contracts into the rest of the world and that's for survival, we have to export to be able to survive, especially in South Africa.*

ABCM2: *it's all about who gets to the market first with some things so it's all about the development in innovation*

A short-lived competitive advantage was also not mentioned by the third participant but from the above two quotes it can be derived that there is competition in the industry and that ABC Motors in South Africa has to constantly come up with new eco-innovations to survive amongst other motor manufacturers. Companies can, through environmental technologies, gain a competitive advantage by establishing unique and inimitable strategies. Therefore, they then distinguish themselves from the competition and become environmental leaders (Hojn, 2017).

The advantages and benefits of introducing eco-innovations in an organisation exceed the consequences thereof, this is deduced from the above answers given by the participants during their interviews.

16. Research Question, Problem and Objectives Addressed

16.1 Research question

Primary research question:

What influence does the adoption of an eco-innovation have on ABC Motors in South Africa during the manufacturing processes of their automobiles?

The research question was answered by utilising a qualitative approach in which information was gained during semi-structured interviews conducted by the researcher with three employees at ABC Motors. Based on the findings of this study, it was determined that the adoption of eco-innovations does have an influence on the manufacturing processes of the automobiles at ABC Motors. Not only did the respondents mention the types of eco-innovations implemented currently and how they assist to keep environmental impact to a minimum, such as lowering electricity usage, cost as a consequence of eco-innovations was also mentioned by respondents because running the plant as well as the operations thereof costs ABC Motors millions of Rands every year. The researcher however also established that respondents felt that the cost outweighed the long-term benefit of having eco-innovations as part of ABC Motor's daily processes.

It was addressed that the *multilevel framework of eco-innovation drivers* was the most mentioned sub-theme. Therefore, it was identified that the eco-innovations adopted by ABC Motors address the micro-, meso- and macro-environments in which the industry finds itself. They further take the future of the organisation, as well as the community, into account. After conducting all three interviews it was recognised by the researcher that ABC Motors have a wide variety of eco-innovations implemented to assist with the environmental impact caused by the industry, as illustrated by the quotes provided above.

16.2 Research problem

The research problem explained the uncertainty of whether ABC Motors directs its attention to the environmental issues posed by the industry in which they operate and whether they are continuously introducing eco-innovations to assist with this.

The research problem was addressed in the interview questions asked – participants were asked about current eco-innovations adopted and the possible plan to continuously implement such into the future. Further, participants were asked what influence this has on ABC Motor's environmental impact. The research question provided insight into the research problem and was aligned with the objectives set out, which were answered with semi-structured interviews investigating the research problem.

16.3 Research objectives

- To determine what kinds of eco-innovations are currently adopted by ABC Motors in South Africa.

ABC Motors in South Africa utilises rain water, plants trees, monitors their electricity usage, has reduced the volatile content of their paint, recognise the detriment of landfills and are moving towards environmental technology.

- To determine if eco-innovations adopted internationally by ABC Motors are in line with the eco-innovations adopted by ABC Motors in South Africa.

It was determined that ABC Motors is integrated and that best practices are rolled out in every country in which they operate. There may be a slight delay in the timing of this but eventually the same processes are adhered to and implemented locally and internationally.

- To determine the environmental impact by ABC Motors in South Africa following the adoption of eco-innovations.

It was determined that the eco-innovations introduced reduce the carbon emissions and waste produced when the automobiles are manufactured. Further, eco-innovations contribute to the sustainability and CSR of ABC Motors in South Africa – as well as the carbon footprint, which decreased.

- To determine whether the eco-innovations adopted have an influence on the manufacturing process or procedures of ABC Motors in South Africa.

It was determined that day to day processes have been adapted to adhere to environmental requirements, locally and internationally. Different and smarter ways of manufacturing the automobiles have been identified so that they are safer for the people purchasing them and the environment in which they will be used.

17. Anticipated Contribution

This study has raised awareness for its readers as well as add to the field of innovation in work or study, specifically eco-innovation, which is not as commonly used and known nationally as it is internationally.

This study has further added to the body of knowledge within the automotive industry or any industry related to it where manufacturing is part of daily procedures. This study may provide possible ways for organisations to implement eco-innovations in South Africa if they see benefits, including SME's.

This study can also be used as a means for further research for automotive or manufacturing companies in South Africa with regard to eco-innovation. Lastly, if eco-innovation brings benefit to an organisation like ABC Motors in South Africa then this study could bring cause for other companies alike to also adopt eco-innovations.

17. Ethical Considerations

Ethics is a moral or professional code of conduct that sets a standard for attitudes and behaviours (du Plooy-Cilliers, et al., 2014, p. 263). In this study there are not any major ethical concerns as the topic is not sensitive to the company or to the IIE. Ethical clearance was given to the researcher by the IIE, with specific guidelines given. There are no risks involved in this study and no harm was be caused, such as having a sensitive topic which may cause emotional damage. Respect for privacy, establishment of honest and open interactions, and avoiding misrepresentations is the main aim of this study.

17.1 Ethical Issues Related to Participants

Interviews were not conducted before consent/ ethical clearance was given by the IIE and then from ABC Motors in South Africa. Consent forms were also be signed by the participants prior to interviews. The participants were also be made aware of their rights and voluntarily chose to be part of the study or not. Participants were also informed of the nature of the study and reminded that their rights will be protected. Questions asking any sensitive information were avoided and each participant with his or her answers were treated with high confidentiality. Audio recordings were also stored in a password protected folder. The above information was also presented in the consent forms which were signed by each of the participants. Informed consent has been recognised as an integral part of ethics in research carried out in different fields (Orb, Eisenhauer & Wynaden, 2001).

17.2 Ethical Issues Related to the Researcher

A researcher's approach to data analysis and data reporting can be unethical in the following ways: falsifying information, distorting results, allowing bias to influence interpretation or results, misusing information and/or using inappropriate research methods (du Plooy-Cilliers, et al., 2014, p. 269).

The researcher ensured that none of the above occurred. The researcher was bound to ethics standards set out by the IIE. The researcher was also bound to a non-disclosure agreement received and after the study was concluded, if any information was leaked or used unethically the researcher would be held liable. Further, QDA Miner Lite will ensure that information is analysed accurately and ethically.

18. Limitations

Limitations of the study include (du Plooy-Cilliers, et al., 2014):

- **Time frame:** If there is a limit on the time for the study then there will be a limit on the amount of information that can be collected by the researcher within this time frame. The researcher may require a longitudinal study.
- **Budget limitations:** This limitation may cause the scope of the research to be redefined. Cellular data was required to conduct the interviews as they could not

be conducted face to face, this was due to the COVID-19 pandemic. This is explained in more detail below.

- **Sample size:** The sample size may be too small and the researcher will then have to spend more individual time with each participant to gain more information. Three from ABC Motors in South Africa is a small sample size therefore responses given were verified to eliminate the researcher's interpretations. The sample size was not a true representation of the population therefore the researcher utilised academic articles and journals as secondary research.
- **Accessibility:** Access to participants may be limited due to working hours and finding the right time to conduct the interview. Lunch breaks may need to be given up by the participants for the interviews so that they do not lose valuable time. Due to the COVID-19 pandemic interviews could only be conducted online or via a phone call.
- **Gaps in the study:** There may be gaps in past literature, as is the case in this study. Eco-innovation is not as well known in South Africa as it is overseas and has therefore not yet been studied to a point where there is enough available research on the topic.
- **COVID-19:** Due to government restrictions implemented during the COVID-19 pandemic the researcher could not conduct face to face interviews. Interviews were therefore conducted via a conference call on a platform called Cisco WebEx. This made it difficult to examine the participants' body language as they did not make use of the video feature. Further, participants could not be observed in their natural environments.
- **Data saturation** can be defined as the point when there is an adequate amount of information to replicate the study, when the ability to obtain additional information has been achieved and lastly, once coding is no longer practicable (Fusch & Ness, 2015). The accessible population of three participants makes reaching data saturation highly unlikely. However, it can be said that data saturation is not about the numbers *per se*, but rather about the depth of the data (Burmeister & Aitken, 2012). This also relates to the richness of the data. The responses by the participants were detailed and layered as the researcher asked follow-up questions – as a result, main themes and relevant sub-themes surfaced.

Technical difficulties when the interviews conducted made some answers difficult to hear by the researcher. Therefore, some answers had to be repeated.

19. Conclusion

In conclusion, this study has followed a qualitative approach which best suits the research question. The researcher has provided background of the study followed by the research rationale, problem statement, as well as a set of research objectives and the primary research question.

The selected paradigm is interpretivism to gain an in-depth understanding of the topic. Semi-structured interviews were conducted via a conferencing platform and the researcher made use of QDA Miner Lite software to analyse the responses transcribed following the interviews. The trustworthiness of the study has been described in detail as well.

An overall literature review was also given by the researcher where it is noted that it will take time for South Africa to concretise the commitment to eco-innovation into law, however there are numerous organisations in the public and private sector supporting eco-innovation. If automotive companies such as ABC Motors in South Africa continue to promote and apply green initiatives into their operations then the term eco-innovation will become a household norm. Further, organisations such as the NCPC continue to speak highly of eco-innovation and add to society's body of knowledge by providing information on the added value of introducing eco-innovation in any organisation. Conceptualisation also formed part of the research report. Finally, presentation of findings, interpretation of findings, ethical consideration and anticipated contribution was provided by the researcher.

Eco-innovation is a field worth studying as it not only contributes to the Corporate Social Responsibility of an automotive company but also presents them with opportunities in new markets, locally and internationally, as well as a much-needed competitive advantage. South Africa is yet to introduce a law enforcing the adoption of eco-innovations – however, the private sector, which includes ABC Motors, are contributing tremendously towards ensuring their environmental impact is kept to a minimum. The long-term rewards therefore outweigh the initial investment.

If organisations can find ways to implement eco-innovation in the macro-, meso-, and micro-environments then they are not only gaining a competitive advantage but ultimately ensuring the sustainability of the firm. Therefore, companies such as ABC Motors in South Africa should continuously conduct research and brainstorm ideas relating to eco-innovation so that they can be put into place as soon as possible. With resources being used up, toxic gases and chemicals released into the environment, carbon footprints not taken into account companies in the automotive industry have a responsibility to do all they possibly can to ensure that their impact is kept to a minimum and that future generations are able to meet their needs the same way that people in the present can. Eco-innovation should become a more recognised and studied term in the industry and laws should be set up to enforce the adoption of these types of innovations in South Africa.

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Figure 3: Bar graph – Frequency: Mentions of sub-themes relating to Main Themes

Appendix A: Interview Schedule

Primary Research Question	Research Objectives	Main themes	Sub-themes	Interview Questions
What influence does the adoption of an eco-innovation have on ABC Motors in South Africa during the manufacturing processes of their automobiles?	To determine what kinds of eco-innovations are currently adopted by ABC Motors nationally.	1. Drivers of Eco-innovation 2. Consequences of Eco-innovation	Types of Eco-innovations.	1. What are current eco-innovations adopted by ABC Motors in South Africa? 1.1. Can you elaborate on this/these? 2. Do you feel that these adopted eco-innovations have an impact on the CSR of the company? 2.1. If so, what kind of impact?
	To determine if eco-innovations adopted internationally by ABC Motors are in line with the eco-innovations adopted by ABC Motors in South Africa.		The emergence of eco-innovation as a field worth studying.	3. Do you feel like the eco-innovations adopted by ABC Motors in South Africa are to the same extent and magnitude as those adopted by ABC Motors internationally? 3.1. Why do you say so? 4. Do you feel these adopted eco-innovations have presented ABC Motors with a competitive advantage in South Africa? 4.1. How so? 5. Have these adopted eco-innovations introduced opportunities for ABC Motors in new markets in South Africa?

				5.1. How so?
	To determine the environmental impact by ABC Motors in South Africa following the adoption of eco-innovations.		Multilevel framework of eco-innovation drivers.	6. What influence does the adoption of eco-innovations by ABC Motors in South Africa have on their environmental impact? 7. Is there a link or relationship between product-design and eco-innovation at ABC Motors in South Africa? 7.1. How so?
	To determine whether the eco-innovations adopted have an influence on the manufacturing process or procedures of ABC Motors in South Africa.			8. Does carrying out environmental product or process innovations have an influence on the manufacturing phase of the automobiles? 8.1. If so, what kind of influence?
			Eco-innovation policies in South Africa. Cost.	9. Has ABC Motors made any major investments in eco-innovation? 9.1. If so, could you elaborate on these?

Appendix B: Ethical Clearance Letter



31 July 2020

Student name: Georgina Eulylia van den Heever

Student number: 16001448

Campus: IIE Varsity College Pretoria

Re: Approval of HBCM412 - Bachelor of Commerce Honours in Management Proposal and Ethics Clearance

HONOURS/PGDIP ETHICAL CLEARANCE LETTER

Your research proposal and the ethical implications of your proposed research topic were reviewed by your supervisor and the campus research panel, a subcommittee of The Independent Institute of Education's Research and Postgraduate Studies Committee.

Your research proposal posed no significant ethical concerns and your supporting documents and instruments are in order to proceed. We hereby provide you with permission to proceed with your research.

In the event of you deciding to change your research methodology in any way, kindly consult your supervisor to ensure all ethical considerations are adhered to and pose no risk to any participant or party involved. A revised ethical clearance letter will be issued.

We wish you all the best with your research!

GENERAL CONDITIONS TO BE FULFILLED IN RELATION TO RESEARCH

Permission is granted to proceed with the above study subject to the conditions listed below being met and may be withdrawn should any of these conditions be flouted.

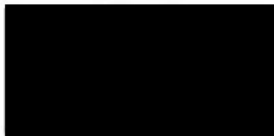
Please note: The panel has not considered the merits, accuracy or ethical soundness of the research. The only merits examined are the use of The IIE as a sample.

Permission is granted subject to the following conditions:

1. The researcher(s) will need to obtain informed consent in writing from all of the participants in his/ her sample if the study is not anonymous.
2. The researcher(s) may only use the data collected for research purposes and in no other way.
3. Photographs of human subjects may only be taken if relevant to the research, informed consent was obtained, and even with informed consent, the photographs may not be published on any online platforms.

4. The researcher is responsible for supplying and utilising his/her own research resources, such as stationery, photocopies, transport, faxes and telephones and should not depend on the goodwill of the institutions and/or the offices visited for supplying such resources.
5. No names or identifying information of participants may be used within the research and the research must be voluntary.
6. Please make it clear that the information will not be used punitively in any way and participants may in no way be counselled/advised based on this.

Supervisor:
Dr RUAN VAN DEN BERG



Campus Postgraduate Coordinator (CPC):

Janus Snyders



Appendix C: Ethics Checklist



HONOURS RESE, RESM and RMET ETHICS CHECKLIST

Dear student

Please complete this checklist and include this in your proposals as an appendix:

Student name: **Georgina Eulylia van den Heever**

Title of the research:

	Yes	No	Comment: Supervisor
Are you using human subjects in your research?	✓		
I intend to use human subjects - I understand that I will not conduct research with human subjects under the age of 18 and other vulnerable groups. - I understand I can only proceed once I receive an ethical clearance letter.			
Interviews/ Focus groups An example of the <i>written consent form</i> I intend to use is attached. (Part 5)	✓		
I will record the interview/focus groups and the sample of the letter where I ask for permission to do so is attached. (Part 7)	✓		
I plan to use an interview schedule: The example of my research instrument is attached.	✓		
I plan to use a questionnaire: The example of my research instrument is attached.		✓	
I plan to use a gate-keepers letter: The example of my letter is attached. (Part 3)	✓		
I plan to do research on an IIE site/with IIE students/staff/artefacts and I filled in the application for permission to do so. The application is attached. I understand I can only proceed once I receive IIE Approval for this. (Annexure E)		✓	

Signed: student.....

Appendix D: Gatekeepers Letter



Gatekeepers letter/ Request to conduct research

Dear [REDACTED]

I am writing to ask your permission to conduct research at [REDACTED]

My name is Georgina Eulylia van den Heever, a HBCM412 - Bachelor of Commerce Honours in Management student at the Varsity College Pretoria a brand of the Independent Institute of Education (IIE). The research I wish to conduct for my Honours Project titled *An exploration of the adoption of eco-innovations in the automotive industry: A closer look at ABC Motors*.

The aim of this study is to investigate the adoption of eco-innovations in the automotive industry. There will be a focus on the types of eco-innovations adopted and these innovations in practice. The project consists of exploring and finding answers to a chosen research question within this theme by means of independent research, critical thinking and sound argumentation. This will enhance the understanding of the field of eco-innovation in work or study, which is not as commonly used and known nationally as it is internationally. The nature of your firm's participation will be contributing to the completion of my HBCM412 - Bachelor of Commerce Honours in Management. Each interview will take approximately 15 minutes. Due to the COVID-19 pandemic, interviews will be conducted on Zoom or Microsoft Teams.

The data will be transcribed on QDA Miner but only I and my supervisor will have access to it. I will not use your name in any research summaries to come out of this research and I will also make sure that any other details are disguised so that nobody will be able to identify you.

Yours sincerely,

Student: [REDACTED]

Supervisor: [REDACTED]

My contact details are as follows:

Georgina Eulylia van den Heever
[REDACTED]

The contact details of my supervisor/navigator/lecturer are as follows:

Ruan van der Berg
[REDACTED]

Appendix E: Gatekeepers Approval

(Participant names and the company name have been blanked out for confidentiality purposes)



Gatekeepers Approval

Consent form to conduct research at my company	
I, [REDACTED]	
Representative of [REDACTED]	
My capacity: [REDACTED]	
Give my permission that Georgina Eulyia van den Heever may conduct research at my company. This research has been explained to me and I understand what participation in this research will involve. I reserve the right to withdraw this permission at any time. I also understand that research reports are available in the library and IIE Repository unless I indicate below that I would not.	
Select below:	
☒ I request that my company's identity be kept confidential.	
☐ My company can be identified in the study.	
☒ The study may never be available on the repository.	
☐ The study may be made available on the repository.	
☐ The study may be made available on the repository after months.	
Signature [REDACTED]	Date 12/08/2020

Appendix F: Consent Form Template to be Explained to Participants



CONSENT FORM

Explanatory information sheet and consent form for participants
To whom it may concern, My name is Georgina Eulylia van den Heever and I am a student at Independent Institute of Education's Varsity College Pretoria . I am currently conducting research under the supervision of Ruan van der Berg about the understanding of the adoption of eco-innovations in the automotive industry, specifically looking at ABC Motors in South Africa. There will be a focus on the types of eco-innovations adopted and these innovations in practice. I hope that this research will enhance our understanding of the field of innovation in work or study, specifically eco-Innovation which is not as commonly used and known nationally as it is internationally. I would like to invite you to participate in my study. In order to explain to you what your participation in my study will involve, I have formulated questions that I will try to fully answer so that you can make an informed decision about whether or not to participate. If you have any additional questions that you feel are not addressed or explained in this information sheet, please do not hesitate to ask me for more information. Once you have read and understood all the information contained in this sheet and are willing to participate, please complete and sign the consent form below.
What will I be doing if I participate in your study?
I would like to invite you to participate in this research because it will raise awareness on the topic at hand. If you decide to participate in this research, I would like to interview you for approximately 15 minutes, the interview will be recorded but full confidentiality adhered to. You can decide whether or not to participate in this research. If you decide to participate, you can choose to withdraw at any time or to decide not to answer particular interview questions.
Are there any risks/ or discomforts involved in participating in this study?
Whether or not you decide to participate in this research, there will be no negative impact on you. There are no direct risks or benefits to you if you participate in this study. You might, however, indirectly find that it is helpful to talk about ABC Motors' adoption of eco-innovations. If you find at any stage that you are not comfortable with the line of questioning, you may withdraw or refrain from participating.
Do I have to participate in the study?
• Your inclusion in this study is completely voluntary; • If you do not wish to participate in this study, you have every right not to do so;

- Even if you agree to participate in this study, you may withdraw at any time without having to provide an explanation for your decision.

Will my identity be protected?

I promise to protect your identity. I will not use your name in any research summaries to come out of this research and I will also make sure that any other details are disguised so that nobody will be able to identify you. I would like to ask your permission to record the interviews, but only my supervisor, I and possibly a professional transcriber (who will sign a confidentiality agreement) will have access to these recordings. Nobody else, including anybody at the **Independent Institute of Education**, will have access to your interview information. I would like to use quotes when I discuss the findings of the research, but I will not use any recognisable information in these quotes that can be linked to you.

What will happen to the information that participants provide?

Once I have finished all interviews, I will write summaries to be included in my research report, which is a requirement to complete my **HBCM412 - Bachelor of Commerce Honours in Management**. You may ask me to send you a summary of the research if you are interested in the final outcome of the study.

What happens if I have more questions about the study?

Please feel free to contact me or my supervisor should you have any questions or concerns about this research, or if there is anything you need to know before you decide whether or not to participate.

You should not agree to participate unless you are completely comfortable with the procedures followed.

My contact details are as follows:

Georgina Eulylia van den Heever

The contact details of my supervisor are as follows:

Ruan van der Berg

Appendix G: Consent Form for Interviews

(Participant names and the company name have been blanked out for confidentiality purposes)



Consent form for participants	
I, [REDACTED], agree to participate in the research conducted by Georgina Eulyia van den Heever about the understanding of the adoption of eco-innovations in the automotive industry, specifically looking at [REDACTED] in South Africa. With a focus on the types of eco-innovations adopted and these innovations in practice. This research has been explained to me and I understand what participation in this research will involve. I understand that: • I agree to be interviewed for this research. • My confidentiality will be ensured. My name and personal details will be kept private. • My participation in this research is voluntary and I have the right to withdraw from the research at any time. There will be no repercussions should I choose to withdraw from the research. • I may choose not to answer any of the questions that are asked during the research interview. • I may be quoted directly when the research is published, but my identity will be protected.	
Signature [REDACTED]	Date 14/03/2020
Signature	Date

Consent form for participants	
I, [REDACTED], agree to participate in the research conducted by Georgina Eulylia van den Heever about the understanding of the adoption of eco-innovations in the automotive industry, specifically looking at [REDACTED] in South Africa. With a focus on the types of eco-innovations adopted and these innovations in practice. This research has been explained to me and I understand what participation in this research will involve. I understand that: • I agree to be interviewed for this research. • My confidentiality will be ensured. My name and personal details will be kept private. • My participation in this research is voluntary and I have the right to withdraw from the research at any time. There will be no repercussions should I choose to withdraw from the research. • I may choose not to answer any of the questions that are asked during the research interview. • I may be quoted directly when the research is published, but my identity will be protected.	
	18/08/2020
Signature	Date

Consent form for participants	
I, [REDACTED], agree to participate in the research conducted by Georgina Eulysia van den Heever about the understanding of the adoption of eco-innovations in the automotive industry, specifically looking at [REDACTED] in South Africa. With a focus on the types of eco-innovations adopted and these innovations in practice. This research has been explained to me and I understand what participation in this research will involve. I understand that: • I agree to be interviewed for this research. • My confidentiality will be ensured. My name and personal details will be kept private. • My participation in this research is voluntary and I have the right to withdraw from the research at any time. There will be no repercussions should I choose to withdraw from the research. • I may choose not to answer any of the questions that are asked during the research interview. • I may be quoted directly when the research is published, but my identity will be protected.	
Signature [REDACTED]	Date 25/8/2020

Appendix H: Consent Form for Audio or Video Recording

(Participant names and the company name have been blanked out for confidentiality purposes)



CONSENT FORM FOR AUDIO OR VIDEO RECORDING

Consent form for participants	
I, [REDACTED], agree to allow Georgina Eulylla van den Heever to audio record my interviews as part of the research about the understanding of the adoption of eco-innovations in the automotive industry, specifically looking at [REDACTED] in South Africa. With a focus on the types of eco-innovations adopted and these innovations in practice. This research has been explained to me and I understand what participation in this research will involve. I understand that: • My confidentiality will be ensured. My name and personal details will be kept private. • The recordings will be stored in a password-protected file on the researcher's computer. • Only the researcher, the researcher's supervisor and possibly a transcriber (who will sign a confidentiality agreement) will have access to these recordings.	
Signature	Date
[REDACTED]	14/07/2020

CONSENT FORM FOR AUDIO OR VIDEO RECORDING

Consent form for participants	
I, [REDACTED], agree to allow Georgina Eulylla van den Heever to audio record my interviews as part of the research about the understanding of the adoption of eco-innovations in the automotive industry, specifically looking at [REDACTED] in South Africa. With a focus on the types of eco-innovations adopted and these innovations in practice. This research has been explained to me and I understand what participation in this research will involve. I understand that: • My confidentiality will be ensured. My name and personal details will be kept private. • The recordings will be stored in a password-protected file on the researcher's computer. • Only the researcher, the researcher's supervisor and possibly a transcriber (who will sign a confidentiality agreement) will have access to these recordings.	
Signature	
	18/08/2020
	Date

CONSENT FORM FOR AUDIO OR VIDEO RECORDING

Consent form for participants	
I, [REDACTED], agree to allow Georgina Eulyia van den Heever to audio record my interviews as part of the research about the understanding of the adoption of eco-innovations in the automotive industry, specifically looking at [REDACTED] in South Africa. With a focus on the types of eco-innovations adopted and these innovations in practice. This research has been explained to me and I understand what participation in this research will involve. I understand that: • My confidentiality will be ensured. My name and personal details will be kept private. • The recordings will be stored in a password-protected file on the researcher's computer. • Only the researcher, the researcher's supervisor and possibly a transcriber (who will sign a confidentiality agreement) will have access to these recordings.	
[REDACTED] Signature	20/8/2020 Date

Appendix I: Concept Document

Research Purpose/Objective	Primary Research Question	Research Rationale	Seminal Authors/Sources	Literature Review – Conceptual Framework	Paradigm	Approach	Data Collection Method(s)	Ethics	Anticipated Findings	References
The overall objective of this study is to generate knowledge regarding the adoption of eco-innovations in the automotive and transport industry, specifically ABC Motors in South Africa.	What influence does the adoption of an eco-innovation have on ABC Motors in South Africa during the manufacturing processes of their automobiles?	This study is worth conducting because protecting the environment is of utmost importance to ensure future generations will be able to meet their needs. Specifically looking at the automotive industry.	Shohana Ahmed and Mohammad Kamruzzaman (2010) Maurice van den Oever (2017) Dr. A.N.Sarkar (2013) Aida Szilagyi (2018) Fawzi Halila (2007) MD Aminul Islam (2018)	Theme 1: Eco-innovation policies in South Africa Theme 2: Types of Eco-innovations Theme 3: The emergence of eco-innovation as a field worth studying.	Paradigm Interpretivism: This research tradition aims to understand and describe meaningful social action and experiences Epistemology Interpretivists accept that truth is dependent on people's interpretation of facts.	A qualitative study. Population Population Parameters •ABC Motors employees in SA. •Men and Woman (different age groups) •Working in various departments •Employed for 6 months or more.	In-depth Interviews - This collection method allows for questions to participants with the aim of learning more about the participants' views, opinions and beliefs about a specific phenomenon. Open and close ended questions will be utilised.	In this study there are not any major ethical concerns as the topic is not sensitive to the company or to the IIE. Consent and anonymity forms will be given to participants to sign.	The adoption of eco-innovations by companies in the automotive industry could have an influence on their environmental impact.	(du Plooy-Cilliers, et al., 2014) (Maree, 2016) (Halila, 2007) (Calza, 2017) (Islam, 2018) (Szilagyi, 2018)
Research Problem	Objectives	Key Concepts	Key Theories			Sampling	Data Analysis Method(s)	Limitations	Anticipated Contribution	
Nowadays, there are many advanced materials and production methods utilised in the automotive industry however, when focusing on such innovations, the environment is often forgotten. This can possibly cause problems when looking at the sustainability of a motor company and the environment as a whole.	•To determine what kinds of eco-innovations are currently adopted by ABC Motors nationally. •To determine if eco-innovations adopted internationally by ABC Motors are in line with the eco-innovations adopted by ABC Motors in South Africa. •To determine the environmental impact by ABC Motors in South Africa following the adoption of eco-innovations. •To determine whether the eco-innovations adopted have an influence on the manufacturing process or procedures of ABC Motors in South Africa.	Innovation Eco-innovation Environmental technology (Envirotech) Sustainability/Sustainable development Entrepreneurship Corporate Social Responsibility (CSR)	Brezet's environmental innovation classification system.	Theme 4: Multilevel framework of eco-innovation drivers	Ontology Reality is fluid and subjective and is created by human interaction. Axiology Discusses the values that shape interpretivists' research, which includes their own interpretations and those of the participants	Non-probability sampling. Purposive Sampling.	Unit of Analysis The unit of analysis in this research study is the employees of ABC Motors in South Africa, men and women. The study further requires at least 3 respondents Data Analysis Method(s): QDAMiner4 – a software that will extract key themes.	•Time constraints •Budget limitations •Sample size: The sample size may be too small •Accessibility: Access to participants may be limited •Gaps in the study	This study will raise awareness for its readers as well as add to the field of Innovation in work or study, specifically eco-Innovation which is not as commonly used and known nationally as it is internationally.	

Provisional Title: An exploration of the adoption of eco-innovations in the automotive industry: A closer look at ABC Motors in South Africa Motors.