RESIDENTS' PERSPECTIVE OF NELSON MANDELA BAY AS A SUSTAINABLE CITY

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I. Declaration by Candidate

I, Martin Calitz, hereby declare that:

- This work has not been previously accepted in substance for any degree and is not being concurrently submitted in candidature for any degree.
- This treatise is being submitted in partial fulfilment of the requirements for the degree of Masters in Business Administration.
- This treatise is the result of my independent work and investigation, except where otherwise stated. Other sources are acknowledged by complete referencing. A reference list is attached.
- I hereby give consent for my treatise, if accepted, to be available for photocopying and for interlibrary loan, and for the title and summary to be made available to outside organisations.

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DATE: December 2018

II. Acknowledgements

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- All the participants of the study's evaluation.

III. Abstract

Currently, environmental issues have firmly entrenched itself at the centre of the world stage with regard to all spheres of development activity. This has been exemplified by the number of global and national agendas and international conferences, which are being held concerning the environment. This began with the Rio de Janeiro Earth Summit in 1992, which evolved into the current relentless environmental campaigns across the world from developed to developing nations. This was followed by the World Summit on Sustainable Development (WSSD), which was held in Johannesburg, South Africa in 2002, which defined critical targets for sustainable development, including the Millennium Development Goals (MDGs). These campaigns have become critical in response to the alarming rate at which human activities are affecting the environment.

Africa is experiencing one of the fastest rates of urbanisation in the world, with sub-Saharan Africa leading the way. In 2009, there were more than 395 million Africans living in urban areas, which equates to approximately 40% of the continent's population. The African population number is estimated to triple to more than 1.2 billion people, with an expected 60% of all Africans to reside in urban areas by 2050. The United Nations Human Settlements' Programme identified that this rapid growth presents two major challenges. First, providing African cities with the ability to better harness their productive potential and secondly, assisting African cities with the ability to better serve the increased demands for municipal services and decent housing. The unique situation that makes Africa different from other global urban migrations is the speed this urban migration process is following.

1994 marked a significant change for politics in South Africa. It provided the new administrative South African government the opportunity to position South Africa on a path towards becoming Africa's first recognised sustainable country. In 1994, the South African government amended the constitutional objective to align local government with focusing on securing ecological sustainable development and making use of natural resources, while promoting justifiable economic and social development. In support of this constitutional objective, the National Environmental Management Act (NEMA) No. 107 of 1998, established cooperative governance principles, institutional mechanisms and sustainable development tools needed to promote environmental sustainability.

The key for South African cities is that they need to find ways of embedding sustainability into their mainstream planning, management, monitoring and evaluation. Embedding this shift in thinking about sustainable into city planning means providing a multitude of services such as economic, social and environmental services. It also requires the allocation of responsibility for managing land and monitoring the efficient consumption of resources.

The purpose of this treatise was to gain an understanding into Nelson Mandela Bay (NMB) residents' sustainable awareness levels. This included investigating the factors that influence sustainable awareness levels. The adoption of these factors should assist NMB with reaching the goal of becoming a sustainable metropolitan. The research takes the form of a quantitative study, consisting of a literature review, which reviewed the key concepts of sustainable cities in the 21st century, along with an empirical investigation, which consisted of surveying NBM residents' sustainable awareness levels. The questionnaires used in this research consisted of questions regarding demographic data, as well as questions regarding the perceptions, practices and factors influencing the residents' sustainable awareness. To summarise the data into a more condensed form, descriptive statistics were used to simplify the identification of patterns in the data.

The primary data were collected from a sample of 236 respondents by means of an online questionnaire using a convenience sample of Nelson Mandela Bay residents. A proposed conceptual model was compiled and tested using exploratory factor analysis. The results of the study indicated that the Awareness factor should be broken down into three sub-factors, Recycling Awareness, Energy Awareness and Awareness Practices. The same was discovered for the Planning factor, which was divided into five sub-factors, Conservation Planning, Eco Planning, Community Planning, Infrastructure Planning and Basic Service Planning. The results for the factor, Citizen Centricity, indicated that it too should be further divided into three sub-factors, Citizen Centric Data, Citizen Centric Collaboration and Citizen centric Investment.

The factors Awareness, Knowledge, Challenges, Leadership, Planning and Citizen Centricity determine Nelson Mandela Bay residents sustainable awareness. The results indicate that the younger population of Nelson Mandela Bay residents are more aware than their older counterparts, without much deviation between income group levels or educational levels. However, despite being more aware of sustainability, neither population showed a serious commitment to exercising sustainable city practises.

Keywords: Nelson Mandela Bay (NMB), Sustainable awareness, Sustainable cities.

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Chapter One. Introduction and Problem Statement

1.1 Introduction

Traditionally, Africa's population predominantly resided in rural areas, however, Africa has recently seen a 3.3% average annual urbanisation rate (Lepczyk, Aronson, Evans, Goddard, Lerman & MacIvor, 2017). This now makes Africa the fastest growing urbanisation region globally (Lepczyk et al., 2017). The United Nations (UN) (2015c) report identifies how African economies are for the first time starting to display signs of high productivity, improved standards of living and job growth. The UN (2015a) add that these developing economies act as growth creators, which drive development in African cities. The basis for sustainable development for both rural and urban African cities is created by progressive, spatial and socio-economic linkages (Cobbinah, Erdiaw-Kwasie & Amoateng, 2015).

The Organisation for Economic Co-operation and Development (OECD) (2013) has identified that with the rapid migration to urban areas, the cities that provide the necessary resources for human life will face substantial challenges concerning the environment and social sustainability. The OECD (2013) has further suggested that the current form of modern-day cities can be viewed as recipe for social and environmental problems. According to Bibri and Krogstie (2017), cities are responsible for 70% of the world's resources consumption. Which places them at the top of the list for consuming energy resources and greenhouse gas emissions. This is due to the concentration of urban populations in cities and the increasing intensity of economic and social activities found in cities (Bibri and Krogstie, 2017).

Mason (2018) highlights the importance of understanding the awareness of citizens about the problems of modern cities. Understanding citizens' awareness means that government is able to understand what its citizens need to do, why they need to do it, how they need to do it and where they can access guidance. Mason (2018) adds that improving the awareness of citizens will be able to assist with changes in management by increasing the commitment towards the adoption of a sustainable city.

Despite the fact that governments and in particular the South African government, understand the need for and is committed to the development of sustainable cities, a key fundamental variable is often forgotten. This independent variable is awareness and in

particular the lack of awareness of citizens when governments implement sustainable city models for sustainability. Therefore, this treatise aims to measure the awareness of the citizens of Nelson Mandela Bay regarding sustainability and then to establish what measures and solutions can be put in place to improve the awareness of citizens.

1.2 Introduction to Sustainable Cities

Hembd and Silberstein (2011) identify that the concept of sustainable development began to emerge during the mid-1980s. This concept encapsulated a multitude of city agendas such as rural and urban economic structures, industrial and agricultural demands and the rapidly evolving component of technology. The World Commission on Environment and Development (1987, 37) defined sustainable development as, "The development that meets the needs of the present without compromising the ability of future generations to meet their own needs".

Höjer and Wangel (2015) discuss how sustainable cities have the ability to deliver the foundation for converting societies into low carbon economies, which increases socio-economic benefits. At the same time, Ericsson (2013) mentions that the smarter use of resources and Information Communication Technology (ICT)-enabled services, such as e-health, e-education and telecommuting, will have a dramatic impact on CO_2 emissions. Today, 70 percent of CO_2 is generated in cities, so as cities grow so does their role in reaching global goals of cutting emissions in half by 2050 (Ericson, 2013).

Cities presently and cities of the future need to adopt sustainable building and transformation practices that can meet the demands of their population's needs and do so in way that does not exploit the environment, but preserves it and uses it to advantage (Höjer and Wangel, 2015). Environmental research supports the view that our environment and the planet are adversely impacted by humanity's lifestyle choices, which are primarily based on the consumption of goods and services (Ericson, 2013).

Ericsson (2013) defines a sustainable city as one that takes an intelligent and long-term collaborative approach to undertaking economic, social and environmental challenges that are the cause of increasing urban population putting pressure on already scarce available resources. For a city to become sustainable, it needs to adopt a long-term, intelligent collaborative approach across all sectors of a city's economic activities, including automotive

and transport, health, education and banking (International Telecommunications Union (ITU) 2015).

Modelling solutions for sustainable cities come in a variety of shapes and sizes. The United Nations Economic and Social Council International Telecommunications Union (UNECE–ITU) (2015) report on Smart Sustainable Cities Indicators identify that one model that has been a leader in terms of sustainability is intelligent buildings. These intelligent buildings make use of connectivity for their security, energy and monitoring of the climate. Intelligent buildings have transitioned over to become net producers of renewable energy.

One of the technologies associated with intelligent buildings is that of smart meters, which are used in intelligent buildings, are able to provide consumers with the knowledge they need to control their energy costs. Another component of sustainable cities are city food initiatives, which provide citizens with the ability to choose healthy and appetising food that was grown with low carbon and water footprints (Ericsson, 2013). Sustainable cities solutions can offer:

- New types of employment opportunities that drive cities GDP.
- Ability to optimise and implement renewable energy consumption.
- Shift government services to the digital e-services environment.
- Ability to raise business, consumer and organisational awareness on their impact on the environment and society (Ericsson, 2013).

According to the Nelsonmandelabay.gov. (2015), the South Africa government has shown commitment to good governance and elevation of previously disadvantaged communities. Communities with these circumstances are the most vulnerable to changes in the environment, for example, climate change, loss of biodiversity and exploitation of natural resources. Recent national events such as energy shortages that resulted in load shedding, in addition to changes in weather patterns and water shortages have shown the impact of unsustainable use of natural resources on civil society (BEPP Situational Analysis of NMB, 2018).

In order to make use of natural resources more effective, a shift to sustainable production and consumption practices must become common practice (Nelsonmandelabay.gov, 2015). The South African government is the largest buyer of goods and services in the country with 11-15% of the national Global Domestic Product (GDP) of NMB being spent on public purchasing (Department of Environmental Affairs and Tourism (DEAT), 2008). With such

significant market power, government is in a prime position to promote the use and development of environmentally friendly products and business activities through public procurement policies that encourage development and the use of environmentally sound goods and services (World Summit on Sustainable Development, 2002).

According to the Built Environment Performance Plan (BEPP) Situational Analysis of NMB (2018), NMB recognises the need to manage natural resources more effectively and responsibly in order to ensure positive effects on citizen health, quality of life and even the cost of living. As a result, the NMB has embarked on developing a green procurement implementation strategy to be incorporated into the NMB's procurement activities. Green procurement applies to the indirect furtherance of social and environmental issues (NMBM Green Procurement Implementation Strategy, 2011).

A study by Gudipudi, Ludeke, Zhou, Zhu, and Kropp (2018) was conducted amongst southern and eastern European cities and discovered that in order for these cities to decrease their current environmental burden and improve socio-economic conditions, a combined approach of both top-down and bottom-up strategies would need to be adopted (Gudipudi et al., 2018). The top-down strategies include:

- Efficiently improving city transportation, for example encouraging non-motorised transportation in order to decrease emission;
- Rethinking how water is managed and used in order to decrease losses and reduce waste; and
- Adopting reuse and recycling strategies, which decrease waste generation.

Bottom-up strategies follow a different perspective. These strategies aim to address awareness and attitudes of citizens towards energy and resource consumption, which is critical to achieve sustainable development goals (Pradhan, Costa, Rybski, Lucht, & Kropp, 2017). Gudipudi et al. (2018) identify that citizens' awareness and perception about the quality of city life is critical when conducting a sustainable city study. The study mentioned above, clearly indicates that citizens' awareness and perception of quality of life within cities are not confined to merely socio-economic factors but crucially include a core vision towards sustainable urban development (Gudipudi et al., 2018).

Gudipudi et al. (2018) and Pradhan et al. (2017) also concluded that their studies found that awareness and perception relating to the quality of life in urban areas reflects socio-economic

well-being and imposes a lower burden on the environment. Strategies which are not environmentally damaging should be encouraged as this practice will therefore improve socio-economic well-being within urban areas and will not negatively influence overall awareness and perception of citizens about the quality of urban life.

In this exploratory study, the focus will be on the factors that influence the awareness of NMB residents' insights towards sustainable cities, which leads to a conceptual model being developed and tested. The following section of this chapter (Section 1.3) will present the study's Problem Statement that will be framed and expanded. Thereafter the Research Objectives (Section 1.4) and Questions (Section 1.5) will be stated. The Research Delimitation (Section 1.6) and key concepts will be explained. This will be followed by the Research Significance (Section 1.7), the Research Methodology and Design (Section 1.8), Data Analysis (Section 1.9) and Ethics (Section 1.10). The chapter concludes with an overview of the structure of this treatise. The overview of Chapter One can be seen in Figure 1.1.

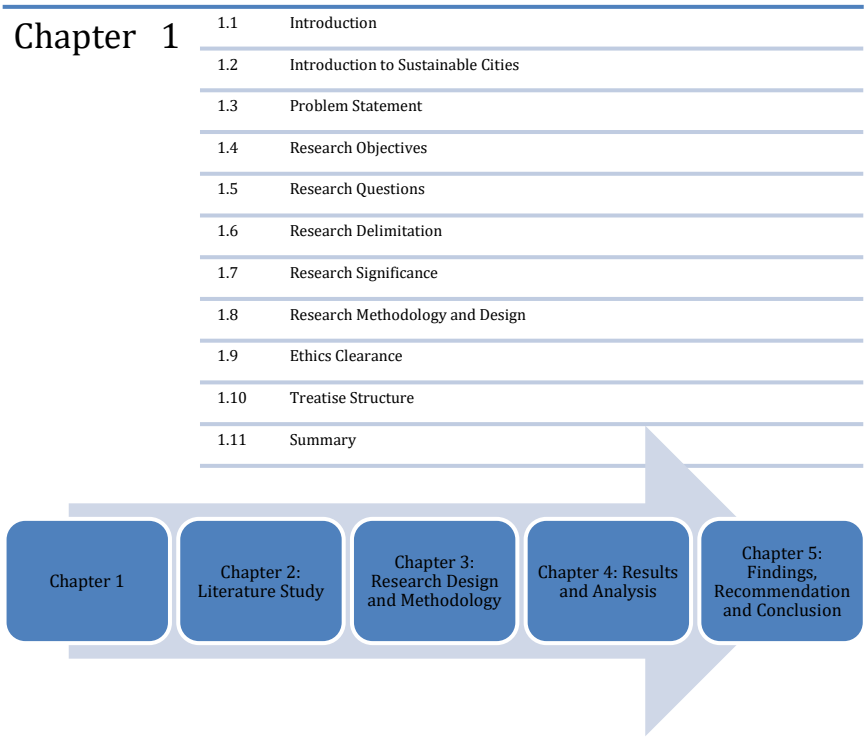

FIGURE 1.1: OVERVIEW OF CHAPTER ONE (AUTHORS OWN CONSTRUCTION)

1.3 Problem Statement

The Constitution of South Africa (1996) makes provision in the Bill of Rights for the protection of the environment for both the present and future generations through the prevention of pollution and ecological degradation (Act 108 of 1996). Further discussed in the Bill of Rights is the promotion of conservation and securing sustainable ecological development, while promoting economic and social development (Hanks, Davies & Perera, 2008).

Currently South African cities are growing in a resource-intensive way that is causing them to suffer from inefficient practices across multiple sectors such as; the provision of energy, the management of food supplies, water, waste and transport management (State of South African Cities Report, 2016). The current silo approach to planning and delivery in South African cities is inefficient and increases risks of exclusion (Behrens and Wilkinson, 2003).

Girardet (2004) states that cities should pursue spatial transformation, which encourages compact cities and sustainable neighbourhoods that value natural and open spaces (Girardet, 2004). Sustainability and growth are interdependent and so sustainability must be fundamentally embedded in a city's development paradigm and not just in its long-term visions and strategies. Cities need to tackle resource efficiency aggressively (SACN, 2016).

As discussed in the introduction, sustainability awareness and education are key components to the success of implementing a sustainable city model. When citizens understand what they need to do, why they need to do it, how they need to do it and where they can access guidance, the possibility of a city becoming a sustainable one is greatly improved. Improving the sustainable awareness levels of citizens, provides citizens with the understanding about what has to be done, when it needs to be done and will encourage an increased commitment of citizens, who form part of the urban environment to change their practices to more sustainable ones. Research has shown that when sustainable information is not available or not actively communicated, it becomes very difficult for people to effectively implement sustainable city practices. This results in the problem statement for this treatise indicated below.

Problem Statement: Nelson Mandela Bay residents are unaware of the factors that influence the sustainability of the city.

1.4 Research Objectives

The investigation into Nelson Mandela Bay Residents Sustainable Awareness levels has resulted in the following research objectives. The main research objective **(RO_M)** of this study is as follows:

- **RO_M:** *To determine the awareness of residents of Nelson Mandela Bay concerning city sustainability.*

In order for the above main research objective to be achieved the following secondary objectives need to be achieved:

- **RO_1:** *To determine the definition of sustainable cities*.
- **RO_2:** *To conduct a review of existing sustainable city models and investigate the factors that affect residents' awareness of sustainable cities*
- **RO_3:** *Explain the components of the research methodology for this study*.
- **RO_4**: *To determine the awareness of Nelson Mandela Bay residents of factors influencing sustainable city awareness.*
- **RO_5:** *Identify the key factors to improve Nelson Mandela Bay residents' awareness of city sustainability.*

1.5 Research Questions

The main research question (**RQ_M**) was formulated based on the main research objective **(RO_M)** and is stated as follows:

- **RQ_M**: *How aware are Nelson Mandela Bay residents' of the factors that influence the sustainability of the city?*

In order to address the main research question effectively, the following secondary research questions need to be addressed based on the secondary research objectives identified in the above section (Section 1.4):

- **RQ_1:** What is the definition of city sustainability awareness?
- **RQ_2:** What factors can be used to evaluate residents' awareness of sustainable cities?
- **RQ_3**: What research methodology can be used for this research study and be replicated in the future?
- **RQ_4:** What factors influence the residents' awareness of sustainable cities?

- **RQ_5:** Which factors influence Nelson Mandela Bay residents' city sustainability awareness?

The research questions, research objectives and the various chapters in which they are addressed are linked in the simplified research alignment plan illustrated in Table 1.1.

Research Question (RQ)	Research Objective (RO)	Chapter
RQ_1: What is the definition of city sustainability awareness?	**RO_1:** To determine the definition of sustainable cities.	**CHAPTER 2:**
RQ_2: What factors can be used to evaluate residents' awareness of sustainable cities?	**RO_2:** To conduct a review of existing sustainable city models and investigate the factors that affect residents' awareness of sustainable cities.	**CHAPTER 2:**
RQ_3: What research methodology can be used for this research study and be replicated in the future?	**RO_3:** Explain the components of the research methodology.	**CHAPTER 3:**
RQ_4: What factors influence the residents' awareness of sustainable cities?	**RO_4:** To determine the awareness of Nelson Mandela Bay residents of factors influencing sustainable city awareness.	**CHAPTER 4:**
RQ_5: Which factors influence Nelson Mandela Bay residents' city sustainability awareness?	**RO_5:** Identify the key factors to improve Nelson Mandela Bay residents' awareness of city sustainability	**CHAPTER 5:**

TABLE 1.1: RESEARCH ALIGNMENT PLAN

1.6 Research Delimitation

As the study focuses on Nelson Mandela Bay residents' awareness of factors affecting sustainable cities, the factors and variables are deemed interchangeable. The study will be open to residents' of Nelson Mandela Bay and visitors to Nelson Mandela Bay. Residents' of

Nelson Mandela Bay include those who currently reside in the city and those who have previously lived in Nelson Mandela Bay and who can provide direct feedback of their experiences while living in Nelson Mandela Bay. The awareness of Nelson Mandela Bay residents' and their experiences while living in Nelson Mandela Bay will be analysed.

1.7 Research Significance

The research investigation aims to gain insight into citizens' perceptions of factors affecting sustainable cities, which are currently not known.

The research will be significant in identifying the following:

- Sustainable city factors, and
- Determining Nelson Mandela Bay residents' awareness on sustainability.

1.8 Research Methodology and Design

The research methodology will address the research approach, data collection and data analysis.

1.8.1 Research Approach

Due to the aims and objectives of this treatise, a research methodology and design approach of a quantitative and descriptive nature has been selected for the purposes of the study. This selection is justified by the fact that the awareness of citizens' forms part of an objective reality of quantitative analysis through statistical and other numerical measures.

1.8.2 Literature Review

A literature review provides the base for this research. The literature review provides insight into the importance of sustainable city awareness, knowledge and challenges facing sustainable cities. It also deals with the leadership and planning process required for sustainable cities and the growing importance of citizen centricity. These topics provide the identification of factors for sustainable cities.

The primary data were collected by means of quantitative statistical techniques by means of an on-line questionnaire (Appendix D), which collected the responses from the sample group. The questionnaire was structured to ask participants to rate their responses to questions based on a 5-point Likert scale (1 = Strongly Disagree and 5 = Strongly Agree). The

questionnaire also included questions which required the respondents to agree or disagree with certain statements. A computer software package called Statistica was used in order to perform the quantitative statistical analysis of the data collected. The NMU statistician, Dr Danie Venter, categorised and cleaned the quantitative data in order to analyse the data.

1.9 Ethics Clearance

Collis and Hussey (2009) identify that typically in research that involves human or animal subjects it is a generally an accepted practice to obtain ethical clearance. The research process embarked upon should adhere to certain acceptable standards. This is the main purpose of obtaining ethical clearance (Cooper & Schindler, 2011). Some of the aspects addressed by these standards are the rights and welfare of research subjects around issues such as informed consent, confidentiality of data and limitation of possible risks to people involved in the research (Collis & Hussey, 2009).

The Ethics Clearance approval documentation Form E (Appendix B) was submitted to the NMU Business School. Full ethics clearance was not required for this study as no vulnerable groups were involved.

1.10 Treatise Structure

The research objectives, questions and the overview of the chapters of the treatise can be seen in Figure 1.2.

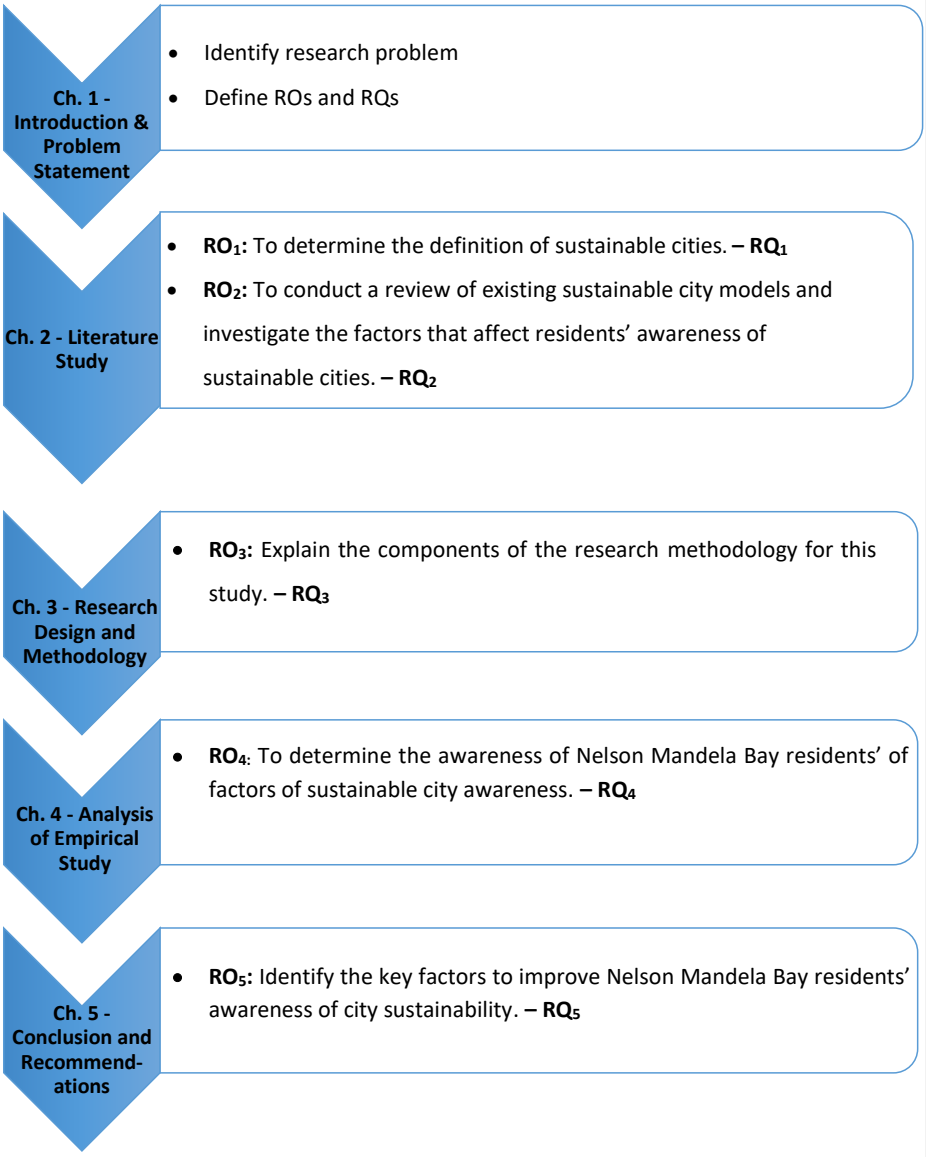

FIGURE 1.2: CHAPTER ONE OVERVIEW

Chapter 1: Introduction, Problem Statement, Research Objectives and Research Questions

Chapter One provides the layout of the study and introduces the research subject. The research problem, research questions and research objectives are presented. Key assumptions are made and the research methodology is explained. The delimitations, the significance of the research topic, a research alignment plan and the proposed chapter headings of the treatise are provided.

Chapter 2: Literature Study

Chapter Two will identify the global factors of sustainable city awareness with a more specific investigation into the factors pertaining Nelson Mandela Bay residents' awareness levels. Chapter Two will two address the following two RQs, **RQ_1:** What is the definition of city sustainability awareness? And **RQ_2:** What factors can be used to evaluate residents' awareness of sustainable cities? The two ROs that needed to be achieve were **RO_1:** To determine the definition of sustainable cities and **RO_2** To conduct a review of existing sustainable city models and investigate the factors that affect residents' awareness of sustainable cities.

Chapter 3: Research Design and Methodology

Chapter Three will discuss and outline the research methodology for this study. In so doing, the specific research paradigm, the sampling design, the measuring instrument, the collection and analysis methods as well as the measures employed to insure the validity, reliability and generalisability of the research findings are determined and discussed. Chapter 3 will address research question **RQ_3**: *What research methodology can be used for this research study and be replicated in the future?* Which will help achieve the research objective *explaining the components of the research methodology for this study* (**RO_3)**.

Chapter 4: Data Analysis of the Empirical Study

Chapter four will address research question: **RQ_4:** *What factors influence the residents' awareness of sustainable cities?* Which corresponds to **(RO_4):** *To determine the awareness of Nelson Mandela Bay residents of factors influencing sustainable city awareness.*

Chapter 5: Conclusion and Recommendations

Chapter Five will address **RQ_5:** Which factors influence Nelson Mandela Bay residents' city sustainability awareness? Which correlates to: Identify the key factors to improve Nelson

Mandela Bay residents' awareness of city sustainability **(RO_5)**. This final chapter will summarise the findings of this treatise by discussing every research question and the outcome thereof. A summary of the contributions and opportunities for future research will be identified and discussed and any possible limitations will be stated.

1.11 Summary

This chapter provided the background to the study to be conducted, the location in which the study will be performed and the need for the study with the questions and objectives to be reached. An overview of the paradigm of the research study is presented together with the concepts and key definitions. The research method and approach were discussed together with the method of data collection and data analysis.

This chapter concluded with a reported structure and the research alignment plan that will be used and illustrated in every chapter and will highlight every research question and research objective. The next chapter, Chapter Two addresses the first four research questions and their corresponding research objectives. This is achieved by a detailed literature study.

Chapter Two. Literature Review

2.1 Introduction

A formal outline in Chapter One provided the purpose, background and awareness of the concept of city sustainability. Chapter One also provided the purpose for the study, the main research questions and the research objectives. Additionally, Chapter One introduced the research problem and identified the research questions and research objectives that are to be investigated in Chapter Two.

The main objective of Chapter Two is to review literature on sustainable cities and their residents' awareness thereof. Lessons from international studies, national studies as well as studies pertaining to sustainability awareness in other cities will be used. The literature review should provide the context and understanding for this study, to identify the factors of a conceptual model for Nelson Mandela Bay as a sustainable city. The following research question is going to be addressed in the literature review.

- **RQ_2:** What factors can be used to evaluate residents' awareness of sustainable cities?

The research question above will be addressed by satisfying the following research objective:

- **RO_2:** To conduct a review of existing sustainable city models and investigate the factors that affect residents' awareness of sustainable cities

At the end of each of the six sub-sections (2.2 – 2.7) the author will indicate that the sub-section form the basis for an independent variable of this study. The objective of this chapter is to identify the independent variables that could have an influence on the dependent variable, identified for this study, namely Nelson Mandela Bay - Sustainable City. The dependent variable 'Sustainable City' refers to Nelson Mandela Bay being classified as a sustainable city. Figure 2.1 provides the layout overview for Chapter Two.

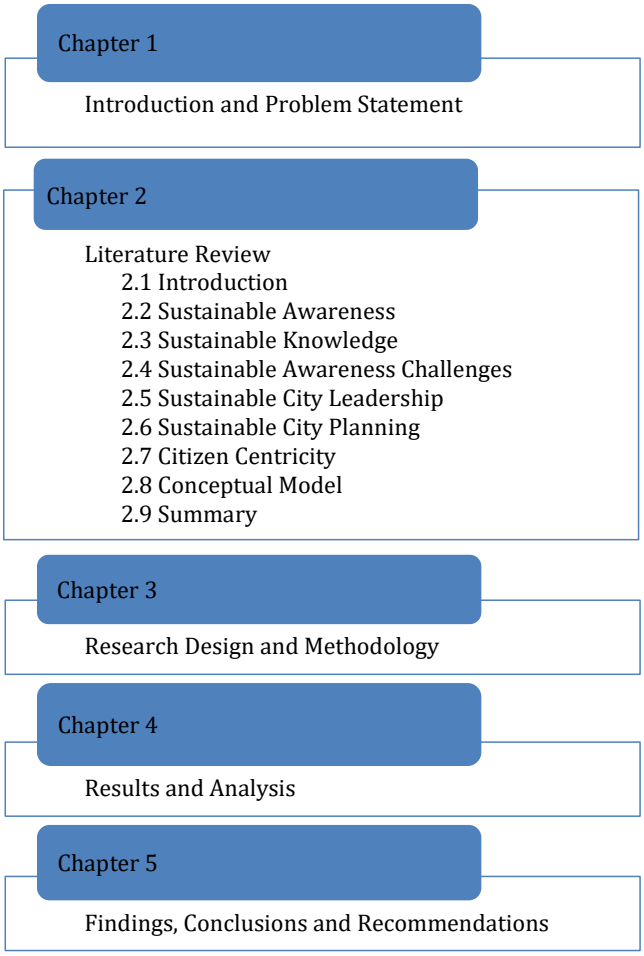

FIGURE 2.1: OVERVIEW OF CHAPTER TWO

City Sustainability

Sustainability and sustainable development both remain serious agenda concerns for global leaders (Hamid, Ijab, Sulaiman, Anwar, & Norman, 2017). However, despite the fact that these concerns about sustainability are at the top of agendas for global leaders, there continues to be limited signs of progress towards achieving viable sustainable solutions (Hamid, et al., 2017). Ericsson (2013) identifies a sustainable city as one that takes an intelligent, long-term collaborative approach to face the economic, social and environmental challenges that arise

due to the pressure on already scarce available resources in cities. According to Hassan, Noordin and Sulaiman (2010), a relationship exists between the practice, attitude, value and level of environmental awareness within sustainable cities.

Citizen awareness

Hassan et al. (2010) identify that there is one underlying critical factor that affects city sustainability, which is the concept of awareness. Juraite (2002) describes the concept of environmental awareness as displaying socially conscious behaviour in one's day-to-day activities in a socially responsible manner. The issue many developing countries face is not the development of sustainable initiatives but the education of their citizens on the importance of adopting a sustainable mind-set (Juraite, 2002). Further, Hamid, et.al. (2017) discuss how the improvement of environmental education has the potential to lead people to a relational change in behaviour towards the environment. With reference to this study, residents' awareness of Nelson Mandela Bay as a sustainable city is measured along with the factors that contribute towards a sustainable city.

Nelson Mandela Bay

Nelson Mandela Bay (NMB) is geographically located on the south-east coast of South Africa in the Eastern Cape. The formation of Nelson Mandela Bay as a metropolitan was in 2001, which covers an administrative area of Port Elizabeth, Uitenhage and Despatch (BEPP, 2018). According to STATS SA (2017), Nelson Mandela Bay has a population of 1 271 776, which is approximately 17% of the population of the Eastern Cape Province. STATS SA (2017) further indicated that the municipality had a growth rate of 1.36%, lower than that of Ekurhuleni (2.47%) and Tshwane (3.1%) metropoles and is characterised by a younger population (STATS SA, 2017).

According SACN (2016) Nelson Mandela Bay has the lowest proportion of informal households among South African Metropolitan Municipalities, having significantly reduced the numbers since 2001. In addition, SACN (2016) identified in 2011, that there was a decrease from 46% to 29% in the total number of people living below the poverty line. Nelson Mandela Bay as a Sustainable City forms the basis as the dependent variable for this study.

Theories that underpin this study

According to research by Juraite (2002) and Andrius (2013), environmental behaviour is described as socially conscious behaviour, which is based on social responsibility. This includes both individual and social motives that a person wants to achieve by behaving in a particular way (Juraite, 2002; Andrius, 2013). This suggests that for people to accomplish what they intend to achieve, their actions will be influenced by their intentions and motivations with hope of fulfilling their expectations (Joachim, Kamarudin, Aliagha, & Ufere, 2015). With reference to environmental consumer behaviour and concerns, the theories of Planned Behaviour (TPB) and Value Belief Norms (VBN) are considered (Juraite, 2002; Andrius, 2013).

The unique attribute of these two theories is the behavioural intentions, motivations, values and norms form the building blocks in predicting actual human behaviour (Joachim, et al., 2015). Andrius (2013) identifies how behavioural intentions have been viewed as an indication of an individual's willingness to carry out a given behaviour. A study by Nurul and Zainul (2013), revealed how changes in behaviour and motivation come about through a psychological process that initiates, guides and maintains goal-oriented behaviours in individuals.

The Theory of Planned Behaviour (TPB) (Ajzen, 1991) started as the theory of Reasoned Action (TRA) in 1980 (Nurul & Zainul, 2013). According to (Joachim, et al., 2015; Ajzen, 1991), the TPB is used to differentiate two determinants that predict behavioural intentions and motivations. These are personal attitudes towards behaviour and subjective norms, which are elements of Stern's Value Belief Norm (VBN) theory (Joachim, et al., 2015; Linda, Nisreen, Mayuresh, & Nicole, 2011). Personal attitudes can be a positive or negative assessment of a particular behaviour, and are formed by a person's behavioural beliefs (Joachim, et al., 2015). Subjective norms are a person's perception of social pressure regarding the performance of behaviour (Linda, et al., 2011). From this analysis, the defining framework for the TPB and VBN is shown in Figure 2.2.

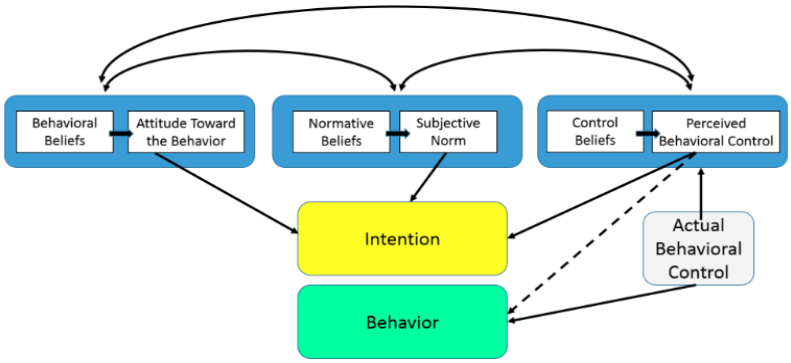

FIGURE 2.2: FRAMEWORK FOR THE THEORY OF PLANNED BEHAVIOUR (LINDA ET AL., 2011)

The subjective norm starts from values, which form the basis for belief. This in turn underlines the norms, which dictate behaviour as suggested by Stern, et al. (1999) in the Value-belief norm theory (VBN). Joachim, et al. (2015) suggest that the application of the two behavioural theories could increase the awareness of pro-environmental habits, attitudes and knowledge and arouse expectations and beneficial factors that could motivate residents' to be more aware of their sustainable actions to promote sustainability for the benefit of future prospects.

2.2 Defining Sustainable Awareness

Sustainable development remains one of the most encouraging development concepts worldwide, yet, there continues to be limited signs of progress towards its achievement in Africa (Hamid et al., 2017). Recent studies identify rapid and unplanned urbanisation as a major threat. Africa is expected to become a home to nearly quarter (1.3 billion) of the world's urban population in 2050. Research into the consequences of urbanisation on the functionality of the region's urban environment is urgent and indeed critical (Cobbinah et al., 2015).

According to Hamid et al. (2017), awareness of environmental sustainability is one of the prerequisites for a change in attitude towards the environment. A change in attitude and behaviour in caring for the natural environment in the face of impending climate change and global warming is essential. An initiative taken on by the Nelson Mandela Bay municipality called the NMBM Green Procurement Implementation Strategy (2011), set out to improve the sustainability of local government projects.

The United Nations (UN) (2015b) report discusses how environmental awareness and sustainability are not only environmental problems but also ethical and social issues that both the old and the new generations need to consider for the reduction and minimisation of further negative impacts on the environment. The improvement of education has the potential to lead people to a relational change in behaviour towards the environment. McKenzie-Mohr (2000) draws attention to two perspectives that are found in relation to behavioural change in terms of creating awareness for environmental sustainability.

The first perspective assumes that changes in behaviour are brought about by increasing public knowledge by raising awareness regarding an issue and by fostering an appropriate attitude. The second perspective proposes that individuals systematically review their choices and then act in their economic self-interest without the need to have enough knowledge and awareness in the first place (McKenzie-Mohr, 2000).

A theoretical and empirical study conducted by Hamid et al. (2017) confirmed that behavioural change may indeed be caused by activities with the objective of raising awareness. Theoretical studies, such as the Transtheoretical Model (TTM) (Prochaska & Velicer, 1997) and empirical research by Swaim, Maloni, Napshin & Henley (2014) have confirmed that increasing awareness about environmental sustainability is one of the keys for behavioural change.

According to the NMBM Green Procurement Implementation Strategy (2011), improving information and awareness is vital to ensure that citizens understand what they need to do, why they need to do it, how they need to do it and where they can access guidance. Hamid et.al. (2017) add to this, by highlighting the importance of education globally as it has the ability to shape and shift the minds of people in terms of environmental awareness. If clear information is not available and is not actively imparted then it is very difficult to expect people to effectively implement sustainable practices (NMBM Green Procurement Implementation Strategy, 2011).

The following thirteen items pertaining to sustainable awareness will be discussed below: Green Energy (Section 2.2.1), Solar Energy (Section 2.2.2), Grid Connection Home Wind and Solar (Section 2.2.3), Public Transport (Section 2.2.4), Cycle to work and public walking tracks and bikeways (Section 2.2.5), Environmentally Friendly Products (Section 2.2.6), Household Waste Recycling (Section 2.2.7), Reusable Shopping Bags (Section 2.2.8), Biodiesel (Section

2.2.9), Water Conservation (Section 2.2.10), Water Recycling (Section 2.2.11), Solar Hot Water (Section 2.2.12) and Chemicals in Storm Water Drains (section 2.2.13).

2.2.1 Green Energy

Due to rapid growth in the use of conventional fuel and rising energy prices and environmental constraints caused by the use of fossil fuels, there has been a shift by consumers and organisations to find alternative methods for satisfying fuel and energy needs (UNEP, 2011). Mekhilef, Saidur and Safari (2011) highlight that households and industries, can significantly reduce their greenhouse emissions by applying alternative systems of renewable energy.

Energy use has become a crucial concern in the last decade because of rapid increase in energy demand. Moreover, environmental issues, the looming decline in conventional energy resources and threats to living conditions, such as climate change and global warming are continuously forcing the exploration of alternative sources of energy (Mekhilef, Saidur & Safari, 2011). Renewable energy sources like solar, wind, biomass, hydropower and tidal energy are promising CO_2 free alternatives (Schnitzer, Christoph & Gwehenberger, 2007). Despite the general awareness the advantages of the use of renewable energy, this source of energy contributed only about 1.5% of world energy demand in 2006 (Bazen & Brown, 2009).

The UNs' (2015c) report on the World Economic and Social Survey identified that access to cleaner energy sources is fundamentally linked to economic development and vice versa. Countries with a higher gross domestic product (GDP) per capita are linked with the greater use of electricity by above 60 per cent of the urban population (Satterthwaite & Sverdlik, 2013). The World Economic and Social Survey (2013) also found that, overall in developing countries, there are about 680 million people who do not have access to modern fuels used for cooking. The use of these cheap fuels increases the strain on the environment due to deforestation, pollution, health risks, energy cost and time burden (Mekhilef, Saidur & Safari, 2011). It is often the case that poor people often have to spend large amounts of their time travelling to purchase or gather these fuels (Satterthwaite & Sverdlik, 2013).

2.2.2 Solar Energy

The Sun, like water and air is one of the Earth's life support systems, providing heat and light. Solar energy, which is renewable, widely available, abundant and clean, provides enough

energy to meet the world's annual consumption needs every 50 minutes (Mekhilef, Saidur & Safari, 2011). The challenge however, is the ability to capture this energy potential (Binali, 2017).

A publication by Walwyn and Brent (2015) discusses two major technologies that have been developed to capture and harness solar energy:

- Photovoltaic solar technology, which directly converts sunlight into electricity by using panels made of semiconductor cells; and
- Solar thermal technology, which captures the sun's heat. This heat is used directly or converted into mechanical energy and in turn electricity, known as concentrated solar power (CSP).

Schnitzer et al. (2007) describe the two different types of installations that are currently used to capture solar energy and convert it into electricity:

- Individual systems for homes or small communities. Photovoltaic panels can power electrical devices, while solar thermal collectors can heat homes or hot water; and
- Photovoltaic or concentrated solar power plants that cover hundreds of acres produce electricity on a large scale, which can be fed into power grids.

The reason why solar energy is one of the most attractive renewable energies is its flexibility (Bazen & Brown, 2009). It has the capacity to power cities and industry by using large solar plants while at the same time offers a stand-alone capability in the most isolated rural regions (Binali, 2017).

2.2.3 Grid connection to home, wind and solar power

There is a growing trend globally, where people are powering their homes or small businesses using a small renewable energy system that is not connected to the electricity grid. This type of energy system is referred to as stand-alone or off-the-grid system (Energy.Gov, 2018). These systems are also used by people who live near the grid and wish to obtain independence from the power provider or demonstrate a commitment to non-polluting energy sources (UNEP, 2005).

The Energy.Gov (2018) has shown that in remote locations, stand-alone systems can be a more cost-effective solution, instead of extending a power line to the electricity grid. This becomes particularly appealing in Africa where often the electricity grid does not reach

certain rural areas where electricity is required (Satterthwaite & Sverdlik, 2013). Energy.Gov (2018) adds that successful stand-alone systems generally take advantage of a combination of techniques and technologies to generate reliable power, reduce costs and minimise inconvenience.

While renewable energy systems are capable of powering houses and small businesses as stand-alone options, the SACN (2016) report discusses that many people prefer the advantages of having a hybrid system electricity solution. A hybrid system according to the Department of Energy Affairs (DEA) (2011) and Energy.Gov (2018) refers to how a grid-connected system allows for the powering of a home or small business with renewable energy during those periods when the sun is shining, the water is running, or the wind is blowing. Any excess electricity produced is fed back and distributed into the grid. When the conditions are not favourable for renewable energy, electricity from the grid is used to meet the electricity requirements (Energy.Gov, 2018).

The Department of Energy (DOE) (2011), South Africa, considered off-grid options due to the limitations of grid system infrastructure, mainly transmission and distribution system availability to remote rural areas. To electrify the sector through the grid, many challenges are being faced by the national electricity supplier (Eskom) including:

1. More than 95% of all non-electrified households are from a low-income group (i.e. annual income around ZAR 50,000.00). For them, payment of connection charges is obviously difficult (Department of Energy (DOE), 2013; University of South Africa, 2012).

2. About 31% of the South African population lives in rural areas of the country. In these areas, more than 60% of households have no access to electricity (Municipal Institute of Learning, 2013; Madzhie, 2013).

3. According to Eskom, 'the consumption levels of rural customers are so low that it is impossible to recover capital and operations costs from the tariffs alone. In most instances, it is not possible to recover operation cost' (Barnard, 2011).

4. The Integrated Energy Plan, developed by the DOE (2011), perceived further increase in the generation and operational costs of the system in future, which will

result in a further financial burden for the government if it opted only for the grid option.

2.2.4 Public Transport

Oxford (2013) mentions how the rapid growth of demand for transportation and high levels of car dependency have resulted in severe traffic congestion in most cities around the world. One of the most favourable solutions to deal with reducing traffic congestion is the use of Intelligence Transportation Systems (ITS) (Bouillet, Verscheure & Gasparini, 2011). The ITS has the ability to use sensor networks, communications and computing technologies to manage existing infrastructure and transportation systems more efficiently (Bouillet et al., 2011).

According to Oxford (2013), there is a problem with the social effectiveness of public transport. The reason for this is discussed by Tzvetkova (2017), who identified that the dynamic of urban traffic and the growing number of personal vehicles is the cause of inadequate social effectiveness of public transport. For example, in European cities, traffic is responsible for 40% of their CO_2 emissions and 70% of other air pollutant emissions (Madzhie, 2013). It has become a global strategy to define the challenges for cities worldwide to as they gear up to provide stable mobility and social effectiveness by facilitating traffic flow in cities, reducing environmental pollution and noise and improving the organisation, accessibility, security and safety of public transport (Tzvetkova, 2017).

With just over 24 years into democracy for South Africa, the dreams of efficient, affordable and integrated public transportation systems remain deferred (Oxford, 2013). A bleak and underwhelming picture is painted of captured users involuntarily using services that lack safety, services that are costly and services that are inaccessible for various reasons (SACN, 2016). Congestion on South Africa's road networks has peaked with nowhere to redirect car users for alternative transit (Mthimkulu, 2017). SACN (2016) breaks down how from an institutional perspective, public transport policies and plans, miss the necessary targets and densities to operate efficient and effective systems. The need for solutions that bring a direct positive impact to the South African public transport system is at a critical junction (Mthimkulu, 2017).

In an occasional paper for the Gauteng City-Region Observatory, Mubiwa and Annegarn (2013) provide a foundation for the conventional way in which public transport has been

delivered. Walters (2008) discusses the three dominantly used transport systems in South Africa:

- Passenger rail - which is primarily operated by the Passenger Rail Agency of South Africa (PRASA);
- Buses - which are provided at provincial scales but operate mainly at the metropolitan/city scale; and
- Mini-bus taxis (MBT) - which operate on a metropolitan scale with specific routes being used and monitored by the different associations and operators that exist.

MBT's remain marginally subsidised by the State although the industry transports the majority of commuters (70%) in relation to rail (10%) and buses (20%) (Walters, 2014).

The significance of public transport in South Africa is clearly shown with how households spend at least 2/3rds of their income on transport (SACN, 2016). The disparity of levels of efficient and affordable public transport for those who are in the lower income range of earners is one of the key challenges that require responding to (Mthimkulu, 2017).

Pillay (2001) states that the greatest challenge in the public transport industry within the South African context is that of diverse disciplines, which are involved in the design, planning, implementation, operation and maintenance of public transport systems working in silos rather than working in an integrated manner. There is a great threat to the objective of integrated public transport systems if the relevant industries are not in communication with each other (Mthimkulu, 2017).

2.2.5 Cycle to work, public walking tracks and bikeways

The introduction of a culture of bicycle commuting in South Africa has not come at a more critical period in our history. Many South Africans are presently involved in conflict and areas of concern on many levels regarding the environment, safety and transport (Arrive Alive, 2016).

The problem is that bicycling lanes alone do not create a commuter cycling culture. Scholars across a range of disciplines have written about transport's systemic dimensions (Morgan, 2017). Different elements – transport technology, industries, social groups and institutions – affect how people move around (Morgan, 2017). Infrastructure, habits, social norms and

knowledge also play a role. A transport system only works efficiently if all the different elements exist (Arrive Alive, 2016).

For eligible or potential bicycle users, it is believed that the type and quality of an EOTF (End-of-transport-facility) would influence their modal choice (Randall, 2016). Randall (2016) for example, describes how having a secure, covered bike rack and shower at work could encourage an employee to cycle instead of using his/her private car. Alternatively, an employee who currently enjoys cycling could choose a place of employment based on both the ability to cycle to work and the quality of the bicycle facilities (Morgan, 2017).

2.2.6 Environmentally friendly products

Environmental consciousness is described as concern for the safety and long-term condition of the environment (Kim & Damhorst, 1998). Many studies have indicated that consumers who are concerned about the environment tend to practise environment-friendly behaviours such as recycling and exhibit intentions to purchase environment-friendly products (Smith, Cho & Smith, 2016). Birgelen et al. (2009) for example revealed that consumers in Germany where there is a high level of environmental awareness tend to have positive attitudes toward beverages with environment-friendly packaging.

Suganya and Kavitha (2017) identify that the past decades have witnessed large-scale industrialisation that has resulted in rapid economic growth and increasing consumption all over the world. This in turn resulted in the deterioration of the environment due to exploitation of natural resources (Nagaraju & Thejaswini, 2014). Considering the importance of the environment, consumers around the globe started showing concern for environmental protection and started avoiding the products that are harmful to the environment (Suganya & Kavitha, 2017). Awareness of the destruction of natural resources has raised the issue of environmental protection, which in turn has created eco-friendly consumption called green consumerism (Moisander, 2007).

According to Mostafa (2007), green purchase behaviour refers to the consumption of products that are beneficial to the environment, recyclable and sensitive to ecological concerns. Consumers are becoming more and more aware of environmental issues and this has increased the demand for ecological products (Suganya & Kavitha, 2017). The quality of Green products' is also a cause of concern for most consumers. Green consumers generally

trust these brands and are not ready to compromise on quality (Nagaraju & Thejaswini, 2014). As there is an expectation on the part of customers that all products offered should be environmentally safe without a need to sacrifice quality, businesses must enhance green product quality as well as focus on environmental benefits of a product and share these aspects with customers in order to achieve the recognition in the market (D'Souza, Taghian & Lamb, 2006).

2.2.7 Household waste recycling

A properly managed, waste management service presents many developmental and economic opportunities for municipalities (Godfrey & Oelofse, 2017). The SA Cities Network (2018) identifies that landfilling is the current and most common method of solid waste disposal in South Africa, which is not sustainable. Therefore, cities need to develop alternative waste management options, which can also bring opportunities for job creation, energy generation and value addition through recycling (SA Cities Network, 2018).

Increasing population growth accompanied by rapid urbanisation and industrialisation has resulted in dramatic increases in the volumes of waste generated by modern societies (Godfrey & Oelofse, 2017). An increase in electricity and food consumption by humans and changing lifestyles generate a massive volume of domestic waste, which creates a critical problem in the developed and developing countries (Agbelie, Lemaire & Bawakyillenuo, 2015).

Strydom and Godfrey (2016) refer to a study conducted in 2010 by the CSIR, which was the first national survey on household waste recycling behaviour in South Africa. Strydom and Godfrey (2016) mention that the study was conducted to assess whether household recycling behaviour has improved over a five-year period. In 2015, the second national survey was conducted and the results showed that the percentage of dedicated recycling households in large urban areas has almost doubled over the five-year period (Godfrey, Phukubye & Strydom, 2016). However, the figure was still very low at 7.2%, with households in smaller towns and rural areas at only 2.6% (Godfrey et al., 2016).

The data also suggest that it is easier for recycling households to recycle more (quantity and diversity of recyclables), than for non-recycling households to start recycling (Godfrey & Oelofse, 2017). The challenge is therefore to find the triggers that will shift consumers'

willingness to recycle into actual recycling behaviour and then to put measures and services in place to support ongoing recycling behaviour (Agbelie et al., 2015).

2.2.8 Reusable shopping bags

According to Chance and Heward (2010), behaviour analysis has great potential to address the many behavioural contributions to a shifting global climate. One small step toward this end is to engineer consumer behaviour towards preference for sustainable products (Carlsson & Johansson-Stenman, 2012). One of the most visible attempts to shift consumers toward sustainable purchasing is the rise of retail stores offering and encouraging the use of reusable shopping bags (de Groot, Abrahamse & Jones, 2013). Many communities and local government agencies have begun to employ a variety of push and pull methods to force a reduction in the use of polyethylene - type single - use shopping bags (de Groot et al., 2013).

In the U.S. alone, over 250 ordinances have been passed banning outright single use shopping bags, while a range of other behavioural adjustments are being used, not limited to associated fees or taxes, consumer education and mandated distributor recycling programmes (Wagner, 2017). Communities that restrict bag use by charging fees or imposing bans have observed dramatic reductions in the use of plastics and current increases in reusable shopping bag applications (Martinho, Balaia & Pires, 2017).

Examining the subjective value of single-use bags in the light of impending taxes found that, on average, individuals in medium to upper tax brackets are more likely to begin using reusable bags when faced with contingent fees (i.e., push methods), as compared to methods intended to promote voluntary adoption of reusable bags (Dunn, Caplan & Bosworth, 2013). Further, participants reporting lower socioeconomic statuses indicated a far greater affinity for reusable bags when subsidisation was available, given the relative upfront costs associated with their use (Dunn et al., 2013).

2.2.9 Biodiesel

Biodiesel is a renewable, biodegradable fuel manufactured domestically from vegetable oils, animal fats, or recycled restaurant grease (REN21, 2012). Biodiesel meets both the biomass-based diesel and overall advanced biofuel requirement of the Renewable Fuel Standard (REN21, 2012). Worldwide biodiesel production increased from 17.8 billion litres in 2009 to 21.4 billion litres in 2012, a four-year increase of 20.2%, with most fuel being produced in the

European Union, although the use of biodiesel projects worldwide have been on the rise due to rising crude oil prices and concerns over global warming (Pruitt, Edgar & Johnson, 2013).

Biodiesel's benefit to industry is not to replace mineral diesel, but to help government policy with the most resulting benefits to South Africa (Pruitt et al., 2013). According to REN21 (2012), a community-based biodiesel distribution programme is one way of increasing the awareness and use of the fuel. A community-based biodiesel distribution programme can benefit the local economy, from the farmers growing the feedstock to local businesses producing and distributing the fuel to the end consumer (REN21, 2012). The money stays in the community while reducing the impact on the local environment and increasing energy security (Pruitt et al., 2013).

2.2.10 Water conservation

Although the 2014–2016 drought has catalysed a national conversation and, to some extent, brought water security into the policy debate in South Africa, the drought did not cause water scarcity (Donnenfeld, Hedden & Crookes, 2018). What the drought did was highlight existing vulnerabilities in South Africa's water system and properly frame the magnitude of the challenge of ensuring water security for the country (Donnenfeld et al., 2018). South Africa is a water-scarce country and has the ability to turn to existing affordable technologies that government, business and private individuals could employ, to help realign supply and demand while ensuring water security for future generations (Water Wise, 2018).

The implementation of water conservation and water demand management (WC/WDM) at municipal level has been inadequate for many years, despite South Africa being one of the driest countries in the world (Wegelin & Jacobs, 2013). This could be attributed to a lack of planning and not realising the consequences and potential benefits of water restrictions. Many South African municipalities do not have a WC/WDM strategy and business plan although many books, publications and software packages have been produced to assist water supply managers (DOE, 2013).

Most of the existing strategies are also vague and of little value and the municipalities do not have the necessary financial, technical and institutional capacity to support such a strategy (Otieno & Ochieng, 2007). Municipalities often fail to realise that most WC/WDM activities will pay for themselves and that financial institutions will fund these projects if a proper

business case could be compiled. Ironically municipalities have complained that they are unable to obtain funding while most financial institutions complain that they cannot find bankable projects because of the poor quality of the applications and strategies (Wegelin & Jacobs, 2013).

2.2.11 Water recycling

According to Donnenfeld et al., (2018), South Africa is currently overexploiting its renewable water resources. Moreover, withdrawals are forecast to increase in all three sectors (agricultural, industrial and municipal). Water resource managers and planners are now forced to think out-of-the-box to consider unconventional water sources, such as desalination of seawater and brackish groundwater, water reuse and rainwater harvesting, as additional water supply alternatives (Water Research Commission, 2016).

In an era where conserving water is growing ever more critical, given the shortage of fresh and drinkable water, recycling and reuse plays a pivotal role in driving sustainable solutions that will allow for the longevity of South Africa's water supply (Wilkinson, 2017). Raising awareness on this subject is imperative, as there is certainly a lot of room for organisations to implement water management practices in their operations, which must become integral to companies' overall business strategies (Wilkinson, 2017).

2.2.12 Solar hot water

The most energy intensive appliance in the home is the hot water cylinder or geyser. It is also the most expensive to run. Solar water heaters provide homes with the ability to be able to replace up to 100% of the electricity used to heat water. Solar water heating should be considered as one of the first steps in energy and cost savings, providing a better return on investment than other renewable energy saving or generating technology in the South African environment (Walwyn & Brent, 2015).

Paton (2018) discusses how the popularity of installed solar water heaters in South African households remains low, despite awareness regarding the potential benefits. Reasons cited are widespread and include, mixed feelings about the quality of products, lack of clarity relating to potential savings and unreliable installers or suppliers (Paton, 2018). A recent study by Buthelezi (2013) suggests that the demand for solar water heaters in South Africa is decreasing. Although there has been phenomenal growth in the supply of solar water heaters

since Eskom introduced its rebate programme in 2008, demand for this technology has not grown at the same rate as supply by the industry (Buthelezi, 2013).

2.2.13 Chemicals in storm water drains

Storm water management in the urban areas of South Africa has focused and continues to predominantly focus on collecting runoff and channelling it to the nearest watercourse. This means that storm water drainage currently prioritises quantity (flow) management with little or no emphasis on the preservation of the environment (Armitage, Vice, Fisher, Winter, Spiegel & Dunstan, 2013). The result has been a significant impact on the environment with the resulting erosion, siltation and pollution. An alternative approach is to consider storm water as part of the urban water cycle, a strategy, which is being increasingly known as Water Sensitive Urban Design (WSUD) with the storm water management component, being known as Sustainable Drainage Systems (SuDS) (Mguni, Herslund & Jensen, 2016).

SuDS attempts to manage surface water drainage systems holistically (Armitage et al., 2013). It aims to design for water quantity management, water quality treatment and the maintenance of biodiversity. In so doing, many of the negative environmental impacts of storm water are mitigated (Mguni et al., 2016).

Sustainable Awareness Summary

The thirteen items pertaining to sustainable awareness discussed above have been identified and are proposed to have a relationship with the dependent variable, NMB - Sustainable City, as depicted in Figure 2.3.

FIGURE 2.3: RELATIONSHIP BETWEEN AWARENESS AND NMB - SUSTAINABILITY

2.3 Sustainable Knowledge

The notion of knowledge for city sustainability awareness raises the question of how knowledge can contribute to the emergence of an alternative political economy, capable of replacing that which currently regulates and exploits so much of the world and its resources (M'kumbuzi, Ibsen & Halvorsen, 2015). To develop knowledge for this alternative, for sustainability, the representative forces who are seeking to transform the present economic

system need information, knowledge and support from researchers and educators (International Council for Science and International Social Science Council (ICS/ISSC), 2015).

All the delegates who joined the debates about the Sustainable Development Goals (SDGs) that emerged from the United Nations' Post-2015 Development Agenda (UN, 2013), accepted that the World's economic system has to change (ICS/ISSC, 2015; UN, 2015). Carbon emissions must be reduced and the burning of fossil fuels be stopped. In addition, poverty had to be brought to an end through the provision of meaningful work for all the economically active citizens of our planet (M'kumbuzi et al., 2015).

However, if this knowledge is derived from, produced by and captured within an economy of competition and accumulation, how likely is it that it will ever contribute to sustainable development or deliver jobs for all (ICS/ISSC, 2015)? The pessimistic view is that science and science-based education is being increasingly drawn into this economic paradigm and is being turned into a tool for competitive states and multilateral companies alike (UN, 2013). At the same time, spaces for the development of alternative paradigms and forms of knowledge are decreasing (ICS/ISSC, 2015). The question posed by the UN (2013), is whether collaborations and partnerships across the North–South divide, have the ability to provide the kinds of networks in which alternative knowledge about a future sustainable human and environmental world can emerge?

The following items pertaining to sustainable knowledge will be discussed below. Business, the Community and the Government should have Sustainable Partnerships (Section 2.3.1), Maintaining the Functions of the Natural Environment (Section 2.3.2), Understanding if the Current Way of Living is Sustainable (Section 2.3.3), Understanding Sustainable Development and Personal Responsibility (Section 2.3.4).

2.3.1 Business, the Community and Government should have Sustainable Partnerships

Strategic alliances between business, government and civil society are a growing feature of both developed and emerging economies. Such multi-sector partnerships are necessary because it is increasingly clear that no one sector in society can solve the complexities of sustainable development on its own (Warner, 2003). Unlike contractual relationships or public–private partnerships, partnerships for sustainable development between business,

government and civil society, seek not to shift responsibility and risk from one party to another, but to share risks and pool resources and talents (Warner, 2003).

In their recent (2002) synthesis report on the World Bank's Business Partners for Development (BPD) programme, Price Waterhouse Coopers (2002) concluded that partnerships between corporate operators, NGOs, local businesses, governments and multi- and bi-lateral development agencies, can deliver many of the same benefits currently attributed to conventional strategic business alliances, such as:

- Knowledge to enable companies to do business in foreign markets.
- Sharing of the risks and costs of new ventures - in particular reducing the long-term costs and reputational liabilities of providing local communities with the public services that should properly be the responsibility of governments; and
- Complementarity of capabilities - where the core competencies of the company (e.g. distribution network, project management skills, procurement policies) are applied or adapted to enhance the geographic reach, time to benefit, quality and/or sustainability of the activities of its strategic partners, in this case NGOs, government agencies, community groups or international donor agencies.

2.3.2 Maintaining the Functions of the Natural Environment

Ecosystem Services are the benefits which nature provides to human well-being. The term is frequently thrown around in academic circles, but why should there be cause for concern? Although the term is quite new, the connection to nature is not. People depend on nature for their survival – without healthy ecosystems, the drinking water is not clean nor is the air breathable (Anderson, 2015).

With an exponentially growing global population, cities have become the primary place of residence, and the majority of the population of the world has fallen out of touch with the workings of Nature. As humans have slowly removed themselves further and further from Nature, they have developed a willing ignorance from Nature and their role and relationship within it (Stoney Brook University, 2014). Anderson (2015) argues that with the growth of cities and trade humans have moved from a subsistent, sustainable economy to one of greed and exploitation. Humans have always had an impact on the environment, but with the age of industry, that impact has been ultra-magnified (Stoney Brook University, 2014).

Although every species plays a unique role in the biosphere and inherently has its own impact, not every species has the cognitive ability to measure its influence nor the capacity to change it (M'kumbuzi et al., 2015). Humans are unique in that respect, which is the root of the problem. Humans are capable of understanding their influence over nature, but there is a tendency to ignore the Earth's reaction to human presence (Stoney Brook University, 2014). The argument is not to purposefully degrade nature, but that environmental degradation is an inherent trait of our population's perpetual progression (Godfrey et al., 2016). Humans have the ability to do something about it, and therefore, should make the changes where necessary.

2.3.3 Understanding if the Current way of Living is Sustainable

While global climate change poses serious challenges to South Africa, opportunities to optimise progress towards more sustainable development lie in a growing awareness of the need to find more sustainable production and consumption processes (in particular in the energy sector), to reduce our high per capita emissions and to respond to climate impacts through mitigation and adaptation (SACN, 2016). Suganya and Kavitha (2017) discuss how harnessing awareness has the potential to drive a shift towards more sustainable farming practices such as organic farming that leads to building the biological capacity of local ecosystems to respond to change. The DEAT (2008) suggests that higher energy prices should not be seen as a growth hindrance, but rather as a driver of increased efficiencies across all production and consumption systems.

According to The Global Footprint Network, currently there is an ecological overshoot, with the current global population being three times the sustainable level (Von Bormann & Gulati, 2014). This means it takes the earth one year and six months to regenerate what it used to do in a year (SANGONeT, 2017). A recent survey done by local design and manufacturing studio, Love Milo, revealed that many people are still not aware of the small things they could do in their daily lives to lead an eco-friendlier lifestyle (Von Bormann & Gulati, 2014). Almost half of people surveyed, admitted to having only a vague idea of how to change their habits, while more than half (54%) said they are only sometimes conscious of their eco-efforts (SANGONeT. 2017).

2.3.4 Understanding Sustainable Development and Personal Responsibility

Ever since the damage done to the environment became one of the modern world's most pressing issues, discussions concerning who caused it and whose task it is to solve it have been frequent. A study by Fahlquist (2008: 1), asked the question, "To what extent it is reasonable to hold individuals and institutions responsible for environmental problems?" This is question about both backward-looking and forward-looking responsibility.

This kind of discussion has become even more prevalent during the last years when the alarms of climate change have become recurrent (Jacobsen & Dulsrud, 2007). To what extent are environmental problems the responsibility of individuals, as consumers and citizens? With the knowledge obtained today about the causes of environmental problems and the fact that citizens in many industrialised societies are well informed about their own role in contributing to the problems, individuals appear to have some responsibility (Fahlquist, 2008).

Williams (2008) states that if responsibility is ascribed to governments and corporations there is a better chance of creating a society in which the opportunities to act in an environmentally friendly way increase. Today, many individuals lack the options or do not have the resources to do the environmentally friendly thing. Jacobsen and Dulsrud (2007) identify just a few general or structural obstacles to individuals in modern societies that make it unreasonably difficult to act in environmentally friendly ways.

- The infrastructure in many societies encourages people to drive instead of using public transport or bicycles.
- It is assumed in many industries that people need to meet face-to-face, hence extensive business travelling.
- The information about the origin and energy costs of producing certain consumer goods, e.g., food, is often inadequate.
- Government information is sometimes unclear, or even conflicting.
- Climate-smart food is often substantially more expensive than regular food.

Sustainable Knowledge Summary

The four items discussed above regarding sustainable knowledge indicate that sustainable knowledge has been identified to have a relationship with the dependent variable, NMB - Sustainable City, as depicted in Figure 2.4.

FIGURE 2.4: RELATIONSHIP BETWEEN KNOWLEDGE AND NMB - SUSTAINABLE CITY

2.4 Sustainable City Challenges

South Africa is among the most urbanised countries in Africa. It has the third largest number of people living in urban centres (after Nigeria and Egypt) and a higher proportion of people living in urban areas than any comparable African country (excluding very small, desert or island states) (Hamid et al., 2017). Hamid et al (2017) further highlight that the inequalities in South African society are most evident in its cities. Apartheid patterns of spatial segregation persist, with poor people located in townships and peripheral areas, far from social and economic opportunities (Cobbinah et al., 2015).

These settlement patterns undermine prospects of economic growth as they absorb considerable household spending and require large public transport subsidies to sustain them. It is clear that twenty-four years into democracy, South Africa has yet to find an appropriate model for effectively harnessing the potential of its cities to drive economic growth and redress the spatial patterns that continue to marginalise poor people (DOE, 2011). This section provides an analysis into the main social, economic and environmental challenges surrounding sustainable cities.

The following items pertaining to sustainable city challenges will be discussed below. Unemployment (Section 2.4.1), Infrastructure Pressure (Section 2.4.2), Climate Change (Section 2.4.3), Limited Resources (Section 2.4.4), Limited Private Sector Investment (Section 2.4.5) and Competition Amongst Cities Seeking Investments (Section 2.4.6).

2.4.1 Unemployment

The rate of urbanisation in developing countries has been much faster than the rate at which cities have been able to generate decent jobs for their ever-growing populations (Nqandeka & Xabadiya, 2018). As a result, a significant proportion of youth and women in many cities remain either unemployed or underemployed. During the next 15 years, 600 million more people will join the global labour market most of whom will be the youth in cities in developing countries (UN Habitat, 2009).

Cobbinah et al. (2015) discuss how, although across Africa there are trends of rapid population growth, economic growth and rising levels of youth education, there is a pressing concern with the high levels of youth unemployment and their inability to break into the labour force. Of the continent's 1.1 billion people, approximately half are under age 25 and approximately 20% are between age 15 and 24 (UN Habitat, 2013). Mwangi (2015) builds on this notion that the reality of a large youth population is expected to hold as the population grows. Projections suggest that by the year 2100, 41% of the world's youth will be African, up from only 15% in 2000.

Faced with an impending crisis, governments, the private sector and programme implementers across the continent are experimenting with a range of models to curb youth unemployment (Nqandeka & Xabadiya, 2018). Mwangi (2015) identifies these models as:

- Demand side focused – aimed at increasing opportunities for employment or entrepreneurship; and
- Supply side focused – aimed at improving the preparation of young people for these opportunities; matching focused – focused on matching, i.e. aimed at aligning the supply and demand for labour (Mwangi, 2015).

2.4.2 Infrastructure Pressure

Palmer, Skeen, Käsner, Fisher-Jeffes, Graham, & Swilling (2013) identify how the South African government has long recognised infrastructure as being essential for economic growth. The extension of access to infrastructural services to the poor has been one of its key strategies for overcoming the conditions of poverty and inequality post-1994. Increasingly, the expansion of infrastructure is also being recognised as an opportunity to facilitate more

resource efficient and less environmentally damaging ways of life that will help the country to achieve its environmental and emission reduction goals (Palmer et al., 2013).

Hu (2015) defines how urban infrastructure has become one of the most pressing challenges facing the world today. Already, the world's cities are home to more than half of the global population; emit more than 70 percent of the world's greenhouse gasses; use 80 percent of the world's energy and drive the vast majority of the world's economic output (KPMG International Cooperative, 2012).

Infrastructure such as water supply and sanitation, flood protection, roads and transport, and energy and telecommunications are all central to achieving green growth and Sustainable Development Goals (Hu, 2015). Achieving poverty eradication, for example, is impossible without providing access to energy and water. Food security relies on irrigation systems in many countries and buildings and transport for clinics and hospitals are essential for health (Fulai, 2018).

For infrastructure to contribute to the Sustainable Development Goals and green growth, however, integrated planning is required. Integrated planning for sustainable infrastructure is necessary to support the transition away from traditional brown infrastructures that cause significant pollution and resource waste (Palmer et al., 2013). It is necessary to ensure that the economic, social and environmental implications of potential infrastructure projects are considered holistically from the earliest stages of planning and development. It is also essential for ensuring coordination between different infrastructure sectors such as transport, energy and water (Fulai, 2018).

2.4.3 Climate Change

El Sioufi (2010) emphasises how climate change is now recognised as one of the most pressing global issues of our planet. It is no coincidence that global climate change has become a leading international development issue at the same time as the world has become urbanised (Bulkeley, 2013). The way cities are planned, managed, operated and consume energy will have a critical role in the quest to reverse climate change and its impact. The climate change phenomenon is making the issue of sustainable urbanisation a matter of urgency (El Sioufi, 2010).

Climate change is the most significant challenge to achieving sustainable development as it threatens to drag millions of people into poverty (Kyte, 2014). Kyte (2014) emphasises this at the same time, by highlighting that humans currently have never had better knowledge and understanding of the solutions available in preventing the development of the crisis further and create opportunities for a better life for people all over the world. Climate change is not just a long-term issue, it is happening today, and it entails great uncertainties for developing countries such as South Africa (Bulkeley, 2013).

According to the UN Habitat (2013), climate change increases the costs of development in the poorest countries by between 25 and 30 percent. Developing countries currently face an annual cost of infrastructure that is resilient to climate change at around R16.8 trillion to R21 trillion. This results in a yearly R9.8 trillion gap in financing. It will take the combined efforts of development banks, financial institutions, export credit agencies, institutional investors and public budgets to meet the climate and development challenge (Kyte, 2014).

2.4.4 Limited resources

A sudden decrease in global demand for a city's output can have a dramatic effect on employment, dragging the city into recession. Nahman, Wise and De Lange (2010) discuss how the scarcity of natural resources poses a threat to the continued prosperity and well-being of the world's population. As both the global economy and population grow, so too does the standard of living and the demand for natural resources. This threatens the security of supply. The Economic Council (EC) (2011) defines resources as all inputs into the economy. These resources include raw materials such as fuels, minerals and metals but also food, soil, water, air, biomass and ecosystems (EC, 2011b).

Cities account for some 75 per cent of the world's energy use and over 70 per cent of the world's carbon dioxide emissions. Urban infrastructure is largely built without giving much thought to ecological sustainability (Nahman et al., 2010). A resource-intensive consumer society drives urban lifestyles, contributing significantly to the pressure on the planet's ecosystems. Humanity's ecological footprint already exceeds the planet's carrying capacity by 50 per cent, while biodiversity is on a gravely negative trend. The ecosystem services depended on for survival and human welfare are at risk of critical levels of degradation (Kyte, 2014).

Conradie (2013) identifies how all nations face the challenge of simultaneously meeting two imperatives: developing their economies to meet the needs of their people and ensuring that the productivity and viability of the underlying ecosystems and ecosystem services are maintained at healthy levels over time. The challenges associated with sustainable development are particularly difficult in developing countries, where complex trade-offs between economic, social and environmental objectives must often be made (Kyte, 2014).

2.4.5 Limited Private Sector Investment

According to the Guardian (2012), private sector players have an integral interest in sustainable development succeeding. The UN Global Compact (2015a) recognises how companies, markets, and economies have become more global and interdependent, while businesses and investors are becoming increasingly aware of the overlap between public and private interests. The UN Global Compact (2015a) mentions how the private sector realises that its ability to prosper and grow depends on the existence of a prosperous and sustainable society.

Lieberman (2018) remarks on how the majority of private sector investments in developing countries is too short term to be relied on as a primary source of funding, especially for key infrastructure projects. Achieving the Sustainable Development Goals will require a shift in the financial sector, specifically a long-term investment strategy that places sustainability as a central issue of investment. Both public and private financial institutions need to be aligned with long-term development (United Nations, 2018). Lack of long-term thinking and planning could mean that some risks, like climate change, will not factor properly into decision-making.

Ultimately, the success of sustainable development requires business sector involvement. Corporate approaches to sustainability tend to focus on projects that affect the bottom line: minimising waste, incorporating energy alternatives or developing environmentally friendly products and processes (Hughes & Hosfeld, 2005). Lieberman (2018) discusses two issues with private sector investment in sustainable development incentives. First, the private sector is rewarded for short-term investment but not financially incentivised to make long-term investments in sustainable development. Secondly, another issue with developing countries is that they may not have the means to invest in the long term, and are limited to borrowing money or investing short term. The United Nations (2018) report pinpoints that in developing

countries, infrastructure investment represents less than 3 percent of global pension fund assets. Investment in sustainable infrastructure in developing countries is lower than these overall rates.

2.4.6 Competition amongst Cities Seeking Investments

As the world becomes more connected, cities are competing ever more fiercely for residents who will help them prosper. People are always attracted to the extensive opportunities offered by global capital cities such as London, New York and Hong Kong. Thwala (2014) gives a perspective of competitive cities, which are characterised by powerful centres of economic and cultural authority. Thwala (2014) further attests that cities are the centres of specialisation for production of goods and services and they must remain distinct from each other. Cities have been the engines of productivity and growth throughout history and will be essential to the future growth and competitiveness of nations and regions.

The World Economic Forum (2014) highlights in its report, six global megatrends especially relevant to cities: (1) urbanisation, demographics and the emerging middle class; (2) rising inequality; (3) sustainability; (4) technological change; (5) industrial clusters and global value chains; and (6) governance. The World Economic Forum (2014) continues to add emphasis that it is up to cities to take advantage of these megatrends, as well as to mitigate negative forces such as rising inequality, pressure on natural resources and the environment and a reduction of trust in public authorities.

According to Jones Lang LaSalle (JLL) (2015), city competitiveness is defined as the set of factors, policies, institutions, strategies and processes that determines the level of a city's sustainable productivity. Sustainability encompasses economic, environmental and social issues. Productivity is about the efficient use of available resources that drive economic growth (Jones, Lang & LaSalle, 2015). However, productivity has to be sustainable and maintained beyond the short term and in a way that reconciles economic, environmental and social goals (World Economic Forum, 2014).

Sustainable City Challenges Summary

The six items pertaining to sustainable city challenges have been identified and are proposed to have a relationship with the dependent variable, NMB - Sustainable City, as depicted in Figure 2.5.

FIGURE 2.5: RELATIONSHIP BETWEEN CHALLENGES AND SUSTAINABLE CITY

2.5 City Leadership

No two cities are the same. The World Economic Forum (2015) recommends that today's cities need leaders and managers in all departments who are experienced in the latest knowledge and best practice about sustainability and the built environment, democracy and how technology can help create an inclusive city community. According to Broman, Robèrt and Gould (2013), cities have become the drivers for growth for nations and not the other way around. A new way of seeing and understanding how cities now and in the future will operate, is with the view as international hubs for relationships, facilitating flows of trade, labour and commerce (Broman et al., 2013).

The following items pertaining to sustainable city leadership will be discussed below. Clear Vision for Sustainable Issues (Section 2.5.1), Citizen Centricity (Section 2.5.2), City Spaces (Section 2.5.3), Smart City Technologies (Section 2.5.4) and Policies to Promote Sustainability (Section 2.5.5).

2.5.1 Clear Vision for Sustainable Issues

Confino (2013) argues that the greatest risk to the sustainability movement is that it is struggling and so far failing to articulate a vision of a future that is both prosperous but remaining within planetary boundaries. Betsill and Kanie (2012) continue to build on this sentiment by discussing how the reforms of the institutional framework for sustainable development have been discussed for decades, both in scholarly and political terms, yet the process has not yet shown an indication of fulfilling expectations. Betsill and Kanie (2012) suggest that one of the reasons for this is a growing gap between the United Nations (UN) institutions, in particular institutions for environment and sustainable development and political reality on sustainable development issues.

City leaders must act now to halt their exodus of people, energy and resources. According to the KPMG (2016) report on the future of cities, cities need to determine the type of people they would like to live and work in their cities, as well as the type of businesses they would

like to invest there and then take decisive, consistent and coordinated action to attract them. Following this vision will help keep and enhance a city's character and set it apart from its rivals. With a strong vision and commitment to sustainability, it is possible to transform a city (Steer, 2014). Embracing sustainability can bring both economic expansion and political rewards.

2.5.2 Citizen Centricity

According to Sharma, Ogra and Guttoo (2014), governments have increasingly needed to adopt the role as a facilitator and enabler between the public, private and community sectors in creating new digital channels and solutions to be closer to citizens and businesses. O'Brien (2018) additionally adds that although citizen centricity is not primarily about technology, technology can dramatically help build better services.

A citizen-centric strategy implies that governments put their citizens at the centre of their planning approach by building services around their citizens (Sharma et al., 2014). This would seem as the obvious approach, however, Berntzen and Johannesen (2016), argue that governments and organisations in the public sector implementing services, are not always considerate to its citizens. A sustainable city is a vision of the future, shared by its citizens.

Further research by Berntzen and Johannesen (2016) indicates that trust in developing countries' governments is often noticeably low, compared to governments of developed nations. Berntzen and Johannesen (2016) recommend that trust could be built by developing local initiatives aimed at engaging citizens in government planning. Meerkamper (2018) accentuates that when organisations and governments incorporate citizens' voices, it enables organisations and governments to create more effective and meaningful change. Measures must be implemented to increase public awareness and knowledge, leveraging social media platforms, as well as traditional communication mechanisms (Meerkamper, 2018).

2.5.3 City Spaces

According to Clos (2014), building inclusive, healthy, practical, and productive cities is perhaps the greatest challenge facing humanity today. There are no easy solutions. A key part of the puzzle, though, lies right at the heart of the world's urban areas: its public spaces. Public spaces are at the heart of democratic living. They are the main stage of urban life and facilitate encounters, exchange of experiences and foster a tolerant urban society through the

exposure to different people and their traditions (Pancholi, Yigitcanlar & Guaralda, 2015). Clos (2014) explains this by discussing that the character of a city is defined through its public space, not its private space.

Clos (2014) introduces the concept of place making in designing public spaces. The principle is based on the following philosophy, if you plan cities for cars and traffic, you will get cars and traffic. If you plan for people and places, you will get people and places (Clos, 2014). Globally the acceptance of knowledge-based urban development (KBUN) as the solution for the social, economic, environmental and spatial challenges being faced by present-day development (Kunzmann 2009; Yigitcanlar & Sarimin 2015) have manifested into the following emergence of a new typology of knowledge environment in the form of knowledge and innovation spaces (KISs) (Asheim 2007). Additionally, one of the major objectives of KBUD, synchronised with the global climate change awareness, is sustainable enviro-urban development (Yigitcanlar, Inkinen & Makkonen, 2015). These needs and requirements are affecting the formation of new typologies of settlements and public spaces within KISs.

Kunzmann (2009) states that if the ultimate goal of governance, urban institutions and development is to make places, communities and regions more prosperous, civilised, and attractive for all people, then government processes need to change to reflect that goal. This requires the development of consensus-building, city consultation processes and institutional reform, all of which enhance citizenship and inclusion (Pancholi et al., 2015).

2.5.4 Smart City Technologies

Emerging trends such as automation, machine learning and the internet of things (IoT) are driving smart city adoption. Theoretically, Rouse (2017) recognises that any area of city management can be incorporated into a smart city initiative. A classic example is the smart parking meter that uses an app. The app is used to help drivers find available parking spaces without prolonged circling of crowded city blocks. The smart meter also enables digital payment, so there is no risk of coming up short of coins for the meter (Rouse, 2017).

According to O'Grady and O'Hare (2012) there are many definitions associated with smart cities, with a wide variety of alternative adjectives used such as intelligent cities or digital cities. They identify that there is no one single template for framing every city due to each

city has its own uniqueness and challenges. Hati, Dey and De (2017) describe a smart city as one which creates an urban vision which manages a city's assets through the integration of information and communication technology (ICT) and the internet of things (IoT).

Cities' assets entail municipal departments, information systems, schools, libraries, transport systems, hospitals, power plants, water services and waste management (Washburn, Sindhu, Balaouras, Dines, Hayes & Nelson, 2010). Harrison et al. (2010) and Washburn et al. (2010) note that smart cities refer to a city's capability of capturing and integrating live real-world data through sensors, meters, appliances and personal devices while allowing for the integration of data into a computing platform that communicates this data to various city services.

Townsend (2013) argues that while the foundation of a smart city is its use of technology to enhance city performance and optimise service delivery, a major factor, which makes a city a smart city is its level of sustainability. Townsend (2013) adds, that a truly smart city uses technology to become self-aware, which enables informed decision making and facilitates positive change. This includes things like tracking weather conditions and measuring water supply and consumption to efficiently manage, track and use waste patterns to create more efficient recycling programmes (Hati et al, 2017).

Aoun (2013) mentions that every city has the ability to become smarter. It begins with smart systems that work for the benefit of both residents and the environment. The cities that succeed in making the transition to smart sustainable ones will be those that improve their critical systems by combining a bottom-up, systems-centric approach with a top-down, data-centric one (Aoun, 2013).

2.5.5 Policies to Promote Sustainability

Kaaronen (2016) discusses how sustainable development is a particularly complex socio-ecological concern. No less complex than that is the question of how to organise effective and relevant scientific support for sustainable development policies. Whilst science, as humanity's best hope, is an essential prerequisite for developing a sustainable future, science–policy interfaces (SPIs) for sustainable development are still often inefficient or simply non-existent. Developing these interfaces is seldom a prime task of national governments (Kaaronen, 2016).

Kaaronen (2016) recognises that policy makers all over the world are facing similar challenges. While they certainly know that the climate will change, there is still great uncertainty as to what the local or regional impacts will be and what the impacts on societies and economies will be (Kyte, 2014). Coupled with this, is often great disagreement among policy makers about underlying assumptions and priorities for action (Kyte, 2014).

Kyte (2014) draws attention to the fact that many decisions to be made today have long-term consequences and are sensitive to climate conditions such as, water, energy, agriculture, fisheries and forest and disaster risk management. Kaaronen (2016) build on this by emphasising that sound decision making is possible if a different approach is used. Rather than making decisions that are optimised to a prediction of the future, decision makers should seek to identify decisions that are sound no matter what the future brings. Such decisions are called robust.

Sustainable Leadership Summary

The five items pertaining to city Leadership have been identified and proposed to have a relationship with the dependent variable, NMB - Sustainable City, as depicted in Figure 2.6.

FIGURE 2.6: RELATIONSHIP BETWEEN LEADERSHIP AND NMB - SUSTAINABLE CITY

2.6 Sustainable City Planning

Planning is a continuous process of anticipating and preparing for foreseeable future changes (Deniz, 2016). Urban Planning, as a procedure to manage such change in spatial terms, makes arrangements for future use of land by public and private owners, with the core objective to improve the quality of life (Cilliers & Timmermans, 2012). Urban planning seeks to balance environmental, economic, and social values to enable sustainable development in planning (Cilliers & Timmermans, 2012).

Sustainable city planning in the developed world faces very different challenges to the cities in the developing world in achieving sustainability. Van Schalkwyk (2012) refers to sustainable thinking as the thought patterns around making decisions that avoid causing negative consequences for both the current and future generations, with the ultimate goal to find

better solutions that provide quantitative, qualitative, physical and psychological benefits to the public. Based on this understanding, Deniz (2016) describes how sustainable design and environmental awareness have the fundamental purpose to preserve natural resources while reaching human and societal wellbeing.

In developed countries sustainable thinking is intended to develop more of environmentally conscious products and processes, environmental effects, however on developing countries have been ignored through the design and planning stages (Deniz, 2016). Therefore, considering that better environmental solutions are derived from awareness and related regulations by developed counties, Leyzerova, Sharovarova and Alekhin (2016) give emphasis to how crucial it is that the applications of sustainable design requires a new way of thinking and particular frameworks for considering environmental issues. It becomes imperative that governments and design professionals take the responsibility to create a better world by considering, environmental issues and creating environmental awareness throughout their countries (Deniz, 2016; Valeriu & Moldoveanu, 2016).

The following items pertaining to sustainable city planning will be discussed below. Asset Maintenance (Section 2.6.1), Natural Habitats and Maintenance of Biodiversity (Section 2.6.2), Larger Percentage of Open/Green Spaces/Parks (Section 2.6.3) and Eco Villages (Section 2.6.4).

2.6.1 Asset Maintenance

According to Mabaso (2014), South African cities' challenge with asset maintenance is currently characterised by substantial infrastructure aging and decay. Mabosa (2014), further discusses how since 1994, the government focused on providing much-needed basic services such as healthcare, water and electricity in rural areas, neglecting general upgrades and maintenance on current infrastructure. This led to decay, which in turn resulted in increased capital expenditure spent on new infrastructure developments (Ganswyk, 2015).

To deal with this challenge, the South African government came up with regulations such as the Government Infrastructure Asset Management Act (2007) No.19, which has the following aims:

- To provide for a uniform framework for the management of an immovable asset that is held or used by a national or provincial department;

- To ensure the coordination of the use of an immovable asset with the service delivery objectives of a national or provincial department;
- To provide for issuing of guidelines and minimum standards in respect of immovable asset management by a national or provincial department; and
- To provide for matters incidental thereto.

This is also supported by pieces of legislation such as Guidelines for Asset Management of Local Government, Generally Recognised Accounting Practices 17, Municipal Finance Management Act and Public Management Finance Act (Ganswyk, 2015).

In contrast, Burger (2015) describes how industries have been pressurised by the global economic meltdown to start appreciating better value of their current physical assets. Mabaso (2014) describes how this has led to the advancement of physical asset management from being engineering's maintenance trouble to an executive strategic imperative and major profit driver. In the case of the public sector, sustainable infrastructure asset management has proven to be an investor confidence booster (Burger, 2015).

A global asset management standard became necessary as ISO 55 000 was developed. The Global Forum on Maintenance and Asset Management (GFMAM) and various global member bodies of which the Southern African Asset Management Association (SAAMA) is a part, have supported it (Ganswyk, 2015).

The South African Institute of Civil Engineering (SAICE) issues an annual Infrastructure Report Card (IRC) that evaluates and grades the current state of the South African infrastructure (Mabaso, 2014). This report is a collective opinion provided by civil engineering professionals at SAICE in the manner of - expert witness on the current condition of these assets. The 2006 report gave South Africa a D+ grade for that year, which improved to a C- in 2011 (SAICE, 2017). The positive gains were because of intense infrastructure development influenced mainly by the Soccer World Cup of 2010. The 2017 figure of a D+ from the report for South Africa is due to the poor maintenance of the existing infrastructure (SAICE, 2017).

2.6.2 Natural Habitats and Maintenance of Biodiversity

Although cities occupy just two per cent of the Earth's surface, their inhabitants use 75 per cent of the planet's natural resources (United Nation Environment Program (UNEP) & United Nation (UN) Habitat, 2005). Urban areas house the majority of the world's population and

there has been a surge in interest in researching urban ecosystems (Lepczyk et al., 2017). For many, urban areas can be sometimes viewed as concrete jungles, although such views are understandable, in truth, urban areas house a great number of species both native and non-native to the surrounding region (Lepczyk et al., 2017; Ives, Lentini, Threlfall, Ikin, Shanahan, Garrard, Bekessy, Fuller, Mumaw, Rayner, Rowe, Valentine, & Kendal, 2016; Aronson, La Sorte, Nilon, 2014).

The UNEP and UN HABITAT (2005) discusses how cities draw on their surrounding ecosystems for goods and services. Their products and emissions can affect regional and even global ecosystems. Healthy ecosystems and biological diversity are vital for cities to function properly (Aronson et al., 2014, Ives et al., 2016). According to Beninde et al. (2015), urban green spaces provide opportunities for citizens to connect with nature, witness ecological processes in action and potentially become scientifically literate citizens who make informed decisions regarding conservation initiatives and policy (Lepczyk et al., 2017).

The UNEP and UN HABITAT (2005) identified three main kinds of services ecosystems: provisioning, regulating and enriching. While some of these services are easily measured, such as the provision of food and fresh water, others are harder to quantify, such as the contribution an ecosystem makes to quality of life in aesthetic or spiritual terms (Beninde et al., 2015). Beninde et al. (2015) refer to biodiversity as diversity among living organisms, which plays an essential role in ensuring the survival of life on earth. Clean water, food production, medicines and quality of life are just a few of the services which biodiversity offers to cities (Lepczyk et al., 2017). Recognising the importance of biodiversity and healthy ecosystems for their survival, cities today undertake many initiatives to use and conserve their surroundings efficiently. These actions can reach far beyond the boundaries of the city, affecting biodiversity on a global scale (UNEP & UN-HABITAT, 2005).

2.6.3 Larger Percentage of Open/Green Spaces/Parks

Shortage of open green spaces has become a common concern in today's compact cities. Rakhshandehroo, Yusof, Tahir and Yunos (2015) recognise that the importance of urban green spaces were known for decades; however, the relationship between urban liveability and green spaces as incorporated in overall urban green structures has become the focus of international studies especially during the last ten to fifteen years.

Based on literature from Belmeziti, Cherqui and Kaufmann (2018) urban open green spaces provide different dimensions of sustainability because of opportunities for social, environmental and economic benefits which contribute to the quality of life in cities. Therefore, sustainable urban planning, design and management are needed to improve urban greening strategies. Belmeziti et al. (2018) discuss how, in order to enhance urban greenery, innovative and creative ideas should be applied in urban management, for instance informal open green spaces.

According to Lategan and Cilliers (2016), urban areas are valued higher than green spaces. Lategan and Cilliers (2016) state this is mainly due to the fact that urban areas can be measured in financial terms or monetary value (property prices, revenue drawn from development), whereas, green spaces mainly have indirect, immeasurable value (social, environmental). The widespread trend of loss of green space loss is of international concern Lategan and Cilliers (2016).

Cilliers (2015) identifies how comprehensive studies that were conducted in Europe have proved the correlation between economic value and proximity to green spaces and that green spaces contribute and enhance the economic value of urban developments. A study by Cilliers (2015) tested the above-mentioned European approach to link economic value to green spaces in the city of Potchefstroom, South Africa. The hypothesis that the economic value of residential properties would increase as distance to the nearby green spaces decreases, as in the cases in Europe, was not the result in Potchefstroom. The proximity to green spaces had a negative effect on the housing prices.

South Africa, being a third world country and acknowledging that there are many diverse and complex problems impacting on urban areas, gives no value to public green spaces, due to many diverse reasons, but mainly because the need for housing and basic services is prioritised (Lategan & Cilliers, 2016). Public green spaces do not always provide direct financial benefits, but their contribution to the well-being of society and the environment are unmistakable (Belmeziti et al., 2018).

2.6.4 Eco-village

The Global Eco-village Network (2018) defines an eco-village as an intentional or traditional community using local participatory processes to holistically integrate ecological, economic,

social, and cultural dimensions of sustainability in order to regenerate social and natural environments. Dawson (2015) highlights, because any group can call itself an eco-village, the term has been adopted by entities ranging from student co-ops to suburban housing developments.

The Global Environment Facility (2011) defines how communities can act as a template for holding and enlarging Social Common Capital and can use eco-villages with the following attributes:

- Harmonising with the natural environment;
- Creating a sustainable social infrastructure with minimal use of energy and resources; and
- Maintaining a community with a governance system that focuses on social and cultural contexts.

Furuhashi (2007) describes how the above-mentioned attributes, mentioned by the Global Environment Facility (2011), will bring important opportunities to society at large when smaller communities look toward a more sustainable earth in the future.

According to Global Eco-village Network (2018), the real and potential impacts of eco-village activities on society is something that is difficult to evaluate, but there seem to be some consistent tendencies. Initially, eco-villages tended to locate themselves outside or in opposition to the mainstream development (Dawson, 2013), seeking to achieve as much self-sufficiency as possible; but, today they are increasingly involved in alliances with other movements and institutions. For Dawson (2013), this is largely due to the fact that some previously counter-cultural values that were typical in eco-villages, such as, environmental protection, communal life and personal growth, are increasingly being absorbed by diverse groups in society (Dawson, 2013). However, Meijering (2012) describes how now to a certain degree, ecovillages also seem to be conforming to some more mainstream ideas.

Sustainable City Planning Summary

The four items pertaining to sustainable city planning, discussed above, have been identified and proposed to have a relationship with the dependent variable, NMB - Sustainable City, as depicted in Figure 2.7.

FIGURE 2.7: RELATIONSHIP BETWEEN PLANNING AND NMB - SUSTAINABLE CITY

2.7 Citizen Centricity

The principle of citizen centricity described by Thomas (2015) maintains that neither the product nor its technology, but the users, citizens in case of public service delivery, have to be the core of the design strategy. Thomas (2015) further discusses how this approach is all about being more responsive and alert to the needs and aspirations of the citizens. Therefore, citizen-centricity requires more of a socio-cultural approach based on multi-disciplinary perspectives, rather than on a mere understanding of tools and trends (Searle, 2017).

Governments at all levels, in both developed and developing nations, have a mandate to provide services, protect society and make the economy prosper (Binali, 2017). While this is a conventional long-term goal, citizens are now expecting greater and faster delivery of government services (Thomas, 2015). Searle (2017) argues that the digital maturity of these public agencies, however, at many levels remains inadequate to meet these demands.

According to Binali (2017), the new type of experience government stakeholders and citizens are seeking is: one that is frictionless; where work and collaboration are seamless and people and process are intertwined with interconnected services; and where technology is intuitive and easy to use. Searle (2017) describes that the beauty of a citizen-centric government is, that it does not just benefit citizens. It is an approach that, when done right, makes life easier for the policy makers, front line staff, ministers and others within the government ecosystem (Thomas, 2015).

The following items pertaining to citizen centricity will be discussed below. Smart Cities (Section 2.7.1), Free Internet Connectivity (Section 2.7.2), Manage City Data as an Asset (Section 2.7.3) and Enable Digital Connectivity (Section 2.7.4).

2.7.1 Smart Cities

Elgazzar and El-Gazzar (2017) discuss how sustainable urbanisation has become a key concern for societies in terms of environmental efficiency and intelligent employment of city resources. This concern has given rise to the notion of a technologically interconnected city

or Internet of Things (IoT), where Big Data is promoted to achieve the efficiency and intelligence in managing cities' resources (Deloitte, 2015). Elgazzar and El-Gazzar (2017) continue, from above, by discussing how societies are becoming increasingly oriented toward achieving sustainability and improving the quality of life with the use of Information and Communication Technology (ICT). The ITU (2015) put forward the concept of a smart sustainable city, which is established to ensure that sustainability is not overlooked at the expense of fancying ICT.

According to Albino, Berardi and Dangelico (2015), in order for a city to achieve sustainability, it needs to implement smart solutions enabled by smart technology. These smart technology solutions require smart city initiatives from the society. Smart city initiatives have to involve citizens, government, businesses, and non-government institutions in collaboration and partnership efforts (Vanolo, 2014; Mosterman and Zander, 2013).

According to Sidler (2016), smart cities are becoming ever more important, especially in the South African context where there is opportunity to implement the basic foundations for cities to become smart-city ready. Smart technology will help cities sustain growth and improve efficiency for citizen welfare and government efficiency in urban areas in the years to come (Rouse, 2017).

2.7.2 Free Internet Connectivity

The Internet has become increasingly important in our lives and our dependency on the internet is rising exponentially. Elgazzar and El-Gazzar (2017) draw attention to how the internet has many benefits including the accessibility of jobs, education and communication with people from all over the world. However, Associates (2016) identifies that the divide between those who have access to the Internet to those who do not is widening, causing detrimental effects to society such as poverty and inequality.

In the context of a smart city, Dubois (2017) discusses how free Internet access has the ability to provide more opportunities for both city administrators and citizens. With a widely available Wi-Fi network, access to the internet will even more prevalently be used with the Internet of Things applications, such as, data collection (Rouse, 2017). A reliable network within a city also enables more innovative use of its services. The city can use data on how its services are used to become more efficient and streamlined (Dubois, 2017).

Dubois (2017) continues by defining how in society, individuals who may not otherwise have reliable access to online services will now be able to go online free for education, job searches, or to communicate. The ability to access online resources will become increasingly important in bridging inequality gaps between socioeconomic groups as more business takes place online (Albino et al., 2015). Sidler (2016) refers to South African cities and describes how cities would benefit from pervasive high-speed connectivity, which is the catalyst of and foundation for the development of a smart city. Sidler (2016) further describes how, connectivity will enable effective data collection and analytics to ensure continuous improvement along with the use of mobile technologies to reach every citizen in South Africa.

2.7.3 Manage City Data as an Asset

A city's data are one of its most valuable assets. According to Adler (2017), urban data are the foundation of a city's performance in managing programme that allow cities to ensure continuous improvement. Price Waterhouse Coopers (PWC) (2016) defines how reliable data can facilitate collaboration, improve partnerships with the private sector, and expand public engagement. Innovative uses of data allow cities to enforce regulation and improve social services (Adler, 2017).

A Data-driven city is characterised by the ability of its agencies of city management to use technologies for the generation of data flows (PWC, 2016). PWC (2016) further discusses how the processing and analysis of data is aimed at the adoption of solutions for improving living standards of residents thanks to the development of social, economic and ecological areas of the urban environment. In other words, the management of a data-driven city may be a basic driver for the transformation of city services and innovations and significantly change management principles within the urban environment (Binali, 2017).

The potentially negative aspect of data-driven cities is citizen privacy. Rouse (2017) identifies how smart city opponents worry that city managers will not keep data privacy and security as a priority. They fear the exposure of the data that citizens produce on a daily basis to the risk of hacking or misuse. Additionally, PWC (2016) discusses how the presence of sensors and cameras in cities may be perceived as an invasion of privacy or government surveillance. To address this, Adler (2017) mentions that smart city data collected should be anonymised and not be personally identifiable information.

Rouse (2017) highlights that city leaders must not only raise awareness of the benefits of smart city technologies being implemented, but also promote the use of open, democratised data to its citizens. If people know what they are participating in and the benefits it can bring, they are more likely to engage (Dubois, 2017).

2.7.4 Enable Digital Connectivity

Technology-driven transformation is redefining the business of running a city. Barbier and Delaney (2017) describe how technology-driven transformation has as much influence on how cities generate revenue as on the assets they own and how they manage them. Adding digital capabilities can bring great benefits to cities as they have the ability to reshape public services and how they are delivered, making it possible to do more with the same available resources (Carayannis & Hanna, 2016). However, Barbier and Delaney (2017) mention that there will be challenges too, where city leaders and workers will have to adapt to new business models, changing regulations and new mandates.

Cocchia (2014) describes how for every city, investments in digital infrastructure and capabilities are interdependent. Barbier and Delaney (2017) and Cocchia (2014) continue to suggest that the more a city is connected and builds on its existing investments, the greater the benefits. The better a city is able to integrate and plan its investments, the more efficient it will be (Barbier & Delaney, 2017).

According to Telefonica (2016), technology advances are generating two new realities for citizens, namely, hyper connectivity, which is the result of the proliferation of connected devices, both between people and between machine-driven applications (IoT) and a collaborative society with new relationship models and the creation of economic value. Carayannis and Hanna (2016) discuss how it cannot be forgotten that the citizens are the most intelligent sensors. A Smart city cannot be based solely on the technology capabilities of the companies integrated into the system or on the vision and ambition of urban managers (Telefonica, 2016).

Citizen Centricity Summary

The smart city needs to generate civic commitment in order to forge an alliance between the city and its interest groups and to ensure that citizens get involved, become committed and perceive their city as a common and exciting project of their own (Telefonica, 2016). The four

items pertaining to citizen centricity have been identified and proposed to have a relationship with the dependent variable, NMB - Sustainable City, as depicted in Figure 2.8.

FIGURE 2.8: RELATIONSHIP BETWEEN CITIZEN CENTRICITY AND NMB - SUSTAINABLE CITY

The next section will describe the conceptual model that this study will use to measure the residents of Nelson Mandela Bay's awareness of sustainable cities.

2.8 Conceptual Model

The literature in this chapter highlighted the importance of awareness for sustainable cities and emphasised the necessity of determining awareness levels of Nelson Mandela Bay's residents. Factors such as sustainable awareness, sustainable knowledge, sustainable city challenges, city leadership, sustainable planning and citizen centricity were highlighted as key items in measuring the awareness levels of residents and as independent variables for this study. As such, a conceptual model based on these factors was designed and is illustrated in Figure 2.8. The empirical study that will be conducted will aim to test each of these variables so that a model can be established, which can be replicated in the future for other South African cities.

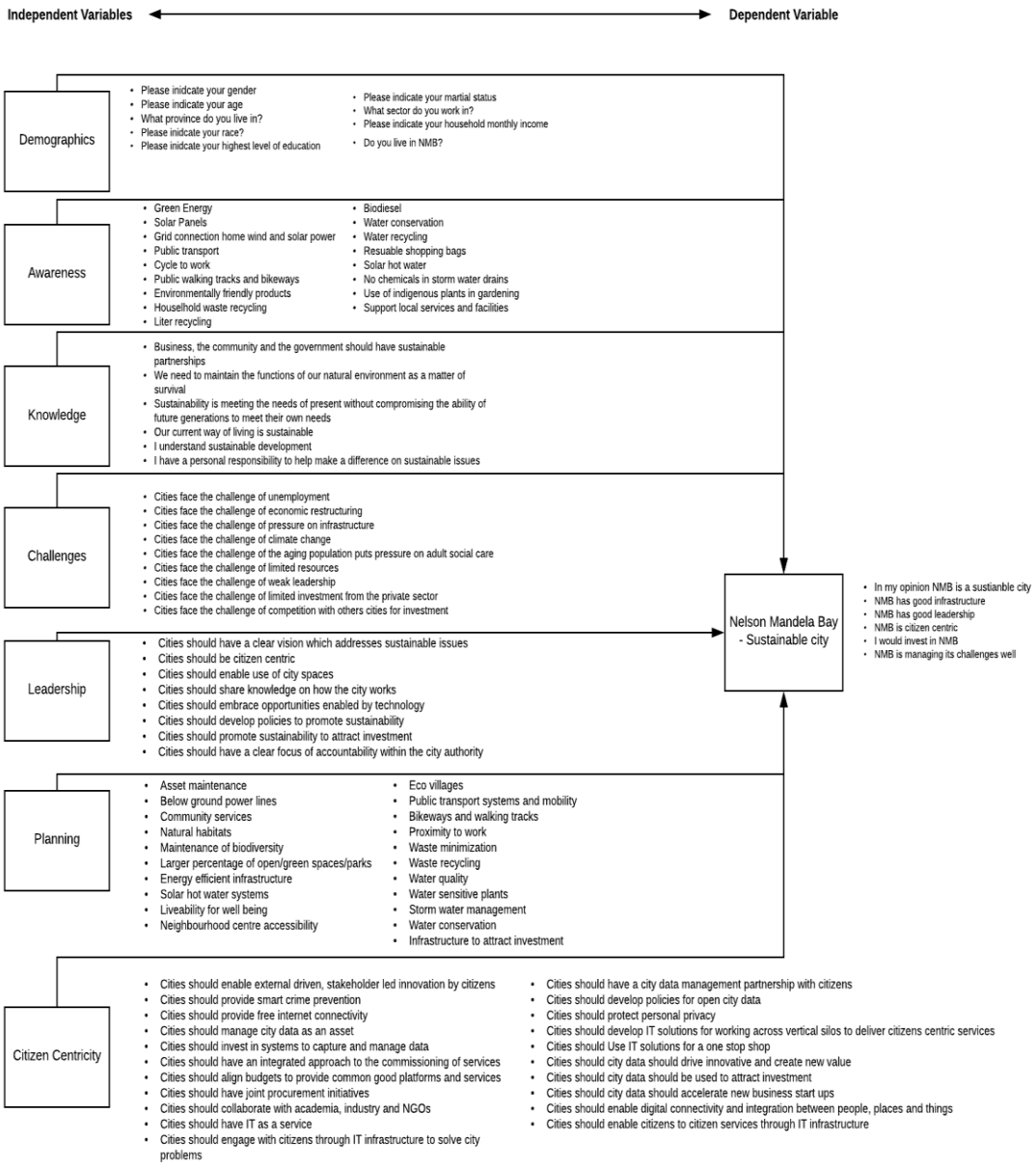

FIGURE 2.9: CONCEPTUAL MODEL

2.9 Summary

This chapter began with the definition of sustainable awareness (RQ_1), along with certain items of sustainable practices. The following section discussed sustainable knowledge and its importance in raising citizen awareness regarding sustainability. The literature highlighted the importance of education and the role education can play in shifting the negative environmental habits of residents to positive ones. The next section discussed the challenges associated with transitioning a city into a sustainable one, by highlighting key crisis areas for cities.

The literature revealed that unemployment and poverty were issues that needed to be addressed foremost before a city was able to transition towards being sustainable. The next section discussed the importance of a city leadership and the role city leadership needs to adopt in facilitating the measures required for all stakeholders of a city to become more sustainably aware. Leadership plays a vital role in the future of any city, even more so in cities, which are on the frontline of the effects of climate change.

The importance of managing the biodiversity of cities was discussed and the significance of the South African cities' ecosystems were highlighted. This led to the next section where sustainable city planning techniques were discussed. The final piece of literature that was discussed related to the topic of citizen centricity and the role of governments in adopting a citizen centric approach. Lastly, the literature review led to the development of a conceptual model (RQ_2). The conceptual model was constructed to incorporate the independent variables: awareness, knowledge, challenges, leadership, planning and citizen centricity, which were theorised to influence the dependent variable of Nelson Mandela Bay – Sustainable City (RO_2). This model will be tested through an empirical study and the results will be discussed in Chapter Four of this study. The next chapter will discuss the research design and methodology (RO_3) that will be followed to conduct the empirical study on Nelson Mandela Bay residents' sustainable awareness levels.

Chapter Three: Research Methodology

3.1 Introduction

The previous chapter introduced key concepts to this study such as defining sustainable awareness and its Importance in the development of sustainable cities, sustainable knowledge, sustainable city challenges, city leadership, sustainable city planning and citizen centricity. Chapter Two addressed the both the first (RO_1) and second research objectives (RO_2).

Chapter Three explains in detail this study's research design and methodology used to achieve the research objective (RO_3). Below, in Table 3.1, the research question and objective pertaining to this chapter are shown. Further, below in Figure 3.1, the overview for this chapter is discussed, followed by Section 3.2, which describes the definition of research. Section 3.3 discusses the definition and the philosophy of this research as well as the existing research paradigms and the paradigm chosen for this study. This section includes the discussion of various research methodologies with the focus on the methodology associated with positivism. Section 3.4 explains the literature review conducted in Chapter Two (Section 2.8) and describes the form and purpose of the literature review.

Based on the proposed conceptual model in Chapter Two (Section 2.8), Section 3.5 introduces and formulates a set of hypotheses for this study. The survey design is discussed in Section 3.6, which includes the questionnaire description, questionnaire scale, questionnaire constructs and measuring instruments. A discussion on the population, sample and sampling technique is held in Section 3.7. The discussion includes the strengths and weaknesses of the data collection method, questionnaire distribution and data analyses. The reliability and validity requirements for the questionnaire design are discussed in Section 3.9, while Section 3.10 discusses the ethical requirements for the study. Lastly, Chapter Three concludes with a summary of the research design and methodology. The chapter outline for Chapter Three is illustrated in Figure 3.1.

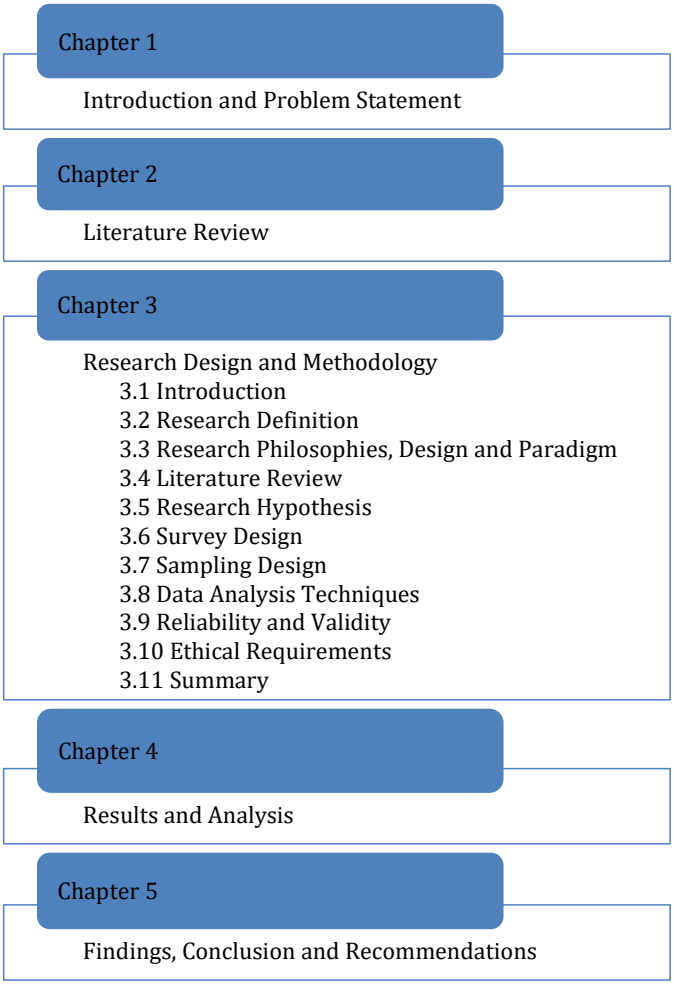

FIGURE 3.1: OVERVIEW OF CHAPTER THREE

Table 3.1 presents the research question and objective related to Chapter 3.

Research Question	Research Objective
RQ_3: What research methodology can be used for this research study and be replicated in the future?	**RO_3:** Explain the components of the research methodology for this study.

TABLE 3-1: RESEARCH QUESTION AND RESEARCH OBJECTIVE OF CHAPTER THREE

3.2 Research Definition

A definition of research by Kothari (2004: 2) identifies research as "*enunciating a problem, formulating a hypothesis, gathering and analysing the data to reach a viable conclusion for the purposes of establishing a solution to a problem or to formulate and prove a theory"*. According to both Collis and Hussey (2014:2) and Saunders et al. (2009), research can be defined as a process of investigation and inquiry that is both methodical and systematic with the aim of increasing knowledge.

The concept of systematic research is well defined by Johnston (2014) and Saunders et al. (2009) who refer to systematic research as research that is not based solely on beliefs, but that it is grounded in a logical relationship between practice and theory. A further elaboration by Johnston (2014), suggests that the relationship between methodical and systematic research will influence the approach followed to advance knowledge. Additionally, Collis and Hussey (2014) describe how research can be further classified into two main categories, namely: applied research and basic research. Applied research can be understood as research findings that are designed to solve an existing problem and specific problem, whereas basic research, can be understood as research findings that are designed to influence theoretical understanding and general knowledge (Collis and Hussey, 2014).

Kothari's (2004) proposed definition of research forms the basis for this study. This research definition indicates that both the research design and the research methodology consist of specific processes. A summary of these processes can be seen below:

- Reviewing and synthesising current knowledge/literature;
- Investigating an existing problem or situation;
- Providing a solution to a problem;
- Examining and studying more general issues;
- Constructing, producing or hypothesising a new system or procedure;
- Explaining new phenomena;
- Creating a new body of information; and
- Combining any of the above (Collis & Hussey, 2013).

Saunders et al. (2009) introduce the metaphor of a research onion, which illustrates how the process of research follows the peeling of progressive layers that a researcher undertakes

during the research process. Figure 3.2 below, shows how the analogy of the onion model begins from the outside moving inward through each layer of the onion. The process begins with the researcher selecting a research philosophy from the outer-most layer. The following steps move inward one by one, shifting toward the centre of the onion. At each layer the researcher must make selections relating to the research approach, the research strategy, the research choices, time horizons and techniques and procedures to be followed in the study (Saunders et al., 2009).

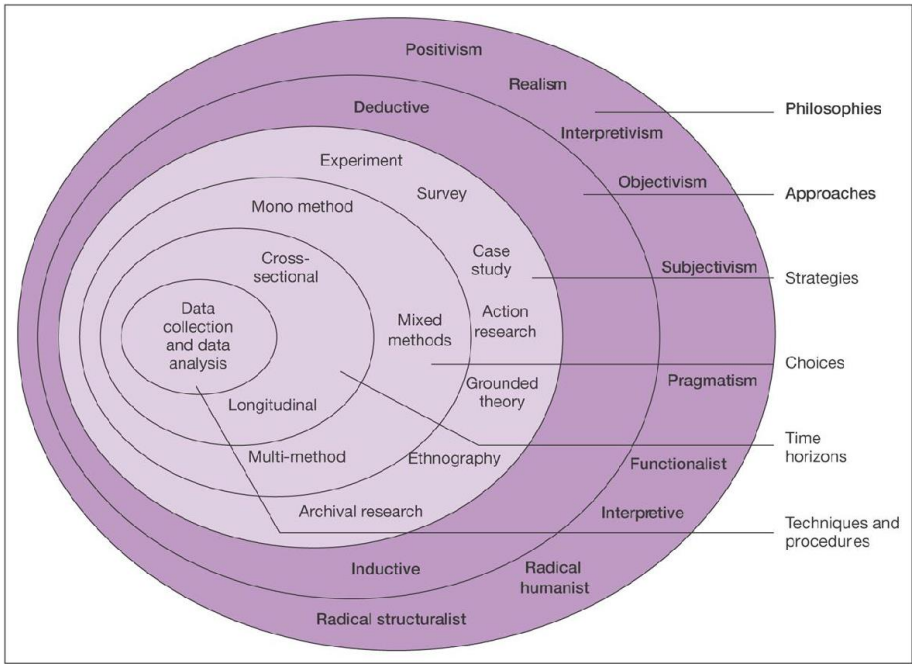

FIGURE 3.2: RESEARCH ONION (SAUNDERS, ET AL., 2009)

3.3 Research Philosophies

In the following sub-sections the research philosophy, research design and research paradigm will be discussed for this study.

3.3.1 Research philosophy of this study

This study follows a positivistic philosophy; therefore, quantitative methods are used to find the causal relationships between the dependent variable of sustainable city and the

independent variables of awareness, knowledge, challenges, leadership, planning, and citizen centricity.

Due to a positivistic paradigm, a large sample population was be examined, where conclusions on this population were inferred from the statistical analysis. The personal worldview of the researcher will have no influence on the results from the research. The potential respondents include both residents and previous residents of Nelson Mandela Bay as well as visitors to Nelson Mandela Bay. The quantitative method allowed for a large quantity of data to be analysed quickly (Pearce, Christian, Smith & Vance, 2014).

3.3.2 Research Design

When research follows a positivistic paradigm, a literature review is used to anchor the research in a relevant theory (Collis & Hussey, 2013). Furthermore, the research has boundaries that are set with a conceptual model derived from the literature review. The paradigm dictates the manner in which the primary and/or secondary data are collected. According to Collis and Hussey (2013), Collis and Hussey (2003) and Creswell (2003), following a quantitative paradigm requires that primary data are collected from original sources like questionnaires, experiments and interviews with individuals and/or focus groups.

The collection of primary data is referred to as the sample or a subset that represents the population considered. Collis and Hussey (2013) define how members of the sample set will answer a structured questionnaire anonymously. Creswell (2003) states that the designing of the questionnaire must not guide respondents are guided into answering specific questions in a biased manner.

3.3.3 Research paradigm for this study

The research paradigm refers to the way in which data about a research project should be gathered, analysed and used. Based on the outer layer of the research onion, Saunders et al. (2009) identify how choosing this philosophical framework is the initial step in the research process. Historically until the late nineteenth century there was only one research paradigm used, which was solely focussed on the natural sciences and referred to as positivistic research rooted in realism. This studies research paradigm is also formed on the source of knowledge, which is based on positive information.

The goal of this research is to explain the cause and effect relationships between the identified variables (Chapter 2). Associated with positivistic research is quantitative analysis methods, as variables are believed to be measurable (Collis & Hussey, 2014).

Collis and Hussey (2014) identify a second paradigm, which focussed on social sciences and is rooted in idealism. Where positivism is built upon objective beliefs, the foundation of social science is highly subjective as it is formed by the perceptions of an individual's view of reality. With social science research, the research affects the social phenomena that are being studied, which means it cannot be objective. This then entails that the results obtained by positivists studying social phenomena cannot be statistically analysed but researchers can only endeavour to define, interpret or come to terms with the phenomena being studied (Collis & Hussey, 2014).

Scientific research has the purpose of forming the process to transforming theories believed into theories known. Collis and Hussey (2014) identify two major research philosophies, positivism and interpretivism that have been identified in the Western tradition of science. The research to be used is dependent on the aim of the study, which leads to the choice between qualitative and quantitative approaches. This study will follow a quantitative approach with a cross-sectional time horizon.

The choice for a cross-sectional time horizon is because of the use of surveys, time sensitivity and the ability to enable the researcher to infer findings to the population if the sample is large enough. This study will follow the cross-sectional time horizon. Collis and Hussey (2009) noted that cross-sectional studies are undertaken when time is short and limited resources are available. This assertion is relevant in the case of this treatise, which justifies the selection of this time horizon.

This research study falls within the positivistic paradigm and the objective of the research is to explain the cause and effect relationships between the dependent variable, *Sustainable City*, and the seven independent variables, *demographics, awareness, knowledge, challenges, leadership, planning and citizen centricity* by using quantitative analysis including correlation analysis and Exploratory Factor Analysis (EFA). The following section discusses the literature review and how it was used to establish the proposed conceptual model for this study.

Figure 3.3 below illustrates the research methodology for this study.

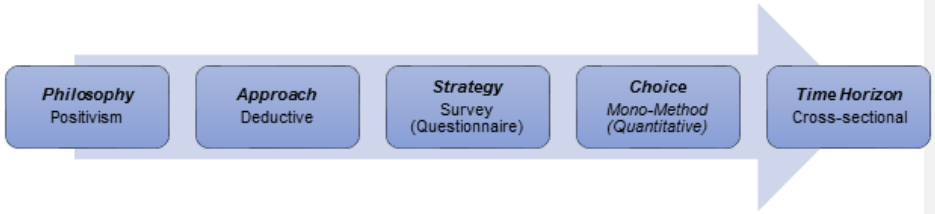

FIGURE 3.3: RESEARCH METHODOLOGY FOR THIS TREATISE (AUTHOR'S OWN CONSTRUCTION)

3.4 Literature Review

According to Collis and Hussey (2013), a literature review can be understood as an accessible body of knowledge. Furthermore, they continue to define how this body of knowledge contains all sources of secondary data applicable to a field of interest. Collis and Hussey (2013) define how secondary data sources can consist of conference papers, academic journals, professional journals, reports, books, statistics, broadcast media and news sources. Through a literature review, a systematic development of a body of knowledge is created, which provides an understanding into a specific subject area (Collis & Hussey, 2003).

Conducting a critical review of the literature enables the researcher to recognize key short comings, which then allows for the body of knowledge to be expanded (Creswell, 2003). Rowley and Stack (2004) identify how a literature review intends to identify and collect secondary data into a meaningful body of knowledge within a specific subject field. In Chapter 2, this has been accomplished.

The process of the literature review began with obtaining a list of top journals in the fields of sustainable cities and awareness. From these sources, keywords were identified for the formulation of the research topic and the description of the research problem. ResearchGate and the Nelson Mandela University library, using Ebscohost, provided the means to survey literature online and refined the research parameters/keywords. With a growing body of literature and knowledge, the researcher formalised a Research Alignment Plan (RAP) with his supervisor (Appendix A).

This research platform provided sufficient information to develop a conceptual model for the research project. The literature review found that there were studies conducted on Nelson Mandela Bay sustainability, yet no studies had been conducted into the awareness of

residents regarding Nelson Mandela Bay as a sustainable city. The following section discusses the proposed research hypotheses developed from the conceptual model in Chapter 2.

3.5 Research Hypotheses

The conceptual model was developed in Chapter 2 (Section 2.8) and shown in Figure 2.8. This section describes the proposed hypotheses for this treatise as illustrated in Figure 3.4. The demographic variables of interest are gender, age, location, ethnicity, education, martial status, work sector, household income, and employment.

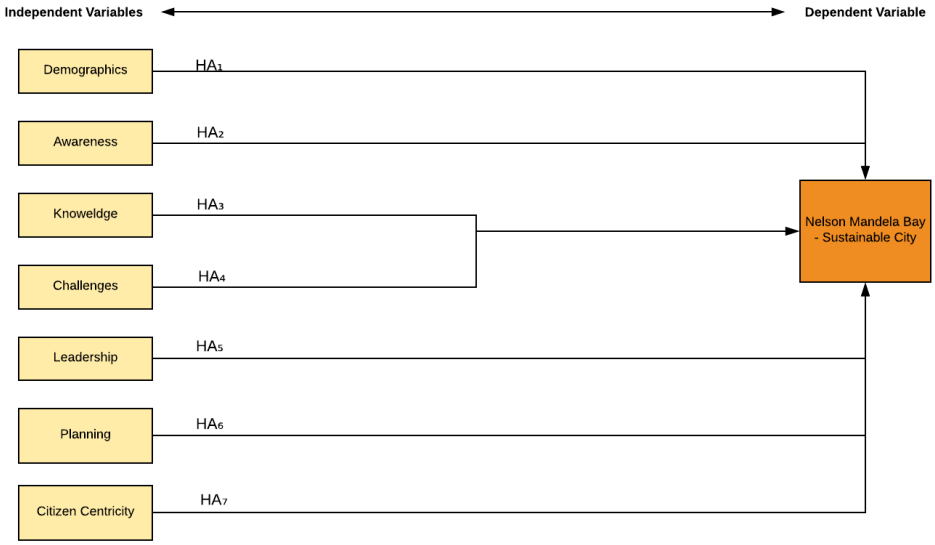

FIGURE 3.4: HYPOTHESISED CONCEPTUAL NELSON MANDELA BAY – SUSTAINABLE CITY

The following is a list of the hypotheses as shown in Figure 3.4.

3.5.1 Demographics

Gender

$H01_1$: Gender - exerts no effect on sustainable city awareness.

$HA1_1$: Gender - exerts a positive effect on sustainable city awareness.

Age

$H01_2$: Age - exerts no effect on sustainable city awareness.

$HA1_2$: Age - exerts a positive effect on sustainable city awareness.

Province

$H01_3$: Province - exerts no effect on sustainable city awareness.

$HA1_3$: Province - exerts a positive effect on sustainable city awareness.

Race

$H01_4$: Race - exerts no effect on sustainable city awareness.

$HA1_4$: Race - exerts a positive effect on sustainable city awareness.

Highest level of Education

$H01_5$: Education - exerts no effect on sustainable city awareness.

$HA1_5$: Education - exerts a positive effect on sustainable city awareness.

Marital Status

$H01_6$: Marital Status - exerts no effect on sustainable city awareness.

$HA1_6$: Marital Status - exerts a positive effect on sustainable city awareness.

Work Sector

$H01_7$: Work Sector - exerts no effect on sustainable city awareness.

$HA1_7$: Work Sector - exerts a positive effect on sustainable city awareness.

Household Income

$H01_8$: Household Income - exerts no effect on happiness.

$HA1_8$: Household Income - exerts a positive effect on sustainable city awareness.

Employment Status

$H01_9$: Employment Status - exerts no effect on sustainable city awareness.

$HA1_9$: Employment Status - exerts a positive effect on sustainable city awareness.

3.5.2 Awareness

$H0_2$: Awareness - exerts no effect on sustainable city awareness.

HA_2: Awareness - exerts a positive effect on sustainable city awareness.

3.5.3 Knowledge

$H0_3$: Knowledge - exerts no effect on sustainable city awareness.

HA_3: Knowledge - exerts a positive effect on sustainable city awareness.

3.5.4 Challenges

$H0_4$: Challenges - exerts no effect on sustainable city awareness.

HA_4: Challenges - exerts a positive effect on sustainable city awareness.

3.5.6 Leadership

$H0_5$: Leadership - exerts no effect on sustainable city awareness.

HA_5: Leadership - exerts a positive effect on sustainable city awareness.

3.5.7 Planning

$H0_6$: Planning - exerts no effect on sustainable city awareness.

HA_6: Planning - exerts a positive effect on sustainable city awareness.

3.5.8 Citizen Centricity

$H0_7$: Citizen Centricity - exerts no effect on sustainable city awareness.

HA_7: Citizen Centricity - exerts a positive effect on sustainable city awareness.

Each of the above hypotheses form an instrument in the questionnaire design. The following section discusses the instrument and the questions forming the instrument.

3.6 Survey Design

In the following sub-sections, the design of the questionnaire will be discussed.

3.6.1 Survey Research Defined

According to Collis and Hussey (2009), the most prevalent method of collecting information from respondents is through the survey technique. Additionally, the information collected typically includes demographic information and any other information that can be collected through a structured and well-formulated questionnaire (Collis & Hussey, 2013). The questionnaire is distributed to respondents online and then this data are analysed using a suitable statistical package. The applicable statistics are determined by the response level of

the questionnaires. Wegner (2013) mentions that a small sample will result in the use of descriptive statistics only and that data cannot be inferred to the population if the sample size is too small. The advantage with online survey questionnaires, is that they allow for respondents to be located geographically anywhere with the only cost being associated with the access to technology required (Collis & Hussey, 2013).

The following sub-section discusses the questionnaire design used for this research study.

3.6.2 Questionnaire Design

Based on Collis and Hussey (2013) and Creswell's (2003) understanding of a questionnaire, a questionnaire design must consider the time, the expense and the effort that is invested in data collection as well as ensuring that the questions are targeted to the intended group of respondents. Furthermore, Collis and Hussey (2013) and Creswell (2003) discuss how questions should be limited to collect data that are only relevant to the study, questions need to be easily understood and questions should be both engaging and appropriate. Researchers have emphasised that measurement forms the foundation for many social research frameworks and it is necessary to quantify the observations. Collis and Hussey (2013) and Wegner (2013) identify how researchers theorised that numerals can be assigned to an occurrence, which indicates the differences in the quality or degrees of agreement.

A Likert scale based questionnaire is designed to measure a respondent's attitude by asking for a response to a particular set of statements (Hartley, 2013). For example, responses are asked in a continuum from Strongly Disagree (1) to Strongly Agree (5). However, Wegner (2013) refers to the fact that researchers pointed out that not all scales measure identically, which therefore, may potentially impact the validity of deduced conclusions.

Furthermore, a Likert scale questionnaire requires for responses to be beyond a *Yes* or *No* answer and is in fact designed for responses to be ranked in degrees of agreement (Wegner, 2013). Likert scale questionnaires typically use a 5-point scale, with the neutral point indicating neither disagreement nor agreement. According to Hartley (2013) and Kalmijn, Arends and Veenhoven (2011), the argument pertaining to a lack of a neutral point option has been identified by researchers to have an effect on the validity and reliability of data.

Hartley (2013) further adds that researchers have suggested that a five-point Likert scale models, do produce a greater validity and reliability due to statistical tendencies. On the other

side of the argument, researchers and others have argued that Likert scale questionnaires, which do offer a neutral point, will more than likely have respondents selecting that point in their responses. This is argued by researchers, who state that questionnaires with a neutral point response option enable respondents to falsely report indifference rather than make response of either agreement or disagreement (Hartley, 2013; Hills & Argyle, 2002).

The current study used a questionnaire with a five-point Likert scale. Response #1 represented (strongly disagree), #2 represented (disagree), #3 represented (neutral), #4 (agree) and #5 (strongly agree) for each statement.

Chapter 2 identified the factors of Sustainable City Awareness. Several research studies were identified, which validate items for each factor. These statements have been used in questionnaires in these studies to measure Sustainable City Awareness.

The measuring instrument for this study was compiled from previous work done on citizens' perspectives of the sustainability of cities (Townsend, 2013). The first questionnaire that was identified was compiled by Grand Valley State University in 2011. The research focused on a Sustainable Community Development Initiative. The second questionnaire which was adapted, was one compiled by Townsville City Council in North Queensland Australia in 2005. Townsville City Council recognised the importance of Sustainability and the vision and opportunity of a Sustainable City. Community consultation was used to determine community vision, expectations and contribution to Sustainable Townsville. These two questionnaires formed the base for the questionnaire for this study. In addition, important factors were operationalised from the literature.

The questionnaire comprised eight sections with Section A collecting demographic information of the participants. Section B addressed the current sustainable city Knowledge (Independent Variable (IV1)) of participants and used a five point Likert Scale to measure this. Section C asked in closed questions whether participants were firstly Aware (Independent Variable (IV2)) of key sustainable practices and then whether they practised those sustainable practices. Section D, E, F and G all used the five point Likert Scale to measure the participants' opinions of the Challenges (Independent Variable (IV3)), Leadership (Independent Variable (IV4)), Planning (Independent Variable (IV5)) and Citizen Centricity (Independent Variable (IV6)) that face sustainable cities.

The final section of the questionnaire, Section H, asked respondents using a five point Likert Scale to measure how sustainable they thought Nelson Mandela Bay (Dependent Variable) is as a City. Table 3.2 shows the IV with each factor item for the independent variable in the questionnaire. Additionally, this table also identifies the code used for each independent variable and the factor items belonging to that independent variable. The descriptive analysis of the dependent variable along with each independent variable is analysed in Section 4.3 (Measurement Items).

Code	Question Statement/Factor Item
Independent Variable: Knowledge (IV1)	
KNW 1	Business, the community and government should have sustainable partnerships
KNW 2	We need to maintain the functions of our natural environment as a matter of survival
KNW 3	Sustainability is meeting the needs of present without compromising the ability of future generations to meet their own needs
KNW 4	Our current way of living is sustainable
KNW 5	I understand sustainable development
KNW 6	I have a personal responsibility to help make a difference on sustainability issues
Independent Variable: Awareness (IV2)	
AWE 1	Green Energy
AWE 2	Solar Panels
AWE 3	Grid connected home wind and solar power
AWE 4	Public Transport
AWE 5	Cycle to work
AWE 6	Public walking tracks and bikeways
AWE 7	Environmentally friendly products
AWE 8	Household waste recycling
AWE 9	Litter recycling
AWE 10	Biodiesel
AWE 11	Water conservation
AWE 12	Water recycling
AWE 13	Reusable shopping bags
AWE 14	Solar hot water
AWE 15	No chemicals in storm water drains
AWE 16	Use of indigenous plants in gardening
AWE 17	Support local services and facilities
Independent Variable: Challenges (IV3)	
CHG 1	Unemployment
CHG 2	Economic restructuring
CHG 3	Pressure on infrastructure
CHG 4	Climate change

CHG 5	The aging population puts pressure on adult social care
CHG 6	Limited resources
CHG 7	Weak leadership
CHG 8	Limited investment from the private sector
CHG 9	Competition with other cities for investment
Independent Variable: Leadership (IV4)	
LDR 1	Have a clear vision which addresses sustainable issues
LDR 2	Be citizen centric
LDR 3	Enable use of city spaces
LDR 4	Share knowledge on how the city works
LDR 5	Embrace opportunities enabled by technology
LDR 6	Develop policies to promote sustainability
LDR 7	Promote sustainability to attract investment
LDR 8	Have clear focus of accountability within the city authority
Independent Variable: Planning (IV5)	
PLN 1	Asset maintenance
PLN 2	Below ground power lines
PLN 3	Community services
PLN 4	Natural habitats
PLN 5	Maintenance of biodiversity
PLN 6	Larger percentage of open/green spaces/parks
PLN 7	Energy efficient infrastructure
PLN 8	Solar hot water systems
PLN 9	Liveability for well being
PLN 10	Neighbourhood centre accessibility
PLN 11	Eco villages
PLN 12	Public transport systems and mobility
PLN 13	Bikeways and walking tracks
PLN 14	Proximity to work
PLN 15	Waste minimisation
PLN 16	Waste recycling
PLN 17	Water quality
PLN 18	Water sensitive plants
PLN 19	Storm water management
PLN 20	Water conservation
PLN 21	Infrastructure to attract investment
PLN 22	Enable externally driven, stake holder led innovation by citizens
Independent Variable: Citizen Centricity (IV6)	
CZC 1	Enable externally driven, stakeholder led innovation by citizens
CZC 2	Provide smart crime prevention
CZC 3	Provide free Internet connectivity
CZC 4	Manage city data as an asset
CZC 5	Invest in systems to capture and manage data

CZC 6	Have an integrated approach to the commissioning of services
CZC 7	Align budgets to provide common good platforms and services
CZC 8	Have joint procurement initiatives
CZC 9	Collaborate with Academia, industry and NGOs
CZC 10	Have IT as a service
CZC 11	Engage with citizens through IT infrastructure to solve city problems
CZC 12	Enable citizen-to-citizen services through IT infrastructure
CZC 13	Have a City data management partnership with citizens
CZC 14	Develop policies for open city data
CZC 15	Protect personal privacy
CZC 16	Develop IT solutions for working across vertical silos to deliver citizen centric services
CZC 17	Use IT solutions for a one-stop shop
CZC 18	City data should drive innovation and create new value
CZC 19	City data should be used to attract investment
CZC 20	City data should accelerate new business start-ups
CZC 21	The City should enable digital connectivity and integration between people, places and things
Dependent Variable: Nelson Mandela Bay - Sustainable City	
NMB 1	In my opinion, Port Elizabeth is a sustainable city
NMB 2	Port Elizabeth has good infrastructure
NMB 3	Port Elizabeth has good leadership
NMB 4	Port Elizabeth is citizen centric
NMB 5	I would invest in Port Elizabeth
NMB 6	Port Elizabeth is managing its challenges well

TABLE 3-2: RESEARCH QUESTION AND RESEARCH OBJECTIVE OF CHAPTER THREE

The following section discusses the sampling design this study followed.

3.7 Sampling Design

According to Collis and Hussey (2014), the next step in research is to ensure that the population is accurately represented. The ideal would be to test every person in the population, however, this is impractical due to the large population size, high costs and time frame associated with it, thus a sample from the population is selected (Saunders et al., 2009). Collis and Hussey (2014) further elaborate how selecting a sample allows the researcher to draw conclusions and extrapolate the findings to the entire population. This also allows the study to be completed in the desired period, budget and allows for easier access to respondents in the population. The following sub-sections will discuss the participants (population) investigated in this study and the data collection methods and questionnaire distribution.

3.7.1 Participants of the Study

The survey designed for this study intended to serve residents of Nelson Mandela Bay. However, because a non-probability sampling method used for the online study, the sample members were not randomly selected. A combination of convenience and snowball sampling methods were used, which included respondents who were previous residents of Nelson Mandela Bay as well as previous visitors to Nelson Mandela Bay. Although the objective of the study was to determine Nelson Mandela Bay residents' sustainable awareness levels, the additional respondents allowed for the data analysis of previous inhabitants of Nelson Mandela Bay and visitors to the metro.

In Chapter 4, the difference between internal and external residents is analysed and reported on. The representation of respondents from the metro is 42% of the total population size (n = 236). The limitation of the study was that the survey was administered online, which means that there was limited access to the full range of the Nelson Mandela Bay population.

3.7.2 Data collection method

Collis and Hussey (2014) discuss that the main reason for collecting data is to investigate a research question in order for knowledge to be generated. Based on the research questions identified in Chapter One, the data collected for this study should align with these research questions. Furthermore, this data should be selected based on the relevance, validity and reliability (Wegner, 2016; Collis & Hussey, 2014). Chapter Two provided the secondary data collection for this study. Therefore, this section will focus on the primary data collection for the study. As discussed in Section 3.3.2, the two primary data collection methods commonly associated with positivistic studies are surveys and experimental design (Park & Park, 2016; Collis & Hussey, 2014).

This study will use a questionnaire that aims to assess the sustainable awareness of residents' of Nelson Mandela Bay and the six Independent Variables (IV's) discussed in Section 2.2. The Nelson Mandela University Online Survey Platform (QuestionPro) was used and a link was emailed to the sample. The next section discusses the questionnaire development.

3.7.3 Questionnaire Distribution

According to Saunders et al. (2009), administering a questionnaire is one of the most important phases in a study, as it determines whether respondents will respond. Therefore, it is vital that the questionnaire is formulated well and worded in such a way that the respondent is motivated to complete the questionnaire (Saunders et al., 2009). In order to avoid ambiguity and be valid, the wording of the questions is important. The questions need to be worded in such a manner that they measure what they say they measure and prompt reliable responses from the sample group (Collis & Hussey, 2014; Saunders et al., 2009).

Distribution of the questionnaire was done via the Nelson Mandela Business School MBA group database as a once-off email. This email explained the purpose of the research and gave the details of the supervisor and explained the confidentiality of the respondents. It included a URL link to the survey on the NMU QuestionPro system. The database has the ability to block duplicate entries. To increase survey response, the survey had an option for the respondent to send the questionnaire to ten other citizens who may be interested in responding.

3.7.4 Strengths and Weaknesses of the Data Collection Method Used

Based on literature from Guzi and de Pedraza Garcia (2015) and Evans and Mathur (2005) online surveys provide convenience for both researcher and respondent, as they are flexible and easy to maintain and analyse. However, on the other hand, online surveys are limited to people who have access to the Internet, which can proportionately leave out a significant sample that does not have access to the Internet. Furthermore they include only those who are prepared to respond to the survey (Evans & Mathur, 2005; Guzi & de Pedraza García, 2015).

In the last decade, the incidence of junk email has increased as well as the concern over issues of security and confidentiality. In spite of these concerns, Guzi & de Pedraza García (2015) found that the results of online surveys are comparable with the results obtained from probabilistic sampling surveys. The researcher therefore decided to use the online data collection method.

3.8 Data Analysis Techniques

3.8.1 Qualitative Research

There are three choices of methods available for researches to choose from, these are qualitative, quantitative and mixed methods. According to Collis and Hussey (2014), qualitative research is primarily exploratory or investigatory research and uses interpretative manner to conduct analyses. Further, Collis and Hussey (2014) and Saunders et al., (2009) describe how qualitative research has the ability to be especially effective in obtaining culturally specific information regarding the values, opinions, behaviours and social contexts of particular populations.

This research provides insights into the problem or helps to develop ideas or hypotheses for potential quantitative research. Due to the fact that qualitative research is subjective, numerical values cannot be assigned to these conclusions. Social relationships are analysed by using qualitative research methods. Common factors in all qualitative research are characterised by the following elements:

- This research examines the phenomenon and all its complexities;
- This research is done in the natural settings of the occurrence of the phenomenon;
- This research does not attempt to quantify the variation of the situation, phenomenon or problem.
- The data of an observed phenomenon is used to identify the characteristics; and
- Qualitative data is gathered and measured through either nominal, ordinal or scaled variables (Kumar, 2011; Leedy & Ormrod, 2010).

3.8.2 Quantitative Research

Collis & Hussey (2009) describe quantitative research as research that aims to address questions about relationships between variables that are measured numerically with the focus on a specific aspect of the phenomenon. This process involves gathering numerical data about a population that is systematically and objectively selected in order to extrapolate the findings to the greater population. Saunders et al. (2009) summarize quantitative research as research, which attempts to establish statistical relationships between variables by determining the amount of variation contained in the data set gathered and measured on

quantitative variables. The purpose of quantitative research is therefore to prove or negate a proposed hypothesis by using statistical analysis of gathered numerical data (Leedy & Ormrod, 2010; Mitchell & Jolley, 2010).

The common factors in quantitative research are identified below:

- This research quantifies the variation of the phenomenon or problem;
- This research aims to predict causal relationships;
- This research aims to describe characteristics of a population;
- This data are gathered and measured by using primarily quantitative variables; and
- Quantitative analysis is used to determine the amount of the variation (Kumar, 2011).

According to Kumar (2011), a common misconception of quantitative research is that statistics form the fundamental underlying element. However, by conducting a quantitative analysis, the researchers only have the option to confirm or negate conclusions based on their understanding of the analysed data set. A statistical method that is commonly used by researchers to confirm or negate conclusions is Correlation Analysis. Collis and Hussey (2014) define correlations as relationships between variables or the measure of linear association between two variables. A change in one variable relates to a change in another and the extent of this change is what correlation analysis determines.

For this study, Pearson's Product Moment Correlations analysis was conducted. The correlation coefficient is deemed statistically significant if the p-value is equal to 0.05 for n = 236 when the correlation coefficient critical (rcrit or |r|) >= .128 and deemed practically significant if |r| >= .300 (Gravetter & Wallnau, 2009: 534). Thus, for the sample size of 236, a result will be deemed both statistically and practically significant if |r| >= .300 (Gravetter & Wallnau, 2009: 534).

A relationship where a correlation between variables exists, is when one variable increases and the other variable either increases (positive correlation) or decreases (negative correlation) and this happens in a predictable fashion (Collis & Hussey, 2014; Leedy & Ormrod, 2010). The correlation coefficient is the statistical measure that measures the strength of such correlation. This correlation coefficient (r) can range from -1 (a perfect negative correlation) to +1 (a perfect positive correlation). The various strengths of correlation can be seen in Figure 3.5.

Correlation Coefficient	Interpretation
+1.00	Perfect positive linear association
+0.90 to +0.99	Very high positive correlation
+0.70 to +0.89	High positive correlation;
+0.40 to +0.69	Medium positive correlation
+0.01 to +0.39	Low positive correlation
0	No linear association
-0.01 to -0.39	Low negative correlation
-0.40 to -0.69	Medium negative correlation
-0.70 to -0.89	High negative correlation
-0.90 to -0.99	Very high negative correlation
-1.00	Perfect negative linear association

FIGURE 3.5: STRENGTHS OF CORRELATION (COLLIS & HUSSEY, 2014)

For this study, variables are each classified as either dependent or independent. The value of the dependent variable (Nelson Mandela Bay – Sustainable City) is influenced by one or more independent variables (Awareness, Knowledge, Challenges, Leadership, Planning and Citizen Centricity). One other view of the relationship between variables is that the independent variable can be seen as the cause and the dependent variable can be seen as the effect (Collis & Hussey, 2014).

As this study collected data quantitatively, precise statistical data analysis methods are used to present the data. The data captured from the designed questionnaire (Appendix D) will be analysed against the secondary data that was collected in Chapter 2, thereby testing the conceptual model illustrated in Figure 2.8. In addition, both descriptive data analysis and inferential data analysis techniques are used to analyse the data. The descriptive statistics that were conducted include frequency distributions of demographic information and measurement items.

Furthermore, central tendency and dispersion of each factor are done. For a result to be regarded as significant it must be both statistically (matched-pair T-test) and practically significant (Cohen's d). To indicate statistical significance, Alpha = 0.05 and the p-value of less than 0.05 is used (Gravetter & Wallnau, 2009). Cohen's d is used for practical significance in a One-sample T-test (Gravetter & Wallnau, 2009). The ranges used for the interpretation of the one-sample T-test are illustrated in Table 3.3.

Interpretation intervals for Cohen's d:	
<0.20	Not significant
0.20 - 0.49	Small
0.50 - 0.79	Medium
0.80+	Large

TABLE 3-3: INTERPRETATION INTERVALS FOR COHEN'S D (GRAVETTER & WALLNAU, 2009: 264)

Cramer's V and p-values are used to indicate practical significance in cross tabulation and Chi-square. The acceptable ranges are depicted in Table 3.4.

	Small	Medium	Large
***df** = 1*	.10 < *V* < .30	.30 < *V* < .50	*V* > .50
***df** = 2*	.07 < *V* < .21	.21 < *V* < .35	*V* > .35
***df** ≥ 3*	.06 < *V* < .17	.17 < *V* < .29	*V* > .29

TABLE 3-4: INTERPRETATION INTERVALS FOR CRAMER'S V (GRAVETTER & WALLNAU, 2009: 268)

For this study, multivariate data analysis is conducted, which provides the researcher with the ability to create knowledge and make better decisions, as it allows multiple measurements to be analysed simultaneously (Hair, Black, Babin & Anderson, 2010). The multivariate method used was Exploratory Factor Analysis (EFA). EFA was used to explore the patterns among the relationships between variables, to reduce the number of variables and to detect structure in the relationship between variables (Hair et al., 2010; Schreiber, Stage, King, Nora & Barlow, 2006).

The items that provide the most significant data were kept, while the items that displayed redundant information were eliminated. (Hair et al., 2010). Two measurement tools help to determine whether an item is significant, Eigenvalues > 1 are deemed significant and minimum factor loadings of 0.300 at $\alpha = 0.05$ are deemed significant for samples $n > 350$ (Hair, Black, Babin, Anderson & Tatham, 2006:128).

Chapter Four will discuss any changes that will be made to the conceptual model after analysing the data. Before designing a research project, it is critical that the researcher identifies the research paradigm pertinent to the project. According to Collis and Hussey (2013), the research paradigm clarifies the design on what methods the researcher uses for gathering and analysing research information. The following paragraph expands on the discussion in Section 3.2 and discusses the research philosophy, design and paradigm for this study.

3.9 Reliability and Validity

According Collis and Hussey (2014: 52), Organisation for Economic Co-operation and Development (OECD) (2013) and Saunders et al. (2009), reliability represents the precision and accuracy of the measurement and the absence of variation if the study were repeated, whereas, validity represents the degree to which the measurement tests what the researcher wants to test and the findings reflect the case under investigation. Therefore, OECD (2013) discuss how these two constructs measure the quality of the measures used in any study. Additionally, a researcher should also test the relevance of the measure, as the relevance must complement additional measurement outcomes (OECD, 2013).

Reliability is the first construct mentioned and directs a researcher to the question of whether the findings and conclusions in fact stand up to scrutiny, if the findings are consistent and whether, if replicated, the study would yield the same results (Collis & Hussey, 2014). Collis and Hussey further describe how in positivistic studies, reliability is considered significant, whereas, in interpretivist studies, reliability is of little significance. Collis and Hussey (2014: 274.275) explain three different ways that reliability can be estimated:

- **Test-retest reliability** – The same sample can be requested to redo the questionnaire a few days later so that the results can be compared. If there is a positive correlation between the two sets of results (correlation ≥0.8), the findings are reliable. This is a form of external reliability testing; however, it is often cumbersome for respondents and they can often change their answers after thinking about the questions;
- **Split-half reliability** – This is a form of internal reliability for multiple-scale items and is achieved by separating the items in the scale into two equal halves. Correlation analyses are run and the correlation coefficients of the two groups are compared. The Cronbach

Alpha coefficient test is considered the most applicable for split-half reliability and an advantage is that the questionnaire can be completed only once. The interpretation for a Cronbach's Alpha scores can be seen in Table 3.6 (Nunnally, 1978).

Unacceptable	< 0.50
Acceptable	0.50 0.69
Good	0.70 0.79
Excellent	0.80 +

TABLE 3-5: INTERPRETATION INTERVALS FOR CRONBACH ALPHA COEFFICIENT (ZIKMUND, BABIN, CARR & GRIFFIN, 2013).

- **Internal consistency reliability** – It is important to rule out multicollinearity. This means that there is a very strong correlation between IVs measuring the same DV in multiple regression models (≥0.90). Multicollinearity generates unreliable approximations of standard errors. Correlation coefficients in the findings are acceptable below ≤0.70.

In addition to reliability, the validity of results needs to be established. As mentioned above, validity denotes the degree to which a measurement tool tests what the researcher wants to test and the findings reflect the case under investigation (Collis & Hussey, 2014: 53; OECD, 2013; Saunders et al., 2009). Collis and Hussey (2014), Saunders et al. (2009) and Blumberg et al. (2008), describe three ways in which validity can be measured:

- **Face validity** – also commonly referred to as content validity is described as the extent to which a measurement delivers satisfactory disclosure to the RQs, which guide the study (Blumberg, et al., 2008). Simply put, it tests whether the measurement tool measures what it is supposed to measure (Collis & Hussey, 2014).
- **Construct validity** – pertains to hypothetical constructs, which are not directly apparent, but rather assumed. The researcher must explain in the research results and observations how the construct explains the hypothetical constructs (Collis & Hussey, 2014; Saunders et al., 2009). These situations tend to consist of elements, which are deficient in empirical validation (Blumberg et al., 2008).
- **Criterion-based validity** – often referred to as predictive validity denotes the extent to which the measurement tool adequately estimates or predicts relevant aspects of the variable or criterion (Saunders et al., 2009; Blumberg et al., 2008).

To validate the questionnaire in this study, the questions were operationalised from the literature and by making use of validated questions from previous studies (as illustrated in

Section 3.6.4). In addition, a senior statistician lecturer at the NMU, Professor Danie Venter was consulted and where required, changes were made to the questionnaire. Therefore, face validity, criterion-based validity and construct validity were adhered to. The next section discusses the ethical requirements that needed to be adhered to for this study.

3.10 Ethical Requirements

Research ethics forms a pivotal part of any research project. Collis and Hussey (2014) discuss how research ethics is concerned with the way in which research is collected and how the findings are conveyed. Collis and Hussey (2014:31) identify a list of ethical principles that researchers should adhere to:

- Avoid potential harm to participants throughout the research process;
- Respect the participant's dignity and avoid making the participant feel uncomfortable or anxious;
- Ensure that the researcher has knowledgeable consent from the participant;
- Protect the privacy of participants or avoid invading their privacy;
- Ensure confidentiality of the collected data;
- Protect the anonymity of participants;
- Avoid deception or misleading behaviour throughout the research process;
- Declare any affiliations, conflict of interests and sponsorship of the research;
- Communicate information in a transparent and honest manner;
- Research does not exploit the participant, but that the research is mutually beneficial;
- Avoid misrepresentation, misleading, misunderstanding or falsely reporting the findings of the research.

NMU has criteria stipulated which research requires full ethical clearance. This treatise did not meet the criteria needed for full ethical clearance, thus Ethical Clearance Form E was sufficient. The signed Form E is attached in Annexure B: Ethical Clearance Form E.

3.11 Summary

Chapter 3 had the focal point of describing the research design and methodology that the study will be following. The RQ Chapter 3 addressed was *RQ_3: What research methodology can be used for this research study and be replicated in the future?* Which corresponds to *RO_3:*

Explain the components of the research methodology for this study. To accomplish RQ_3, literature was reviewed to explore the main two research philosophies: interpretivism and positivism and the deductive and inductive approaches to research were discussed. Additionally, this chapter reviewed the differences between qualitative and quantitative research methodologies and outlined the different data collection methods associated with each methodology. The positivistic philosophy, deductive approach, mixed method research methodology, survey data collection method and cross-sectional time horizon were chosen for this study as illustrated in Figure 3.2.

This chapter further identified the unit of analysis as Nelson Mandela Bay - Sustainable City and discussed the sampling design, which consists of a database used to collect the data. The data collection methods of secondary data (conducted in Chapter 2) and primary data, which will be collected through the questionnaire were discussed as well as the questionnaire development and operationalisation of questions through the literature review in Chapter 2. The data analysis methods, the validity and reliability were discussed to ensure that the data collected are valid and reliable. This chapter concluded with the ethical requirements needed to conduct this study. The next chapter will analyse the collected data and the findings will be presented and discussed.

Chapter Four: Results

4.1 Introduction

The previous chapter (Chapter 3) discussed the research methodology and approach this study would followed. The RQs Chapter 3 addressed was RQ_3: *What research methodology can be used for this research study and be replicated in the future?* Which corresponds to RO_3: *Explain the components of the research methodology for this study.* Chapter 3 in addition introduced various statistical data analysis techniques that will be used in Chapter 4 to evaluate the results of the study.

Chapter 4 addresses *RQ_4: How sustainably aware are residents of Nelson Mandela Bay?* Which corresponds to *RO_4* – To determine the awareness of Nelson Mandela Bay residents of factors influencing sustainable city awareness. *Additionally, t*his chapter discusses the various aspects of the questionnaire, beginning with demographics, then analysing and discussing the various measurement items. The statistical methods of Exploratory Factor Analysis (EFA) are conducted in order for the number of factors to be reduced and Cronbach's Alpha analysis to be done.

As mentioned in Chapter 3 (Section 3.8.2) both descriptive and inferential statistics are presented and the relationships between the Dependent Variable (DV): Nelson Mandela Bay – Sustainable City and selected demographic information and various Independent Variables (IV's) and demographic information are explored. In conclusion, the chapter ends with Confirmatory Factor Analysis (CFA), which allows for the effectiveness of the measurement instrument to be established. The Chapter outline is illustrated in Figure 4.1.

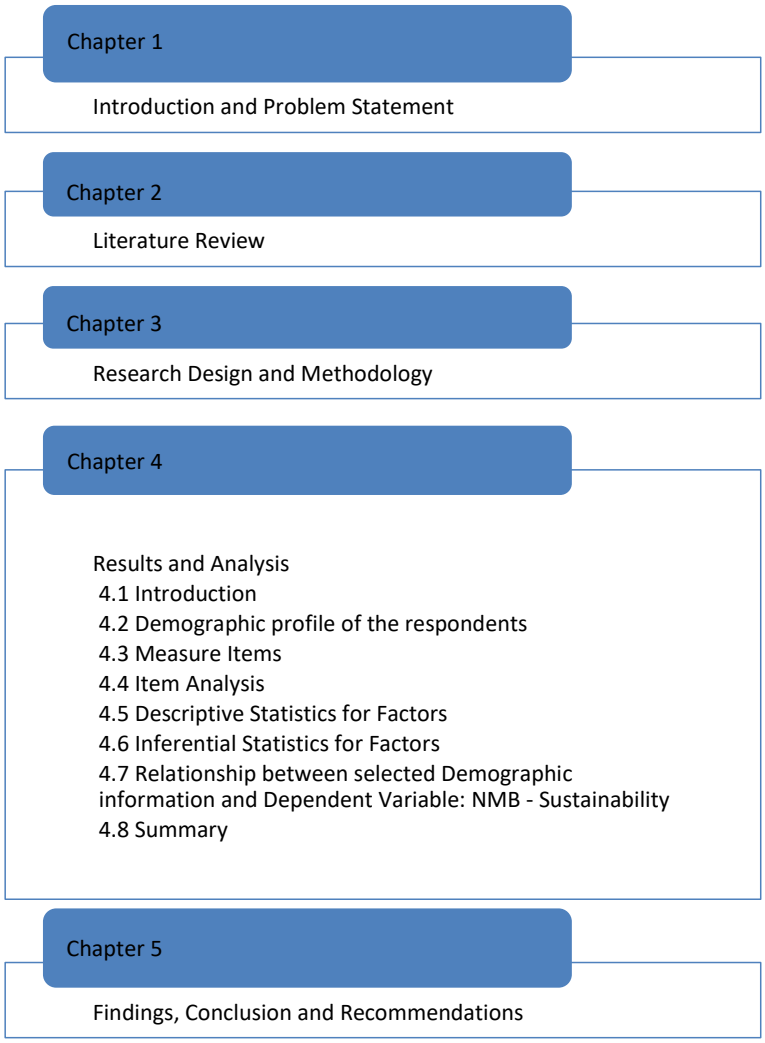

FIGURE 4.1: OVERVIEW OF CHAPTER 4

4.2 Demographic Profile of the Respondents

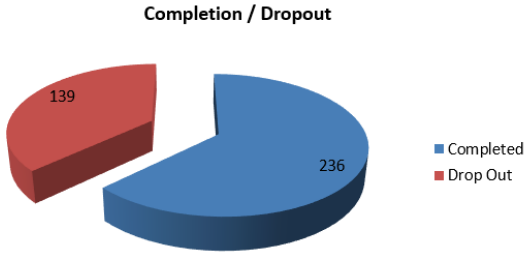

FIGURE 4.2: QUESTIONNAIRE COMPLETION AND DROPOUT

Figure 4.2 reveals that a total of 375 participants started the questionnaire or partially completed the questionnaire with a total of 236 respondents fully completing the questionnaire, which resulted in a 63% response rate.

4.2.1 Geographic information

What province do you live in?	Frequency	Percentage
Eastern Cape	135	56%
Free State	0	0%
Gauteng	39	17%
Mpumalanga	3	1%
Northern Cape	0	0%
North West	1	1%
Western Cape	18	6%
KZN	40	19%
Limpopo	0	0%
Total	236	100.00%

TABLE 4-1: GEOGRAPHIC INFORMATION OF RESPONDENTS

Table 4.1 indicates that the majority of respondents (n = 135, 56%) live in the Eastern Cape, followed by n = 40 (19%) living in KwaZulu Natal and n = 39 (17%) living in Gauteng.

Figure 4.3 exhibits that 42% (n = 99) of the respondents were living in Nelson Mandela Bay, whilst a larger fifty six percent of responses indicated that they lived outside the metropolitan.

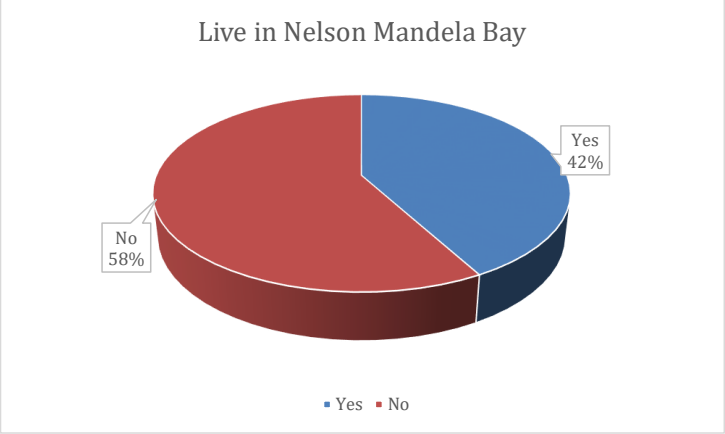

FIGURE 4.3: RESPONDENTS WHO LIVE IN NELSON MANDELA BAY (N = 236)

4.2.2 Demographic Characteristics

Figure 4.4 illustrates that there was an equal split in the gender of respondents. Male respondents were n = 120 (51%) versus female respondents n = 116 (49%), which provides the firm foundation that this report will not have any potential gender bias.

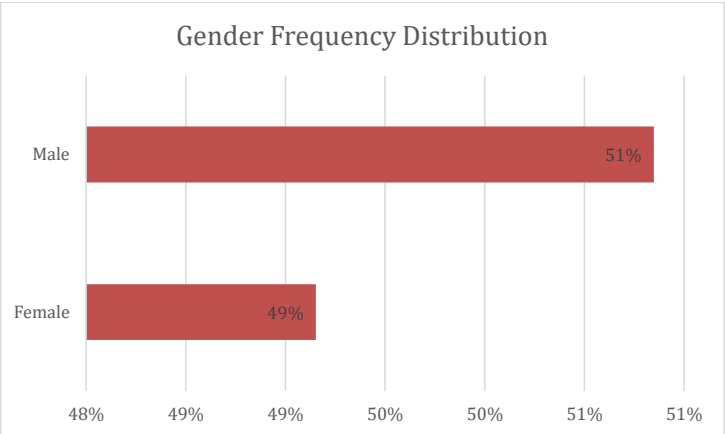

FIGURE 4.4: FREQUENCY DISTRIBUTION: GENDER (N = 236)

Furthermore, Table 4.2 illustrates that most of the respondents (n = 101, 43%) were between the ages of 26 and 35, followed by age group 36 to 45, which consisted of 36% (n = 84). This indicates that 82% (n = 194) of the respondents were under the age of 46 years and 18% (n = 42) were older than 46 years. With regard to marital status, the majority of the respondents

were married (n = 132, 56%). Thirty-two percent (n = 75) of the respondents indicated that they were single, while 6% (n = 15) indicated that they were divorced. In addition, the majority of respondents were black (n = 91, 38%), while 28% (n = 65) of respondents were white, n = 39 (17%) Indian, n = 38 (16%) Coloured and two (1%) respondents indicated that they were Chinese.

Age of respondents	Frequency	Percentage
18-25	9	4%
26-35	101	43%
36-45	84	36%
46-55	31	13%
56-65	7	3%
Older than 65	3	1%
Total	**236**	**100%**
Marital Status	**Frequency**	**Percentage**
Single	75	32%
Living together	9	4%
Married	132	56%
Divorced	15	6%
Widowed	5	2%
Total	**236**	**100%**
Respondents' race	**Frequency**	**Percentage**
Black	91	38%
Coloured	38	16%
Indian	39	17%
White	65	28%
Other	2	1%
Total	**236**	**100%**

TABLE 4-2: DEMOGRAPHIC CHARACTERISTICS OF RESPONDENTS

Figure 4.5 indicates that the majority of the respondents (n = 93, 39%) had a post-graduate degree, n = 74 (31%) have a degree, while n = 57 (24%) have a diploma and n = 12 (5%) have a matric certificate.

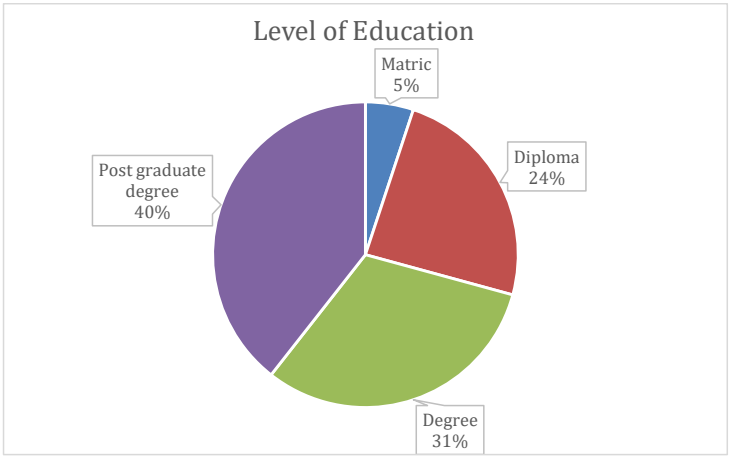

FIGURE 4.5: LEVEL OF EDUCATION (N = 236)

4.2.3 Employment Information

Table 4.3 illustrates the employment information of the respondents. Table 4.3 reveals that respondents came from a diverse professional background, which provides the opportunity to understand the different views and opinions towards sustainability. The highest sector in which respondents worked was the engineering sector (n = 33, 14%), which was followed by other (n = 36, 15%), which consisted of a variety of professional sectors, including: wholesale and retail, energy, occupational health, media, aviation, recruitment, logistics SOEs, transport and life coaching. Table 4.3 further illustrates that the majority (n = 199, 84%) of the respondents indicated that they were employed, while 30 (13%) indicated that they were self-employed, five (2%) were unemployed and two (1%) were retired.

Sector in which you work in	Frequency	Percentage
Agriculture, forestry and fisheries	5	2%
Arts, entertainment and recreation	2	1%
Banking	6	3%
Construction	5	2%
Education	15	2%
Engineering	33	14%
Finance and Insurance	13	6%
FMCG	7	3%
Government and public administration	25	11%
Healthcare	18	8%
Information Technology	16	7%
Legal	3	1%
Manufacturing	31	13%
Marketing	6	3%
Mining	6	3%
Retail	7	3%
Telecommunications	6	3%
Other, please indicate...	36	15%
Total	236	100%
Respondents employment status	**Frequency**	**Percentage**
Employed	199	84%
Self employed	30	13%
Unemployed	5	2%
Retired	2	1%
Total	236	100%

TABLE 4-3: DEMOGRAPHIC CHARACTERISTICS OF RESPONDENTS

Figure 4.6 shows that the average (n = 75, 32%) household income of respondents was between R25k-R45k per month. Forty-five (19%) of the respondents indicated monthly income between R45k-R65k per month and n = 38 (16%) household income levels between

R15k-R25K per month. Both income levels categories of R65k-R85k and +R85k per month had an equal number of respondents (n = 29, 12%).

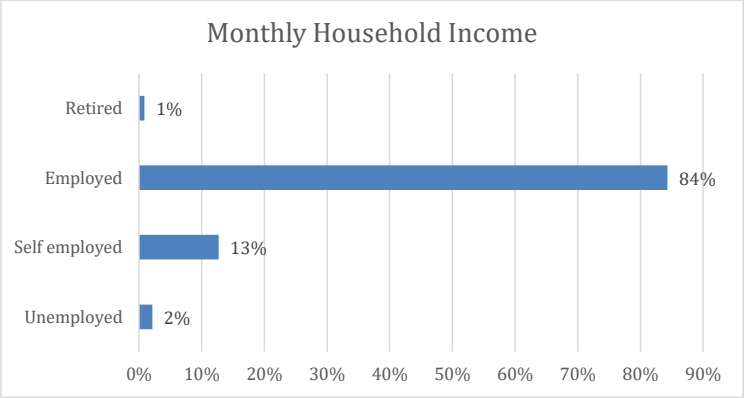

FIGURE 4.6: HOUSEHOLD MONTHLY INCOME LEVELS (N = 236)

4.3 Measurement Items

4.3.1 Dependent variable: Nelson Mandela Bay – Sustainable City

This section in the questionnaire aimed to establish the overall opinion of respondents for Nelson Mandela Bay being a Sustainable City. Descriptive statistics for the summated score derived from the responses to these items are presented and discussed in Section 4.5. Frequency distributions for these items are reported in Table 4.4.

Code	Statement	Disagree	Neutral	Agree	Total
NMB 1	In my opinion, Port Elizabeth is a sustainable city.	56 (24%)	114 (48%)	66 (28%)	236 (100%)
NMB 2	Port Elizabeth has good infrastructure.	54 (23%)	102 (43%)	80 (34%)	236 (100%)
NMB 3	Port Elizabeth has good leadership.	26 (11%)	121 (51%)	89 (38%)	236 (100%)
NMB 4	Port Elizabeth is citizen centric.	47 (20%)	125 (53%)	64 (27%)	236 (100%)
NMB 5	I would invest in Port Elizabeth.	36 (15%)	71 (30%)	129 (55%)	236 (100%)
NMB 6	Port Elizabeth is managing its challenges well.	39 (17%)	136 (58%)	61 (26%)	236 (100%)

TABLE 4-4: FREQUENCY DISTRIBUTION: DV: NELSON MANDELA BAY - SUSTAINABLE CITY

The results in Table 4.4 show that 48% (n = 113) of respondents are neutral to the belief that Nelson Mandela Bay is a Sustainable City (NMB 1), while 28% (n = 66) agreed with the question

and 26% (n = 61) answered negatively to view the city is a sustainable one. NMB 2: "Port Elizabeth has good infrastructure" had 43% (n = 101) neutral responses, with only 34% (n = 80) of respondents agreeing and 23% (n = 54) disagreeing. Although NMB 3: "Port Elizabeth has good leadership", had a 51% (n = 120) neutral response, 38% (n = 90) agreed with the question, indicating that respondents were more in favour that the city had good leadership structures. In addition, 53% (n = 125) of respondents were neutral to the fact that Port Elizabeth is citizen centric (NMB 4), while 51% (n = 120) said that they would likely invest in the City (NMB 5) and 30% (n = 71) were neutral to the idea of investing in the city. Finally, 58% (n = 137) of respondents felt neutral regarding how Port Elizabeth manages its challenges (NMB 6), only 17% (n = 40) disagreed with the statement and 26% (n = 94) agreed. In summary, most respondents were predominantly neutral and positive towards Nelson Mandela Bay being a sustainable city.

4.3.2 Independent Variable 1 (IV1): Awareness

This section in the questionnaire aimed to establish both the awareness of respondent's sustainable cities practices as well as whether respondents practiced these sustainable practices. Table 4.5 summarises the responses to the seventeen items associated with Sustainable City Awareness.

Code	Statement	No	Yes	Total
AWE 1	Green Energy	12 (5%)	224 (95%)	236 (100%)
AWE 2	Solar Panels	5 (2%)	231 (98%)	236 (100%)
AWE 3	Grid connected home wind and solar power	19 (8%)	217 (92%)	236 (100%)
AWE 4	Public transport	5 (2%)	231 (98%)	236 (100%)
AWE 5	Cycle to work	7 (3%)	229 (97%)	236 (100%)
AWE 6	Public walking tracks and bikeways	19 (8%)	217 (92%)	236 (100%)
AWE 7	Environmentally friendly products	9 (4%)	227 (96%)	236 (100%)
AWE 8	Household waste recycling	6 (3%)	230 (97%)	236 (100%)
AWE 9	Litter recycling	5 (2%)	231 (98%)	236 (100%)
AWE 10	Biodiesel	44 (19%)	191 (81%)	236 (100%)
AWE 11	Water conservation	4 (2%)	232 (98%)	236 (100%)
AWE 12	Water recycling	14 (6%)	222 (94%)	236 (100%)
AWE 13	Reusable shopping bags	3 (1%)	233 (99%)	236 (100%)
AWE 14	Solar hot water	7 (3%)	229 (97%)	236 (100%)
AWE 15	No chemical in storm water drains	42 (18%)	194 (82%)	236 (100%)
AWE 16	Use of indigenous plants in gardening	47 (20%)	188 (80%)	236 (100%)
AWE 17	Support local services and facilities	27 (11%)	209 (89%)	236 (100%)

TABLE 4-5: FREQUENCY DISTRIBUTION: IV1: AWARENESS

The results in Table 4.5 indicate that almost every respondent was aware of the sustainable practices associated with sustainable city awareness. Only AWE 10 (81%, n = 191), AWE 15 (82%, n = 194), AWE 16 (80%, n = 189) and AWE 17 (89%, n = 210) were less than 90% (n = 212), however, they were all above 80% (n = 189). Solar panels (AWE 2 - 98%, n = 231), Public transport (AWE 4 -98%, n = 231), Litter recycling (AWE 9 - 98%, n = 231), Water conservation (AWE 11 - 98%, n = 231) and Reusable shopping bags (AWE 13 - 99%, n = 234) were the most aware sustainable practices amongst respondents. In summary, most respondents were either aware or entirely aware of the associated sustainable practices with sustainable cities. The results for whether respondents practised sustainable practices are summarized in Table 4.6.

Code	Statement	No	Yes	Total
AWE 1	Green Energy	100 (70%)	43 (30%)	236 (100%)
AWE 2	Solar Panels	118 (75%)	40 (25%)	236 (100%)
AWE 3	Grid connected home wind and solar power	134 (91%)	13 (9%)	236 (100%)
AWE 4	Public transport	129 (76%)	41 (24%)	236 (100%)
AWE 5	Cycle to work	168 (96%)	7 (4%)	236 (100%)
AWE 6	Public walking tracks and bikeways	104 (63%)	61 (37%)	236 (100%)
AWE 7	Environmentally friendly products	36 (22%)	131 (78%)	236 (100%)
AWE 8	Household waste recycling	90 (50%)	89 (51%)	236 (100%)
AWE 9	Litter recycling	84 (49%)	89 (51%)	236 (100%)
AWE 10	Biodiesel	128 (96%)	5 (4%)	236 (100%)
AWE 11	Water conservation	22 (12%)	162 (88%)	236 (100%)
AWE 12	Water recycling	88 (52%)	81 (48%)	236 (100%)
AWE 13	Reusable shopping bags	46 (23%)	156 (77%)	236 (100%)
AWE 14	Solar hot water	127 (74%)	44 (26%)	236 (100%)
AWE 15	No chemical in storm water drains	73 (46%)	86 (54%)	236 (100%)
AWE 16	Use of indigenous plants in gardening	70 (48%)	76 (52%)	236 (100%)
AWE 17	Support local services and facilities	29 (18%)	134 (82%)	236 (100%)

TABLE 4-6: FREQUENCY DISTRIBUTION: IV1: PRACTICE AWARENESS

Table 4.6 indicates that respondents did not in fact practice most of the sustainable practices associated with sustainable city awareness. The four noteworthy sustainable practices respondents were practicing were the use of "environmentally friendly products" (AWE 7 – 78%, n = 184), "water conservation" (AWE 11 – 88%, n = 208), "reusable shopping bags" (AWE 13 – 77%, 182) and "Support for local services and facilities" (AWE 17 – 82%, n = 194). The notable sustainable practices respondents said that they were not practicing were "solar panels" (AWE 2 – 75%, n = 177), "grid connected home wind and solar power" (AWE 3 – 91%, n = 215), "public transport" (AWE 4 – 91%, 215), "cycle to work" (AWE 5 - 96%, 227) and "biodiesel" (AWE 10 – 96%, n = 227). In summary, despite respondents being aware of sustainable city practice (Table 4.5), respondents were not practicing (Table 4.6) most of these sustainable city practices.

4.3.3 Independent Variable 2 (IV2): Knowledge

This section in the questionnaire was designed to establish the knowledge of respondents regarding sustainable cities. Table 4.7 depicts the responses to the six items related to Sustainable City Knowledge.

Code	Statements	Very Negative 1.00 to 1.79	Negative 1.80 to 2.60	Neutral 2.60 to 3.40	Positive 3.41 to 4.20	Very Positive 4.21 to 5.00	Total
KNW 1	Business, the community and government should have sustainable partnerships	1 (0%)	5 (2%)	6 (3%)	87 (37%)	137 (58%)	236 (100%)
KNW 2	We need to maintain the functions of our natural environment as a matter of survival	2 (1%)	2 (1%)	5 (2%)	65 (28%)	162 (69%)	236 (100%)
KNW 3	Sustainability is meeting the needs of present without compromising the ability of future generations to meet their own needs	5 (2%)	13 (6%)	10 (4%)	69 (29%)	139 (59%)	236 (100%)
KNW 4	Our current way of living is sustainable	59 (25%)	111 (47%)	46 (19%)	13 (6%)	7 (3%)	236 (100%)
KNW 5	I understand sustainable development	2 (1%)	8 (3%)	29 (12%)	154 (65%)	43 (18%)	236 (100%)
KNW 6	I have a personal responsibility to help make a difference on sustainability issues	4 (2%)	7 (3%)	10 (4%)	120 (51%)	95 (40%)	236 (100%)

TABLE 4-7: FREQUENCY DISTRIBUTION: IV2: KNOWLEDGE

Table 4.7 depicts a strong association with respondent's knowledge of sustainable cities and sustainable practices. There was a favourable majority (37%, n = 87 and 58%, n = 137) in respondent's positive belief that there needs to be sustainable partnerships between business, the community and government (KNW 1). The majority of respondents also had strong positive response towards both maintaining the functions of the natural environment

as a matter of survival (KNW 2 – 69%, n = 163) and the function of sustainability meeting the needs of the present without compromising future generations' needs (59%, n = 139). A noteworthy majority of respondents (47%, n = 111 and 25%, n = 59) felt that the current way we, as humans, are living is unsustainable (KNW 4). Furthermore, most respondents understood sustainable development (KNW 5 – 65%, n = 154) and understood the personal responsibility towards making a difference on sustainable issues (KNW 6 – 51%, n = 120 and 40%, n = 94).

4.3.4 Independent Variable 3 (IV3): Challenges

This section in the questionnaire was designed to establish what the main challenges respondents thought were prominent for a sustainable city. Table 4.9 illustrates the responses to the nine items pertaining to the IV3: Challenges facing Sustainable Cities.

Code	Statement	Disagree	Neutral	Agree	Total
CHG 1	Unemployment	3 (1%)	9 (4%)	224 (95%)	236 (100%)
CHG 2	Economic restructuring	6 (3%)	32 (14%)	198 (84%)	236 (100%)
CHG 3	Pressure on infrastructure	3 (1%)	11 (5%)	222 (94%)	236 (100%)
CHG 4	Climate change	2 (1%)	25 (11%)	209 (89%)	236 (100%)
CHG 5	The aging population puts pressure on adult social care	23 (10%)	49 (21%)	164 (69%)	236 (100%)
CHG 6	Limited resources	10 (4%)	22 (9%)	204 (86%)	236 (100%)
CHG 7	Weak leadership	8 (3%)	24 (10%)	204 (86%)	236 (100%)
CHG 8	Limited investment from the private sector	15 (6%)	58 (25%)	163 (69%)	236 (100%)
CHG 9	Competition with other cities for investment	19 (8%)	50 (21%)	167 (71%)	236 (100%)

TABLE 4-8: FREQUENCY DISTRIBUTION: IV3: CHALLENGES

Nearly every respondent felt that unemployment (CHG 1 – 95%, n = 224) and pressure on infrastructure (CHG 3 – 94%, n = 222) were the most pressing challenges facing sustainable cities. Additionally, more than eighty percent of respondents felt that economic restructuring (CHG – 84%, n = 198), climate change (CHG 4 – 89%, n = 210), limited resources (CHG 6 – 86%, n = 203) and weak leadership (CHG 7 – 86%, n = 203) were challenges that needed to be addressed.

Finally, the aging population (CHG 5 – 69%, n = 163), limited investment from the private sector (CHG 8 – 69%, n = 163) and competition with other cities for investment (CHG 9 – 71%, n = 168) shows that all the challenges identified are important challenges that need to be addressed.

4.3.5 Independent Variable 4 (IV4): Leadership

This section in the questionnaire was aimed to determine respondents views on the different components of leadership required in sustainable cities. Table 4.9 summarises the responses to the eight items related to Sustainable City Leadership.

Code	Statement	Disagree	Neutral	Agree	Total
LDR 1	Have a clear vision which addresses sustainable issues	5 (2%)	6 (3%)	225 (95%)	236 (100%)
LDR 2	Be citizen centric	4 (2%)	18 (8%)	214 (91%)	236 (100%)
LDR 3	Enable use of city spaces	4 (2%)	20 (8%)	212 (90%)	236 (100%)
LDR 4	Share knowledge on how the city works	3 (1%)	10 (4%)	223 (94%)	236 (100%)
LDR 5	Embrace opportunities enabled by technology	3 (1%)	12 (5%)	221 (94%)	236 (100%)
LDR 6	Develop policies to promote sustainability	5 (2%)	8 (3%)	223 (94%)	236 (100%)
LDR 7	Promote sustainability to attract investment	6 (3%)	9 (4%)	221 (94%)	236 (100%)
LDR 8	Have clear focus of accountability within the city authority	6 (3%)	6 (3%)	224 (95%)	236 (100%)

TABLE 4-9: FREQUENCY DISTRIBUTION: IV4: LEADERSHIP

Table 4.9 reveals that leadership is one of the key components in sustainable cities. Every item under leadership had a greater than 90% (n = 212) agreement. "Having a clear vision which addresses sustainable issues" (LDR 1 – 95%, n = 224) and "Have a clear focus of

accountability within the city authority (LDR 8 – 95%, n =224) were the two highest items on which respondents had the highest agreement. In summary, these statistics reveal that having the right leadership is imperative to a city's becoming a sustainable.

4.3.6 Independent Variable 5 (IV5): Planning

This section in the questionnaire was designed to determine how important respondents thought planning was required in Sustainable Cities. Table 4.10 below summarises the responses to the 21 items pertaining to Planning.

Code	Statement	Disagree	Neutral	Agree	Total
PLN 1	Asset maintenance	1 (0%)	9 (4%)	226 (96%)	236 (100%)
PLN 2	Below ground power lines	6 (3%)	9 (4%)	191 (81%)	236 (100%)
PLN 3	Community services	3 (1%)	9 (4%)	223 (94%)	236 (100%)
PLN 4	Natural habitats	4 (2%)	9 (4%)	206 (87%)	236 (100%)
PLN 5	Maintenance of biodiversity	3 (1%)	9 (4%)	208 (88%)	236 (100%)
PLN 6	Larger percentage of open/green spaces/parks	3 (1%)	9 (4%)	208 (88%)	236 (100%)
PLN 7	Energy efficient infrastructure	3 (1%)	9 (4%)	227 (96%)	236 (100%)
PLN 8	Solar hot water systems	4 (2%)	9 (4%)	215 (91%)	236 (100%)
PLN 9	Livability for well being	3 (1%)	9 (4%)	223 (94%)	236 (100%)
PLN 10	Neighbourhood centre accessibility	9 (4%)	9 (4%)	197 (83%)	236 (100%)
PLN 11	Eco villages	5 (2%)	9 (4%)	171 (72%)	236 (100%)
PLN 12	Public transport systems and mobility	4 (2%)	9 (4%)	217 (92%)	236 (100%)
PLN 13	Bikeways and walking tracks	11 (5%)	9 (4%)	197 (83%)	236 (100%)
PLN 14	Proximity to work	14 (6%)	9 (4%)	184 (78%)	236 (100%)
PLN 15	Waste minimisation	1 (0%)	9 (4%)	228 (97%)	236 (100%)
PLN 16	Waste recycling	1 (0%)	9 (4%)	227 (96%)	236 (100%)
PLN 17	Water quality	1 (0%)	9 (4%)	230 (97%)	236 (100%)
PLN 18	Water sensitive plants	7 (3%)	9 (4%)	200 (85%)	236 (100%)
PLN 19	Storm water management	2 (1%)	9 (4%)	226 (96%)	236 (100%)
PLN 20	Water conservation	0 (0%)	9 (4%)	229 (97%)	236 (100%)
PLN 21	Infrastructure to attract investment	3 (1%)	9 (4%)	225 (95%)	236 (100%)

TABLE 4-10: FREQUENCY DISTRIBUTION: IV5: PLANNING

The majority of respondents agreed with the different items associated with sustainable city planning. Asset maintenance (PLN 1 – 96%, n = 227), energy efficient infrastructure (PLN 7 – 96%, n = 227), solar hot water systems (PLN 8 – 91%, n = 215), livability for well-being (PLN 9 – 94%, n = 222), public transport systems and mobility (PLN 12 – 92%, n = 217) waste minimisation (PLN 15- 97%, n = 229), waste recycling (PLN 16 – 96%, n = 227), storm water management (PLN 19 – 96%, n = 227), water conservation (PLN – 97%, n = 229) and infrastructure to attract investment (PLN 21 – 95%, n = 224) were all regarded as the most important aspects of sustainable city planning. Despite the lowest two planning items, eco villages (PLN 11 – 72%, n = 170) and proximity to work (PLN 14 – 78%, n = 184) being under 80%, they are both still above 70% indicating that they are still important factors involved in sustainable city planning. In summary, it can be concluded that most respondents agreed with the importance of sustainable city planning.

4.3.7 Independent Variable 6 (IV6): Citizen Centricity

This section in the questionnaire was designed to establish how respondents viewed Citizen Centricity and its role in Sustainable Cities. Table 4.11 illustrates the responses to the 21 items related to Citizen Centricity.

Code	Statement	Disagree	Neutral	Agree	Total
CZC 1	Enable externally driven, stakeholder led innovation by citizens	5 (2%)	36 (15%)	195 (83%)	236 (100%)
CZC 2	Provide smart crime prevention	1 (0%)	7 (3%)	228 (97%)	236 (100%)
CZC 3	Provide free Internet connectivity	12 (5%)	45 (19)	179 (76%)	236 (100%)
CZC 4	Manage city data as an asset	4 (2%)	27 (11%)	205 (87%)	236 (100%)
CZC 5	Invest in systems to capture and manage data	2 (1%)	25 (11%)	209 (89%)	236 (100%)
CZC 6	Have an integrated approach to the commissioning of services	1 (0%)	26 (11%)	209 (89%)	236 (100%)
CZC 7	Align budgets to provide common good platforms and services	1 (0%)	12 (5%)	223 (94%)	236 (100%)
CZC 8	Have joint procurement initiatives	4 (2%)	25 (11%)	207 (88%)	236 (100%)
CZC 9	Collaborate with Academia, industry and NGOs	2 (1%)	18 (8%)	216 (92%)	236 (100%)
CZC 10	Have IT as a service	5 (2%)	32 (14%)	199 (84%)	236 (100%)
CZC 11	Engage with citizens through IT infrastructure to solve city problems	5 (2%)	32 (14%)	199 (84%)	236 (100%)
CZC 12	Enable citizen to citizen services through IT infrastructure	4 (2%)	44 (19%)	188 (80%)	236 (100%)
CZC 13	Have a City data management partnership with citizens	6 (3%)	38 (16%)	192 (81%)	236 (100%)
CZC 14	Develop policies for open city data	9 (4%)	40 (17%)	187 (79%)	236 (100%)
CZC 15	Protect personal privacy	4 (2%)	7 (3%)	225 (95%)	236 (100%)
CZC 16	Develop IT solutions for working across vertical silos to deliver citizen-centric services	2 (1%)	36 (15%)	198 (84%)	236 (100%)
CZC 17	Use IT solutions for a one-stop shop	8 (3%)	50 (21%)	178 (75%)	236 (100%)
CZC 18	City data should drive innovation and create new value	3 (1%)	21 (9%)	212 (90%)	236 (100%)
CZC 19	City data should be used to attract investment	4 (2%)	15 (6%)	217 (92%)	236 (100%)
CZC 20	City data should accelerate new business start-ups	2 (1%)	15 (6%)	218 (93%)	236 (100%)
CZC 21	The City should enable digital connectivity and integration between people, places and things	5 (2%)	21 (9%)	209 (89%)	236 (100%)

TABLE 4-11: FREQUENCY DISTRIBUTION: IV6: CITIZEN CENTRICITY

Table 4.11 indicates that the majority of respondents agreed with a sustainable city having a citizen-centric approach. The notable citizen centricity items respondents all exceedingly agreed on were providing smart crime prevention (CZC 2 – 97%, n =229), aligning budgets to provide common good platforms and service (CZC 7 – 94%, n = 222) and collaborating with academia, industry and NGOs (CZC 9- 92%, n = 217).

Additionally, respondents strongly agreed upon the importance of protecting personal privacy (CZC 15- 95%, n = 224), city data should drive innovation and create new value (CZC 18- 90%, n = 212), city data should be used to attract investment (CZC 19 – 92%, n = 217) and the city data should accelerate new business start-ups (CZC 20 – 93%, n = 219) showing that both citizen and city data are key resources in the foundation of sustainable cities. In summary, it can be concluded that citizen centricity forms a crucial component for sustainable cities.

4.4 Item Analysis: Exploratory Factor Analysis (EFA)

Exploratory factor analysis (EFA) was conducted to explore the relationships among variables so that patterns could be identified, the number of variables could be reduced and structure in the relationship between variables could be detected (Hair et al., 2010; Schreiber et al., 2006). Only the items that were significantly related to the intended construct were kept and the others were eliminated (Hair et al., 2010). The three measurement tools that helped determine the significance of items were Eigenvalues, factor loadings and Cronbach's Alpha. The number of factors per construct was determined using Eigenvalues greater than 1 as the guideline, whilst for a sample size of n = 236, the minimum loading deemed significant is 0.345 (Hair et al., 2006:128).

4.4.1 Eigenvalues and Scree Plot Diagrams

Dependent Variable: Nelson Mandela Bay - Sustainable City

IV1: Awareness

Factor	Eigenvalue	% Total Variance
1	3.8824	22.8
2	1.7254	10.1
3	1.3715	8.1
4	1.2488	7.3
5	1.1006	6.5
6	1.0127	6.0
7	0.8732	5.1
8	0.7943	4.7
9	0.7559	4.4
10	0.7045	4.1
11	0.6911	4.1
12	0.6445	3.8
13	0.5542	3.3
14	0.5213	3.1
15	0.4447	2.6
16	0.3592	2.1
17	0.3156	1.9

TABLE 4-12: EXPLORATORY FACTOR ANALYSIS (EFA) EIGENVALUES: IV1 AWARENESS (N = 236)

The eigenvalues in Table 4.12 indicate that there are six factor items that are greater than one (>1), thus six factor model is indicated.

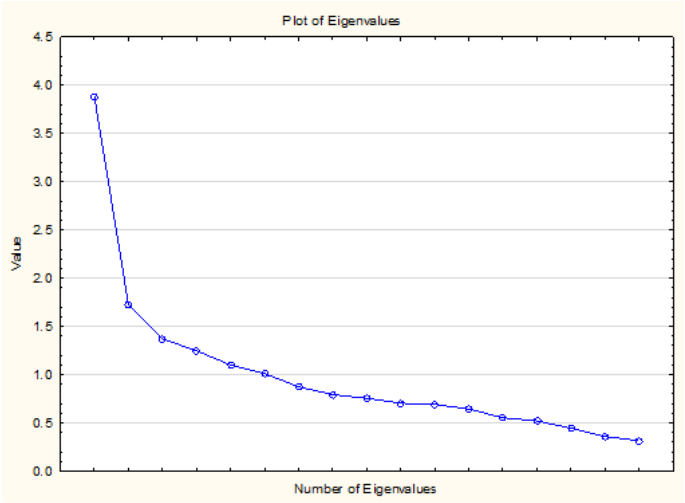

FIGURE 4.7: SCREE PLOT: IV1 AWARENESS (N = 236)

According to the Awareness Scree Plot diagram (Figure 4.7) two factor items were indicated. The EFA was conducted to extract 2, 3, 4, 5 and 6 factor item solutions. Two items were omitted due to non-significant loading, Public transport and Public walking tracks and

bikeways to create an optimal solution (i.e. meaningful factors with no cross loadings). A three factor (Table 4.13) indicates the optimal three-factor solution.

Item	Factor 1 - Recycling Awareness	Factor 2 – Energy Awareness	Factor 3 – Awareness Practices
Household waste recycling	**.713**	.012	.131
Litter recycling	**.669**	.029	.224
Reusable shopping bags	**.629**	.041	.066
Water conservation	**.627**	.190	.009
Support local services and facilities	**.620**	.104	.141
Environmentally friendly products	**.568**	.012	**.377**
Water recycling	**.420**	.210	.245
Solar Panels	.061	**.829**	.087
Solar hot water	.086	**.774**	.031
Grid connected home wind and solar power	.068	**.592**	**.429**
Cycle to work	.176	**.374**	.095
No chemicals in storm water drains	.227	.030	**.719**
Biodiesel	.072	.034	**.665**
Use of indigenous plants in gardening	.271	.153	**.614**
Green Energy	.209	.251	**.489**
Exploratory Variance	2.849	1.961	2.070
% of Total	19.0%	13.1%	13.8%
Minimum loading deemed significant = .345; **Percentage of Total Variance Explained = 45.9%**			

TABLE 4-13: EXPLORATORY FACTOR ANALYSIS (EFA) LOADINGS: IV1 AWARENESS (N = 236)

From Table 4.13, a minimum loading was deemed significant at 0.345 and the percentage of total variance explained was 45.9%. Additionally, the three factors in Table 4.13 were named: Factor 1 – Recycling Awareness, Factor 2 – Energy Awareness and Factor 3 – Awareness Practices.

IV2: Knowledge

Factor	Eigenvalue	% Total Variance
1	2.4677	49.4
2	0.9397	18.8

3	0.6279	12.6
4	0.4984	10.0
5	0.4662	9.3

TABLE 4-14: EXPLORATORY FACTOR ANALYSIS (EFA) EIGENVALUES: IV2 KNOWLEDGE (N = 236)

The eigenvalue in Table 4.14 indicates that only one factor item is greater than one (>1), thus a one factor items is deduced.

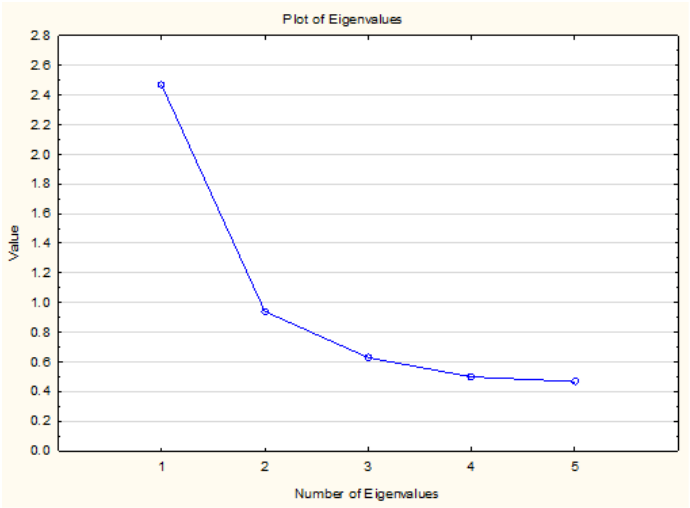

FIGURE 4.8: SCREE PLOT: IV2 KNOWLEDGE (N = 236)

According to the Knowledge Scree Plot diagram (Figure 4.8), one factor was indicated.

Item	Factor 1 - Knowledge
Household waste recycling	**.801**
Litter recycling	**.732**
Reusable shopping bags	**.681**
Water conservation	**.672**
Support local services and facilities	**.612**
Exploratory Variance	2.468
% of Total	49.4%
Minimum loading deemed significant = .345; **Percentage of Total Variance Explained = 49.4%**	

TABLE 4-15: EXPLORATORY FACTOR ANALYSIS (EFA) LOADINGS: IV2 KNOWLEDGE (N = 236)

From Table 4.15, a minimum loading was deemed significant at 0.345 and the percentage of total variance explained was 49.4%. Additionally, one factor in Table 4.15 was named, Factor 1 – Knowledge.

IV3: Challenges

Factor	Eigenvalue	% Total Variance
1	3.7141	41.3
2	0.9917	11.0
3	0.8674	9.6
4	0.7960	8.8
5	0.6791	7.5
6	0.5728	6.4
7	0.5350	5.9
8	0.4631	5.1
9	0.3807	4.2

TABLE 4-16: EXPLORATORY FACTOR ANALYSIS (EFA) EIGENVALUES: IV3 CHALLENGES (N = 236)

The eigenvalue in Table 4.16 indicates that only one factor item is greater than one (>1), thus a one factor items is deduced.

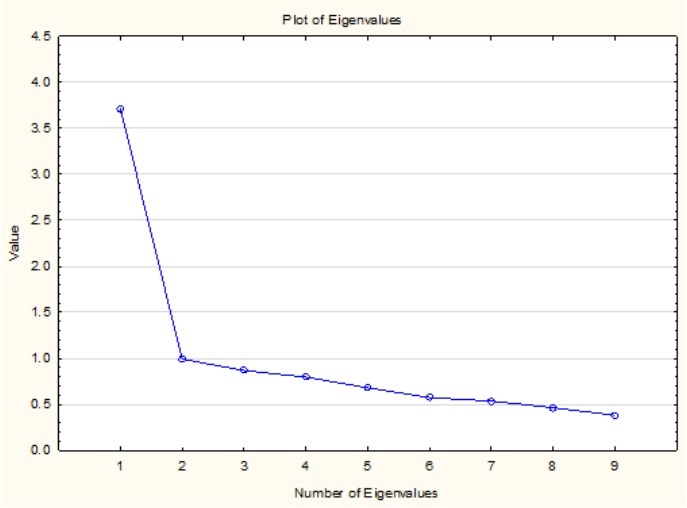

FIGURE 4.9: SCREE PLOT: IV3 CHALLENGES (N = 236)

According to the Knowledge Scree Plot diagram (Figure 4.9), one factor was indicated.

Item	Factor 1 - Challenges
Pressure on infrastructure	**.705**
Limited resources	**.693**
The aging population puts pressure on adult social care	**.672**
Climate change	**.659**
Unemployment	**.653**
Competition with other cities for investment	**.629**
Economic restructuring	**.617**
Limited investment from the private sector	**.590**
Weak leadership	**.549**
Exploratory Variance	3.714
% of Total	41.3%
Minimum loading deemed significant = .345; **Percentage of Total Variance Explained = 41.3%**	

TABLE 4-17: EXPLORATORY FACTOR ANALYSIS (EFA) LOADINGS: IV3 CHALLENGES (N = 236)

From Table 4.17, a minimum loading was deemed significant at 0.345 and the percentage of total variance explained was 41.3%. Additionally, one factor in Table 4.17 was named, Factor 1 – Challenges.

IV4: Leadership

Factor	Eigenvalue	% Total Variance
1	5.3896	67.4
2	0.6497	8.1
3	0.6036	7.5
4	0.4118	5.1
5	0.3123	3.9
6	0.2385	3.0
7	0.2264	2.8
8	0.1680	2.1

TABLE 4-18: EXPLORATORY FACTOR ANALYSIS (EFA) EIGENVALUES: IV4 LEADERSHIP (N = 236)

The eigenvalue in Table 4.18 indicates that only one factor item is greater than one (>1), thus a one factor items is deduced.

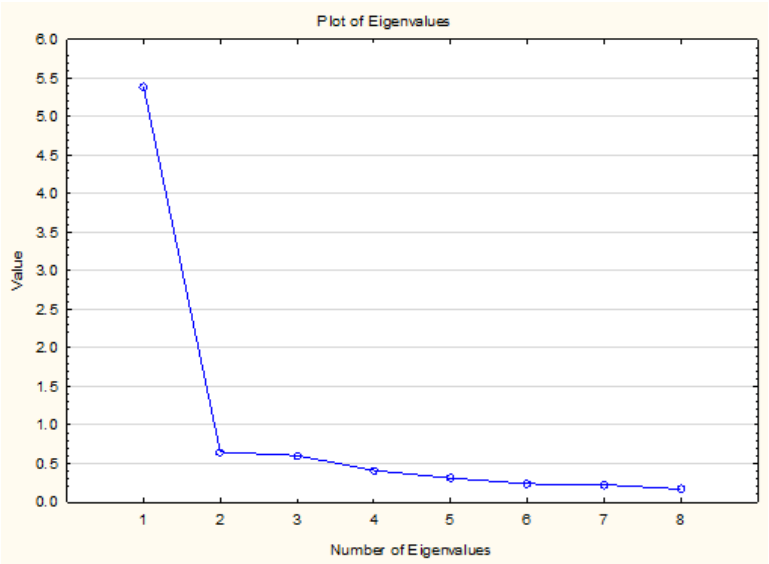

FIGURE 4.0.10: SCREE PLOT: IV4 LEADERSHIP (N = 236)

According to the Knowledge Scree Plot diagram (Figure 4.10), one factor was indicated.

Item	Factor 1 - Leadership
Develop policies to promote sustainability	**.890**
Embrace opportunities enabled by technology	**.861**
Promote sustainability to attract investment	**.858**
Have a clear vision which addresses sustainable issues	**.820**
Have clear focus of accountability within the city authority	**.804**
Be citizen centric	**.793**
Share knowledge on how the city works	**.770**
Enable use of city spaces	**.762**
Exploratory Variance	5.390
% of Total	67.4%
Minimum loading deemed significant = .345; Percentage of Total Variance Explained = 67.4%	

TABLE 4-19: EXPLORATORY FACTOR ANALYSIS (EFA) LOADINGS: IV4 LEADERSHIP (N = 236)

From Table 4.19, a minimum loading was deemed significant at 0.345 and the percentage of total variance explained was 67.4%. Additionally, one factor in Table 4.19 was named, Factor 1 – Leadership.

IV5: Planning

Factor	Eigenvalue	% Total Variance
1	8.1377	38.8
2	1.4231	6.8
3	1.1702	5.6
4	1.1560	5.5
5	1.0694	5.1
6	0.9575	4.6
7	0.8131	3.9
8	0.7821	3.7
9	0.6924	3.3
10	0.6373	3.0
11	0.5906	2.8
12	0.5472	2.6
13	0.4548	2.2
14	0.4418	2.1
15	0.4352	2.1
16	0.3656	1.7
17	0.3341	1.6
18	0.3128	1.5
19	0.2593	1.2
20	0.2150	1.0
21	0.2046	1.0

TABLE 4-20: EXPLORATORY FACTOR ANALYSIS (EFA) EIGENVALUES: IV5 PLANNING (N = 236)

The eigenvalues in Table 4.20 indicate that there are five factor items that are greater than one (>1), thus five factor items are indicated.

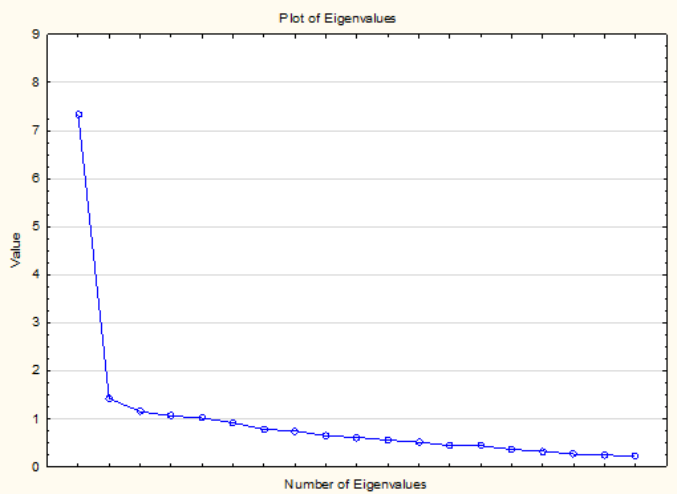

FIGURE 4.11: SCREE PLOT: IV5 PLANNING (N = 236)

According to the Planning Scree Plot diagram (Figure 4.11), one factor item was indicated. The EFA was conducted to extract 2, 3, 4 and 5 factor item solutions. A five factor (Table 4.21) indicates the optimal five-factor solution.

Item	Factor 1 - Conservation Planning	Factor 2 – Eco Planning	Factor 3 – Community Planning	Factor 4 – Infrastructure Planning	Factor 5 – Basic service Planning
Storm water management	**.751**	.062	.062	.080	.340
Water conservation	**.730**	.062	.062	.224	.334
Water sensitive plants	**.722**	.312	.312	.145	.132
Eco villages	.062	**.749**	**.749**	.302	.123
Bikeways and walking tracks	.152	**.689**	**.689**	.031	.190
Community services	.228	.143	.143	.272	.241
Asset maintenance	.275	.015	.015	.256	.136
Below ground power lines	.212	.258	.258	.031	.058
Public transport systems and mobility	.256	.338	.338	.196	.297
Energy efficient infrastructure	.231	.005	.005	**.694**	.335
Solar hot water systems	.295	.172	.172	**.657**	.213
Liveability for well being	.038	.104	.104	**.634**	**.453**
Larger percentage of open/green spaces/parks	.126	.344	.344	**.614**	.008
Maintenance of biodiversity	**.445**	.263	.263	**.528**	.020
Neighbourhood centre accessibility	.127	.301	.301	**.514**	.263
Waste recycling	**.361**	.106	.106	.190	**.774**
Waste minimisation	.222	.286	.286	.217	**.713**
Water quality	**.349**	.041	.041	.247	**.680**
Proximity to work	.031	.305	.305	.007	**.510**
Exploratory Variance	2.557	1.847	1.847	2.728	2.727
% of Total	13.5%	9.7%	9.7%	14.4%	14.4%
Minimum loading deemed significant = .345; **Percentage of Total Variance Explained = 63.0%**					

TABLE 4-21: EXPLORATORY FACTOR ANALYSIS (EFA) LOADINGS: IV5 PLANNING (N = 236)

From Table 4.21, a minimum loading was deemed significant at 0.345 and the percentage of total variance explained was 63.0%. Additionally, the five factors in Table 4.21 were named: Factor 1 – Conservation Planning, Factor 2 – Eco Planning, Factor 3 – Community Planning, Factor 4 – Infrastructure Planning and Factor 5 – Basic Service Planning.

IV6: Citizen Centricity

Factor	Eigenvalue	% Total Variance
1	8.9754	42.7
2	1.9696	9.4
3	1.1746	5.6
4	1.0921	5.2
5	1.0247	4.9
6	0.8641	4.1
7	0.7074	3.4
8	0.6173	2.9
9	0.5475	2.6
10	0.5370	2.6
11	0.4517	2.2
12	0.4424	2.1
13	0.4057	1.9
14	0.3729	1.8
15	0.3606	1.7
16	0.3243	1.5
17	0.3068	1.5
18	0.2436	1.2
19	0.2404	1.1
20	0.1857	0.9
21	0.162	0.7

TABLE 4-22: EXPLORATORY FACTOR ANALYSIS (EFA) EIGENVALUES: IV6 CITIZEN CENTRICITY (N = 236)

The eigenvalues in Table 4.22 indicate that there are five factor items that are greater than one (>1), thus five factor items are indicated.

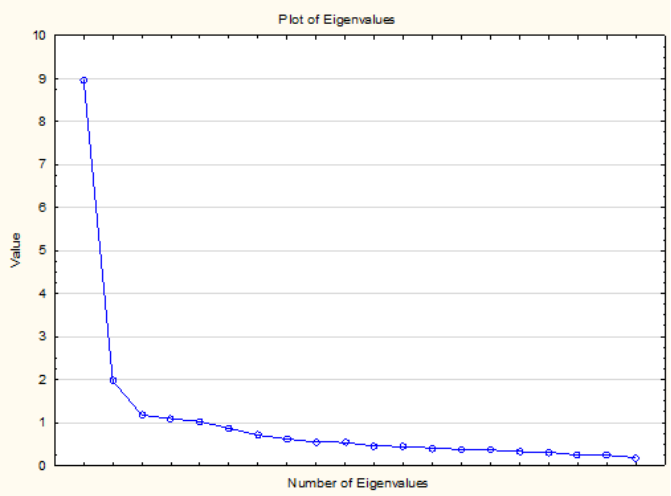

FIGURE 4.12: SCREE PLOT: IV6 CITIZEN CENTRICITY (N = 236)

According to the Citizen Centricity Scree Plot diagram, (Figure 4.12) two factor items were indicated. The EFA was conducted to extract 2, 3, 4 and 5 factor item solutions. The best solution (i.e. meaningful factors with at least two items but with cross loadings) was found to be three factor solution. The cross loading item removed to achieve the optimal solution was Enabling externally driven, stakeholder-led innovation by citizens. An analysis was repeated in Table 4.23 without the omitted item, which indicates the optimal three-factor solution.

Item	Factor 1 - Citizen Centric Data	Factor 2 – Citizen Centric Collaboration	Factor 3 – Citizen Centric Investment
Enable citizen to citizen services through IT infrastructure	**.827**	.150	.115
Have a City data management partnership with citizens	**.825**	.210	.082
Engage with citizens through IT infrastructure to solve city problems	**.783**	.078	.115
Use IT solutions for a one stop shop	**.760**	.079	.210
Develop IT solutions for working across vertical silos to deliver citizen centric services	**.688**	.237	.268
City data should drive innovation and create new value	**.688**	.187	.231
Develop policies for open city data	**.660**	.314	.203
City data should accelerate new business start ups	**.554**	.289	**.413**
City data should be used to attract investment	**.519**	.083	**.397**
The City should enable digital connectivity and integration between people, places and things	**.503**	**.366**	**.395**
Collaborate with Academia, industry and NGOs	.224	**.752**	.174
Provide smart crime prevention	.201	**.717**	.096
Protect personal privacy	.227	**.692**	.088
Align budgets to provide common good platforms and services	.098	**.624**	**.499**
Have joint procurement initiatives	.157	**.601**	**.449**
Have IT as a service	**.379**	**.423**	.325
Invest in systems to capture and manage data	.203	.211	**.812**
Manage city data as an asset	.271	.268	**.707**
Provide free Internet connectivity	.115	.027	**.660**
Have an integrated approach to the commissioning of services	.263	**.419**	**.554**
Exploratory Variance	5.285	3.274	3.233
% of Total	26.4%	16.4%	16.2%
Minimum loading deemed significant = .345; **Percentage of Total Variance Explained = 59.0%**			

TABLE 4-23: EXPLORATORY FACTOR ANALYSIS (EFA) LOADINGS: IV CITIZEN CENTRICITY (N = 236)

From Table 4.23, a minimum loading was deemed significant at 0.345 and the percentage of total variance explained was 59.0%. Additionally, the three factors in Table 4.23 were named:

Factor 1 – Citizen Centric Data, Factor 2 – Citizen Centric Collaboration and Factor 3 – Citizen Centric Investment.

DV: Nelson Mandela Bay Sustainable City

Factor	Eigenvalue	% Total Variance
1	3.0045	50.1
2	0.8279	13.8
3	0.7151	11.9
4	0.5881	9.8
5	0.5051	8.4
6	0.3593	6.0

TABLE 4-24: EXPLORATORY FACTOR ANALYSIS (EFA) EIGENVALUES: DV NELSON MANDELA BAY AS A SUSTAINABLE CITY (N = 236)

The eigenvalue in Table 4.24 indicates that only one factor item is greater than one (>1), thus a one factor item is deduced.

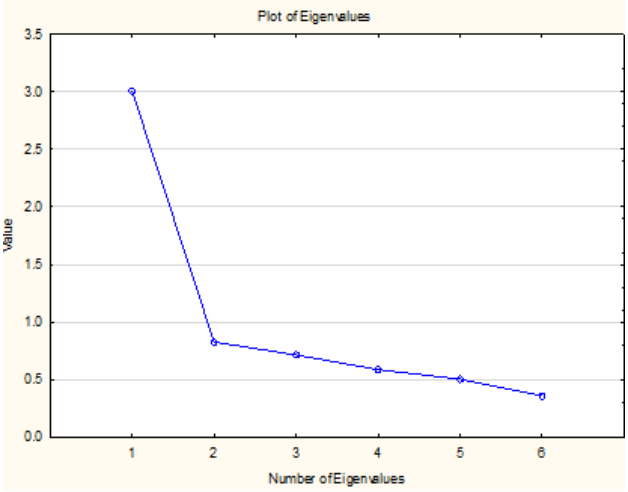

FIGURE 4.13: SCREE PLOT: DV NELSON MANDELA BAY SUSTAINABLE CITY (N = 236)

According to the Knowledge Scree Plot diagram (Figure 4.13), one factor was indicated.

Item	Factor 1 - Leadership
Port Elizabeth is citizen centric	**.789**
Port Elizabeth is managing its challenges well	**.776**
Port Elizabeth has good leadership	**.725**
In my opinion, Port Elizabeth is a sustainable city	**.684**
I would invest in Port Elizabeth	**.631**
Port Elizabeth has good infrastructure	**.623**
Exploratory Variance	3.004
% of Total	50.1%
Minimum loading deemed significant = .345; **Percentage of Total Variance Explained = 65.1%**	

TABLE 4-25: EXPLORATORY FACTOR ANALYSIS (EFA) LOADINGS: DV NELSON MANDELA BAY SUSTAINABLE CITY (N = 236)

From Table 4.25, a minimum loading was deemed significant at 0.345 and the percentage of total variance explained was 65.1%. Additionally, one factor in Table 4.25 was named, Factor 1 – Nelson Mandela Bay Sustainable City.

4.4.2 Exploratory Factor Analysis: Resulting Factors and Items

In Table 4.26, the final factor with each factor loading is listed. A minimum factor loading of 0.300 is deemed significant at $\alpha = 0.05$ significance level. Some items were omitted from a scale if either their factor loading was less than 0.300 or if their inclusion resulted in unacceptable Cronbach's alpha values. The items depicted in strikethrough font were removed.

Code	DV: Nelson Mandela Bay Sustainable City	Factor Loading
NMB 4	Port Elizabeth is citizen centric	**.789**
NMB 6	Port Elizabeth is managing its challenges well	**.776**
NMB 3	Port Elizabeth has good leadership	**.725**
NMB 1	In my opinion, Port Elizabeth is a sustainable city	**.684**
NMB 5	I would invest in Port Elizabeth	**.631**
NMB 2	Port Elizabeth has good infrastructure	**.623**

	IV1: Recycling Awareness	
AWE 8	Household waste recycling	**.713**
AWE 9	Litter recycling	**.669**
AWE 13	Reusable shopping bags	**.629**
AWE 11	Water conservation	**.627**
AWE 17	Support local services and facilities	**.620**
AWE 7	Environmentally friendly products	**.568**
AWE12	Water recycling	**.420**
	IV1: Energy Awareness	
AWE 2	Solar Panels	**.829**
AWE 14	Solar hot water	**.774**
AWE 3	Grid connected home wind and solar power	**.592**
AWE 5	Cycle to work	**.374**
	IV1: Awareness Practices	
AWE 15	No chemicals in storm water drains	**.719**
AWE 10	Biodiesel	**.665**
AWE 16	Use of indigenous plants in gardening	**.614**
AWE 1	Green Energy	**.489**
AWE 4	~~Public transport~~	
AWE 6	~~Public walking tracks and bikeways~~	
	IV2: Knowledge	
KNW 2	We need to maintain the functions of our natural environment as a matter of survival	**.801**
KNW 6	I have a personal responsibility to help make a difference on sustainability issues	**.732**
KNW 1	Business, the community and government should have sustainable partnerships	**.681**
KNW 3	Sustainability is meeting the needs of present without compromising the ability of future generations to meet their own needs	**.672**
KNW 5	I understand sustainable development	**.612**
KNW 4	~~Our current way of living is sustainable~~	
	IV3: Challenges	
CHG 3	Pressure on infrastructure	**.705**

CHG 6	Limited resources	**.693**
CHG 5	The aging population puts pressure on adult social care	**.672**
CHG 4	Climate change	**.659**
CHG 1	Unemployment	**.653**
CHG 9	Competition with other cities for investment	**.629**
CHG 2	Economic restructuring	**.617**
CHG 8	Limited investment from the private sector	**.590**
CHG 7	Weak leadership	**.549**
	IV4: Leadership	
LDR 1	Develop policies to promote sustainability	**.890**
LDR 2	Embrace opportunities enabled by technology	**.861**
LDR 3	Promote sustainability to attract investment	**.858**
LDR 4	Have a clear vision which addresses sustainable issues	**.820**
LDR 5	Have clear focus of accountability within the city authority	**.804**
LDR 6	Be citizen centric	**.793**
LDR 7	Share knowledge on how the city works	**.770**
LDR 8	Enable use of city spaces	**.762**
	IV5: Conservation Planning	
PLN 19	Storm water management	**.751**
PLN 20	Water conservation	**.730**
PLN 18	Water sensitive plants	**.722**
	IV5: Eco Planning	
PLN 11	Eco villages	**.749**
PLN 13	Bikeways and walking tracks	**.689**
	IV5: Community Planning	
PLN 3	Community services	**.648**
PLN 1	Asset maintenance	**.641**
PLN 2	Below ground power lines	**.548**
PLN 12	Public transport systems and mobility	**.488**
	IV5: Infrastructure Planning	
PLN 7	Energy efficient infrastructure	**.694**
PLN 8	Solar hot water systems	**.657**
PLN 9	Liveability for well being	**.634**

PLN 6	Larger percentage of open/green spaces/parks	**.614**
PLN 5	Maintenance of biodiversity	**.528**
PLN 10	Neighbourhood centre accessibility	**.514**
	IV5: Basic Service Planning	
PLN 16	Waste recycling	**.774**
PLN 15	Waste minimisation	**.713**
PLN 17	Water quality	**.680**
PLN 14	Proximity to work	**.510**
PLN 4	~~Natural habitats~~	
PLN 21	~~Infrastructure to attract investment~~	
	IV6: Citizen Centric Data	
CZC 11	Enable citizen to citizen services through IT infrastructure	**.827**
CZC 12	Have a City data management partnership with citizens	**.825**
CZC 10	Engage with citizens through IT infrastructure to solve city problems	**.783**
CZC 16	Use IT solutions for a one stop shop	**.760**
CZC 15	Develop IT solutions for working across vertical silos to deliver citizen centric services	**.688**
CZC 17	City data should drive innovation and create new value	**.688**
CZC 13	Develop policies for open city data	**.660**
CZC 19	City data should accelerate new business start ups	**.554**
CZC 18	City data should be used to attract investment	**.519**
CZC 20	The City should enable digital connectivity and integration between people, places and things	**.503**
	IV6: Citizen Centric Collaboration	
CZC 8	Collaborate with Academia, industry and NGOs	**.752**
CZC 1	Provide smart crime prevention	**.717**
CZC 14	Protect personal privacy	**.692**
CZC 6	Align budgets to provide common good platforms and services	**.624**
CZC 7	Have joint procurement initiatives	**.601**
CZC 9	Have IT as a service	**.423**
	IV6: Citizen Centric Investment	
CZC 4	Invest in systems to capture and manage data	**.812**
CZC 3	Manage city data as an asset	**.707**

CZC 2	Provide free Internet connectivity	**.660**
CZC 5	Have an integrated approach to the commissioning of services	**.554**

TABLE 4-26: RESULTING FACTORS AND ITEMS FROM EXPLORATORY FACTOR ANALYSIS

4.4.3 Cronbach's Alpha Coefficient Analysis

From Chapter 3, Section 3.9 Cronbach's Alpha coefficient scores can be interpreted where a minimum score for *Good* reliability is 0.70 to 0.79 and the cut off for *Acceptable* reliability is 0.50 to 0.69 (Nunnally, 1978). A score of above 0.80 is deemed *Excellent* (Zikmund et al., 2013). Table 4.27 provides the figures in the initial Cronbach Alpha coefficient scores calculated. Table 4.28 then indicates final Cronbach Alpha coefficient scores once the items depicted in strikethrough font in Table 4.26 had been removed.

The initial Cronbach Alpha coefficient scores (Table 4.27) revealed that three (Awareness, Knowledge and NMB - Sustainability) out of the seven variables had Cronbach alpha coefficients for their factors over 0.70, resulting in *Good* data reliability (Zikmund et al., 2013). The remaining four variables (IV3: Challenges, IV4: Leadership, IV5: Planning, IV6: Citizen Centric Data and IV6: Citizen Centric Collaboration) all had Cronbach Alpha scores greater than 0.80, resulting in *Excellent* data reliability (Nunnally, 1978).

Factors	Cronbach Alpha Coefficients	Interpretation
DV: NMB - Sustainability	0.79	Good
IV1: Awareness	0.78	Good
IV2: Knowledge	0.73	Good
IV3: Challenges	0.82	Excellent
IV4: Leadership	0.93	Excellent
IV5: Planning	0.91	Excellent
IV6: Citizen Centricity	0.93	Excellent

TABLE 4-27: INITIAL CRONBACH'S ALPHA COEFFICIENTS FOR THE FACTORS (N = 236)

Factors	Cronbach Alpha coefficient	Interpretation
DV: NMB - Sustainability	0.79	Good
IV1: Recycling Awareness	0.75	Good
IV1: Energy Awareness	0.62	Acceptable
IV1: Awareness Practices	0.63	Acceptable
IV1: Awareness	0.59	Acceptable
IV2: Knowledge	0.73	Good
IV3: Challenges	0.82	Excellent
IV4: Leadership	0.93	Excellent
IV5: Conservation Planning	0.77	Good
IV5: Eco Planning	0.54	Acceptable
IV5: Community Planning	0.66	Acceptable
IV5: Infrastructure Planning	0.82	Excellent
IV5: Basic service Planning	0.76	Good
IV5: Planning	0.82	Excellent
IV6: Citizen Centric Data	0.91	Excellent
IV6: Citizen Centric Collaboration	0.83	Excellent
IV6: Citizen Centric Investment	0.76	Good
IV6: Citizen Centricity	0.82	Excellent

TABLE 4-28: FINAL CRONBACH'S ALPHA COEFFICIENTS FOR THE FACTORS (N = 236)

From Table 4.28, it is clear to see that all the Cronbach's alpha coefficients for the factors meet the minimum requirement of 0.70 required for *Good* and *Excellent* reliability (Nunnally, 1978), except for IV1: Energy Awareness, IV1: Awareness Practices, IV1: Awareness, IV5: Eco Planning and IV5:Community Planning that meet the 0.50 A*cceptable* reliability (Zikmund et al., 2013).

4.5 Descriptive Statistics for Factors

The validity (discussed in Chapter 3) and reliability (illustrated above) of the summated scores derived from the various factors have been established. In this section, descriptive statistics for these scores are presented.

4.5.1 Frequency Distributions of Factors

Frequency distributions for the factors are depicted in Table 4.29. As explained in Chapter 3, the scores for the factors were categorised in accordance with the 5-point Likert scale that was used for this study into Negative (1.00 to 2.59), Neutral (2.60 to 3.40) and Positive (3.41 to 5.00).

Variable	Negative 1.00 to 2.59		Neutral 2.60 to 3.40		Positive 3.41 to 5.00	
DV: NMB Sustainability	2	1%	11	5%	223	94%
IV1: Recycling Awareness	4	2%	56	24%	176	75%
IV1: Energy Awareness	23	10%	154	65%	59	25%
IV1: Awareness Practices	66	28%	63	27%	107	45%
IV1: Awareness[#]	16	7%	96	41%	124	53%
IV2: Knowledge	1	0%	10	4%	225	95%
IV3: Challenges	3	1%	7	3%	226	96%
IV4: Leadership	1	0%	10	4%	225	95%
IV5: Conservation Planning	7	3%	19	8%	210	89%
IV5: Eco Planning	1	0%	6	3%	229	97%
IV5: Community Planning	2	1%	3	1%	231	98%
IV5: Infrastructure Planning	1	0%	5	2%	230	97%
IV5: Basic service Planning	0	0%	4	2%	232	98%
IV5: Planning	1	0%	17	7%	218	92%
IV6: Citizen Centric Data	0	0%	7	3%	229	97%
IV6: Citizen Centric Collaboration	1	0%	15	6%	220	93%
IV6: Citizen Centric Investment	0	0%	8	3%	228	97%
IV6: Citizen Centricity	33	14%	127	54%	76	32%

TABLE 4-29: FREQUENCY DISTRIBUTIONS FOR FACTORS (N = 236)

As illustrated in Table 4.29, the majority of the respondents indicated positive scores for all the factors with the exception of IV1: Energy Awareness, IV1: Awareness Practices, IV1: Awareness and IV6: Citizen Centricity. IV1: Energy Awareness the respondents distributed between negative (10%), neutral (65%) and positive (25%) scores and for IV1: Awareness Practices distributed between negative (28%), neutral (27%) and positive (45%) scores. Similar

results for IV1: Awareness with a distribution between neutral (41%) and positive (53%) and IV6: Citizen Centricity: the majority of responses indicate neutral (54%) and positive (32%).

4.5.2 Central Tendency and Dispersion of Factors

The central tendency measures: median, mean, standard deviation and dispersion of each factor, which are illustrated in Table 4.30.

	Mean	S.D.	Minimum	Quartile 1	Median	Quartile 3	Maximum
DV: NMB Sustainability	3.20	0.60	1.00	2.83	3.17	3.50	5.00
IV1: Recycling Awareness	3.94	0.71	1.00	3.29	3.86	4.43	5.00
IV1: Energy Awareness	3.14	0.51	1.00	3.00	3.00	3.13	5.00
IV1: Awareness Practices	3.14	0.82	1.00	2.50	3.00	4.00	4.50
IV1: Awareness#	3.40	0.51	1.00	3.10	3.43	3.72	4.67
IV2: Knowledge	4.34	0.54	1.00	4.20	4.40	4.60	5.00
IV3: Challenges	4.24	0.53	1.67	3.89	4.22	4.67	5.00
IV4: Leadership	4.49	0.58	1.00	4.13	4.63	5.00	5.00
IV5: Conservation Planning	4.53	0.54	2.00	4.33	4.67	5.00	5.00
IV5: Eco Planning	4.08	0.69	1.50	3.50	4.00	4.50	5.00
IV5: Community Planning	4.42	0.49	2.25	4.00	4.50	4.75	5.00
IV5: Infrastructure Planning	4.40	0.52	2.17	4.00	4.50	4.83	5.00
IV5: Basic service Planning	4.50	0.49	2.25	4.25	4.50	5.00	5.00
IV5: Planning	4.39	0.42	2.95	4.10	4.40	4.72	5.00
IV6: Citizen Centric Data	4.53	0.54	2.00	4.33	4.67	5.00	5.00
IV6: Citizen Centric Collaboration	4.08	0.69	1.50	3.50	4.00	4.50	5.00
IV6: Citizen Centric Investment	4.42	0.49	2.25	4.00	4.50	4.75	5.00
IV6: Citizen Centricity	4.40	0.52	2.17	4.00	4.50	4.83	5.00

TABLE 4-30: CENTRAL TENDENCY AND DISPERSION: FACTORS (N = 236)

Using the same threshold values as those used to classify scores into negative (1.00 to 2.59), neutral (2.60 to 3.40) and positive (3.41 to 5.00) categories, it can be concluded, based on the results in Table 4.30 that no factor obtained a negative (μ<2.60) mean score. Four factors obtained neutral (2.60 to 3.40) mean scores, these were DV: Nelson Mandela Bay Sustainability (μ = 3.20), IV1: Energy Awareness (μ = 3.14), IV1: Awareness Practices (μ = 3.14) and IV1: Awareness (μ = 3.40). The remaining fourteen factors all obtained positive (μ > 3.41) mean scores with the lowest positive mean assigned to IV5: Eco Planning (μ = 4.08) and the highest positive mean score assigned with both IV5: Conservation Planning (μ = 4.53) and IV6: Citizen Centric Data (μ = 4.53).

4.6 Inferential statistics for the Factors

In this section, inferential statistics that were generated to test the various hypotheses postulated for the factors are presented.

4.6.1 One Sample T-tests

Discussed in Chapter 3 (Section 3.8.2) for a result to be regarded as significant it must be both statistically and practically significant. As per Table 3.3 (Chapter 3 – Section 3.8.2) Cohen's d can be interpreted in the following way, <0.20 (Not significant), 0.20-0.49 (Small significance), 0.50-0.79 (Medium significance) and 0.80+ (Large significance) (Gravetter & Wallnau, 2009: 264). Table 4.31 shows the results for the one-sample T-tests, which were conducted to determine the respondents' mean scores.

Variable	Mean	S.D.	t	p	Cohen's d	Interpretation
DV: NMB Sustainability	3.20	0.60	-5.19	**<.0005**	**0.34**	Small
IV1: Recycling Awareness	3.94	0.71	11.61	**<.0005**	**0.76**	Medium
IV1: Energy Awareness	3.14	0.51	-7.82	**<.0005**	**0.51**	Medium
IV1: Awareness Practices	3.14	0.82	-4.97	**<.0005**	**0.32**	Small
IV1: Awareness	3.40	0.51	0.12	.901	n/a	Not Significant
IV2: Knowledge	4.34	0.54	26.99	**<.0005**	**1.76**	Large
IV3: Challenges	4.24	0.53	24.29	**<.0005**	**1.58**	Large
IV4: Leadership	4.49	0.58	28.99	**<.0005**	**1.89**	Large
IV5: Conservation Planning	4.53	0.54	32.47	**<.0005**	**2.11**	Large
IV5: Eco Planning	4.08	0.69	15.28	**<.0005**	**0.99**	Large
IV5: Community Planning	4.42	0.49	32.04	**<.0005**	**2.09**	Large
IV5: Infrastructure Planning	4.40	0.52	29.92	**<.0005**	**1.95**	Large
IV5: Basic service Planning	4.50	0.49	34.29	**<.0005**	**2.23**	Large
IV5: Planning	4.39	0.42	36.08	**<.0005**	**2.35**	Large
IV6: Citizen Centric Data	4.18	0.55	21.91	**<.0005**	**1.43**	Large
IV6: Citizen Centric Collaboration	4.43	0.48	32.81	**<.0005**	**2.14**	Large
IV6: Citizen Centric Investment	4.26	0.59	22.56	**<.0005**	**1.47**	Large
IV6: Citizen Centricity	4.29	0.46	29.60	**<.0005**	**1.93**	Large

TABLE 4-31: ONE-SAMPLE T-TESTS: FACTORS (H1: M ≠ 3.40; N = 236; D.F. = 235)

Table 4.31 depicts that there was one variable factor (IV1: Awareness – p = .901) that had a p value greater than 0.05 indicating that it was not statistically significant. Indicated in Table 4.31, the remaining variable factors all had p values that were <.005 indicating that all these factors are statistically significant. Based on the interpretation of Cohen's d, both DV: Nelson Mandela Bay Sustainability (0.34) and IV1: Awareness Practices (0.32) had small practical significance, while IV1: Recycling Awareness (0.76) and IV1: Energy Awareness (0.51) showed medium practical significance. The remaining variable factors all revealed a strong statistical and large (practical) relationship with the dependent variable.

4.6.2 Inferential Ranking of factors

Variables are ranked, using matched-pair t-tests (statistical significance) and Cohen's d (practical significance), such that:

a) The mean of the first variable in Signif.Group *i* differs statistically and practically from the mean of the first variable in Signif.Group (*i* + 1);

b) The mean of all variables in Signif.Group *i* do not differ significantly from the mean of the first variable in that group.

					Low	High
Variables	Rank	Signif. Group	Mean	SD	95% Conf. Interval for M	
IV5: Conservation Planning	1	1	4.53	0.54	4.47	4.60
IV5: Basic Service Planning	1	1	4.50	0.49	4.43	4.56
IV4: Leadership	1	1	4.49	0.58	4.42	4.57
IV6: Citizen Centric Collaboration	4	2	4.43	0.48	4.37	4.50
IV5: Community Planning	4	2	4.42	0.49	4.35	4.48
IV5: Infrastructure Planning	4	2	4.40	0.52	4.34	4.47
IV5: Planning	4	2	4.39	0.42	4.33	4.44
IV2: Knowledge	4	2	4.34	0.54	4.27	4.41
IV6: Citizen Centricity	9	3	4.29	0.46	4.23	4.35
IV6: Citizen Centric Investment	9	3	4.26	0.59	4.19	4.34
IV3: Challenges	9	3	4.24	0.53	4.17	4.31
IV6: Citizen Centric Data	12	4	4.18	0.55	4.11	4.25
IV5: Eco Planning	12	4	4.08	0.69	3.99	4.17
IV1: Recycling Awareness	14	5	3.94	0.71	3.85	4.03
IV1: Awareness	15	6	3.40	0.51	3.34	3.47
DV: NMB Sustainability	16	7	3.20	0.60	3.12	3.27
IV1: Energy Awareness	16	7	3.14	0.51	3.07	3.21
IV1: Awareness Practices	16	7	3.14	0.82	3.03	3.24

TABLE 4-32: INFERENTIAL RANKING OF THE FACTORS ACCORDING TO SAMPLE MEAN SCORES (N = 236)

From Table 4.32, the three factors which rank first and are grouped together according to their mean results are IV5: Conservation Planning, IV5: Basic Service Planning and IV4: Leadership. The second ranking group contained factors: IV6: Citizen Centric Collaboration, IV5: Community Planning, IV5: Infrastructure Planning, IV5: Planning and IV2: Knowledge. The lowest ranking group based on the inferential ranking of factors was DV: Nelson Mandela Bay Sustainability, IV1: Energy Awareness and IV1: Awareness Practices.

Variables	Rank	Signif. Group	Mean	SD	Low 95% Conf. Interval for M	High 95% Conf. Interval for M
IV4: Leadership	1	1	4.49	0.58	4.42	4.57
IV5: Planning	2	2	4.39	0.42	4.33	4.44
IV2: Knowledge	2	2	4.34	0.54	4.27	4.41
IV6: Citizen Centricity	4	3	4.29	0.46	4.23	4.35
IV3: Challenges	4	3	4.24	0.53	4.17	4.31
IV1: Awareness	6	4	3.40	0.51	3.34	3.47
DV: NMB Sustainability	7	5	3.20	0.60	3.12	3.27

TABLE 4-33: INFERENTIAL RANKING OF THE 2ND ORDER FACTORS ACCORDING TO SAMPLE MEAN SCORES (N = 236)

Table 4.33 represents the variables being grouped back to the original variables proposed prior to the exploratory factor analysis. Based on the inferential ranking of the 2nd order factors, Table 4.33 ranks the variables in the following order: IV4: Leadership (1), IV5: Planning (2), IV2: Knowledge (3), IV6: Citizen Centricity (4), IV3: Challenges (5), IV1: Awareness (6) and the dependent variable (Nelson Mandela Bay Sustainability) last.

4.6.3 Pearson Product Moment Correlations

As discussed in Chapter 3, a correlation coefficient is statistically significant at 0.05 level for n = 236 if |r| >= .128 and practically significant if |r| >=.300 (Gravetter & Wallnau, 2009). According to Collis and Hussey (2014) correlation coefficients (Section 3.8.2) are classified as follows: values between 0.01 and 0.39 are regarded as Low positive correlations, values between 0.40 and 0.69 are regarded as Medium positive correlations, values between 0.70 and 0.89 are regarded as high positive correlations and values of 0.90 are Very high positive correlations. The correlations between Nelson Mandela Bay Sustainability and the independent variables are reflected in Tables 4.34.

	Knowledge	Recycling Awareness	Energy Awareness	Awareness Practices	Awareness	Challenges	Leadership	Conservation Planning	Eco Planning	Community Planning
Knowledge	-	.155	-.040	.029	.073	***.382***	***.305***	.257	.232	.250
Recycling Awareness	.155	-	.244	***.438***	***.776***	.150	.093	.252	.099	.136
Energy Awareness	-.040	.244	-	.291	***.600***	.000	.049	-.002	-.003	-.106
Awareness Practices	.029	***.438***	.291	-	***.831***	-.057	-.108	.067	.081	-.094
Awareness	.073	***.776***	***.600***	***.831***	-	.039	.002	.152	.087	-.023
Challenges	***.382***	.150	.000	-.057	.039	-	***.445***	***.495***	***.365***	***.553***
Leadership	***.305***	.093	.049	-.108	.002	***.445***	-	***.358***	.281	***.527***
Conservation Planning	.257	.252	-.002	.067	.152	***.495***	***.358***	-	***.329***	***.538***
Eco Planning	.232	.099	-.003	.081	.087	***.365***	.281	***.329***	-	***.386***
Community Planning	.250	.136	-.106	-.094	-.023	***.553***	***.527***	***.538***	***.386***	-
Infrastructure Planning	***.334***	.207	.064	.052	.144	***.491***	***.473***	***.563***	***.493***	***.587***
Basic Service Planning	.256	.235	-.029	-.058	.068	***.517***	***.398***	***.588***	***.413***	***.571***
Planning	***.341***	.234	-.017	.021	.114	***.616***	***.515***	***.763***	***.718***	***.773***
Citizen Centric Data	.242	.036	-.025	.043	.031	***.491***	***.437***	***.364***	***.406***	***.445***
Citizen Centric Collaboration	***.328***	.158	-.004	-.024	.059	***.537***	***.512***	***.599***	***.375***	***.619***
Citizen Centric Investment	.246	.069	-.033	-.028	.006	***.386***	***.378***	***.344***	***.331***	***.479***
Citizen Centricity	***.314***	.098	-.025	-.003	.035	***.543***	***.510***	***.497***	***.431***	***.593***
NMB Sustainability	-.076	.001	.045	-.067	-.020	-.082	.000	-.028	.023	-.071

TABLE 4-34: PEARSON'S PRODUCT MOMENT CORRELATIONS BETWEEN NELSON MANDELA BAY SUSTAINABILITY AND THE INDEPENDENT VARIABLES

	Infrastructure Planning	Basic Service Planning	Planning	Citizen Centric Data	Citizen Centric Collaboration	Citizen Centric Investment	Citizen Centricity	NMB Sustainability
Knowledge	***.334***	.256	***.341***	.242	***.328***	.246	***.314***	-.076
Recycling Awareness	.207	.235	.234	.036	.158	.069	.098	.001
Energy Awareness	.064	-.029	-.017	-.025	-.004	-.033	-.025	.045
Awareness Practices	.052	-.058	.021	.043	-.024	-.028	-.003	-.067
Awareness	.144	.068	.114	.031	.059	.006	.035	-.020
Challenges	***.491***	***.517***	***.616***	***.491***	***.537***	***.386***	***.543***	-.082
Leadership	***.473***	***.398***	***.515***	***.437***	***.512***	***.378***	***.510***	.000
Conservation Planning	***.563***	***.588***	***.763***	***.364***	***.599***	***.344***	***.497***	-.028
Eco Planning	***.493***	***.413***	***.718***	***.406***	***.375***	***.331***	***.431***	.023
Community Planning	***.587***	***.571***	***.773***	***.445***	***.619***	***.479***	***.593***	-.071
Infrastructure Planning	-	***.613***	***.830***	***.456***	***.609***	***.503***	***.604***	-.028
Basic Service Planning	***.613***	-	***.802***	***.381***	***.584***	***.419***	***.530***	-.033
Planning	***.830***	***.802***	-	***.530***	***.705***	***.528***	***.678***	-.031
Citizen Centric Data	***.456***	***.381***	***.530***	-	***.610***	***.577***	***.851***	-.007
Citizen Centric Collaboration	***.609***	***.584***	***.705***	***.610***	-	***.628***	***.854***	.001
Citizen Centric Investment	***.503***	***.419***	***.528***	***.577***	***.628***	-	***.869***	.011
Citizen Centricity	***.604***	***.530***	***.678***	***.851***	***.854***	***.869***	-	.002
NMB Sustainability	-.028	-.033	-.031	-.007	.001	.011	.002	-

TABLE 4-34: PEARSON'S PRODUCT MOMENT CORRELATIONS BETWEEN NELSON MANDELA BAY SUSTAINABILITY AND THE INDEPENDENT VARIABLES (CONTINUED)

Table 4.34(1) shows the independent variable IV2: Knowledge had low positive correlations ($r \geq 0.01$ and $r \leq 0.39$) with all the other Independent Variables, excluding IV1: Energy

Awareness (-.040) and Nelson Mandela Bay Sustainability (-.076) producing a non-significant correlation. For the sub-factors of IV1: Awareness, Recycling Awareness (.776 – High), Energy Awareness (.600 - Medium) and Awareness Practices (.831 - High) had the strongest positive correlations. Identical correlations were associated with overall IV1: Awareness variable and the Awareness sub-factors (Recycling - .776; Energy - .600; Practices - .831). The remaining correlations amongst IV1: Awareness and the Awareness sub-factors with the other independent variables produced either low positive or non-significant (negative - $r \leq .000$) correlations.

The correlation between IV3: Challenges and other independent variables indicated positive correlations ($r \geq 0.390$ and $r \leq .616$) for most independent variables, with the highest correlation associated with IV5: Planning (.616). The independent variables, which had negative correlations ($r \leq .000$), were IV: Energy awareness (.000), IV1: Awareness Practices (-.057) and Nelson Mandela Bay Sustainability (-.082). The correlations between IV4: Leadership and other independent variables produced similar results to that of the IV3: Challenges with positive correlations existing between most independent variables. The four notably significant correlations between IV4: Leadership and independent variables were with IV5: Community Planning (.527 – Medium significance), IV5: Planning (.515 – Medium significance), IV6: Citizen Centric Collaboration (.512 – Medium significance) and IV6: Citizen Centricity (.510 – Medium significance).

IV5: Planning as well as the Planning sub-factors (Conservation, Eco, Community, Infrastructure, and Basic Service) produced some strong positive correlations. All the IV5: Planning sub-factors: Conservation Planning (.763), Eco Planning (.718), Community Planning (.773), Infrastructure Planning (.830) and Basic Service Planning (.802) produced both High positive correlations and were associated with the overall IV5: Planning variable. As a whole, IV5: Planning replicated the same High positive correlations with the sub-factors of planning ranging between $r \geq .718$ and $r \leq .830$, as well as Medium positive correlations with IV3: Challenges (.616), IV4: Leadership (.515) and Citizen Centricity (.678).

The strongest correlations for IV6: Citizen Centricity existed between its sub-factors, Citizen-Centric Data (.851 - High), Citizen-Centric Collaboration (.854 - High) and Citizen-Centric Investment (.896 - High). IV6: Citizen-Centric Data had three notable Medium correlations with IV5: Planning (.530), Citizen-Centric Collaboration (.610) and Citizen-Centric Investment

(.577). A High correlation (.705) was produced between Citizen-Centric Collaboration and IV5: Planning. A second notable correlation existed between Citizen-Centric Investment and Citizen-Centric Collaboration (.628) indicating a strong significance between Investment and Collaboration. Citizen Centricity displayed Medium to High Correlations with IV3: Challenges (.543), IV4: Leadership (.510), Infrastructure Planning (.604) and IV5: Planning (.678).

The Correlations between Nelson Mandela Bay Sustainability and the independent variables indicated low and negative (non-significant) results. The only independent variables, which showed positive correlation were: IV1: Recycling Awareness (.001), Eco Awareness (.045), Eco Planning (.002), Citizen Centric Collaboration (.001), Citizen Centric Investment (.011) and Citizen Centricity (.002), however, these were very low correlations. Thus indicating that there were no noteworthy relationships between any of the independent variables and Nelson Mandela Bay Sustainability.

4.7 Relationship between Selected Demographic information and Nelson Mandela Bay Sustainability

The following sub-section, reports on the results of ANOVAs which were conducted to examine the relationship between the selected demographic variables and the variables identified by the Exploratory factor Analysis (Section 4.4.2). This information will aid in making recommendations and in concluding this study. These statistics will become valuable when the conceptual model proposed in Chapter Two is validated. The following demographic variables were used for the statistically evaluation using ANOVA tests: Gender, Age, Highest Level of Education, Household Monthly Income and Live in Port Elizabeth.

4.7.1 Selected demographic variables: ANOVA tests

Based on the ANOVA test conducted between the demographic variables and IV2: Knowledge, neither any practical nor any statistical significance was shown. Table 4.35 shows the result for the ANOVA test on IV1: Recycling Awareness and demographic variables. The results showed that there is a difference in Recycling Awareness between the Age group of 18-35 and 46+ ($p = 0.01$; Cohen's $d = 0.76$) and there is a difference between the Age groups of 36-45 and 46+ ($p = 0.01$; Cohens's $d = 0.67$). These results indicate that Age plays a significant role in residents Recycling Awareness.

Effect	Level 1	Level 2	M_1	M_2	Scheffé p	Cohen's d
Age	18-35	36-45	3.88	3.83	.885	0.07
	18-35	46+	3.88	4.33	.001	0.76
	36-45	46+	3.83	4.33	.001	0.67

TABLE 4-35: POST-HOC RESULTS – IV1: RECYCLING AWARENESS

The ANOVA test conducted between the demographic variables and IV1: Energy Awareness established neither practical nor statistical significance. The ANOVA test for the demographic variables and IV1: Awareness Practices indicated that Gender, Age and Highest level of education had some sort of significance level. However, Table 4.36 shows that the only significant difference was between the Age group of 18-35 and 46+ (p = 0.01; Cohen's d = 0.65). Although there was a difference between Genders (Cohen's d = 0.36), the difference between the Age group 36-45 and 46+ (Cohen's d = 0.56) and differences between Highest level of education (Degree - Cohen's d = 0.48; Post Graduate Degree - Cohen's d = 0.44), all three factors had p values >0.05 indicating that these factors do not influence Awareness Practices.

Effect	Level 1	Level 2	M_1	M_2	p*	Cohen's d
Gender	Female	Male	2.99	3.28	.009	0.36
Age	18-35	36-45	3.02	3.09	.793	0.09
	18-35	46+	3.02	3.54	.001	0.65
	36-45	46+	3.09	3.54	.012	0.56
Highest Level of Education	Matric or Diploma	Degree	3.25	2.88	.016	0.48
	Matric or Diploma	Post graduate degree	3.25	3.25	1.000	0.00
	Degree	Post graduate degree	2.88	3.25	.009	0.44

TABLE 4-36: POST-HOC RESULTS – IV1: AWARENESS PRACTICES

The ANOVA test illustrated in Table 4.37 between the demographic variables and IV1: Awareness, that Age and Highest level of education showed very clear signs of difference. Table 4.37 reveals a large significant difference in Sustainable City Awareness between the Age groups of 18-35 and 46+ (p = 0.00; Cohen's d = 0.80) and the Age groups of 36-45 and 46+ (p = 0.02; Cohen's d = 0.62). This ANOVA test also showed a difference in Sustainable City Awareness in the group the Highest level of education (p = 0.04; Cohen's d = 0.49).

Effect	Level 1	Level 2	M_1	M_2	Scheffé p	Cohen's d
Age	18-35	36-45	3.33	3.36	.944	0.05
	18-35	46+	3.33	3.69	.000	0.80
	36-45	46+	3.36	3.69	.002	0.62
Highest Level of Education	Matric or Diploma	Degree	3.47	3.24	.019	0.47
	Matric or Diploma	Post graduate degree	3.47	3.49	.954	0.05
	Degree	Post graduate degree	3.24	3.49	.004	0.49

TABLE 4-37: POST-HOC RESULTS – IV1: AWARENESS

The ANOVA test between the Demographic Variables and IV3: Sustainable Challenges indicated that there was a slight difference according to income in Household Monthly Income between the ranges of R0 - R15 000 and R15001 - R25000 (Cohen's d = 0.96) and R0-R15 000 and R85 001+ (Cohen's d = 1.06). However, both these difference had p values greater than 0.05 thus nullifying the statistical difference for these variable factors on Sustainable Challenges.

A similar result was shown in the ANOVA test for the Demographic variables and IV4: Sustainable Leadership. Table 4.38 shows the initial results indicated that Household Monthly Income (Cohen's d = 0.97) and Live in Port Elizabeth (Cohen's d = 0.22) had differences, however, the Post-hoc results showed that both these demographic variables had p values greater than 0.05 deeming them non statistically significant. Therefore, there is no difference between Household Monthly Income and Living in Port Elizabeth concerning Sustainable Leadership.

Effect	Level 1	Level 2	M_1	M_2	p*	Cohen's d
Household Monthly Income	up to R 15 000.00	R 15 001.00-R 25 000.00	4.12	4.46	.469	0.54
	up to R 15 000.00	R 25 001.00-R 45 000.00	4.12	4.50	.214	0.55
	up to R 15 000.00	R 45 001.00-R 65 000.00	4.12	4.65	.037	0.97
	up to R 15 000.00	R 65 001.00-R 85 000.00	4.12	4.49	.429	0.56
	up to R 15 000.00	R 85 001.00+	4.12	4.53	.309	0.67
	R 15 001.00-R 25 000.00	R 25 001.00-R 45 000.00	4.46	4.50	.999	0.07
	R 15 001.00-R 25 000.00	R 45 001.00-R 65 000.00	4.46	4.65	.789	0.43
	R 15 001.00-R 25 000.00	R 65 001.00-R 85 000.00	4.46	4.49	1.000	0.06
	R 15 001.00-R 25 000.00	R 85 001.00+	4.46	4.53	.999	0.14
	R 25 001.00-R 45 000.00	R 45 001.00-R 65 000.00	4.50	4.65	.859	0.26
	R 25 001.00-R 45 000.00	R 65 001.00-R 85 000.00	4.50	4.49	1.000	0.03
	R 25 001.00-R 45 000.00	R 85 001.00+	4.50	4.53	1.000	0.04
	R 45 001.00-R 65 000.00	R 65 001.00-R 85 000.00	4.65	4.49	.915	0.37
	R 45 001.00-R 65 000.00	R 85 001.00+	4.65	4.53	.972	0.31
	R 65 001.00-R 85 000.00	R 85 001.00+	4.49	4.53	1.000	0.08
Live In Port Elizabeth	Yes	No	4.57	4.44	.040	0.22

TABLE 4-38: POST-HOC RESULTS – IV4: LEADERSHIP

The ANOVA tests for IV5: Conservation Planning, IV5: Eco Planning, IV5: Infrastructure Planning, IV5: Basic Service Planning and IV5: Planning showed no difference amongst any demographic variables. The IV5: Community Planning ANOVA test initially suggested there was a difference between the Monthly Household Income of R0 – R15 000 and R25 001 – R45 000. However, the p value was 0.42, which resulted in there being no statistical significance and indicating no difference between demographic factors and Sustainable Planning.

The ANOVA tests for IV6: Citizen Centric Data, IV6: Citizen Centric Collaboration, IV6: Citizen Centric Investment and IV6: Citizen Centricity indicated no differences with the demographic factors. IV6: Citizen Centric Collaboration had an initial difference indicated by a Cohen's d value of 0.86, however, the Post-hoc Results produced a p value of 0.046 eliminating any

significant differences. The same scenario played out for Citizen Centric Investment, where a difference was initially picked up with Gender (Cohen's d = 0.28), however, the Post-hoc results showed that there was no difference (p = 0.026) between male and females with relation to Citizen Centric Investment.

The final ANOVA test was between the demographic variables and Nelson Mandela Bay Sustainability. Table 4.39 shows that there were no differences identified between demographic factors and Nelson Mandela Bay Sustainability. There was neither any statistical significance, as the p values were all > 005, while the Cohen's d results produced N/A, indicating that there was no practical significance. Therefore, there is no difference between demographic variables of Nelson Mandela Bay Residents and the city's sustainability.

Effect	F-value	D.F.	p	Cohen's d
Gender	1.66	1; 224	.199	n/a
Age	2.02	2; 224	.135	n/a
Highest Level of Education	0.47	2; 224	.626	n/a
Household Monthly Income	1.39	5; 224	.230	n/a
Live In Port Elizabeth	1.69	1; 224	.195	n/a

TABLE 4-39: UNIVARIATE ANOVA RESULTS – DV: NELSON MANDELA BAY SUSTAINABILITY

4.7.2 New Proposed Conceptual Model

The conceptual model (without the question factors) from Chapter Two is illustrated in Figure 4.14. Here, all of the variables were treated as independent variables that lead to the DV: Nelson Mandela Bay – Sustainable City.

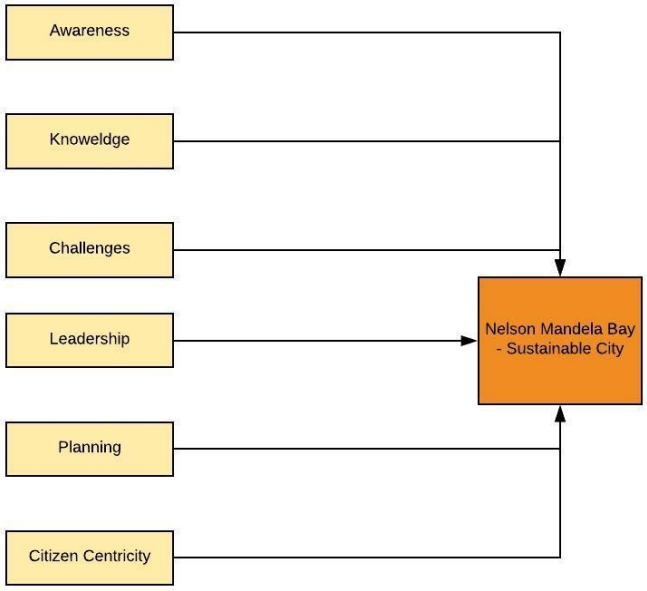

FIGURE 4.14: MODEL 1 (PREVIOUSLY ILLUSTRATED AS FIGURE 2.8 – CONCEPTUAL MODEL)

Model 2, illustrated in Figure 4.15, was statistically constructed as Model 1 was found to be not feasible after the exploratory factor analysis (Section 4.4.2) was conducted. Here, IV1: Awareness was broken into three additional sub-factors: Recycling Awareness, Energy Awareness and Awareness Practices. The same scenario panned out for IV5: Planning, which was further divided into five sub-factors, namely, Conservation Planning, Eco Planning, Community Planning, Infrastructure Planning and Basic Service Planning. Lastly, Citizen Centricity was also divided into three separate sub-factors, these were: Citizen Centric Data, Citizen Centric Collaboration and Citizen Centric Investment. IV2: Knowledge, IV3: Challenges and IV4: Leadership were directly linked to the DV: Nelson Mandela Bay – Sustainability.

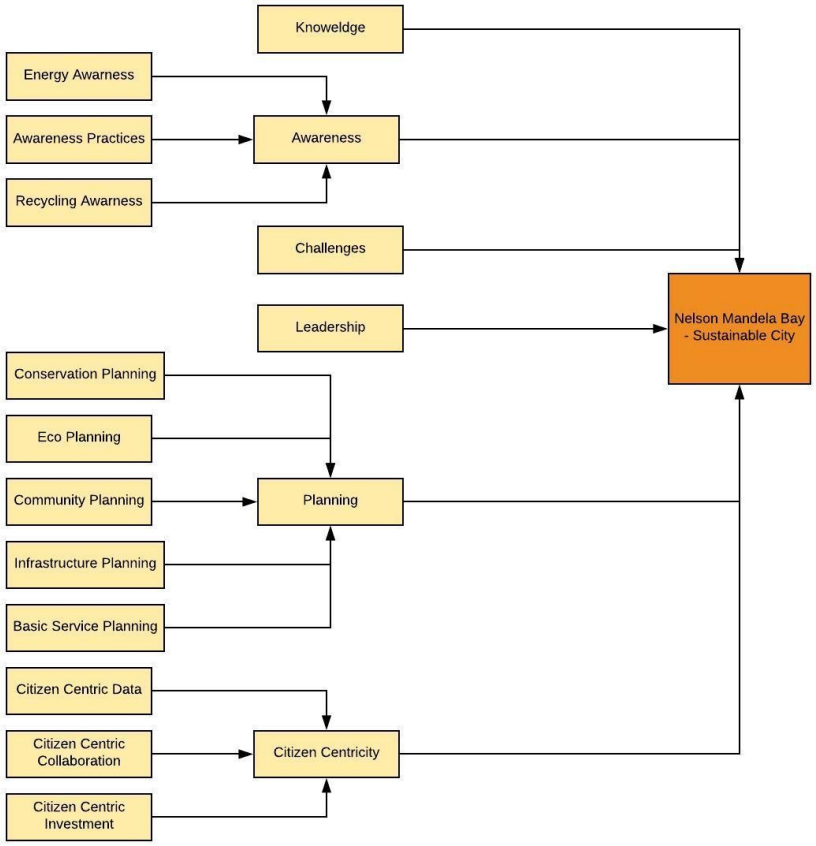

FIGURE 4.15: MODEL 2 RELATING KNOWLEDGE, AWARENESS, LEADERSHIP, PLANNING AND CITIZEN CENTRICITY WITH NMB SUSTAINABILITY

4.8 Summary

The primary aim of Chapter 4 was to address RQ_4: *How sustainably aware are residents of Nelson Mandela Bay?* Which corresponds to RO_4*:* To determine the awareness of Nelson Mandela Bay residents of factors influencing sustainable city awareness. The results indicate that the younger population of Nelson Mandela Bay residents are more aware than their older counterparts, without much deviation between income group levels or educational levels. However, despite being more aware of sustainability, neither population showed a serious commitment to exercising sustainable city practises. The results of the primary research study were analysed and discussed in detail. Two hundred and thirty six respondents participated

in this study. An Exploratory Factor Analysis, descriptive statistics and various inferential statistics were conducted, with the result that the factors were deemed *Good* to *Excellent,* with all of the Cronbach's Alpha scores measuring above 0.73.

Statistical relationships between the independent variables and dependent variable were explored through Pearson's correlation analysis. Furthermore, relationships between selected demographic information and both the dependent variable and selected independent variables were explored through ANOVA tests.

Chapter Four, therefore, concluded with a new recommended model (Model 2 – Figure 4.16) for measuring Nelson Mandela Bay residents' sustainable awareness levels. The first four research questions and research objectives were addressed in the first four chapters. In Chapter 5, a conclusion to the study will be made and RQ5: Which factors influence Nelson Mandela Bay residents' city sustainability awareness? Which corresponds with RO5: Identify the key factors to improve Nelson Mandela Bay residents' awareness of city sustainability. Chapter 5 further addresses (RQ_M): *How aware are Nelson Mandela Bay residents' of the factors that influence the sustainability of the city?* Which correlates to (RO_M): *To determine the awareness of residents of Nelson Mandela Bay concerning city sustainability.*

Chapter Five: Conclusions and future research

5.1 Introduction

Chapter 4 began with the testing of the initial conceptual model proposed at the end of Chapter 2. The results of the empirical study were presented, analysed and discussed. Chapter 4 concluded with a new proposed conceptual model for measuring the sustainable awareness of Nelson Mandela Bay residents. The chapter further addressed:

RQ_4: *How sustainably aware are residents of Nelson Mandela Bay?* Which corresponds to

RO_4 – To determine the awareness of Nelson Mandela Bay residents of factors influencing sustainable city awareness.

This is the final chapter of the study and presents the findings, managerial recommendations and conclusion to this study by answering (RQ_5): Which factors influence sustainability awareness of residents of Nelson Mandela Bay city? Which correlates to (RO_5): Identify the key factors to improve Nelson Mandela Bay residents' awareness of city sustainability.

The Chapter outline is illustrated in Figure 5.1.

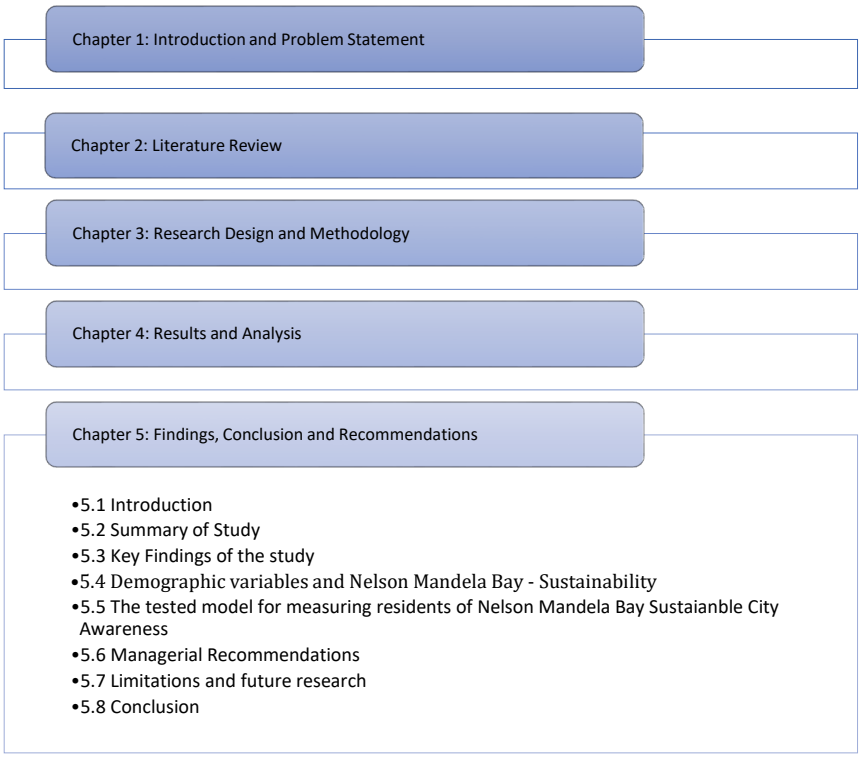

FIGURE 5.1: CHAPTER 5 OUTLINE

5.2 Summary of Study

5.2.1 Chapter 1: Introduction and Problem Statement

Chapter One began with an introduction to the treatise and an overview of the concept of Sustainable Cities. Next, the study's purpose and problem statement (*Nelson Mandela Bay residents' are unaware of the factors that influence city sustainability), were identified, a*long with the formation of the main research objective RO_M - *To determine the awareness of residents of Nelson Mandela Bay concerning city sustainability*. Which corresponds to main research question RQ_M - *How aware are Nelson Mandela Bay residents of the factors that influence the sustainability of the city?* Further, the chapter depicted the research delimitation and significance and provided the research methodology and design for the

thesis. The chapter concluded with the treatise structure and Research Alignment Plan, which guided the researcher throughout the treatise.

5.2.2 Chapter 2: Literature Review

Chapter Two's main objective was to answer the first and second research questions identified for this study. RQ_1: *What is the definition of city sustainability?* Which correlated with RO_1: *To determine the definition of sustainable cities*. This provided the following definition: City sustainability takes an intelligent, long-term collaborative approach to face the economic, social and environmental challenges that arise due to the pressure on already scarce available city resources (Ericsson, 2013).

The second research question, RQ_2: *What factors can be used to evaluate residents' awareness of sustainable cities?* This corresponded with RO_2: *To conduct a review of existing sustainable city models and investigate the factors that affect residents' awareness of sustainable cities.* This exploration and review of various literature on sustainable cities and residents' awareness thereof, provided the context and understanding for the identification of factors proposed for the conceptual model, which formed the foundation of the development of this study's questionnaire.

The independent variables (IVs) also referred to as factors that could have an influence on the dependent variable (DV), were identified for this study (DV: Nelson Mandela Bay - Sustainable City) are identified below. The dependent variable 'Sustainable City' refers to Nelson Mandela Bay being classified as a sustainable city.

- IV1: Awareness - which introduced the importance of awareness and how awareness was crucial in aiding cities to become sustainable (Hamid et.al., 2017). Thirteen items were associated with IV1: Awareness;
- IV2: Knowledge – Knowledge about sustainable cities refers to the understanding of contribution that the emergence of an alternative political economy, capable of replacing that which currently regulates and exploits so much of the world and its resources (Kyte, 2014). Four items were associated with IV2: Knowledge;
- IV3: Challenges – Sustainable cities face a unique set of challenges as to how cities traditionally have been managed and developed (UN Habitat, 2009). This section

provides an analysis into the main social, economic and environmental challenges surrounding sustainable cities. Six items were identified with IV3: Challenges;

- IV4: Leadership -Today's cities need leaders and managers who are experienced in the latest knowledge and best practice about sustainability and the built environment, democracy and how technology can help create an inclusive city community (Broman et al., 2013). Five items were identified within IV4: Leadership;
- IV5: Planning - Urban planning seeks to balance environmental, economic, and social values to enable sustainable development in planning a Sustainable city. Planning in the developed world faces very different challenges to the cities in the developing world in achieving sustainability (UNEP & UN-HABITAT, 2005). Four items were identified within IV5: Planning; and
- IV6: Citizen Centricity – Refers to citizens placing a city's citizens at the core of the design strategy (Thomas, 2015). Four items were identified within IV6: Citizen Centricity.

5.2.3 Chapter 3: Research Design and Methodology

Chapter Three provided an outline of the research philosophy, research design and research paradigm used in this study. The study followed a positivistic philosophy and made use of quantitative research methods, which allowed for an understanding into the causal relationships between the dependent variable (NMB - Sustainability) and the independent variables (IV1: Awareness, IV2: Knowledge, IV3: Challenges, IV4: Leadership, IV5: Planning and IV6: Citizen Centricity).

A positivistic paradigm was followed, which meant a large sample population was examined, where conclusions on this population were inferred from statistical analysis. Chapter Three discussed the proposed hypotheses for this treatise and selected the demographic variables (Age, Ethnicity, Location, Gender, Income, Employment and Marital status). Further, Chapter Three discussed the operationalisation of the questionnaire, which was compiled from previous work done on citizens' perspectives of the sustainability of cities (Townsend, 2013 and Grand Valley State University, 2011) and outlined the reliability and validity of this questionnaire. As such, this chapter addressed RQ_3: What research methodology can be used for this research study and be replicated in the future? This corresponded to RO_3: Explain the components of the research methodology for this study.

5.2.4 Chapter 4: Results

Chapter Four addressed the *RQ4:* How sustainably aware are residents of Nelson Mandela Bay? *Which* matched *RO4:* To determine the awareness of Nelson Mandela Bay residents of factors influencing sustainable city awareness. This was done by collecting primary data through an online survey, which was distributed via the Nelson Mandela Business School MBA group database as a once-off email. The first set of data captured within the questionnaire was demographic information of respondents, which was as follows. Of the 375 participants whom started the questionnaire only 236 respondents fully completed the questionnaire.

More than half of respondents indicated that they lived in the Eastern Cape (n = 135, 56%), however, only 42% (n = 99) of respondents were living in Nelson Mandela Bay. There was an almost equal split in the gender of respondents with the predominant age group between the age of 26 and 35 years(n = 101, 43%), followed by 36 to 45 years (n = 84, 36%). More than half of the respondents were married (n = 132, 56%), while the largest ethnic group was black (n = 91, 38%), followed by white (n = 65, 28%). The largest group of respondents had post-graduate degree (n = 93, 39%) qualifications, followed by respondents who had a degree (n = 74, 31%). The highest average household income group was between the R25k-R45k (n = 75, 32%), followed by R45k-R65k per month (n = 45, 19%).

An Exploratory Factor Analysis (EFA) was conducted to explore the relationships among variables derived from the conceptual model at the end of Chapter Two. The EFA allowed for patterns to be identified, so that the number of variables could be reduced and the structure in the relationship between variables could be detected (Hair et al., 2010; Schreiber et al., 2006). The EFA found that for IV1: Awareness, the optimal solution was three-factors. Therefore, awareness was broken down into recycling awareness, energy awareness and awareness practices. For IV2: Knowledge the EFA indicated that the optimal solution be a one factor item. The same result occurred for IV3: Challenges and IV4: Leadership, where one-factor items were deemed to be the optimal solution. The EFA found that for IV5: Planning, the optimal solution was a five-factor solution, dividing planning into, Conservation Planning, Eco Planning, Community Planning, Infrastructure Planning and Basic Service Planning. For the final IV6: Citizen Centricity, the EFA indicated that the optimal solution was a three-factor solution. This meant that citizen centricity was sub-divided into citizen centric data, citizen centric collaboration and citizen centric investment. The final product of the EFA produced a

list of factors items with each factor loading. This was done by removing factor items that were less than 0.300.

Chapter Four then provided the Cronbach's Alpha coefficient scores, which are interpreted as 0.50 to 0.69 to be *acceptable* reliability, 0.70 to 0.79 for *good* reliability and ≥0.80 as *excellent* reliability (Zikmund et al., 2013; Nunnally, 1978). The following factors all had *excellent* reliability: IV3: Challenges (0.82), IV4: Leadership (0.93), IV5: Planning (0.82), IV6: Citizen Centric Data (0.91) and IV6: Citizen Centric Collaboration (0.83). The descriptive statistics of the studied showed that the majority of the respondents responded positively to the most of the factors, with the exception of IV1: Energy Awareness ($\mu = 3.14$), IV1: Awareness Practices ($\mu = 3.14$), IV1: Awareness ($\mu = 3.40$) and DV: NMB Sustainability ($\mu = 3.20$), which indicated neutral responses.

The Inferential statistics conducted in Chapter Four were used for the factors, which indicated significant relationships between selected variables and demographic information. The first inferential statistics test was the One Sample T-tests, which revealed that only one factor IV1: Awareness was neither statistically ($p = .901$) nor practically (Cohen's d = n/a) significant. All the remaining factors showed statistical significance and a ranged from small to large practical significance. The One Sample T-test was followed by the inferential ranking of factors, which ranked as follows: IV4: Leadership, IV5: Planning, IV2: Knowledge, IV6: Citizen Centricity, IV3: Challenges, IV1: Awareness and DV: NMB Sustainability. The final inferential statistics test was Pearson Product Moment Correlations, which measured the correlations between DV: NMB Sustainability and the independent variables. A significant high correlation was seen between IV1: Awareness and IV1: Awareness Practices (.831). A similar high correlation was identified between IV5: Planning and two of its sub factors, Infrastructure Planning (.830) and Basic Service Planning (.802). The highest correlations existed between IV6: Citizen Centricity and its three sub-factors, Citizen Centric Data (.851), Citizen Centric Collaboration (.854) and Citizen Centric Investment (.869). The Correlations between Nelson Mandela Bay Sustainability and the independent variables indicated predominately low negative (non-significance) and low positive (small significance) results.

Chapter Four then reported on the relationship between selected demographic information and NMB Sustainability. A significant difference was found for recycling awareness between the age groups of 18-35 years and 46+ years ($p = 0.01$; Cohen's d = 0.65). A second significant

relationship was found for IV1: Awareness between the age groups of 18-35 years and 46+ years (p = 0.00; Cohen's d = 0.80). Chapter Four concluded with a new tested model for measuring the DV: Nelson Mandela Bay - Sustainability.

5.2.5 Chapter 5: Findings, Conclusion and Recommendations

The final chapter (Five) of this study, serves as a summary of the entire study. It presents the key findings from the literature in Chapter Two and the empirical study in Chapter Four and addresses any gap between the literature and empirical results. In addition, the implications of the study and managerial recommendations are discussed and the limitations to the study are noted and a call for future research is made. Finally, the study's conclusions are made based on the research findings. Therefore, the *RQM: How aware are Nelson Mandela Bay residents' of the factors that influence the sustainability of the city?* Which is linked to *ROM: To determine the awareness of residents of Nelson Mandela Bay concerning city sustainability.*

5.3 Key Findings of the Study

This section summarises the key findings of the study by each variable and finally discusses the conceptual model for Nelson Mandela Bay as a Sustainable City.

5.3.1 Nelson Mandela Bay Residents' Awareness of Sustainability.

Chapter Two introduced the Theory of Planned Behaviour (TPB) and Value Belief Norms (VBN) both of which formed the anchor to this study. The unique attributes of these two theories is that the behavioural intentions, motivations, values and norms, have been recognised as the building blocks in predicting actual human behaviour (Joachim, et al., 2015). Further, the application of the two behavioural theories has the potential to increase the awareness of pro-environmental habits, attitudes and knowledge and arouse expectations and beneficial factors that could motivate residents' to be more aware of their actions to promote sustainability for the benefit of future prospects (Joachim, et al., 2015).

In this study on Nelson Mandela Bay (NMB) as a sustainable city, the following independent variables (IVs): awareness, knowledge, challenges, leadership, planning and citizen centricity were measured on their impact on residents awareness of sustainability. These IVs formed the conceptual model on the DV: NMB Sustainability and set the boundaries for this research.

The results of the descriptive statistics in this study indicated that the overall opinion of respondents was predominantly neutral on the opinion as to whether NMB could be classified as a sustainable city. This is backed up by further investigation. The DV: NMB Sustainability had a positive mean score ($\mu = 3.20$, $n = 223$) and had both statistical ($p < .005$) and a small practical significance (Cohen's $d = 0.34$). As such, it can be concluded that Nelson Mandela Bay residents somewhat agree that the city is sustainable. The Cronbach's Alpha score of 0.79 indicates good reliability (Nunnally, 1978) of the measurement and an absence of variation if the study were to be repeated (Collis & Hussey, 2014: 52; OECD, 2013; Saunders et al., 2009).

To determine whether a relationship existed between the DV and the IVs, a correlation had to exist, where one variable increases and the other variable either increases (positive correlation) or decreases (negative correlation) and this happens in a predictable fashion (Collis & Hussey, 2014; Leedy & Ormrod, 2010). One other view of the relationship between variables is that the independent variable can be seen as the cause and the dependent variable can be seen as the effect (Collis & Hussey, 2014). The majority of all the correlations between DV: NMB Sustainability and the IVs indicated low negative (non-significant) results. The only IVs, which showed a positive correlation, were IV1: Recycling Awareness (.001), Eco Awareness (.045), Eco Planning (.002), Citizen Centric Collaboration (.001), Citizen Centric Investment (.011) and Citizen Centricity (.002). However, these were very low correlations.

When different potential relationships were explored between NMB Sustainability and demographic factors, it was determined that no significant relationship existed between any of the demographic factors and NMB Sustainability. This was highlighted by p values > 0.05 and Cohen's d values which all returned N/A results.

5.3.2 Awareness

According to the NMBM Green Procurement Implementation Strategy (2011), improving information and awareness is vital to ensure that citizens understand what they need to do, why they need to do it, how they need to do it and where they can access guidance. Hamid et.al. (2017) add to this, by highlighting the importance of education globally as it has the ability to shape and shift the minds of people in terms of environmental awareness.

Various theoretical and empirical studies have confirmed that behavioural change may indeed be caused by activities with the objective of raising awareness (Hamid et al., 2017). An

initiative taken on by the Nelson Mandela Bay municipality called the NMBM Green Procurement Implementation Strategy (2011), set out to improve the sustainability of local government projects. It was discovered that if clear information was neither available nor actively imparted then the success of sustainable initiatives was dramatically reduced (NMBM Green Procurement Implementation Strategy, 2011).

The results of the enquiry into the awareness of NMB residents of a sustainable city, indicated that majority were aware of sustainable city practices (93%, n = 220), however, when asked if these sustainable city practices were in fact practised, only 44% (n = 104) of respondents indicated that they were. The Exploratory Factor Analysis (EFA) on Awareness found the optimal solution to be a three-factor solution. This meant that awareness needed to sub-divide into recycling awareness, energy awareness and awareness practices.

The Cronbach Alpha scores for awareness (0.59), energy awareness (0.62) and awareness practices (0.63) indicate acceptable reliability, while recycling awareness (0.75) indicated good reliability. Despite recycling awareness (3.94), energy awareness (3.14), awareness practices (3.14) and overall awareness (3.40) all having positive mean scores, they were the lowest mean scores out of all the variables measured. Additionally, the three sub-factors of Awareness were statistically and practically significant, however, overall Awareness was not deemed statistically (p =.901) nor practically significant (N/A).

When potential relationships were explored between demographic information and awareness, recycling awareness, energy awareness and awareness practices, it was determined that a significant relationship existed between awareness and recycling awareness with age. The age group 18-35 years (47%, n = 111) was significantly more aware of recycling and sustainable city awareness than the age groups 36-45 years (36%, n = 85) and 46+ years (17%, n = 40), indicating that younger people have had more exposure to the importance of recycling and sustainable city awareness. These results indicate that increased effort needs to be made by city management to improve sustainable city awareness by campaigns amongst older generations.

5.3.3 Knowledge

According to Kyte (2014), humans currently have never had better knowledge or understanding of the solutions available in preventing natural catastrophe and creating

opportunities for a better life for people all over the world. The fundamental question is, if knowledge is derived from, produced by and captured within an economy of competition and accumulation, how likely is it that it will ever contribute to sustainable development or deliver jobs for all? (M'kumbuzi et al., 2015). One view is that science and science-based education is being increasingly drawn into this economic paradigm and is being turned into a tool for competitive states and multilateral companies (UN, 2013). At the same time, spaces for the development of alternative paradigms and forms of knowledge are decreasing (ICS/ISSC, 2015).

The findings of the study indicated that the majority of respondents were positive ($\mu = 4.34$) concerning knowledge about a sustainable city. Knowledge was both statistically significant ($p < .005$) and had a large practical (Cohen's $d = 1.76$) significance. Further, 95% ($n = 224$) of respondents agreed that sustainable partnerships need to exist between business, community and government. There was agreement (96%, $n = 227$) that the functions of our natural environment need to be maintained. Eighty-three percent said they understand sustainable development and importantly, 91% ($n = 215$) agreed that it is the personal responsibility of each individual to help make a difference on sustainable issues. The Cronbach Alpha loading of 0.73 showed good reliability for exploratory research (Nunnally, 1978). No significant relationships were detected between Knowledge and any of the demographic factors. Knowledge had a low negative correlation (-.076) with the dependent variable: NMB Sustainability.

5.3.4 Challenges

South Africa is among the most urbanised countries in Africa. It has a higher proportion of people living in urban areas than any comparable African country. The weight of South Africa's past has meant that the extension of access to infrastructural services to the poor has been one of its key challenges to overcome the conditions of poverty and inequality post-1994 (DOE, 2011). Adding to this, the literature indicates that during the next 15 years, more than 600 million more people will join the global labour market. Most of whom will be the youth in cities in developing countries (UN Habitat, 2009). This leaves a major challenge South African cities already dealing with high levels of youth unemployment.

Bulkeley (2013) identifies that it is no coincidence that global climate change has become a leading international development issue at the same time as the world has become urbanised. Cities account for some 75 per cent of the world's energy use and over 70 per cent of the world's carbon dioxide emissions. Urban infrastructure is largely built without giving much thought to ecological sustainability (Nahman et al., 2010). The way cities are planned, managed, operated and consume energy will have a critical role in the quest to reverse climate change and its impact.

The descriptive statistics of this study showed that 83% (n = 195) of respondents indicated agreement with sustainable city challenges. The mean score for challenges was $\mu = 4.24$ with a large practical significance (Cohen's d = 1.58). The Cronbach's Alpha loading was 0.82, which indicates excellent reliability for exploratory research (Nunnally, 1978). Challenges had a low negative correlation (-.082) with the dependent variable: NMB Sustainability.

5.3.5 Leadership

City Leadership, according to Broman et al. (2013) has become the drivers for growth for nations. A new way of seeing and understanding how cities, now and in the future, will operate, is the view that they will operate as international hubs for relationships and facilitating flows of trade, labour and commerce. With a strong vision and commitment to sustainability, it is possible to transform a city (Steer, 2014).

Cities leaders need to determine the type of people they would like have living and working in their cities, as well as the type of businesses they would like to have invest there and then take decisive, consistent and coordinated action to attract them (Broman et al., 2013). Embracing sustainability can bring both economic expansion and political rewards. There are no easy solutions. With relation to smart cities, Townsend (2013) identifies that the foundation of a smart city is its use of technology and its ability to enhance city performance and optimise service delivery. A major factor, which makes a city a smart, is its level of sustainability.

The results of the empirical study indicated that 95% (n = 226) of respondents agreed with the factor items associated with leadership. The mean score for Leadership was $\mu = 4.49$, which also had large practical (Cohen's d = 1.89) significance. The Cronbach's Alpha of 0.93 indicates excellent reliability (Zikmund et al., 2013). Leadership had low positive correlation

(.000) with the dependent variable: NMB Sustainability. In summary, these statistics reveal that having the right leadership is imperative to a city's becoming a sustainable.

5.3.6 Planning

According to Mabaso (2014), South African cities face a challenge with asset maintenance which is currently characterised by substantial infrastructure aging and decay. Although cities occupy just two per cent of the Earth's surface, their inhabitants use 75 per cent of the planet's natural resources (UNEP & UN-HABITAT, 2005). Cities draw on their surrounding ecosystems for goods and services, which means products and emissions of cities, affect both regional and global ecosystems (UNEP & UN-HABITAT, 2005). Healthy ecosystems and biological diversity are vital for cities to function properly (Aronson et al., 2014, Ives et al., 2016).

According to Beninde et al. (2015), the planning of urban green spaces provides opportunities for citizens to connect with nature, witness ecological processes in action and potentially become scientifically literate citizens who make informed decisions regarding conservation initiatives and policy (Lepczyk et al., 2017). Based on literature from Belmeziti et al. (2018) and Rakhshandehroo et al. (2015), open urban green spaces provide different dimensions of sustainability because of opportunities for social, environmental and economic benefits, which contribute to the quality of life in cities.

The results of the empirical study show that 90% (n = 212) of respondents indicated that planning is an important component in city sustainability. The EFA for Planning found that the optimal solution was deemed a five-factor solution. Therefore, planning was sub-divided into conservation planning, eco planning, community planning, infrastructure planning and basic service planning. The Cronbach Alpha scores for eco (0.54) and community planning (0.66) indicate acceptable reliability, while conservation (0.77) and basic service planning (0.76) indicated good reliability. Both infrastructure planning (0.82) and overall planning (0.82) showed excellent reliability for exploratory research (Nunnally, 1978). The mean score for planning was $\mu = 4.39$, while the mean scores for the sub-factors of planning were conservation ($\mu = 4.53$), eco ($\mu = 4.08$), community ($\mu = 4.42$), infrastructure (4.40) and basic service planning (4.50). Additionally, all five of the sub-factors of Planning, as well as overall planning were statistically significant and had large practical significance.

When potential relationships were explored between demographic information and Planning and planning sub-factors, no significant relations existed. Planning had a low negative correlation (-.031) with the dependent variable NMB sustainability.

5.3.7 Citizen Centricity

The principle of citizen centricity described by Thomas (2015) is that citizens, in case of public service delivery, have to be the core of a city's design strategy. Citizen centricity requires more of a socio-cultural approach based on multi-disciplinary perspectives, rather than on a mere understanding of tools and trends (Searle, 2017). Citizens are now expecting greater and faster delivery of government services (Thomas, 2015). According to Binali (2017), the new type of experience government stakeholders and citizens are seeking is: one that is frictionless; where work and collaboration are seamless and people and process are intertwined with interconnected services; and where technology is intuitive and easy to use. Searle (2017) describes that the beauty of a citizen-centric government is, that it does not just benefit citizens, when done right, it makes life easier for the policy makers, front line staff, ministers and others within the government ecosystem (Thomas, 2015).

Elgazzar and El-Gazzar (2017) discuss how sustainable urbanisation has become a key concern for societies in terms of environmental efficiency and intelligent employment of city resources. This concern has given rise to the notion of a technologically interconnected city or Internet of Things (IoT), where Big Data is promoted to achieve the efficiency and intelligence in managing cities' resources (Deloitte, 2015). However, Associates (2016) identifies that the divide between those who have access to the Internet to those who do not is widening. A city's data are one of its most valuable assets. PWC (2016) defines how reliable data can facilitate collaboration, improve partnerships with the private sector, and expand public engagement. Innovative uses of data allow cities to enforce regulation and improve social services (Adler, 2017). The smart city needs to generate civic commitment in order to forge an alliance between the city and its interest groups and to ensure that citizens get involved, become committed and perceive their city as a common and exciting project of their own (Telefonica, 2016).

The results of the empirical study show that 87% (n = 205) of respondents indicated that they agreed with cities adopting a citizen centric approach. The EFA for Planning found that the

optimal solution was deemed a three-factor solution. Therefore, citizen centricity was sub-divided into citizen centric data, citizen centric collaboration and citizen centric investment. The Cronbach Alpha score for citizen centric investment (0.76) indicated good reliability, while citizen centric data (0.91), citizen centric collaboration (0.83) and citizen centricity (0.82) showed excellent reliability for exploratory research (Nunnally, 1978). The mean score for citizen centricity was $\mu = 4.40$, while the mean scores for the sub-factors of citizen centricity were citizen centric data ($\mu = 4.53$), citizen centric collaboration ($\mu = 4.08$) and citizen centric investment ($\mu = 4.42$). Additionally, all three sub-factors of citizen centricity, as well as citizen centricity were statistically significant and had large practical significance.

When potential relationships were explored between demographic information with citizen centricity and citizen centricity sub-factors, no significant relations existed. Citizen centricity had a low positive correlation (.002) with the dependent variable NMB sustainability.

5.4 Demographic variables and Nelson Mandela Bay - Sustainability

Potential relationships between demographics and the dependent variable, NMB Sustainability were explored (Section 4.7). Various tests, including descriptive statistics, T-tests, Pearson's correlation and ANOVA were conducted to establish possible relationships. However, no differences were identified between any of the demographic factors and the DV. All p values were greater than .005, indicating no statistical significance and the Cohen's d results all showed N/A indicating no practical significance.

5.5 The tested Model for measuring Nelson Mandela Bay Residents' Awareness of City Sustainability.

The conceptual model for measuring the Nelson Mandela Bay Residents' awareness of city sustainability from Chapter 2 was found not to be a feasible model after the EFA (Section 4.4.2) was conducted. As such, a second model was explored, Model 2, illustrated in Figure 4.15, proved to be an adequate model for measuring awareness of city sustainability among Nelson Mandela Bay residents. In this model, recycling awareness, energy awareness and awareness practices had significant relationships with IV1: Awareness. IV5: Planning had a similar result, where conservation planning, eco planning, community planning, infrastructure planning and basic service planning all had significant relationships with IV5:

Planning. IV6: Citizen Centricity had significant relationships with citizen centric data, citizen centric collaboration and citizen centric Investment. IV1: Awareness, IV2: Knowledge, IV3: Challenges, IV4: Leadership, IV5: Planning and IV6: Citizen Centricity were directly linked to the DV: Nelson Mandela Bay – Sustainability.

5.6 Managerial Recommendations

The managerial recommendations are formulated to bridge the gap between the literature and the results of the empirical study. These recommendations aim to improve the overall awareness of city sustainability of Nelson Mandela Bay residents', which addresses the research problem: *Nelson Mandela Bay residents are unaware of the factors that influence the sustainability of the city.* The factors in this section are all in the new Model 2 (Figure 4.15) and have been tested as the items of Nelson Mandela Bay residents' awareness of city sustainability.

The following observations and managerial recommendations are provided:

- The awareness of city sustainability among respondents was notably high (93%, n = 219), however, it was found that city sustainable practices were only practised by 44% (n = 104) of respondents. This shows that the city needs to shift the focus of city sustainable awareness to understanding what it is that residents' need in order to move to the adoption of sustainable practices.
- The results of the descriptive statistics in this study indicated that the central tendency of respondents was predominantly neutral on whether NMB could be classified as a sustainable city. Further investigation revealed that NMB Sustainability had positive mean scores ($\mu = 3.20$) and had both statistical ($p < .005$) and a small practical significance (Cohen's $d = 0.34$), which can be concluded that the city needs to start rolling out more sustainable initiatives across the city to show residents that the city is adopting a sustainable approach. Improving the awareness of citizens can assist with changes in management and increase commitment towards the adoption of a sustainable city.
- The age group 18-35 years (47%, n = 111) was significantly more aware of recycling and sustainable city awareness than the age groups 36-45 years (36%, n = 85) and 46+ years (17%, n = 40), indicating that younger people have had more exposure to the importance of recycling and sustainable city awareness. These results indicate that

increased effort needs to be made by city management to promote sustainable city awareness campaigns amongst older generations.

- Despite many of the respondents having visited or previously resided in Nelson Mandela Bay, only 42% (n = 95) of respondents indicated that they currently live in the city. Therefore, it would be advisable that the study takes in a broader sample population of residents who currently reside in Nelson Mandela Bay.
- Only 5% (n = 12) of respondents had a matric or less as formal education, which does not represent a large majority of Nelson Mandela Bay residents. Additionally, only 9 respondents were 56 years and older, which makes it very difficult to assume that the older generations were less aware than the younger generations, who had the majority of respondents. It would be recommended that a wider audience be reached, to determine a more accurate understanding of Nelson Mandela Bay residents' awareness of sustainability.
- As the study's questionnaire was distributed online, and as a larger percentage of Nelson Mandela Bay residents' who have limited or no access to the internet, it would be advisable that these types of residents should be reached for future studies.
- Most of the respondents (87%, n = 205) indicated that they agreed that Nelson Mandela Bay should adopt a citizen centric approach in its service. This means that the city needs to understand that citizens must be put at the core of the city strategy. This approach may seem unrealistic, but research in other cities has shown that this approach to city management, improves the outcome for all stakeholders involved.
- Residents are ready for the city to transform into a digital landscape where they can access services through an IT infrastructure. City management needs to engage with service providers who are able to develop systems that will allow the city to provide encompassing digital solutions to all types of Nelson Mandela Bay citizens.
- Respondents identified that the biggest challenge for Nelson Mandela Bay is the pressure on its existing infrastructure. City management needs to focus on eradicating the corruption that surrounds state owned infrastructure and pull together to ensure that adequate infrastructure maintenance plans are drawn up for the city.

5.7 Limitations and future research

The limitations are that certain items were reversed or removed from the study due to insufficient factor loadings. After these factors were removed, the Cronbach's Alpha scores improved. All Cronbach's Alpha scores were either acceptable, good or excellent. The Pearson's correlations between the independent variables and the dependent variable: Nelson Mandela Bay Sustainability (Table 4.34) varied from *low negative correlations* to *low positive correlations.* The correlations between Nelson Mandela Bay Sustainability and the independent variables indicated low and negative (non-significant) results. The only independent variables, which showed positive correlation were: IV1: Recycling Awareness (.001), Eco Awareness (.045), Eco Planning (.002), Citizen Centric Collaboration (.001), Citizen Centric Investment (.011) and Citizen Centricity (.002), however, these were very low correlations.

In addition, very few significant relationships were identified between demographic variables and the DV and IVs. The EFA indicated that the tested model, Model 2, is a suitable instrument for measuring Nelson Mandela Bay residents' awareness of city sustainability.

5.8 Conclusion

The main objective of the study was to determine the Nelson Mandela Bay residents' awareness of city sustainability and explore what the factors are that influence awareness of city sustainability. Additionally, a conceptual model was constructed from the literature and used to measure the awareness levels of Nelson Mandela Bay residents in the study. After an Exploratory Factor Analysis was conducted, a tested model was proposed for measuring awareness of city sustainability.

The deliverables, based on the ROs, that this treatise achieved include:

- To determine the definitions of sustainable cities.
- To conduct a review of existing sustainable city models and investigate the factors that affect residents' awareness of sustainable cities.
- Explain the components of the research methodology for this study.
- To determine the awareness of Nelson Mandela Bay residents of factors influencing sustainable city awareness.

- Identify the key factors to improve Nelson Mandela Bay residents' awareness of city sustainability.

As such, the research problem – *Nelson Mandela Bay residents are unaware of the factors that influence the sustainability of the city,* as well as the *RQ_M: How aware are Nelson Mandela Bay residents of the factors that influence the sustainability of the city?* and RO_M: *To determine the awareness of residents of Nelson Mandela Bay concerning city sustainability*

Additionally, managerial recommendations, limitations to the study and a call for future research were discussed. If these recommendations are implemented, city management should be successful in increasing the awareness of city sustainability. As the extensive literature review indicated improving information and awareness are vital to ensure that citizens understand what they need to do, why they need to do it, how they need to do it and where they can access guidance. This awareness can lead people to a relational change in behaviour towards the environment. Additionally, the literature has shown that cities understand the multiple factors that are required for a city to become sustainable, however, as the empirical study has shown, if residents are unaware of the sustainability, efforts to transition a city into a sustainable one are highly improbable.

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Appendices

Appendix A: Research Alignment Plan

RESEARCH ALIGNMENT PLAN				
Title: RESIDENTS' PERSPECTIVE OF NELSON MANDELA BAY AS A SUSTAINABLE CITY				
Main Research Problem: There is currently no indication of the factors that affect Nelson Mandela Bay residents' sustainable awareness levels. Residents that are unaware of sustainability could adversely affect Nelson Mandela Bay in its effort to become a sustainable city.				
Problem statement: Nelson Mandela Bay residents are unaware of the factors that influence the sustainability of the city.				
Main research objective (RO_M): *To determine the awareness of residents of Nelson Mandela Bay concerning city sustainability.*				
Main research question (RQ_M): *How aware are Nelson Mandela Bay residents' of the factors that influence the sustainability of the city?*				
Secondary research questions		**Research objective**	**Chapter**	**Deliverable**
RQ_1	What is the definition of city sustainability awareness?	To determine the definition of sustainable cities.	2	A definition of sustainable awareness
RQ_2	What factors can be used to evaluate residents' awareness of sustainable cities?	To conduct a review of existing sustainable city models and investigate the factors that affect residents' awareness of sustainable cities.	2	A list of factors that affect residents' sustainable awareness.
RQ_3	What research methodology can be used for this research study and be replicated in the future?	Explain the components of the research methodology for this study.	3	Research methodology to be used in this study.
RQ_4	How sustainably aware are residents of Nelson Mandela Bay?	To determine the awareness of Nelson Mandela Bay residents' of factors of sustainable city awareness.	4	The evaluation and validation of the proposed awareness model.
RQ_5	Which factors influence Nelson Mandela Bay residents' city sustainability awareness?	Identify the key factors to improve Nelson Mandela Bay residents' awareness of city sustainability.	5	Proposed sustainable awareness model for residents of Nelson Mandela Bay.

Appendix B: Ethical Clearance Form (Form E)

NELSON MANDELA
UNIVERSITY

FORM E

ETHICS CLEARANCE FOR TREATISES/DISSERTATIONS/THESES

Please type or complete in black ink

FACULTY: _____

SCHOOL/DEPARTMENT: Nelson Mandela Business School

I, (surname and initials of supervisor) Simpson. T

the supervisor for (surname and initials of candidate) Calitz. M

_____ (student number) 21003498

a candidate for the degree of Masters in Business Administration

with a treatise/dissertation/thesis entitled (full title of treatise/dissertation/thesis):

Residents Perspective of Nelson Mandela Bay as a Sustainable City.

considered the following ethics criteria *(please tick the appropriate block):*

	YES	NO
1. Is there any risk of harm, embarrassment of offence, however slight or temporary, to the participant, third parties or to the communities at large?		X
2. Is the study based on a research population defined as 'vulnerable' in terms of age, physical characteristics and/or disease status?		X
2.1 Are subjects/participants/respondents of your study:		
(a) Children under the age of 18?		X
(b) NMMU staff?		X
(c) NMMU students?		X
(d) The elderly/persons over the age of 60?		X

(e) A sample from an institution (e.g. hospital/school)?		X
(f) Handicapped (e.g. mentally or physically)?		X
3. Does the data that will be collected require consent of an institutional authority for this study? (An institutional authority refers to an organisation that is established by government to protect vulnerable people)		X
3.1 Are you intending to access participant data from an existing, stored repository (e.g. school, institutional or university records)?		X
4. Will the participant's privacy, anonymity or confidentiality be compromised?		X
4.1 Are you administering a questionnaire/survey that:		
(a) Collects sensitive/identifiable data from participants?		X
(b) Does not guarantee the anonymity of the participant?		X
(c) Does not guarantee the confidentiality of the participant and the data?		X
(d) Will offer an incentive to respondents to participate, i.e. a lucky draw or any other prize?		X
(e) Will create doubt whether sample control measures are in place?		X
(f) Will be distributed electronically via email (and requesting an email response)? Note: • If your questionnaire **DOES NOT** request respondents' identification, is distributed electronically and you request respondents to return it *manually* (print out and deliver/mail); **AND** respondent anonymity can be guaranteed, your answer will be NO. • If your questionnaire **DOES NOT** request respondents' identification, is *distributed via an email link and works through a web-response system (e.g. the university survey system);* ***AND*** respondent anonymity can be guaranteed, your answer will be NO.		

*Please note that if **ANY** of the questions above have been answered in the affirmative **(YES)** the student will need to complete the full ethics clearance form (REC-H application) and submit it with the relevant documentation to the Faculty RECH (Ethics) representative.*

and hereby certify that the student has given his/her research ethical consideration and full ethics approval is not required.

SUPERVISOR(S) — **DATE** 27/08/2018

HEAD OF DEPARTMENT — **DATE**

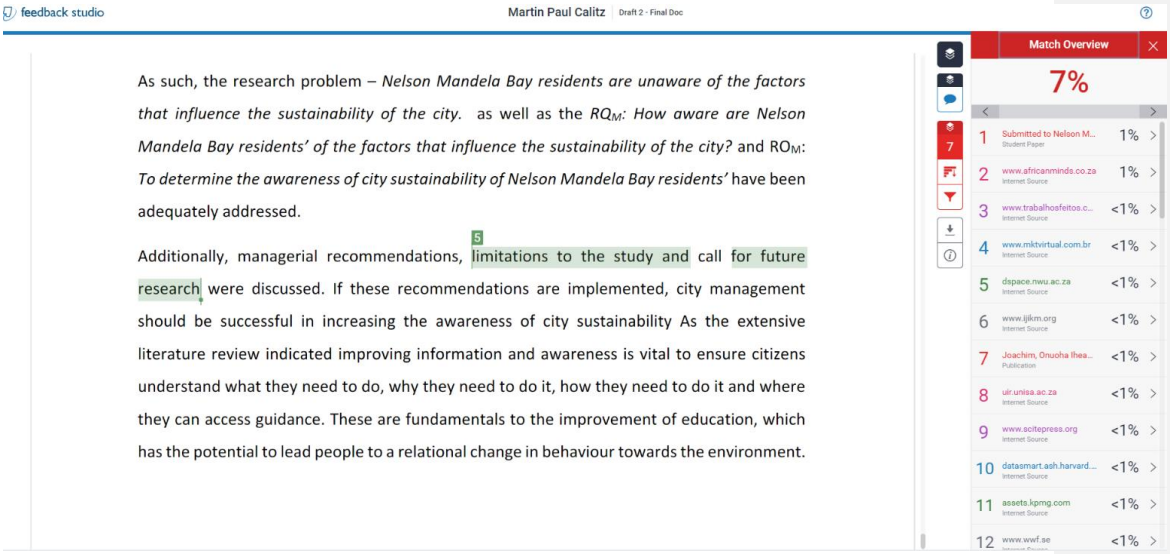
STUDENT(S) — **DATE** 19/06/2018

Student(s) contact details (e.g. telephone number and email address):

S210034998@mandela.ac.za 0664752298

Please ensure that the research methodology section from the proposal is attached to this form.

Appendix C: Turnitin Report

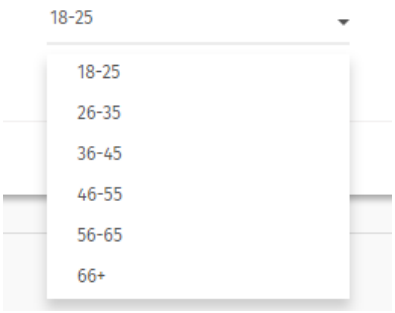


Appendix D: Questionnaire

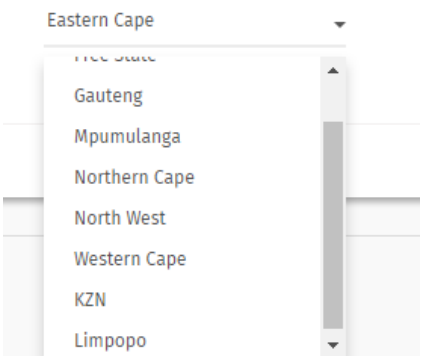
Sustainable Cities Questionnaire

* Please indicate your gender

* Please indicate your age



* What province do you live in?



* Please indicate your race?

Black

- Black
- Coloured
- Indian
- White
- Other- please indicate

* Please indicate your highest level of education

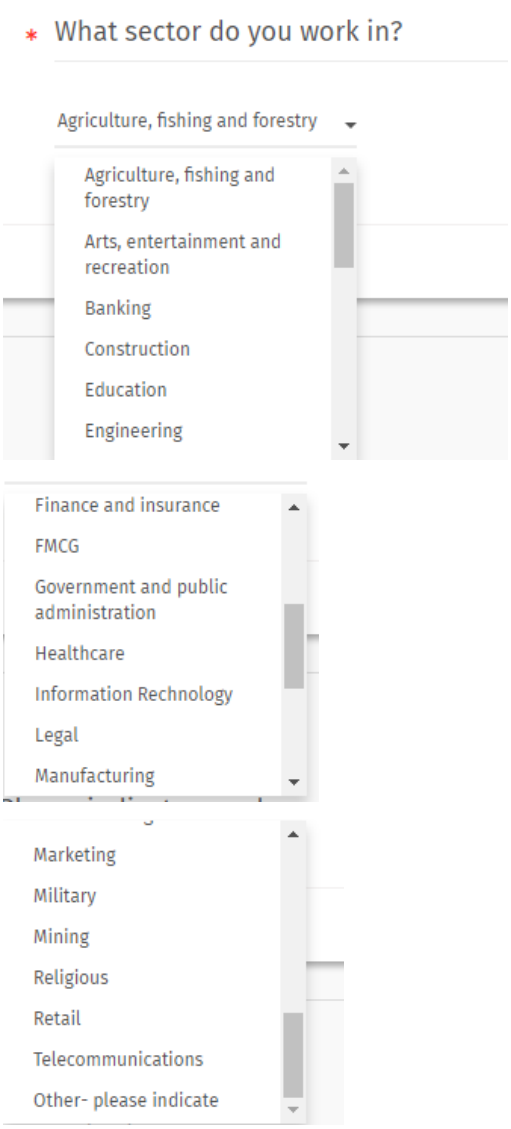
Les than matric

- Les than matric
- Matric
- Diploma
- Degree
- Post graduate degree

* Please indicate your marital status

Single

- Single
- Married
- Divorced
- Widowed
- Living together


* What sector do you work in?
Agriculture, fishing and forestry
Agriculture, fishing and forestry
Arts, entertainment and recreation
Banking
Construction
Education
Engineering
Finance and insurance
FMCG
Government and public administration
Healthcare
Information Rechnology
Legal
Manufacturing
Marketing
Military
Mining
Religious
Retail
Telecommunications
Other- please indicate

* Please indicate your household monthly income

up to R 15 000.00

- up to R 15 000.00
- R 15 001.00-R 25 000.00
- R 25 001.00-R 45 000.00
- R 45 001.00-R 65 000.00
- R 65 001.00-R 85 000.00
- R 85 001.00+

* Please tick the appropriate response with regard to your employment. Are you?

Unemployed

- Unemployed
- Self employed
- Employed
- Retired

* Do you live in Port Elizabeth?

- ◯ Yes
- ◯ No

* Please indicate your level of agreement with the following statements.

	Left Anchor				Right Anchor
	Totally disagree	Disagree	Not sure	Agree	Totally agree
Business, the community and government should have sustainable partnerships	◯	◯	◯	◯	◯
We need to maintain the functions of our natural environment as a matter of survival	◯	◯	◯	◯	◯
Sustainability is meeting the needs of present without compromising the ability of future generations to meet their own needs	◯	◯	◯	◯	◯
Our current way of living is sustainable	◯	◯	◯	◯	◯
I understand sustainable development	◯	◯	◯	◯	◯
I have a personal responsibility to help make a difference on sustainability issues	◯	◯	◯	◯	◯

RESIDENTS' AWARENESS OF SUSTAINABLE CITIES

* Please tick the appropriate box if you are aware of the listed sustainability applications and tick the appropriate box if you practise them:

	NO NOT AWARE	YES AWARE	NO I DON'T PRACTISE THEM	YES I PRACTISE THEM
Green energy	☐	☐	☐	☐
Solar Panels	☐	☐	☐	☐
Grid connected home wind and solar power	☐	☐	☐	☐
Public transport	☐	☐	☐	☐
Cycle to work	☐	☐	☐	☐
Public walking tracks and bikeways	☐	☐	☐	☐
Environmentally friendly products	☐	☐	☐	☐
Household waste recycling	☐	☐	☐	☐
Litter recycling	☐	☐	☐	☐
Biodiesel	☐	☐	☐	☐
Water conservation	☐	☐	☐	☐
Water recycling	☐	☐	☐	☐
Reusable shopping bags	☐	☐	☐	☐
Solar hot water	☐	☐	☐	☐
No chemicals in storm water drains	☐	☐	☐	☐
Use of indigenous plants in gardening	☐	☐	☐	☐
Support local services and facilities	☐	☐	☐	☐

* Cities face the following challenges

	Left Anchor				Right Anchor
	Totally disagree	Disagree	Neutral	Agree	Totally agree
Unemployment	○	○	○	○	○
Economic restructuring	○	○	○	○	○
Pressure on infrastructure	○	○	○	○	○
Climate change	○	○	○	○	○
The aging population puts pressure on adult social care	○	○	○	○	○
Limited resources	○	○	○	○	○
Weak leadership	○	○	○	○	○
Limited investment from the private sector	○	○	○	○	○
Competition with other cities for investment	○	○	○	○	○

RESIDENTS' AWARENESS OF SUSTAINABLE CITIES

* Cities should

	Left Anchor				Right Anchor
	Totally disagree	Disagree	Neutral	Agree	Totally agree
Have a clear vision which addresses sustainable issues	○	○	○	○	○
Be citizen centric	○	○	○	○	○
Enable use of city spaces	○	○	○	○	○
Share knowledge on how the city works	○	○	○	○	○
Embrace opportunities enabled by technology	○	○	○	○	○
Develop policies to promote sustainability	○	○	○	○	○
Promote sustainability to attract investment	○	○	○	○	○
Have clear focus of accountability within the city authority	○	○	○	○	○

* Please rate the following when planning for a sustainable city

	Left Anchor				Right Anchor
	Extremely unimportant	Unimportant	Neutral	Important	Extremely important
Asset maintenance	○	○	○	○	○
Below ground power lines	○	○	○	○	○
Community services	○	○	○	○	○
Natural habitats	○	○	○	○	○
Maintenance of biodiversity	○	○	○	○	○
Larger percentage of open/green spaces/parks	○	○	○	○	○
Energy efficient infrastructure	○	○	○	○	○
Solar hot water systems	○	○	○	○	○
Liveability for well being	○	○	○	○	○
Neighbourhood centre accessibility	○	○	○	○	○
Eco villages	○	○	○	○	○
Pubilc transport systems and mobility	○	○	○	○	○
Bikeways and walking tracks	○	○	○	○	○
Proximity to work	○	○	○	○	○
Waste minimisation	○	○	○	○	○
Waste recycling	○	○	○	○	○
Water quality	○	○	○	○	○
Water sensitive plants	○	○	○	○	○
Stormwater management	○	○	○	○	○
Water conservation	○	○	○	○	○
Infrastructure to attract investment	○	○	○	○	○

* Cities should:

	Left Anchor				Right Anchor
	Totally disagree	Disagree	Neutral	Agree	Totally agree
Enable externally driven, stake holder led innovation by citizens					
Provide smart crime prevention					
Provide free Internet connectivity					
Manage city data as an asset					
Invest in systems to capture and manage data					
Have an integrated approach to the commissioning of services					
Align budgets to provide common good platforms and services					
Have joint procurement initiatives					
Collaborate with Academia, industry and NGOs					
Have IT as a service					
Engage with citizens through IT infrastructure to solve city problems					
Enable citizen to citizen services trough IT infrastructure					
Have a City data management partnership with citizens					
Develop policies for open city data					
Protect personal privacy					
Develop IT solutions for working across vertical silos to deliver citizen centric services					
Use IT solutions for a one stop shop					
City data should drive innovation and create new value					
City data should be used to attract investment					
City data should accelerate new business start ups					
The City should enable digital connectivity and integration between people, places and things					

RESIDENTS' AWARENESS OF SUSTAINABLE CITIES

* Please answer the following statement with refefence to Port Elizabeth. Even if you do not live there or have never visited the City, your opinion/ perception is valuable.

	Left Anchor				Right Anchor
	Totally disagree	Disagree	Neutral	Agree	Totally agree
In my opinion, Port Elizabeth is a sustainable city	○	○	○	○	○
Port Elizabeth has good infrastructure	○	○	○	○	○
Port Elizabeth has good leadership	○	○	○	○	○
Port Elizabeth is citizen centric	○	○	○	○	○
I would invest in Port Elizabeth	○	○	○	○	○
Port Elizabeth is managing its challenges well	○	○	○	○	○

End of survey