

**TOWARDS EFFECTIVE PLANNING AND MANAGEMENT OF URBANISATION TO
MITIGATE CLIMATE CHANGE: A CASE OF THE CITY OF POLOKWANE, SOUTH
AFRICA**

by

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DECLARATION

I, Ngoako Johannes Mokoete, declare that the doctoral thesis titled "TOWARDS EFFECTIVE PLANNING AND MANAGEMENT OF URBANISATION TO MITIGATE CLIMATE CHANGE: A CASE OF THE CITY OF POLOKWANE, SOUTH AFRICA" is my work in both the design and execution. All the sources that were used or quoted in the document have been acknowledged and listed in a complete list of references. This doctoral research work has not been submitted before for any other degree at any other institution.

Mr NJ Mokoete



Date: 15 November 2021

DEDICATION

This doctoral thesis is dedicated to my late grandfather, Ngoako Johannes Mokoete, (whom I was named after to immortalise his name), who raised me and instilled the love for education on me at a very tender age. You will forever be missed Rakgolo. May your soul continue to rest in perfect peace *Kgomo*.

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ABSTRACT

The study aims to evaluate the effectiveness in planning for and management of urbanisation towards climate change mitigation at the City of Polokwane, Polokwane Local Municipality in the Limpopo Province. In Africa, various studies have demonstrated that unplanned urbanisation has resulted in increasing Greenhouse Gas emissions, which has contributed to the intensification of climate change. Although every country has contributed to climate change, African countries have blamed the current climatic conditions (floods, drought, changing precipitation patterns, sea-level rise, heatwaves and high temperature) on the excessive development alternatives that are highly polluting from the developed countries. In South Africa, the Spatial Planning Land Use Management Act (SPLUMA) is an important planning instrument to plan and manage urbanisation. Although there has been a transformation of legislative framework in South Africa, its implementation remains unreformed. The study adopted a mixed method approach to integrate the strengths of both the qualitative and quantitative methods. The study was undertaken at four areas around the City of Polokwane, namely Legae le Batho, Serala View, Emdo Park and Flora Park by engaging with the local communities on their perceptions regarding the planning and management practices within the municipality.

The findings of the study indicate that there is a gap between the municipality and the local communities in the planning and management of urbanisation. The collaboration between the communities and Polokwane Local Municipality in planning serves as a strategy for efficient climate change mitigation. The use of solar systems for street lights, solar geysers, hybrid system (solar and batteries) and gas application can significantly reduce electricity consumption, which is currently generated from the combustion of fossil fuels. Therefore, the study recommends implementation of bio-digesters and solar plants to mitigate climate change. The study recommends proper alignment between the Polokwane Local Municipality and Capricorn District Municipality in terms of climate

change mitigation to ensure effective implementation of project initiatives such as biogas digesters (for gas generation) and solar plants for electricity generation.

Key concepts: Management; Planning; Urbanisation; Climate change mitigation; Greenhouse Gas; Collaborative planning; South Africa

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1 CHAPTER 1: INTRODUCTION AND BACKGROUND TO THE STUDY

1.1 INTRODUCTION AND BACKGROUND

Over the years, the global urbanisation rate has been unprecedented as developing countries continue to experience major growth (Roy, 2009; Vasilevska, Vranic & Marinkovic, 2014; Moriarty & Honnery, 2015). This rate of urbanisation has transformed the urban landscape with more than 50 per cent of the world's population located in urban areas (da Silva, dos Santos, Maiar & da Rosa, 2019). Urbanisation has resulted in physical expansion of urban areas (Hao, Sliuzas & Geertman, 2011; Shen & Zhang, 2014), which has led to the abatement of green infrastructure (Cobbinah & Nimmingu-Beka, 2017; Roggema, 2019). According to Oteng-Ababio, Owusu & Asafo, 2019), the lack of proper management and planning for such a burgeoning urban population and physical expansion of an urban system pose a mammoth challenge for the municipalities, which are confronted with multiple environmental challenges such as climate change, improper waste management and air pollution. Therefore, the inability to effectively manage urbanisation has led to the high consumption of resources, energy, land, traffic congestion and Greenhouse Gas (GHG) (carbon dioxide, nitrogen and methane) emissions into the atmosphere.

Human activities have already contributed towards warming of the earth's atmospheric temperature by 1°C, which in turn destroys the climatic conditions necessary for human survival (Welborn, 2018). In cities like Berlin, London and Amsterdam; planning interventions have been explicitly put in place to address economic efficiency and urban growth (Savini, Majoor & Salet, 2015), though their success in managing urbanisation continues to encounter challenges. During the Conference of the Parties (CoP 21 held in Paris, France, from 30 November to 12 December 2015, the developing countries argued that the contemporary changing climate conditions are attributed to the past burning of fossil fuels in the developed countries. In India, big cities such as Mumbai and Bangalore have experienced high temperatures and floods that have claimed the lives of many people (Moriarty & Honnery, 2015; Parida & Dash, 2019; Roy & Haider, 2019). According to Newburger (2021), the historic heat waves that scotched the most part of Pacific Northwest, which caused high temperatures in Canada were blamed for causing hundreds of deaths in Oregon,

Washington and British Columbia during the month of June 2021. Therefore, the changing climatic condition threatens the object of many countries to achieve sustainable development and prospects to provide the developmental aspirations of their populations.

Africa's rate of urbanisation has overwhelmed the capacity of most municipalities to effectively plan and manage this process (Cobbinah, Erdiaw-Kwasie & Amoateng, 2015; Cobbinah & Nimmingu-Beka, 2017). Africa is home to the harshest climatic conditions in the world and with the most vulnerable population, although it has contributed very little towards climate change (Welborn, 2018). Therefore, African countries should consider harmonising their planning and implementation of economic development with climate change mitigation aspirations. Various scholars argue that many African countries are still using unreformed planning systems inherited during the colonial or apartheid regime (Ogbazi, 2013; Cobbinah, Nunbogu & Gyogluu, 2016) that fail to address the current environmental challenges. Nairobi, Lagos and Accra (in Kenya, Nigeria and Ghana respectively) are amongst the most urbanising cities in Africa, which are plagued by high traffic congestion, high consumption of non-renewable resources, air pollution, land pollution and increasing emissions (Cobbinah *et al.*, 2015). Consequently, climate change is a human-induced environmental problem that Africa intensely continues to contribute towards. In South Africa, cities are growing both in size and population density, which presents a serious and important dimension of urbanisation (Integrated Urban Development Framework (IUDF), 2014; Robbins & Culwick, 2015). Accordingly, the IUDF has revealed that "South African urban areas are very resource-intensive, highly polluted and wasteful" (IUDF, 2014: 10). Consequently, the heavy reliance on private cars, non-renewable resources and burning fossil fuels to generate electricity has contributed to the increasing levels of carbon emissions in South Africa (IUDF, 2014). South Africa is the highest contributor of GHG emissions in the atmosphere among all African countries. Therefore, there is an urgent need for a new effective and efficient intervention that aims to balance economic efficiency and environmental protection.

In South Africa, the Gauteng Province is currently facing extreme temperature levels, changing rainfall patterns, changing patterns of precipitation, floods and drought. The amalgamation of the notion of environmental management in urban planning and the promotion of green growth has permeated most provincial and local government regulations. In South Africa, some cities and

towns are attracting migrants because of the creation of mining towns and various other growth points, which includes that City of Polokwane. Thus, the increasing rate of urbanisation has resulted in high consumption of scarce resources such as land, water, energy and increasing production of wastes (IUUDF, 2014; Robbins & Culwick, 2015). However, in the City of Polokwane like any other cities in South Africa, there is an urgent need for effective planning for and management of urbanisation in an attempt to mitigate the global climatic changes that pose calamitous and multifarious effects on humanity. Thus, the study aimed to evaluate the effectiveness of planning and management of urbanisation process towards mitigation of climate change.

1.2 STATEMENT OF THE RESEARCH PROBLEM

The changing climatic conditions that the world is experiencing is blamed on the lack of proper planning and management of urbanisation process, which is characterised by the extensive resource consumption, high greenhouse gas (GHG) emissions, reduction of green spaces and waste production (Allen, 2009, Roy, 2009; Shen *et al.*, 2011; Ho & Rajabiford, 2012; Moriarty & Honnery, 2014; Shen *et al.*, 2013; Shen & Zhang, 2014; Zhang, 2015). The urbanisation process is characterised by high consumption of energy, intensive resource consumption, the increment of industries, waste production and a huge population located in a small space which is unsustainable. Furthermore, different planning approaches have been used to manage the urbanisation process, but increasing traffic congestion, pollution, high waste production and increasing deforestation (Welbon, 2018; da Silva *et al.*, 2019), in cities connotes that urban planning remains ineffective in planning for and managing urbanisation towards climate change mitigation. It can be argued that the manifestation of climate change can be attributed to the improper planning for and management of urbanisation by the cities towards mitigating this human-induced phenomenon. Despite the different approaches to plan for and manage urbanisation, much is still unknown regarding their effectiveness and efficiency towards climate change mitigation. The City of Polokwane like many global cities is confronted with increasing traffic congestion, physical urban expansion, the reduction of green infrastructure and densification of informal settlers. Therefore, the study seeks to evaluate the effectiveness of planning and management of urbanisation within Polokwane Local Municipality towards climate change mitigation.

1.3 RESEARCH QUESTIONS

The general research question of the study is; how can the municipality effectively plan and manage urbanisation in an attempt to mitigate climate change in the City of Polokwane? From the general research question, the following specific questions are:

- What are the typologies of urbanisation?
- What are the indicators for effective management of urbanisation?
- What is the contemporary planning praxis for effective management of the process of urbanisation?
- What are the characteristics of climate change?
- How are the operative strategies employed towards climate change mitigation in developing countries?
- How can the contemporary planning and management of the urbanisation process be effectively employed in mitigating climate change?

1.4 AIM AND OBJECTIVES

1.4.1 Aim of the Study

The study aims to evaluate the effectiveness of planning for and management of urbanisation towards climate change in the City of Polokwane.

1.4.2 Objectives of the Study

- To investigate the typologies of urbanisation;
- To assess the indicators for effective management of urbanisation;
- To evaluate the contemporary planning praxis for effective management of the urbanisation process;
- To examine the characterisation of climate change;
- To explore the operative strategies employed towards climate change mitigation in developing countries;

- To evaluate the extent to which the contemporary planning and management of urbanisation can be effectively employed towards climate change mitigation; and
- To recommend effective strategies that could be adopted in planning for and management of the urbanisation process in an attempt to mitigate climate change.

1.5 DEFINITION OF CONCEPTS

This section provides clarification and conceptualisation of the concepts that are used in this study. It further provides a context within which these concepts should be understood for the purpose of the study. The concepts that will be described in this section are urbanisation, climate change and climate variability.

- **Urbanisation** can be defined as a process of increasing the concentration of population in densely built-up areas such as cities, which is characterised by industrialisation, economic growth and increasing job opportunities (Wikstrom & Dolmen, 2001). According to Cobbinah *et al.* (2015: 62), urbanisation can be understood as “a demographic, ecological, sociological and economic phenomenon that concentrates the population in urban areas and has the potential to either stimulate or retard growth and development of these areas – towns, cities, metropolis, megacities, megalopolis – in both developed and developing countries”. Due to the multiplicity of ways to define urbanisation, the study adopts the definition by Cobbinah *et al.* (2015).
- **Climate change** refers to the changing climatic conditions that are attributed directly or indirectly to human activities that destabilise the global atmospheric composition (United Nations, 1992). Consequently, the changing climate condition results in extreme temperature, floods, changing weather patterns, changing precipitation patterns, sea level raising and drought. Furthermore, UN-Habitat (2011) states that climate change remains attributed to various human-induced driving forces such as the combustion of fossil fuels and land-use changes, but with wide-ranging consequences for the planet and human settlements all over the world.

- **Climate variability** refers to the change in the climatic condition, which results in the emergence of extreme weather such as heatwaves, drought, floods, changing patterns of precipitation and rising temperature (Moriarty & Honnery, 2014). The study adopted the definition by Moriarty and Honnery (2014).

1.6 RESEARCH DESIGN AND METHODOLOGY

The study adopted a normative research design to examine the complexities of the effectiveness of planning and management of urbanisation towards climate change mitigation. Correlational research helped to examine the correlations between urbanisation and climate change. Furthermore, the study adopted a mixed method approach (qualitative and quantitative approaches) to comprehensively provide an unequivocal examination of the complexities of the effectiveness of planning and management of urbanisation in mitigating climate change. Qualitative and quantitative approaches are important research approaches in evaluating the realities and existing laws that define the world humanity resides in (Bless, Higson-Smith & Sithole, 2013). The qualitative approach emerges as a consequent of philosophical beliefs that the truth is a relative concept and that “knowledge is constructed” by a human being (Bless *et al.*, 2013). This connotes that the conceptualisation of truth and knowledge is constructed. Therefore, the application of qualitative approaches in research enabled the researcher to be inventive and create new ideas, thereby contributing to the existing body of knowledge. On the other hand, the quantitative approach emerged from the philosophical beliefs also, however, its notion is rooted in the understanding that the world runs according to natural laws, and these pre-existing laws need to be explored and uncovered by social scientists (Bless *et al.*, 2013). Quantitative data predominantly relies on numbers and statistics for analysing and interpreting the research findings that can be generalised to the entire population. The use of quantitative data is profound because the meaning of the data is unambiguous and not subject to different interpretations regardless of the context. Thus, the use of mixed methods assisted to combine the strengths of the two approaches to improve the validity and soundness of the findings.

1.6.1 Description of the Study Area

The study was undertaken at the City of Polokwane, which is located in the Polokwane Local Municipality, Capricorn District Municipality, Limpopo Province in South Africa. The City of Polokwane is located among the following towns: Makhado in the North, Tzaneen on the Eastern side and Mokopane in the South. According to Statistics South Africa, the City of Polokwane had a population growth rate of approximately 4.94% in 2021, which has resulted in the expansion of the city. The densification of urban inhabitants has resulted in traffic congestion, informal settlements, high consumption of electricity and non-renewable natural resources, the reduction of productive land and increasing waste production. Although the City of Polokwane is small as compared to many big international cities, which are emitting a lot of pollutants, there is a need for the city to implement proper planning and management strategies towards climatic change mitigation. Despite the densification of the urban population, the City of Polokwane is surrounded by manufacturing industries and a mine that contribute to the increasing levels of greenhouse gas (GHGs) emissions.

The city has different manufacturing industries that produce various products, which are responsible for the increasing proportion of GHG emissions in the city. The main sources of pollution in Polokwane include several informal settlements, the Polokwane Industrial Area, situated 1.5 km North of the City centre, the Witkop Silica Mine, Witkop Kiln, Witkop Tailings Dump, the Silicon smelter (Rautenbach, Walton & van Nierop, 2006) and emissions from motor vehicles. Monitoring the level of Greenhouse gas (GHG) emissions around the City of Polokwane is undertaken using the ambient air monitoring system. The City of Polokwane is the economic hub of the Limpopo Province, which makes the city to be an appropriate area to undertake this study.

1.6.2 Kinds of Data Needed

Factual data were collected to understand the contemporary strategies used to abate carbon emissions in the City of Polokwane. Opinion data were collected concerning the current planning and management praxis, the perception of the local communities about the impact of climate change in the city and urban greenery. Furthermore, in order to promote inclusivity in planning for and management of urbanisation, the participation of communities is very important in the

governance of the city. The study collected data about public participation in planning for urbanisation and the emergence of environmental problems in the cities. The data on the approaches to planning and management were qualitative in nature to provide an imperative insight into understanding urbanisation. Furthermore, the data required were the disjuncture between policy and climate change mitigation and adaptation strategies. The study collected data about the praxis in planning and management of urbanisation and the strategies used in the City of Polokwane towards climate change mitigation. Furthermore, the study collected data on the characterisation of climate change.

1.6.3 Target Population

The target population of the study was the households located in the four (4) urban areas around the City of Polokwane, Polokwane Local Municipality and the Capricorn District Municipality. The four urban areas were selected from the 4 municipal wards located in the Polokwane Local Municipality namely: Ward 20, 21, 22 and 23. The wards were selected because they are located near the City of Polokwane. The study collected data from Legae la batho, Emdo Park, Flora Park and Serala View, which are location in the four wards. Furthermore, the study targeted the following key informants: the Integrated Development Plan (IDP) manager and the Director in Planning and Development.

1.6.4 Sampling Procedure

The study employed both probability and non-probability sampling designs to solicit pertinent data from the respondents. The application of probability sampling assisted the researcher to estimate the accuracy of generalising research findings to the entire population in the City of Polokwane. According to Kothari (2004), non-probability sampling is based on a non-random selection of a sample. The application of both probability and non-probability sampling increases the possibility of getting both representative and valid results.

1.6.4.1 Stratified sampling

Based on probability sampling, the study adopted the stratified sampling design to sample the respondents from the four urban areas that were selected (Legae la Batho, Emdo Park, Flora Park and Serala View). One important factor of stratified sampling is that each element of the population must belong only to one group. Therefore, each stratum must contain only homogeneous characters. Thus, the four (4) areas surrounding the City of Polokwane which fall under these Wards (20, 21, 22 and 23) within Polokwane Local Municipality were used as groups because of their distinct characteristics. These areas were used as strata due the homogeneous characteristics such as their location, experiences and challenges around the City of Polokwane. A total of 185 respondents were selected for the purpose of the study. Thereafter, simple random sampling was used to sample respondents from each cluster.

1.6.4.2 Purposive sampling

Based on non-probability sampling, the study adopted purposive sampling for the study. One of the disadvantages of purposive sampling is that the results may lead to non-representativeness and thus, cannot be generalised to the entire population. The sample is chosen based on the judgement of the researcher for what is considered typical units. Purposive sampling was used to sample only those people who are knowledgeable about the particular subject under investigation. Purposive sampling was used to sample the following participants: the environmental planner, IDP manager, community participation coordinator and Director in Planning and Management.

1.6.5 Data Collection Methods

The study adopted mixed methods to solicit data to evaluate the planning and management praxis of the urbanisation process to mitigate climate change. Despite the fact that the study employed a mixed-method, it was predominantly a quantitative study. The study used the theoretical discourse of the complexity of urbanisation in laying out the context (secondary data) and the collection of empirical data (primary data). Secondary data was collected from academic journal articles, government reports, policies, government legislations, the Constitution of the Republic of South Africa (1996), books, statistics and the United Nations Habitat publications, which were collected

through literature review. These types of data were appropriate for addressing the aim and objectives of the study, particularly because the data were collected towards answering specific research questions. The empirical data were collected from the respondents and key informants. For this study, the questionnaire and interview schedule were used to collect data from the respondents.

1.6.5.1 Questionnaire

The questionnaire consisted of closed-ended questions to collect purely quantitative data. The questionnaires were administered to community members within the four wards – ward 20, 21, 22 and 23 – which are located near the City of Polokwane. The application of questionnaire presents both advantages and limitations during data collection. According to Kothari (2004), the application of a questionnaire is less expensive even when applied in a widely spread geography. Due to its fixed form and sequential questioning, it avoids a vast amount of biases in the answers as compared to the interview. Furthermore, unlike the interview, respondents have ample time to give well-thought answers, which can improve the pertinence of the data.

1.6.5.2 Interview

An interview involves the direct interaction with the participants, which allows the researcher to gain in-depth knowledge about their perceptions about the study. This is because the interview is a qualitative data collection instrument. One important feature of the interview is that the researcher may intercede to request clarification in cases where there is lack of understanding and clarity and thus, making sure that the context is understood and the meaning is kept. However, while the interviewer's presence has the potential to enhance the comprehensiveness and objectivity of the answers, on the other hand, it may limit the participants' ability to express their true feelings. A structured interview was administered with the environmental planner, IDP manager and Director in Planning and Development.

1.6.6 Data Analysis Techniques

Qualitative data were analysed using the thematic analysing technique. The data that were collected through the interview went through the process of emersion, coding, classification and then analysed through thick descriptions. Data from the interview schedule were read and re-read to establish the meaning. The data went through data cleaning to avoid data that could be used to identify the respondents. After the data were cleaned, the data were coded. The codes were used to classify data looking at its uniqueness and homogeneous characters that it portrayed. Such classes were formulated in accordance with the research problem under investigation. After coding the data, coding definition (Bless *et al.*, 2013) is the next important step in the analysis of qualitative data. The definition of codes entailed the title and the thorough description of what data were included or excluded. This provided a thorough understanding of the data and how the data was interpreted. Furthermore, through data coding and definition of codes, the systematic pattern of data that is appropriate to answer the research questions emerged, thus giving an in-depth correlation between urbanisation and climate change.

Quantitative data that were collected through the questionnaire were manipulated quantitatively, and then analysed qualitatively. Analysing and interpreting quantitative data for the study followed four steps of analysis. The first step was that the data from the questionnaire were edited and cleaned to ensure quality and completeness. Secondly, data were coded and captured into the Statistical Package for Social Sciences (SPSS) and Microsoft Excel for manipulation. Thirdly, the study used the SPSS and Microsoft Excel to manipulate the data to produce frequencies, charts and graphs. Lastly, the findings were drawn from the charts, frequencies and graphs, and analysed qualitatively.

1.6.7 Validity and Reliability

Validity and reliability are among the most important components of research that ensure that the data collected address the set objectives. According to Bless *et al.* (2013), validity in research ask questions about what the instrument used in the study measures. This means that unless the research can validate that the measurement techniques are measuring the elements that are set to measured, the validity of the interpretation will be difficult to qualify. Thus, validity ensures that

errors are minimised during data collection to help answer research questions pertinently. Validity refers to a situation where the instruments used to collect data gives information concerning the acceptable meaning of a particular concept (Babbie & Mouton, 2001). Thus, to ensure validity, the study adopted various methods of collecting data. A pilot study was employed in this study to refine and adjust the data collection instruments (interview and questionnaire) to ensure the validity of the collected data. Furthermore, the use of different instruments such as interviews and questionnaires was subjected to a pre-test to improve the validity of the data. Furthermore, the study used the triangulation method to ensure the validity of data. Reliability is concerned with measuring consistency in research (Bless *et al.*, 2013). Reliability is a measure of an instrument to reproduce equivalent results when applied repeatedly (Babbie & Mouton, 2001; Bless *et al.*, 2013) over time. However, in social sciences where the truth is contingent on participants' opinions about the world they live in, reliability becomes difficult to accomplish. The researcher used the process of triangulation as an approach to achieve the reliability of the data collected. The researcher read and re-read the data and transcripts to minimise the errors. Furthermore, coding and pertinently defining codes of data were used as strategies to minimise the errors and to ensure the reliability of the data.

1.7 SIGNIFICANCE OF THE STUDY

The study adds to the current theoretical discourse in the complexities of effective planning for and management of urbanisation towards climate change mitigation and adaptation in South African cities. The study provides an insight into the planning and management approaches employed in cities. The study used the complexity theory and resilient theory as a theoretical lens to evaluate the complexity of planning and managing urbanisation, thus adding valuable insight into the planning and management discourse. The application of complexity theory provides an important narrative in the implementation of planning and management approaches within local government to balance their developmental mandates and their expedition towards environmental protection, thereby providing an important insight to mitigate and adapt to changing climatic conditions in South Africa. Thus, the study contributes to contemporary theoretical thinking in planning and management employed in the city. Planning and management of urbanisation has always been viewed as complex, which is rooted in the complexity of the city. Therefore, the study contributes

to the discipline of urban planning through the provision of a fundamental basis for the conceptualisation of planning and management approaches from the complexity theory perspective. The complexity embodied within the city makes it difficult to plan and manage urbanisation.

Complexity theory and resilient theory were used as fundamental bases in the development of policy frameworks that serve as enablement for collaborative planning as an effective strategy for managing urbanisation. Furthermore, the study offers urban planning practitioners the basis within which to implement their developmental mandate and the promulgation of climate change policy framework. The study provided a theoretical bridge between policy and implementation as well as insights into effective planning and management typologies and methodologies that help plan and manage urbanisation and its aftermaths. The uniqueness of the study is that it demonstrates the application of micro solutions and approaches to planning and management of urbanisation as effective strategies towards climate change mitigation and adaptation. Many studies focused on the role of governments to provide leadership to address the issues of climate change. This study is unique because it advocates for the collaboration between the local municipality and local communities within the climate change mitigation discourses. Furthermore, the study recognised the importance that the ordinary citizens in urban areas can play towards climate change mitigation.

1.8 ETHICAL CONSIDERATIONS

The importance of ethics is not only seen in research, but even within the society. The word ethics is related to the concept of morality that researchers must uphold when conducting research studies (Bless *et al.*, 2013). Therefore, ethics are significant in the research where human beings are involved to ensure that they are not dehumanised and that their rights are not violated.

1.8.1 Consent from participants

Before the collection of data, the researcher requested permission to undertake the process of data collection from the Turfloop Research Ethics Committee (TREC) within the University of Limpopo for approval. Upon receiving ethical clearance from the University of Limpopo, the researcher

requested approval to collect data from Capricorn District Municipality, Polokwane Local Municipality and communities (Legae la Batho, Serala View, Emdo Park and Flora Park), which were granted. The participants were not forced to participate in the study against their will. The participation of individuals in the study was on voluntary basis. Furthermore, the moral base of the study was based on the concept of reciprocity by ensuring that all participants are treated with respect. During data collection, no respondents were humiliated or emotionally hurt or abused. Therefore, during the process of data collection, all participants were respected.

1.8.2 Confidentiality and anonymity

For this study, respondents' names, Identification Number and any form of data that could identify an individual were not required. Therefore, any form of data that could be used to identify a respondent such as names and ID numbers were not required for this study. Respondents were not required to provide their names and ID numbers during data collection. The data collected from the respondents were used solely for academic purposes. Thus, the study upheld the principle of confidentiality and anonymity, which means that the respondents remained anonymous. Data that had the potential to identify participants were kept confidential and were not used for the purpose of the study. Before data analysis, data were subjected to cleaning to remove data that had the potential to identify the participants and thus, applying the notion of confidentiality and anonymity. The purpose of the study was presented to all the respondents so that they could know that the data collected were to be used for academic purposes only. Furthermore, all the information that was used in text was duly referenced in the list of references. The study complied with the plagiarism policy of the University of Limpopo, which states that the similarity must be less than 15%.

2 CHAPTER 2: THE COMPLEXITY OF URBAN PLANNING AND MANAGEMENT: THEORETICAL FRAMEWORK

2.1 INTRODUCTION

The transformation of the urban landscape as a consequence of urbanisation processes has attracted scholars' attention from various fields of study (Roy, 2009; Ogbazi, 2013; Meerow, Newell & Stults, 2016; Meerow & Newell, 2019). The densification of the urban population has brought multiple challenges in cities and deepened the complexity in planning and management of urban systems. However, it is worth noting that science aims to reduce these complexities (Portugali, 2006; 2011; 2012). The interaction between demographical, sociological and economical aspects of the city increases such complexities (complex interaction of people from cultural backgrounds and the growth of the city). Due to these complexities, conventional planning and management practices such as master planning continue to demonstrate their inadequacy to address the current urban environmental problems (Shen *et al.*, 2011; Ogbazi, 2013; Shen *et al.*, 2013; Shen & Zhang, 2014). Therefore, due to the inadequacy of the conventional planning and management praxis to address the urban environmental problems, complexity and resilient theories offer invaluable insight into understanding the cities' environmental and planning problems.

With the growth of many cities coupled with the inability of urban planners to address the uncertainties like climate change; resilient and complexity theories have become favourable theoretical lenses to explain planning and management of cities (Portugali, 2006; 2012; Meerow *et al.*, 2016). The resilient theory provides an important perspective in understanding the complex socio-ecological and economic system (Meerow *et al.*, 2016), especially from a climate change and urbanisation perspective. Etymologically, the resilient theory originates in the fields of economics and ecology, which made inroads into social science, planning, climate change and engineering. Resilient theory initially gained popularity in the field of ecology (Holling, 1973; Cosens, 2010; Moore, Westley, Tjornbo & Holroyd, 2011; Meerow *et al.*, 2016; Meerow & Newell, 2019) and traversed into the fields of planning and climate change. Although resilient theory emerged in ecology, it provides an important insight in understanding the ability of a city to bounce back and

remain operational post-disaster. The resilient theory is increasingly gaining momentum as an academic discourse in explaining any complex system (Mehmood, 2016).

Urban centres are confronted with an avalanche of exploding populations, particularly in the third world countries. Bradshaw (1987) refers to the exploding forms of urbanity as nothing more than just the shift or structural transformation from the agrarian to the industrial economy. This structural transformation requires closer scrutiny on contemporary urban issues. As scholars such as Allen (2009) and Portugali (2006; 2012) closely scrutinise the cities, Batty (2007) states that there is an overwhelming sense of inadequacy in the ability to comprehensively understand and change these urban developments. However, complexity theory provides a new and effective methodological approach to planning and management of urbanisation towards climate change mitigation. The continuous morphological expansion of cities was immediately confronted with various complexities. Allen (2009) asserts that urban centres in contemporary societies are an embodiment of the complex system and historical co-evolution of knowledge. Cities are composed of multiple elements that are operating together in a complex manner and an attempt to plan and manage it requires the consideration of all the elements. Portugali (2006; 2012) state that Peter Allen who was the first to develop the complexity theory of cities opened an increasing research interest in this subject. In this regard, cities were viewed as non-equilibrium and unstable environments because of complexities. However, many resilient scholars such as Holling (1973), Cosens (2010), Moore *et al.* (2011) and Meerow and Newell (2015) have made proposals on how to plan and manage urbanisation, thereby making cities resilient to any external or internal perturbation. This theoretical contestation within cities requires a continuous academic discourse towards finding solutions to the contemporary and evolving environmental problems confronting urban areas. The chapter evaluates the theoretical discourses on planning for and management of urbanisation using complexity theory and resilient theory. The chapter begins by providing a theoretical grounding of complexity theory in the social sciences.

2.2 CONTEXTUALISATION OF COMPLEXITY THEORY

Etymologically, complexity theory emanates from a Latin word called *plexus*, which means interwoven (Haken, 2012). Complexity theory is a theoretical framework, which embraces a wide

variety of studies ranging from natural, social and economic phenomenon (Crawford, 2016) that is currently making serious inroads in the social sciences such as urban planning, management and cities. Complexity theory can be understood as a property of a language expression, which makes it difficult to formulate its behaviour even when given almost complete information about its atomic components and inter-relations. Modern societies embody the inherent characteristics of complexity (Heylighen, Cilliers & Gershenson, 2006). For ages, the antagonists of the complexity theory criticised it for lacking a clear fundamental theoretical base and its applicability in the social sciences was also questioned. Therefore, complexity theory was relegated from theory to development discourses, which demonstrated its inability to be applied in social science. However, the protagonists of complexity theory like Haken, Portugali, Cilliers, Crawford and many others advocate for complexity as a new science that offers a new way of thinking about complex systems (Cilliers, 1998; Haken, 2012; Portugali, 2006; 2012; Crawford, 2016). It is significant to note that urbanisation, planning, management and cities are fields that continuously draw theories from various fields of study, and complexity theory is no different. The complexity theory in social science is perceived to offer a new and effective methodological perspective of addressing complex systems arising from the world. “Three decades ago, complexity theory was just a narrow field of study, however, it has since become not just floods but an established interdisciplinary research hub of engaging urban geographers, planners and urban designers” (Portugali, 2006: 1) in addressing complex systems. Therefore, complexity theory is an important theoretical discourse for any form of complex system and city in which urban planning and urbanisation are an embodiment of.

A complex system is one where various elements interact with each other in a manner that is difficult to separate individual behaviour within the system (Haken, 2012 cited in Gershenson, 2008). Therefore, scrutinising cities in terms of demographic (resources consumption, traffic congestion and densification of the population), sociological and economic properties portrays an interaction of various components, which simulate complex systems (Dijkema, Xu, Derrible & Lifset, 2015). Crawford (2016) asserts that complexity theory uses various theories to draw insights about the dawn of complex systems, characteristics and dynamics. Through complexity theory, Portugali (2009) and Dijkema *et al.* (2015) posit that beneath the disorder and chaos witnessed within cities lies a strong order and a pattern that unfolds from the myriad of the decision process that enables

the cities to grow and develop. Thus, complexity theory gives a thorough account of cities, urbanisation and urban planning.

To pertinently understand the complexity theory and its inherent characters, it is important to view a complex system as a system that is adaptive, self-organising and non-equilibrium (Crawford, 2016). Some scholars have argued that etymologically, complexity theory finds its base on the chaos theory and the notion of Newtonian science (Cilliers, 1998). Unlike chaos theory and Newtonian science that view the complex system as linear, which can be reduced to individual components (Cilliers, 1998), complexity science does not exhibit those characters. Because of the level of interaction that cities exhibit, complexity theory views complex systems as non-linear, adaptive, self-organised and non-equilibrium (Portugali, 2006; 2012). Therefore, a complex system that exhibits these characters cannot be addressed using chaos theory that portrays a reductionist view. Complexity science does not view the interaction of the city components as the sum of the whole system but through the notion of holism and emergence. Therefore, the integrative approach to planning for and management of urbanisation offers a rich methodological approach to the emergence of the environmental problems arising from the city.

Other scholars who devoted their time studying cities, advocate for the application of resilient theory (Cosens, 2010; Moore *et al.*, 2011; Meerow & Newell, 2015) as another important theoretical discourse that provides the potential to address the emergence of environmental problems associated with urbanisation such as climate change. Therefore, a thorough examination of resilient theory as an urban planning discourse in dealing with the emerging problems offers urban planners a theoretical base of understanding cities' resilience.

2.3 RESILIENT THEORY

The etymological origin of the concept of resilience stretches back to the 1620s and “stems from the Latin term *resilio*” (Meerow & Newell, 2015: 2). The literal connotation of the term *resilio* means to bounce back or spring back (Holling, 1973; Cosens, 2010; Moore *et al.*, 2011; Meerow & Newell, 2015; Meerow *et al.*, 2016). However, Simmie & Martin (2009) posit that the notion of resilience from the Latin term *resilire*, means to leap back or rebound. Regardless of the different connotations

of the term “resilience”, its meaning is centralised on the ability of the system to bounce back post perturbation. The resilient theory has its roots in the field of ecology (Holling, 1973) and now is applied in various fields of study. Due to the etymology of the resilient theory, its application in social sciences should be carefully scrutinised. The central conceptualisation of the theory remains contested due to the applicability of resilience in different fields. Resilient theory has been conceptualised as the ability of a system, community or city to bounce back to its original state post-disturbance or change (Meerow *et al.*, 2016). Furthermore, Liao (2012) and Mehmood (2016) define resilience from an engineering perspective, which is solely concerned with the threat posed by the disturbance on the stability of the engineering system. It can be stated that the more stabilised the system is post-perturbation, the more resilient the engineering system is (Liao, 2012). This notion of resilience is concerned with the low probability of the engineering system to fail amid disturbance or the quick recovery time to its normalcy. However, cities are not static systems as those in engineering fields but rather they are dynamic. According to Cosens (2010: 231), resilience can be described as the “capacity of the system to absorb disturbance, adapt and reorganise while changing to retain essentially the same function, structure, identity and feedbacks”. The view of resilient theory as the ability of a system to return to its normalcy can be somewhat misleading in understanding the dynamism of the city and climate change. In clearing the confusion, resilience in a city context connotes multiple equilibria (Cosens, 2010) in which a system settles in another different but stable state. However, in understanding urban resilience, the ecological system offers a fertile avenue to planning discourses.

The manifestation of disturbances experienced within the city has demonstrated that cities will never stabilise to the original state, which shows multi-equilibria (Liao, 2012). Multi-equilibria exist when dynamic systems such as cities, can absorb disturbances, however, stabilising in a different state or equilibrium (Liao, 2012). Multiple equilibria offer cities and urban planners with an important insight in planning for climate change mitigation. Resilient theory can be further described as the ability of the system to respond to external or internal disturbance factors without changing its original state (Ahern, 2011). Therefore, “building resilience capacity through the landscape and urban planning requires planners and designers to identify the stochastic processes and disturbances that a particular landscape or city is likely to face; the frequency and intensity of the

events and how the city can build the adaptive capacity to respond to the disturbance while remaining in a functional state of resilience” (Ahern, 2011: 342).

Resilient as a planning theory to address urban environmental problems remains contested. Duit, Galaz, Eckerberg and Ebbesson (2010) posit that resilient theory remains a cumbersome concept in the social system. The resilient theory demonstrates various challenges in addressing society. Thus, Duit *et al.* (2010) identify various clashes – power, governance and self-determination - in the application of resilient theory into the social system and therefore, provide two fundamental reasons. The difficulty of applying the resilient theory is that, regardless of the similarities between societies and the ecosystem, these are inherently different in various ways. With governance, societies are composed of individuals who can reflect on their situations and actions thereby changing the way things appear. On the contrary, the resilient theory provides a new view to planning and it is more strategic. Therefore, to be effective, various factors inform the effectiveness of resilience (Ahern, 2011). The factors that must inform resilience of a particular place are entrenched in the environment, ecology, social and economic drivers and the dynamism of that place, which must be linked to planning and design.

Mehmood (2016) describes the resilient theory as the human-nature association (socio-ecological resilience) and new contemporary approach to planning theory and management, particularly in urban areas. Furthermore, resilient thinking is viewed as an interdisciplinary approach, which helps to address a complex system like cities (Meerow *et al.*, 2016; Mehmood, 2016; da Silva *et al.*, 2019; Meerow & Newell, 2019). Resilient thinking offers a new effective perspective to planning and management of cities for planners. The effective planning and management of urbanisation through resilient thinking offers a proactive notion of addressing and adapting to climate change. Mehmood (2016) highlights that spatial planning through resilient thinking helps to explore the conceptualisation and planning practice in the face of uncertainty. Therefore, resilient theory in planning fields stresses the importance of assuming change and explaining stability other than assuming stability and explaining change (Mehmood, 2016). This is an important thinking within urban planning in maintaining equilibrium post disturbances. Thus, regardless of various criticisms by the antagonists of resilient theory, it provides an important dimension in planning and urban

resilience. However, due to the contestation of both science and philosophy, there is a requirement for an in-depth interrogation into this notion.

2.4 COMPLEXITY THEORY AS A PHILOSOPHY AND SCIENCE

Complexity theory has always been viewed as a collection of works to address the fundamental environmental problems in nature for all complex systems (Walby, 2007). Many authors attest to the notion that complexity science is a philosophy even within social science (Cilliers, 1998; Heylighen, Cilliers, & Gershson, 2007; Walby, 2007). A basic understanding of philosophy is the ability to analyse and criticise the ontological basis that underpins the implicit assumption behind thinking (Heylighen, Cilliers, & Gershson, 2007). Furthermore, the basis of a philosophy is rooted in the analysis and criticism of thinking, whether based on science, culture and common sense (Heylighen *et al.*, 2007). In the contemporary world, the bases of science and philosophy do not operate in silos but the relationship is entering a new phase (Cilliers, 1998). “At first glance, one would suspect that this may decrease the importance of the philosophical perspective that the importance of philosophy is somehow linked to the importance of theory only” (Cilliers, 1998: 1). This does not nullify the importance of theory or theoretical aspects surrounding science not been philosophical. Concerning the clear understanding of complexity, few scientific endeavours viewed complexity theory as ‘philosophical’ within the contemporary theoretical physics (Cilliers, 1998; Phelan, 2001; Heylighen *et al.*, 2007). This connotation is rooted on the basis that complexity theory is both scientific and philosophical.

Complexity theory is a philosophy and science that can be coined to the natural sciences to address the fundamental problems of nature (Phelan, 2001; Heylighen *et al.*, 2007). Complexity science is based on a set of knowledge practices, which view the nature of time as irreversible (Popolo, 2006). Therefore, complexity theory harbours the notion of the irreversibility of time that exhibits the complex interaction of the system, which cannot be reduced to individual components. However, Newtonian science that is the basis of philosophy in science is based on simplicity and the notion of reversibility of time. The irreversibility of time is a representation of the knowledge embedded in the European intellectual tradition (Popolo, 2006).

The notion of Newtonian science is based on a theoretical discourse of simplicity and reductionism (Heylighen *et al.*, 2007). The understanding of a complex system from a reductionist view means that the participation of the observer in the system can be reduced from various interactions into individual interacting components (Phelan, 2001; Popolo, 2006; Heylighen *et al.*, 2007). The simplicity of Newtonian science is incapable of finding inroads into unravelling the urban challenges that the contemporary cities are facing in the 21st century. This is based on the fact that cities are adaptive, self-organising and non-linear, which produce an emergence of complex and irreversible phenomena in the form of climate change (Allen, 2009; Boonstra & Boelens, 2011; Solansky, Beck & Travis, 2014; Zhang, 2014; Shen & Zhang, 2015). The concept of complexity theory in an urban setting brings to light the notion of non-linearity, instability, disorder, uncertainty and unpredictability when managing these complex urban systems (Solansky *et al.*, 2014). The etymological nature of complexity theory is based on the idea that it exists between disorder and chaos and far from equilibrium.

Self-organisation occurs when there is an emergence of order from the bases of chaos and freedom (Solansky *et al.*, 2014). Therefore, cities within most local governments exhibit the character of self-organisation. Portugali (2009) states that within the local government, the theory of self-organisation exhibits the potential to address the contemporary challenges faced within cities in the 21st century for both the developing and developed countries. Self-organisation emerges from complexity theory, which demonstrates the ability of complexity to solve the problems confronted by the cities. This is due to the densification of the urban population and the increasing industrialisation surrounding many cities around the globe.

2.5 PRAGMATIC SCIENCE OF COMPLEXITY IN URBAN PLANNING

Complexity theory has been a contested theoretical discourse both as a theory and science. It was argued that the contestation surrounding complexity theory questioned the empirical applicability of this theory in social sciences. The adoption of complexity theory as a science does not necessitate the nullification of other theories as scientific discourses. However, the basis of science is inherent in solving the contemporary problems that humankind is facing and the reduction of complexity in the world. In the same vein, “complexity is a new science” (Phelan, 2001: 130)

because it develops new ways of addressing contemporary problems facing humanity. However, Phelan (2001) posits that science has always been used to reduce the complexity of the world. Thus, the world interacts in a very irregular and unpredictable way. Therefore, complexity theory as science offers a new discourse in addressing the irregularities and unpredictability currently confronting the world. Complexity theory is a new science in the development discourse because it has brought new ways and approaches to studying irregularities. Therefore, complexity theory serves as a toolkit and new methodological approach to address the challenges emerging in the cities.

Heylighen *et al.* (2007) posit that the traditional science that is primarily rooted in analysing, collecting and gathering pieces of comprehensive information about a phenomenon, continue to be incapable to solve complex systems. The incapability of traditional science to solve these problems is entrenched on the irregularities and unpredictability of the contemporary world. Therefore, complexity theory offers an alternative way of addressing these irregularities and unpredictability. Heylighen *et al.* (2007) argue that complexity science is a little more than the amalgamation of models, methods and metaphors but it is an integrative theory. The traditional science was based on chaos theory that conceptualises events from a reductionism perspective. However, the new science focuses on the emergence character of an interactive system, which is at the core of understanding complexity theory. Complexity science is not based on reductionism but on holism and emergence (Phelan, 2001; Heylighen *et al.*, 2007). Complexity as a new science offers an integrative alternative solution to addressing the complex unpredictable system. Complexity theory addresses the complexity of the world away from Newtonian's thinking (Phelan, 2001; Pobolo, 2006; Solansky *et al.*, 2014). Newtonian science is based in the world from a simplistic perspective, where complex systems are apparent and in dealing with them, there is a need to analyse the system into its simplest components. This view is that of reductionists, where a complex system can be analysed into its interacting components. It is not many elements in a system that makes it a complex system. It is the degree of their interaction that makes a system complex. Therefore, the reduction of a complex system such as cities into individual components become impossible. Additionally, complexity theory contributes to the understanding of a complex system in its entirety. Phelan (2001) and Heylighen *et al.* (2007) posit that complexity science contributes to the awareness of issues surrounding irregular, uncertain and broader societal

involvement such as interacting components in the city. The complexity of urban systems requires the rethinking and re-evaluation of the orthodox way of planning and managing the city. Urbanisation in most developing countries is a consequent of an emergence of multifaceted interaction of various elements in the cities. This interaction has contributed to the emerging characters of an urban setting. Portugali (2011; 2012) argues that in planning and managing a complex system, care must be taken, as a result of irregular and unpredictability and non-linearity of the system. Therefore, planning for and management urbanisation requires new ways of understanding the city and all its interacting elements. Complexity theory offers a new interactive planning and management approach within the city.

2.6 COMPLEX SYSTEM AND COMPLEXITY OF THE CITY

As stated earlier, the etymological origin of complexity theory can be traced from the field of natural science and has made serious inroads into social sciences (Portugali, 2009; Haken, 2012). These inroads into social science signalled new methods of addressing the emergence of environmental problems facing many cities. The question remains, what constitutes a complex system? Can cities and urbanisation be viewed as complex systems? Cilliers (1998) identifies two fundamental approaches to the understanding of a complex system – a simple and complex system and complex and complicated system. Many systems can be viewed as simple, however, exhibit remarkable complexity when closely examined. These paradoxes are based on the level of interaction that the individual components within a system exhibit. “Some systems have a very large number of components and perform sophisticated tasks but in a way that can be analysed (in the full sense of the word) accurately” (Cilliers, 1998: 3), thus, demonstrating a complicated system. Therefore, this connotes that not all large systems are complex nor small systems simple. The etymology of complex or simple system can be coined from the character of their nonlinearity, level of interaction, the degree of connectivity and the adaptability of a system over time (Cilliers, 1998; Heyghen *et al.*, 2007; Solansky *et al.*, 2014; Crawford, 2016).

Based on this background, cities exhibit most characters in a complex system. The composition of material elements and the human component makes the city to be a complex system (Portugali, 2006; 2012). The scrutiny of the interaction within city elements is somewhat complex, which is

nonlinear, adaptive and self-organising. Many scholars in the field of complexity theory of cities (CTC) opine that cities demonstrate an open and complex system (Portugali, 2006; Crawford, 2016). Portugali (2006; 2012) and Crawford (2016) argue that the planning and managing of a complex system can be very difficult. This is because of the incapacity of planners to predict the emerging character of the city. Planning for and management of urbanisation remain a complex process and continue to challenge planners (Ogbazi, 2013). The inability of the planners to effectively plan and manage all aspects of urbanisation (demographic, sociology and economic) both in developed and developing countries continue to pose a serious threat to humanity in the 21st century. Complexity theory offers new and effective methodologies of addressing (Cilliers, 1998; Phelan, 2001; Heylighen *et al.*, 2007; Portugali, 2006; Crawford, 2012) modern city problems because of the perpetual inability of planners to manage urbanisation (Ogbazi, 2013).

The human and non-human interactions within the environment have resulted in the emergence of a human-induced phenomenon in the form of climate change. Climate change and the increasing variability of climatic conditions continue to pose a serious threat to humanity. Therefore, Haken (2012) concludes that the contemporary complexity theory is not monolithic but can be used as a toolbox to address the emerging problems of population growth and the growth of the city. However, the unpredictability and uncertainty, which is acknowledged by the proponents of complexity theory present the city as a complex self-organizing system.

Over the years, many theories and approaches have been implemented to depict cities as complex adaptive systems (Crawford, 2012). However, the new approach to understand cities sees individuals as planners, where each one exhibits their interpretation of the desired future states (Crawford, 2012). This new way of planning that tries to inculcate the citizen in cities into planning perpetuates the level of complexity. However, Davoudi (2015) posits that there is nothing wrong with knowledge-based planning, which is based on the incorporation of the citizens in the city into planning. The application of complexity theory in the development of effective models and methods of reducing urban problems is paramount. The incapability of the urban planners to apply complexity to planning and manage urbanisation poses a serious problem in the expedition to address climate change. Consequentially, the incapability of the city planners to plan and manage

urbanisation continue to challenge many developing countries in the quest to achieve sustainable development.

The densification of the urban population and industrialisation in the city pose serious environmental problems, which affects humanity negatively. All these factors make the city to be a complex system, which exhibits nonlinearity, adaptive, self-organisation and operates far away from equilibrium (Cilliers, 1998; Phelan, 2001; Heylighen *et al.*, 2007; Portugali, 2009; Crawford, 2016). Multiple theories were applied to the city to address the environmental problems, however, years after this application climate change continues to negatively affect humanity. In many cities around the world, the application of complexity theory and its successes in addressing urban environmental problems remains the largest part unknown. Therefore, complexity theory offers urban planning a new integrative approach to planning discourses (Portugali, 2006). In the development lexicon, complexity theory has shifted from focusing on questioning whether the cities are complex to the exploration of new methods of engagement and cognition (Sengupta, Rauws & de Roo, 2016). In the expedition to comprehensively address the environmental aftermath of urbanisation, there is a need to understand the notion of complexity as a new planning and management paradigm.

2.6.1 Complexity as an urban planning paradigm

According to Sengupta *et al.* (2016), there is an urgent need for planning rationales – technical and communicative – to include the concept of time for non-linear kinds of rationale to emerge. “This step of temporality is necessary for a dynamic kind of complexity within the planning theory, to bridge with concepts from the complexity sciences such as non-linearity, emergence, path dependency, transitions, co-evolution, adaptive and self-organisation” (Sengupta *et al.*, 2016: 971). Urban planning has always been confronted with uncertainty and unpredictability in planning for and management of urbanisation (Ogbazi, 2013; Sengupta *et al.*, 2016). In the context of planned interventions, unpredictability and uncertainty are viewed as high risks (Abbott, 2009; Sengupta *et al.*, 2016) and planning aims to reduce or avoid the effects of climate change at all costs. However, the unpredictability of the aftermath of urbanisation remains complex in addressing the urban environmental problems in the cities. In urban planning, the intellectual challenge in addressing

environmental problems for planning is not the acquisition of knowledge but how such demarcations are produced, including what functions they serve in channelling knowledge and power (Davoudi, 2015). Therefore, there is an urgent need to scrutinise the knowledge in the expedition to improve planning within the cities. Urban uncertainties are produced and reproduced by the interaction and interdependencies between the components and dynamic “environments and as such are an intrinsic part of how urban systems and networks function” (Sengupta *et al.*, 2016: 971). Unforeseen development paths can be viewed as both risk and opportunity in the expedition to effectively plan for and manage urbanisation.

The comprehensive understanding of cities as a rational network, which exhibits a heterogeneous multiplicity of roles, happenings and practices portrays a clear example of a complex system (Moroni, 2015). Therefore, to address the problems surrounding cities, examining these heterogeneous multiplicities of function is paramount. The persistence of uncontrolled and unordered urbanisation in the cities continue to challenge development planning to address the urban environmental problems, thus threatening the achievement of the notion of sustainable development. Portugali (2009) states that the complexity theory of the cities provides urban planning with a theoretical basis with mathematical formalism to the intuitive notion, which was recommended by Jean Jacobs in 1961. Regardless of this formalism, Chettiparamb (2014: 6) cited in Grunau and Schonwandt (2010) argues that “the concept of complexity has the unenviable distinction of meaning ‘all things to all people’ and is characterised by imprecise and general ambiguous usage”. This notion of complexity theory to mean all things to all people creates huge problems in the planning discourses. However, for complexity theory to offer urban planning methodological principles to address urbanisation, a new theoretical discourse is required that is alienated from the notion of “all things to all people”. The complexity of the interaction between human and non-human activities requires a unified theoretical basis to address all these emergence characters of the cities. However, cities are no longer viewed as disorderly, because, beneath the chaos, there are underlining levels of order and a pattern that emerges from the myriad (Portugali, 2006; Moroni, 2015). Therefore, in the field of urban studies, some formal models (based on the ideas of cellular automata, neural networks and fractal geometries, which are more sophisticated than the traditional ones) have recently been advanced to explain how cities function (Portugali, 2009).

Crawford (2012) states that complexity has a significant implication for the practice of planning in addressing urban problems. The inability to quantify the effects of intervention probes the questioning of urban planning. According to Crawford (2012: 6), in terms of planning for the city, “the idea of the planned city as a knowable utopia is a chime”. Despite this notion, urban planners continue to put in measures to address problems in the city. Theoretically, planning and development have always been perceived as people-centred. The practical applicability of a people-centred approach to urban planning in the city continues to challenge urban planners. The conventional theoretical frameworks employed in the cities to address the aftermath of urbanisation continue to demonstrate fewer successes. Therefore, complexity theory has attracted serious attention in planning (Chettiparamb, 2014) and management of the process of urbanisation in an attempt to mitigate the adverse effects of climate change on humanity. The incapability of urban planners to address these challenges is based on the methodological application of complexity theory, which emerges to be based on reductionism (Chettiparamb, 2014). The reductionist approach is based on the chaos theory, which explains systems as linear but its applicability within cities can be questioned. However, as discussed earlier, cities should be viewed as non-linear and adaptive complex systems. Therefore, the complexity theory should be perceived from the perspective of holism and emergence.

2.6.2 Complexity as a new urban management paradigm

Many scholars of human interaction view complexity theory as a new theory that provides a fundamentally new way of thinking about the management (Stacey, Griffin & Shaw, 2000) of urbanisation. Although complexity theory finds its etymology in natural science just like Newtonian science and chaos theory, their application and understanding contradict each other. Newtonian mechanics is identified from the universal law of linearity, which describes phenomena in a deterministic and regular state towards a state of equilibrium (Stacey *et al.*, 2000). The interaction of cities denotes that the reduction of this complex system to manage it might be problematic or provide an invalid analysis of the system. Contrary to Newtonian science, which is based on reductionism in the management of cities and urbanisation, complexity science offers a new way of thinking that is focused on holism and emergence (Phelan, 2001; Heylighen *et al.*, 2007;

Portugali, 2006; Sengupta *et al.*, 2014). Due to the complex nature of many cities, the management of urbanisation should not be managed using Newtonian science. Newtonian science connotes that the whole of the system equals to the sum of all its components. The focus of managing the city from a holism and emergence perspective demonstrates the limitation to predictability, therefore, challenging the traditional and Newtonian science of simple forms of control by human interaction between nature and the environment (Stacey *et al.*, 2000).

Contrary to this notion, a comprehensive understanding of cities and urbanisation is rooted in their character as nonlinearity, irregular, adapting and operating far from the state of equilibrium (Cilliers, 1998; Stacey *et al.*, 2000; Phelan, 2001; Heylighen *et al.*, 2007). As stated above, the complexity theory of the city has demonstrated that the cities exhibit an open system, which is characterised by a dynamic, changing, nonlinearity and full of uncertainty in predicting the future trends (Portugali, 2006; 2012; Sengupta *et al.*, 2014; Portugali, 2016). The management of cities requires a theoretical perspective that embraces the character of non-linearity, adaptive and operating far from equilibrium to tackle the problems holistically. Therefore, complexity can be used as a toolbox to unravel the environmental problems associated with urbanisation.

There is an increasing scholarly view that complexity theory is harbouring the potential to provide a new management approach (Simpson, 2010). Furthermore, it is argued that as long as complexity theory is viewed using a narrow framework of chaos theory and system theory, it will be incapable of providing a rich dialogue and learning that is essential for managing complex systems such as cities and urbanisation (Simpson, 2010). The continuous focus on blueprint plans to manage urbanisation in the development discourses is important for an academic dialogue to provide innovative and creative ways of addressing this development gap. In most cases, the use of a blueprint plan in managing urbanisation provides an insufficient nostrum to the development discourses in particular cities. However, most urban planners state that there will be no coherent management strategy without the application of a blueprint plan (Stacey *et al.*, 2000). Therefore, “complexity theory, they say, is a way to better understand the continual emergence of new and novel ways of every day relating and communicating in organizational life” (Simpson, 2010: 132).

2.7 RESILIENT THEORY VS COMPLEXITY THEORY

Resilient and complexity theories are theoretical discourses that find their etymology from other scientific fields that are non-social such as ecology and natural science respectively. It is imperative to note that their application into social sciences should be done with caution. Resilient theory and complexity theory have been inherited from other disciplines. Duit, Galaz, Eckerberg and Ebbesson (2010) argue that they still have a long way to go before they can be considered as part of social science discourses. Many scholars acknowledged this thinking as theories that can shed light and help remedy the challenges associated with urbanisation and cities (Duit *et al.*, 2010; Davoudi, 2012). The resilient theory has been applied to cities in addressing the environmental problems arising from urbanisation, however, it was criticised for lacking a clear and unified definition. Duit *et al.* (2010) and Davoudi (2012) state that the notion of resilient theory connotes the ability of the system to bounce back to its equilibrium state. However, the examination of resilient theory from a city context demonstrates a system with multi-equilibria. The effectiveness of planning for and management of urbanisation using the resilient theory by urban planners provides an interesting perspective to development discourses. Swanstrom (2008) states that the resilient theory can be used to address disasters that develop slowly over time. Therefore, the resilient theory can be used as an adaptation strategy towards environmental problems such as climate change. In contrast, complexity theory focuses on the emergent properties arising from the interaction of multiple components within the city (Duit *et al.*, 2010). Complexity theory views the city as a complex system, which operates far from equilibrium and is adaptive.

Regardless of the differences between resilient and complexity theory, they are similar in their articulation of complex systems. Since cities are viewed as non-linear and adaptive, these theories demonstrate that a complex system portrays a complex adaptive system (Portugali, 2006; Swanstrom, 2008; Duit *et al.*, 2010; Sengupta *et al.*, 2014). It is important to note that, rather than assuming that all social systems are characterised by stability and equilibrium, the analytical focus should be on the processes of change and how governance arrangements try to cope and adapt to dynamic interactions between humans and their environment (Duit *et al.*, 2010). Therefore, there is an urgent need for cooperation across various city sectors to deal with the manifestation of rapid urbanisation from both a demographic and economic perspective. Complexity and resilient theory

are also based on the notion that cities are self-organising (Portugali, 2006; 2012), complex adaptive systems (Swanstrom, 2008; Crawford, 2012; Solansky *et al.*, 2014) and dynamic (Duit *et al.*, 2010). This synergy between resilient theory and complexity theory offers a rich niche in dealing with the emergence of environmental problems associated with urbanisation. Therefore, it is important to explore resilience theory as a planning paradigm in urban areas.

2.7.1 Resilience as an urban planning paradigm

Over the years, planning and management of urbanisation in mitigating various environmental problems have been confronted with convoluted challenges. The densification of the urban population increased the complexity of cities thereby intensifying the inability of planners to plan and manage urbanisation. Davoudi (2015) highlights that there is a growing emphasis on planning theory within the context of evidence-based policy and practice. This notion implies that, for planning to become effective, evidence is important in policymaking. Therefore, in Britain, the planning practice was front-loaded with evidence-based thinking, which implies the collection of evidence by planners from a specific location during the preparation of various plans (Davoudi, 2015). In contrast to the notion of evidence-based policy by Davoudi (2015) that evidence is important in planning, it can be argued that the ability of the system to absorb and continue to function post-disaster is an important planning theory (Stumpp, 2013). It can be argued that despite the collection of evidence during planning, if the system is unable to function or absorb disturbance, it is important to question the idea of evidence-based thinking in urban planning and the resiliency of an urban system.

Since 2009, the resilient theory has gained momentum in the planning discourse, particularly in Europe. This increasing momentum propelled the Association of European Schools of Planning (AESOP) annual congress to hold a conference under the theme “Planning for resilient cities and region” (Stumpp, 2013). The resilient theory was now a buzzword in the planning lexicon. Therefore, there was a shift from a heavy focus on sustainability to resilience by the local government as a new bottom-up approach to planning. Resilient thinking immediately offered planners a new and effective perspective to planning for complex systems like cities and climate change (Moore *et al.*, 2011, Stumpp, 2013; Mehmood, 2016).

The protagonists of resilient theory argue that social innovation is an important component of resilience in its capacity to improve adaptability, flexibility and the ability to learn about planning (Moore *et al.*, 2011; Ahern, 2016). Furthermore, urbanisation as a complex system that is characterised by skilled labourers and high literacy in the city, offer planners the potential to provide innovative ways of planning for the city. Moore *et al.* (2011: 91) state that the “theory of resilience provides a meaningful lens to build a better understanding of the conditions that enable innovation to emerge and succeed, which public sector policy support”. Social innovation offers planners the ability to provide innovative ways to manage the city. As stated earlier, resilient theory enables the ability of a system to re-organise itself after disturbance. Thus, it can be argued that resilient theory is a bottom-up approach to planning due to its important consideration of people’s innovative capacity to plan for and manage the process of urbanisation and climate change. In the quest to achieve resilience, various sectors are urged to collaborate, promote innovation and multiple management of cities to reduce the heavy reliance on fossil fuel to cleaner products (Mehmood, 2016). This was echoed by the Cop21 agreement in Paris that was held in France, from 30 November to 12 December 2015 about the transition from the heavy reliance on fossil fuel to cleaner products such as solar, gas, wind, water and nuclear power to reduce the amount of carbon emissions into the atmosphere. Moore *et al.* (2011) state that resilient theory rests upon the notion of a resilient ecosystem as a dynamic process through an adaptive cycle. In improving planning through resilient theory, the adaptive cycle has four phases that any resilient system goes through, namely release, reorganisation, exploitation and conservation. This gives a thorough explanation of how a complex system self-organises. In this case, planning for cities as self-organising systems becomes important in addressing these adversities.

2.7.2 Planning and management of the urban complex system

The unmatched level of urbanisation has transformed the urban landscape over the past few decades (Allen, 2009; Shen *et al.*, 2011; Shen *et al.*, 2013; Zhang, 2015; Meerow *et al.*, 2016; Meerow & Newell, 2019). Although urban areas cover approximately 3% of the earth surface, it is responsible for more than 71% of the energy consumption and carbon dioxide emissions into the atmosphere (Meerow *et al.*, 2016). According to da Silva *et al.* (2019), there is a strong

overdependence on non-renewable resources and the combustion of fossil fuel in generating electricity. Contrary to the engineering resilience that offers a static equilibrium, social resilience is dynamic. Due to the future orientation of the concept of planning, its application in addressing uncertainty (Holling, 2001) deepens the complexity of the urban system.

According to Meerow and Newell (2015: 2), complexity theory can be defined as a system that “exhibit patterns that emerge from interactions between individual components in unexpected and nonlinear ways”. Holling (2001) postulates that the complexity of living systems and nature can self-organise. Self-organisation refers to a “term that characterises the development of complex adaptive systems, in which multiple outcomes typically are possible depending on accidents of history”. Therefore, it is imperative to embrace resilient and complexity theories in understanding the insight about the complex adaptive system in urban areas. These complex adaptive systems are an aggregation of diverse components that are connected and provide the ability of the system to self-organise into some multiple equilibria.

2.8 THE CITY AS A SELF-ORGANISING SYSTEM

As stated above, complex systems are characterised by their ability to self-organise amid disturbance. Self-organisation is one important feature in a complex system that can be used to plan and manage urbanisation by a local government. For local government to practice inclusive planning, public participation should be the core of urban development. However, planning remains controlled by the local municipality (Boonstra & Boelens, 2011). Hence, the inability of the local government to address the emerging environmental problems and growing complexities connotes that cities are not adaptive (Boonstra & Boelens, 2011). To address the environmental problems arising in the cities, self-organisation offers an innovative idea for planning and management approaches. Self-organisation is key through a complex system to self-innovate and self-stabilise in the face of ever-changing systems (Rauws & De Roo, 2016). Self-innovativeness and self-stabilisation can be brought to the city by including people during the planning and management of urbanisation. The proliferation of environmental problems in the cities can be attributed to the lack of innovation that can be realised through participatory planning processes. It is argued that citizens' involvement has the potential to bring a new form of accountability for the special condition

in various areas (Boonstra & Boelens, 2011). To comprehensively apply self-organisation, this can be understood in an urban development context as an inclusive special initiative, where its originality finds its etymology on the civil society and community-based network that operates without the government control (Boonstra & Boelens, 2011; Rauws & De Roo, 2016).

Rauws and De Roo (2016) put forward both disruptive and enabling conditions for self-organisation in the city context. However, the focus here will be on the enabling conditions for actualising self-organisation to address arising problems in the city. The densification of the urban population might be viewed as a factor that enables the emerging challenges in most urbanising cities. Self-organisation in an urban context is a condition that helps development planners to establish a collaborative system following their motivation and interest (Boonstra & Boelens, 2011). Citizens' motivation in a system has the potential to self-innovate and address the emerging character in urban areas. Hence, urban planners should be motivated to start sizable projects that are manageable for an ordinary citizen to avoid despondence within the team (Rauws & De Roo, 2016 cited in Boonstra & Boelens, 2011). Urban planners should encourage collaboration "by creating fora for interaction and mobilizing creative minds, strategists and visionaries; by devising institutional frameworks and spatial designs that support small-scale projects; and by considering citizens as co-creators of the city who should be able to understand and contribute to the rules and regulations which guide urban development" (Rauws & De Roo, 2016: 1057-1058).

2.9 HOLISM AND EMERGENCE

In the contemporary world, science is used to solve the problems affecting humanity. Due to increasingly complex systems in social sciences, science is used to reduce the level of complexity of the world. From a Newtonian science, a complex system can be reduced to the individual components when planning and managing the city. Therefore, Newtonian science and chaos theory demonstrate the simplicity and linearity of the world and it can be viewed from a reductionist perspective. The methodological principle that Newtonian and chaos theory portrays neglects the complex interaction which complex systems exhibit. The understanding of a complex system as the sum of the whole demonstrates the disintegration embedded within the whole system. However, complexity theory offers a new and comprehensive view of complex systems and refute a

reductionist perspective within the planning discourse. Therefore, complexity theory views a complex system as a system that exhibits holism and emergent character.

In most complex systems, the notion of reductionism is refuted, which gives rise to the concepts such as holism and emergence. Holism can be explained as an overarching theoretical discourse that views the world as a whole and not divisible to its components (Erlbaum, 2001). In this context, complexity theory refutes the Newtonian notion of the universal law of the reductionist view, which questions its applicability to the world as a whole (Erlbaum, 2001). This is in spite of the Newtonian science continuing to offer generalisations of the contemporary world problems from both natural and social phenomena. Therefore, in dealing with complex systems, holism should be adopted in order to understand the interacting components in the whole system. Since cities are complex systems, the contemporary planning philosophy that does not focus on the wholeness of the systems offers a narrow-minded perspective to planning and fails to employ an important characteristic of complexity theory. Therefore, to provide an effective methodological plan to address the aftermath of urbanisation, it is imperative to focus on the demographic, sociological and economic aspects of the city as a whole. In a city context, planners need to be capacitated to address the emerging problems in urban areas in an integrated manner. The ability to provide integrative planning in urban areas, focusing on the sector that directly affects the climate, will help to reduce the emergence character of climate change.

2.10 CONTESTATION OF THE URBAN RESILIENCE

“Resilient theory provides insight into a complex socio-ecological system and its sustainable management” (Meerow *et al.*, 2016: 39). Contrary to complexity theory, which views a complex system as a system that operates far from equilibrium; resilient theory offers a different but important view to urban planning philosophy. The notion of adaptability, flexibility, efficiency and learning of the urban system provides a new perspective in planning and management of urbanisation (Holling, 2001; Moore *et al.*, 2011). Thus, contrary to the bright planning perspective that the resilient theory projects, its effective application in an urban context remains unknown. However, there has been a contestation on whether the resilient theory can offer a new and effective perspective in the planning for and management of urbanisation or not. Scholars have

argued that the fact that the notion of resilience continues to evolve, they continue to question its applicability in an urban planning context (Meerow *et al.*, 2016; Meerow & Newell, 2019).

Some scholars state that the inability of the resilient theory to demonstrate any success in urban planning is based on the fact that it does not have a pertinent conceptual framework (Holling, 2001; Moore *et al.*, 2011; Meerow *et al.*, 2016; Meerow & Newell, 2019). Therefore, Meerow *et al.* (2016) reviewed 25 definitions of urban resilience in the literature. The review indicates the contestation of the notion of resilience in an urban context. The contestation demonstrates a lack of conceptual clarity due to the inconsistencies and the unambiguity of the concept (Meerow *et al.*, 2016). The application of resilience theory can be hindered by the inconsistencies and unambiguity that the theory portrays. Furthermore, not limited to the inconsistencies and unambiguity, the fact that resilience theory is rooted in the ecology field; its application should be contextualised into an urban context. More than thirty years (30) since the inception of resilient theory, its definition has become broad and to a larger extent, meaningless in understanding the ability of an urban system to return to its normalcy. To apply this theory, a more contextualized definition is required.

2.11 MODERNISM AND POSTMODERNISM

There has been a contestation between modernism and postmodernism. Barrett (1997) posits that most political leaders saw modernism as the route to social transformation with the view that reasoning provides the potential to justify an agrarian social order. There has been a contestation as to whether the world is currently in the period of postmodern or not. Regardless of this contestation, there is a unified idea that the contemporary period is complex, thus requires urban planners to address this complexity to survive (Cilliers, 1998). However, the emergence of postmodernism has signalled the death of modernism as a theoretical discourse. Therefore, to make sense of modernism and postmodernism, a clear distinction between the concepts is required. Many scholars state that the postmodern approach provides an acknowledgement of the imperativeness of self-organisation although it refutes the conventional theory of representation (Cilliers, 1998). If postmodernism should be understood as social constructionism, it portrays an old version of sociology with an important strand of the discipline's project (Byrne, 2000). This is because postmodernism is a social construction of knowledge (Byrne, 2000). Furthermore,

postmodernism does not chronologically follow modernism (Barrett, 1997). Postmodernism is viewed as an antithesis of modernism. Therefore, the notions of postmodernism and modernism contradict one another in their conceptualisation and application. However, regardless of the contradictions, the preoccupation is to determine which theory will offer urban planners a viable theoretical discourse in dealing with the emergence of urban environmental problems.

Table 2.1: Principles of Scientific Management

Principles of Scientific Management	Modern lens	Postmodern lens
(1) The development of a true science	Efficiency – a measurement of industrial production	Effectiveness – a measurement of knowledge outcomes
(2) The scientific selection of the workman	Rigidity – a selection of the fittest	Flexibility – selection by quality
(3) The scientific education and development	Hierarchy – control	Delaying – empowerment
(4) Intimate friendly co-operation between the management and the men	Division – authority	Sharing – teamwork

Source: (Kemp, 2013)

Kemp (2013) draws a distinction between modern and postmodern within the management context. Postmodernism offers effective and flexible management principles as compared to modernism. Therefore, postmodernism offers effective management because it embraces empowerment and teamwork. The continuous engagement of people in management offers cities a new effective methodology in the management of urbanisation.

2.12 HERMENEUTICS

The understanding and interpretation of a text are always contingent on context. For an idea to be accepted, it should be based on the meaning that individuals attach, which results from mental interpretative processes (Di Lorio, 2015). Nkuna, Sebola and Tsheola (2013) state that hermeneutics is the postmodern tradition that is based on the work of Heidegger (1962), Gadamer (1975), Habermas (1972), Ricoeur (1971) and Taylor (1975). Furthermore, hermeneutics is a theory based on an interpretation of the text to draw meaning and help in the understanding of concepts (Nkuna *et al.*, 2013). Gadamer noted that the notion of knowledge is interpreted focusing

on the historical position resulting from the experience (Di Lorio, 2015). This affirms the notion that all texts and knowledge must be subjected to interpretation to draw meaning and improve the level of understanding of certain concepts. The incapability to understand meaning poses a serious problem in planning and management in the city context. Tepe (2011) states that cognitive hermeneutics put out rules that help in the explanatory interpretation and thus, their applicability can be on all literary texts. This methodological principle of hermeneutics can be employed in various disciplines when studying different phenomena. In contrast, Di Lorio (2015) argues that a human being is the imposer of meaning on reality and that the external environment cannot influence the thought and actions of the interpreter.

Locating the human being as the imposer of meaning is rooted in the fact that the intention of the writer is always unknown in this case. Tepe (2011: 605) posits that the text is “constantly transferred into a new context by appropriative interpretations but the properties of the text themselves always remain dependent” on the author and context. Despite the argument put forward by Tepe (2011), objectivity in interpreting a text is imperative to understand the concepts pertinently to create room for proper planning and management to solve the contemporary problems facing the world. In social science, scholars continue to redefine concepts and give them new meanings and characteristics, hence there is a need for urban planners to shift towards the new meaning when planning and managing urbanisation. Therefore, urban planners and managers should always appraise the new direction in developmental discourses.

2.13 CITIES AND URBANISATION: THE COMPLEX ADAPTIVE SYSTEMS

The adaptive cycle of the resilient theory demonstrates the applicability of the theory during planning and management of the urban complex system (Holling; 2001; Moore *et al.*, 2011; Meerow & Newell, 2015). The adaptive cycle of the resilient theory in understanding the insight of the complex dynamic system takes place in four stages (Holling, 2001), which are release, conservation, exploitation and re-organisation (Holling, 1973). These stages were used by Holling (1973) to explain the adaptive capacity of the ecological system. However, the principle offers an interesting perspective on urban thinking as a social system. The adaptive cycle of ecology describes how the ecology returns to a stable state post-disturbance. As an interdisciplinary theory,

the resilient theory is also making its inroad into the management and planning of an urban complex system. It describes the adaptive cycle as a profound unit of dynamic change comprising of a forward and backward loop: exploitation (rapid growth), conservation, release and reorganisation. The description of the adaptive cycle in ecology is as follows:

“In the forward loop, systems self-organize through rapid growth in which processes exploit and accumulate free energy towards a point of maximum conservation and connectedness epitomised by complex or mature states... In geomorphic terms, this process may be viewed as the evolution of landforms to a point of incipient instability where intrinsic or extrinsic thresholds are more easily exceeded. In the back loop, perturbations force destabilization and the release of potential energy..., before the system gradually stabilizes through re-organization. The attribute of resilience is rising between the re-organization and exploitation phases and declining between conservation and release phases. In resilient theory, the system’s resilience is defined as being able to tolerate disturbance without collapsing into a qualitatively different state controlled by a different set of processes” (Dearing, 2008: 118).

The notion of the adaptive cycle in ecology paves a trajectory for its application in the social system, particularly in the planning and management of cities. The need for new ideas and innovations is entrenched in the release stage (Moore *et al.*, 2011). The increasing urban population and emissions in the city provoke the requirement for innovative ideas. The phase does not clearly define the problem. The lack of a clear definition of the problem and the envisioned solution, collaboration and social learning are useful in improving knowledge. The resilient theory is rooted in the capacity of various sectors to collaborate in the enhancement of knowledge of the problem to build resilience. In re-organisation, the proper and clear definition of the problem is required in the formulation of an effective policy. In the release phase, collaboration is witnessed, however, this phase makes a transition from ideas that talk to planning initiatives for the implementation of the policy. Moore *et al.* (2011: 98) posits that “public policies that support social innovation in this phase are those that assist innovators and newly formed groups to develop short- and long-term plans and then encourage a selection process to choose among the range of options or ideas that emerge”. This phase promotes the collective selection of ideas that need to be implemented in the planning and management of the complex adaptive system. Although the resilient theory and complexity theory are derived from different ontological bases, they find synergies in the promotion of integrative planning.

The exploitation phase is characterised by the use of resources to support the development and adoption of the innovation selected in the previous phase (Holling, 2001; Moore *et al.*, 2011). Conservation becomes imperative as the process of completing the current innovative cycle in the quest to build the reliance of the cities. Furthermore, this is important to consider what will happen next, what needs to be adjusted; and what consequences and implications will occur and the best way to respond to the disturbance (Holling, 2001; Dearing, 2008; Moore *et al.*, 2011; Meerow & Newell, 2015). In planning and management of urbanisation, most governments become complacent with the policy framework, forget to look for new innovative ways in building a resilient system. The resilience scholars have identified various theorising characteristics of a resilient system, which are adaptability, flexibility, diversity, efficient learning and redundancies (Meerow & Newell, 2015). The effective planning and management of an urban system require the system to be adaptive, flexible and efficient in order to achieve resilient thinking. Therefore, many urban scholars are calling for urban resilience in the face of climate change, planning and natural disaster adaptation (Meerow & Newell, 2015).

2.14 CONCLUSION

For many years, scholars have interrogated the complexity of the city to plan for and manage urbanisation. Thus, the complexity theory and resilient theory advocate that cities are adaptive, self-organising and operate far from equilibrium. Therefore, complexity theory offers a new methodology and approach to planning and management as both a science and philosophy. These new principles are based on a bottom-up approach to planning. Contrary to the notion of Newtonian science and chaos theory, which advocate that a complex system should be understood from a reductionist view, complexity theory is based on an integrative approach to planning and management.

3 CHAPTER 3: THE COMPLEXITIES OF CONTEMPORARY PLANNING AND MANAGEMENT OF URBANISATION IN LOCAL GOVERNMENT

3.1 INTRODUCTION

Globally, the movement of people from rural to urban areas has demonstrated contrasting trends between developing and developed countries. Over the years, developed countries have been experiencing urban depopulation while a major population growth remains rooted in cities of the developing countries (Roy, 2009; Hao *et al.*, 2011; Ho & Rajabifard, 2012; Govindarajulu, 2014; Shen *et al.*, 2014; Zhang, 2015; Alnsour, 2016). Thus, developing countries continue to experience the densification of the urban population. The global occurrence of urbanisation has resulted in economic inefficiency in some developing countries while some developed countries experienced economic efficiency (Shen *et al.*, 2011; Shen *et al.*, 2013; Shen & Zhang, 2014; Morris *et al.*, 2016). The burgeoning urban population and the physical expansion, if not well planned and managed, they pose a mammoth task on urban planners (Oteng-Ababio *et al.*, 2019). According to Oteng-Ababio *et al.* (2019), the emerging challenges in urban areas is attributed to the process of urbanisation taking place under the auspices of low gross domestic products. These challenges and the dynamism of urbanisation have brought new predicaments in planning for and management of this process. The convolution of the challenges of the urbanisation process in urban areas resulting from its dynamism and non-linearity has created a complex city (Poturgali, 2011; 2012).

In the modern age, the promotion of urbanisation was conceived to harbour economic efficiency both in developed and developing countries. In China, urbanisation and economic growth occurred under the auspices of resource-intensive and high pollution (Li, Liu & McKinnell, 2006). This intensification of resource consumption and high pollution resulted in multifarious environmental challenges such as climate change. However, urbanisation in most developing countries took place without effective institutions and the capacity to plan and manage this process in an attempt to mitigate climate change. In an attempt to bridge these institutional inefficiencies, many governments, development practitioners and researchers have dedicated efforts to policy development, legislative frameworks and strategies as a nostrum to plan for and manage

urbanisation (Shen & Zhou, 2014). The promulgation of laws and policies helps to create systems and institutions as enablement to plan and manage urbanisation. The management of cities does not occur in a vacuum but operate under strict regulations, laws and policies to promote efficiencies (Zhang, 2015; Alnsour, 2016). Different governments have promulgated regulations and laws to manage the urbanisation process through the management of urban growth and expansion (da Silva *et al.*, 2019; Oteng-Ababio *et al.*, 2019). Despite these sets of regulations, policies and laws; planning for and management of urbanisation continue to challenges most development planners in cities in both developed and developing countries. Due to its complexities, Allen (2009) alludes that planning for and management of urbanisation embody a non-linearity that characterises the metabolism of the city. Alnsour (2016) demonstrates these complexities that cities are a complex mixture of physical and human systems, which interact at various levels such as social, economic and cultural levels. Therefore, the complexities embodied in the urbanisation process complicate the management of this process through legislations, acts and policies.

According to Roy (2009), cities in developed and developing countries represent a three-fold linkage concerning climate change issues. Firstly, cities are emblematic of high consumption of energy generated from coal, the concentration of economic activities, traffic congestion and the combustion of fossil fuels, which are responsible for high carbon emissions. Secondly, the vulnerability of cities to climate change is intensified by the densification of the urban population, and the concentration of man-made infrastructure. Cities are more vulnerable to many local manifestations of climate change effects such as flooding, rising sea level, cyclones, landslides, drought, cold and heatwaves (Roy, 2009; Moriarty & Honnery, 2015). Lastly, another emblematic character of the city is the increasing consumption of energy and the high production of wastes pose a serious threat to the changing climatic conditions. Moriarty and Honnery (2015) posit that the wastes that are dumped at the landfill are responsible for the emission of methane. Furthermore, it was noted that the emissions of methane and carbon pose a serious threat to the Ozone layer and consequently, lead to climate change in the distant future. Due to high levels of carbon emissions and methane in urban areas, climate change can now be labelled as a human-induced phenomenon (Govindarajulu, 2014). Therefore, to mitigate climate change, there is a need for effective planning and management of urbanisation to address these environmental problems.

Developing countries have always blamed developed countries for burning fossil fuels and high emissions of GHGs from industrial areas, which caused environmental problems (Cop21, 2015). The question is, is there any importance of the “blame game” within the climate change discourse or the focus should be vested on the development of concerted efforts to promulgate and implement strategies to mitigate climate change? Although developed countries have and continue to contribute immensely towards the changing climatic conditions, major cities in developing countries such as Mumbai, Bangalore, Lagos and Johannesburg continue to emit more carbon than some of the cities in the developed countries (Cobbinah *et al.*, 2015). When scrutinising the global carbon emissions, South Africa is the only African country, which is counted amongst the top 20 carbon emitters (Cobbinah *et al.*, 2015). The process of urbanisation in South Africa like any other developing country took place without proper systems and institutions to plan and manage this process. Thus, it can be argued that climate change cannot solely be blamed on developed countries but all countries must take the blame for its occurrence. Ogbazi (2013) and Savini *et al.* (2014) postulate that these challenges have overwhelmed the capacity of countries (both developing and developed) to manage urbanisation by applying unreformed planning systems that are inherited from the colonial era. Contrary to Ogbazi (2013) and Savini *et al.* (2014), Watson (2009) puts it very succinctly that due to the complexity in the management of urbanisation in the global South, all cannot be blamed on planning processes. This is due to the complexity of an urban system that is rooted in the interaction of economic growth, economic development and social systems. The complexity of urban challenges requires new and effective planning and management approaches to urbanisation. The approaches to urban planning and management of urbanisation provide a rich niche for research in mitigating and adapting to climate variability. Thus, it calls for the contextualisation of urban planning philosophy that will serve as enablement for cities to unravel and offer a concerted, yet effective planning and management paradigm in addressing the aftermath of urbanisation.

3.2 GLOBAL URBANISATION TRENDS

Globally, the rate of urbanisation has contributed to various environmental, social, demographic and economic problems (Graham, Tachizawa, Alvarez-Gil & Montes-Sancho, 2015; Kasai, Li & Fang, 2015; Welborn, 2018). The rate of urbanisation has been very dramatic in the past few

decades (Graham *et al.*, 2015; da Silva *et al.*, 2019) due to the emergence of modernisation ideologies and models that support urban growth and industrialisation. The densification of the urban population, urban growth and expansion and unprecedented rates of urbanisation can be attributed to the global push towards modernisation and industrialisation. In 2013, the World Bank stated that the global urban population has significantly increased from 28.3% in the 1950s to 53% in 2013 (Kasai *et al.*, 2015), which contributed to the increasing consumption of energy. Consequently, urban areas consume over 80% of the world's resources (da Silva *et al.*, 2019). The global population increase saw for the first time in history, the proportion of urban inhabitants surpassing that of rural inhabitants. The densification of the urban population and its envisaged benefits were short-lived with the emergence of various urban environmental problems such as climate change, high land pollution and emissions from vehicles. Amid the push towards modernity and urbanity; urban problems such as traffic congestion, environmental pollution (Roggema, 2019), non-renewable resource depletion and high consumption of energy became inevitable, which are currently emblematic character of the urban landscape (Kasai *et al.*, 2015). This new urban landscape has challenged the planning and management of urbanisation in both developed and developing countries. The continuous occurrence of environmental problems in cities demonstrates the failing system of conventional planning and management approaches.

The growth in the global urban population is projected by UN-Habitat (2009) to reach 70% by 2050 (Ahern, 2011; Fuseini & Kemp, 2015; Graham *et al.*, 2015; Hope, 2016). With the current problems confronting most cities, which are attributed to the high rate of urbanisation and urban growth coupled with the inability of urban planners to effectively and efficiently manage this process, the projections present a dire picture in pursuit to achieve sustainable development and curb climate change. According to Brorström (2015), the management of urbanisation remains complex and intricate for planners, particularly in most developing countries. The intricacy and complexity of managing urbanisation are intense because most developing countries are confronted with serious problems of planning and management capacity in most local municipalities. Furthermore, the rate of urbanisation in developing countries took place without systems and institutions to plan and manage this process (Cobbinah & Nimminga-Beka, 2017a). The densification of the urban population overwhelmed the capacity of urban infrastructure to support urban growth. With the inability of the current urban infrastructure to cater for the growing population, the projected population trends

present a dire picture. Graham *et al.* (2015) state that the projected future population trends will increase pressure on urban infrastructure while the investment in new ones to support this densification and flow of goods remain the biggest challenge for most city planners, particularly in developing countries. The densification of the urban population and industries have resulted in the increment of resources and energy consumption in cities. Regarding the rapid urbanisation in most developing countries, the incursion of urban population is dominated by unskilled, illiterate and people who lack knowledge (King, Gurtner, Firdaus, Harwood & Cottrell, 2016) can be used to harness the potential that this process presents.

UN-Habitat (2011) states that currently, the fastest global rates of urbanisation are witnessed in developed countries, then followed by those in developing countries. Contrary to this assertion, most developed countries are experiencing an increasing rate of urban-rural migration. Furthermore, a scholar such as Alern (2011) states that most developed countries are experiencing depopulation in the urban population. Therefore, the proportion of people living in urban areas is currently reducing, which signals the reducing rate of urbanisation in most developed countries. This is supported by scholars such as Fuseini and Kemp (2015) who state that global data on population growth presents a significant difference between developed and developing countries, where the major increase of urban population will occur.

Developed countries' growth in the economy was due to the extensive burning of fossil fuels explicitly to improve production, consequently contributing to a high rate of carbon emissions and environmental degradation. This new character of urbanisation in which developing countries harbour the majority of urban inhabitants is unsustainable. The new character of cities in developing countries is dominated by unskilled labourers, illiterate people, squatter settlements and people with an overreliance on private cars. According to World Bank Urban Development Overview (2020), around 90% of the urban growth in developing countries takes place near hazardous and unplanned settlements. There is a need to assist cities to strengthen their planning systems and local capacity, which leads to the betterment of design, plan and manage city assets and urban environments (World Bank Urban Development Overview, 2020). Furthermore, within the planning and management discourse, urbanisation presents a developmental gap in the pursuit to achieve sustainable development. According to King *et al.* (2016), to address climate change, there is a

need for an effective and efficient policy framework and good practice that explicitly targets urban growth and problems associated with urbanisation in both developed and developing countries. As stated earlier, the new rapid rate of urbanisation took place without systems and institutions to plan and manage this process, and thus remain unplanned in developing countries.

3.3 RAPID AND UNPLANNED URBANISATION IN DEVELOPING COUNTRIES

Urbanisation has changed the urban landscape in terms of urban morphology (Welborn, 2018; Balkaran, 2019; Oteng-Ababio *et al.*, 2019) in most developing countries. The changing urban landscape in the developing countries took place without effective institutions and the capacity to plan and manage the urbanisation process. Many African cities grew under the auspices of the colonial regimes, which were dominated by by-laws (Korah, Cobbinah, Nunbogu & Gyogluu, 2016), legislative frameworks and policies that controlled urbanisation, particularly the invasion of black inhabitants into the city centres. Therefore, the dawn of democracy and the demise of colonialism in most African countries witnessed an unprecedented rate of urbanisation. This process occurred after dismantling the discriminatory planning and management approaches, however, it lacked new and effective structures and institutions to replace the old systems. Therefore, it can be argued that the demise of the colonial planning systems was confronted with an inability to implement new post-colonial planning ideologies. This compelled most African countries to inherit colonial planning ideologies. The dearth of planning capacity is an emblematic character of most local municipalities in developing countries that witnessed unprecedented urbanisation, which increased the pressure on the current infrastructure (Kasai *et al.*, 2015). This conventional planning praxis failed to envisage the negative effects of urbanisation such as a reduction in green spaces, increased wastes, traffic congestion and high GHG emissions. Thus, in most African countries, an unprecedented rate of urbanisation remains unplanned and without the development of new systems that can support it.

Years into the attainment of democracy and the demolition of colonial planning frameworks, cities continue to be confronted with multifarious urban challenges. The contemporary planning and management approaches in developing countries continue to demonstrate their ineffectiveness and inefficiency to resolve urban challenges such as congestion, urban environmental problems,

reducing open spaces and greenery. Regardless of the perceived annihilation of colonial policy planning frameworks in most developing countries, planning approaches remain unreformed. Many scholars have argued that the inability of the contemporary planning and management approaches to redress urban problems is due to the unreformed colonial planning systems (Cobbinah *et al.*, 2015; Korah *et al.*, 2016; Cobbinah & Niminga-Beka, 2017a). This denotes that the ontological basis of the contemporary planning and management approaches finds their etymology in the colonial era. Therefore, planning approaches continue to discriminate against the urban population in decision making. The potentialities that urbanisation harbours remain untapped and unharnessed.

In Ghana, cities such as Accra and Kumasi are characterised by rapid urbanisation, which has increased the demand for commercial spaces resulting in poor urban planning, weak institutions, lack of enforcement of the planning approaches and political interference (Cobbinah *et al.*, 2015; Cobbinah & Niminga-Beka, 2017a). Korah *et al.* (2016) postulate that Kumasi, the second-largest city in Ghana, is characterised by unprecedented, unregulated and unplanned development. The propellant urban growth of Kumasi city was weak planning systems and a lack of strong institutions to manage urbanisation (Korah *et al.*, 2016). The basis of this argument is that urbanisation in developing countries is unplanned because of the emergence of urban sprawls, destruction of ecologically sensitive landscape, erection of slums, congestion, increasing consumption of resources, growing informality, deteriorating urban greenery and urban poverty.

In South Africa, spatial planning in most cities was characterised by small streets and infrastructure incapable to support the increasing population and industrial growth (IUDF, 2014). The genesis of the new democratic dispensation in South Africa witnessed an unprecedented rate of urbanisation – with people from within the country and foreign nationals. Consequently, South African cities such as Johannesburg, Pretoria, Durban and Cape Town were confronted with multifarious problems such as traffic congestion, densification of the population and the inability of local government to cater for the new inhabitants. Due to this incapability embodied in local government, as a sphere that is constitutionally afforded a developmental mandate to plan and manage urbanisation, the mushrooming of urban sprawls, densification of urban poverty, increasing carbon emissions and high energy consumptions have intensified. This means that local government and development

planning in this democratic era has continuously demonstrated their incapability to manage urbanisation. Despite the successive planning and management systems, the White Paper on Local Government, the Constitution of the Republic of South Africa (1996), Local Government Municipal Structured Act, 1998, Local Government Municipal Systems Act, 2000 and Integrated Framework of Urban Development (Musandu-Nyamayaro, 2008); the planning systems in urban areas remain unreformed and discriminative. Regardless of a plethora of legislative prescripts within local government, the majority of urban dwellers and other stakeholders remain outside the mainstream of decision making and planning.

The post-apartheid regime, South Africa has put in place systems and policy frameworks as enablement for smooth planning and management approach to solve the problems bequeathed by the apartheid administration. Regardless of these systems put in place in South Africa, local governments are overwhelmed by the manifestation of urban problems such as providing citizens with basic services and the emergence of environmental problems. South African local government is confronted with many problems such as lack of political will, capacity and inability to implement policy on urban planning. Other scholars have argued that South Africa's legislative framework is one of the best in the world (Ramaphosa, 1998; Musandu-Nyamayaro, 2008). This means that South Africa is good at making policies and systems beyond its capacity to implement them. However, the question remains on how scholars qualify that South Africa has the best policy frameworks when it is without pragmatic evidence to support this assertion? Tsheola, Segage and Ramonyai (2014) argue that the legislative goodness of South Africa should be based on the pragmatic evidence felt by the ordinary populace. Despite the overwhelming support for South Africa's legislative frameworks and systems as the best, until it can effectively help resolve the contemporary urban problems, its goodness will remain as a theoretical discourse without any pragmatic evidence to qualify it. The inability of local government to foster public participation in planning and management of the city connotes that the ideology behind the planning approaches remain unreformed and colonially grounded. Since most African countries emerged under the auspices of the colonial era, the next section assesses the colonial planning and management approaches as being emblematic in the post-colonial era in developing countries.

3.4 COLONIAL PLANNING AND MANAGEMENT APPROACHES IN POST-INDEPENDENCE AFRICA

Most African countries emerged under the auspices of colonial administration, which was discriminative and exploitative, particularly towards black people (Cobbinah *et al.*, 2015; Cobbinah & Nimmingu-Beka, 2017a). Africa was administered based on western colonial ideologies that did not benefit or conform to an African context to help address development challenges. After the demise of most colonial governments ruling in Africa, the fragment of the colonial planning and management in most African countries remain unreformed. Therefore, with an unprecedented rate of urbanisation in Africa such as in Ghana, Nigeria and South Africa, there is a need for a new form of planning and management approaches of urban areas and cities to address the emerging challenges. This connotes that the employment of top-down planning and management approach in urban areas has failed to address urban challenges. Freire, Lall and Leipziger (2014) state that the rate of urbanity in Africa is occurring at an unprecedented rate. Although UN-Habitat (2009) has projected that the global urban population will reach 70% by 2050 (da Silva *et al.*, 2019), Africa is projected to reach 60%. According to Freire *et al.* (2014), based on the current urban population trends, the African urban population is expected to triple in the next 50 years, thus requiring policy frameworks that will help harness the opportunities presented by urbanisation for sustainable development and inclusive growth. Freire *et al.* (2014) postulate that although there is a plethora of literature on this phenomenon, it is clear that it is pragmatically impossible to resolve Africa's growth and poverty without effective management of urbanisation that will be able to address African problems. Africa's success in growing the economy and poverty eradication is contingent on the successful management of urbanisation. However, the planning and management approaches remain unreformed and colonially grounded (Cobbinah & Nimmingu-Beka, 2017a).

Due to the rapid rate of urbanisation, various scholars have observed that the impacts are amongst others: "encroachment on and extinction of public open spaces and ecologically sensitive areas, the pervasiveness of slums communities, unregulated informal economic activities, congestion, flooding, haphazard and unauthorised land development and increasing conversion of traditional land into other uses" (Cobbinah & Nimmingu-Beka, 2017a: 389). These multifarious impact of

urbanisation has contributed to urban planning and management failure (Ogbazi, 2013; Cobbinah & Nimmingu-Beka, 2017a). In Nigeria, the implementation of the National Urban Development Policy espouses the democratic principles to guide the management of cities to attain sustainable urban development (Ogbazi, 2013). The National Urban Development Policy of the Republic of Nigeria, 2006 drew lessons from the Environmental Planning and Management (EPM) process which was conceptualised by UN-Habitat (Ogbazi, 2013). This policy promotes the participation of citizens within the planning and management of the city. According to Ekemode (2019), the multiplicity of urban challenges in urban areas made the Nigerian government implement the urban renewal strategy. The employment of urban renewal strategies in Nigeria was aimed at upgrading slums, transport infrastructure, drainage systems and disposal systems (Raimi, Adelopo & Yusuf, 2018; Ekemode, 2019). Urban renewal is understood by Ekemode (2019) as a plan, process and programme through which environmental-quality redevelopment occurs in derelict urban areas via large-scale demolition and clearance. The employment of participatory planning approaches such as the National Urban Development Policy and urban renewal did not yield intended collaborative planning. Ekemode (2019) postulates that urban renewal resulted in the clearing of slums and upgrading informal settlements in Lagos. This approach led to the displacement of people who procured the land from the traditional leaders. Therefore, the management of cities in Nigeria was coupled with multiples challenges. It is worth noting that rapid urbanisation in Nigeria took place without effective planning institutions which resulted in a proliferation of slums, urban poverty, informality and unmet needs for infrastructure (Ogbazi, 2013; Ekemode, 2019).

Urban planning in African countries such as Zimbabwe and Ghana are inherited from the colonial rule, which largely focused on the establishment of town councils as control centres (Musandu-Nyamayaro, 2008; Cobbinah & Nimmingu-Beka, 2017). This system was based on a Master planning system that was adopted from the British colony as a way to regulate and control growth development in the city. In Zimbabwe, the contemporary urbanisation, which resulted in multiple urban challenges such as slums, waste and pollution mirrors that elsewhere in Sub-Saharan Africa (Musandu-Nyamayaro, 2008). Post-independence in Ghana, the successive government failed to decentralise planning and management approaches (Cobbinah & Nimmingu-Beka, 2017a) by ensuring participatory urban planning. The colonial planning system was centralised on a national government, which makes all developmental decisions and policy direction. The effects of these

planning paradigms in the management of urbanisation result in the lack of inclusivity of various stakeholders. The types of planning failed to bring development, improve the economy and lessen poverty. However, 64 years since Ghana gained independence, the planning approaches remain centralised and insensitive to community aspirations due to the limitations of public engagement in decision making (Cobbinah *et al.*, 2015; Korah *et al.*, 2016; Cobbinah & Nimmingu-Beka, 2017a).

With the post-colonial regime in Ghana and the push towards modernisation, many scholars have expressed concerns regarding the sustainable management of urbanisation. However, Cobbinah and Nimmingu-Beka (2017a) state that Ghana has witnessed an estimation of a 240% increase in an urban population in Accra alone, which represents a sharp rising net migration of 97.7%. This process took place without a new planning paradigm that is used to address the aftermath of urbanisation (Cobbinah *et al.*, 2018). On the other hand, Cobbinah & Nimmingu-Beka (2017a) argue that urban planning presents a perfect and effective management approach to managing demographic challenges post-independence. Contrary to this argument, Laryea-Adjei (2000) cited in Cobbinah and Nimmingu-Beka (2017a) argue that urban planning in Ghana post-independence has been ineffective in planning and managing urbanisation. These conflicting planning arguments provoke a deeper emotion about the seriousness of planning and managing urbanisation in pursuit to solve the contemporary problems in the city.

In South Africa, local and district municipalities are important to ensure decentralisation and deepening democracy (Mapitsa, 2019). The local government is mandated to draft Integrated Development Plan (IDP), which is a five-year plan to guide the budgeting and management decision making (Mapitsa, 2019). It is important to note that South African cities are resource-intensive and suffer from inefficiencies in sectors such as energy, water and transport (Balkaran, 2019). IDP is a participatory process that enables local communities to participate in decision making and guide transport planning, settlement and service delivery provision. IDP is a strategic document that guides development trajectory and it should infuse the notion of smart cities. Furthermore, local governments have promulgated the Spatial Planning and Land Use Management Act (SPLUMA) established as a framework for spatial planning and land use (Mapitsa, 2019). SPLUMA is an important framework that helps to clarify the roles and responsibilities in the management of urbanisation, which guide transport planning and smart cities.

According to Balkaran (2019: 1), in South Africa, “it is posited that local government managers have hastily applied the smart futures approach, which has further entrenched spatial segregation and inequality which were the hallmarks of apartheid planning in South Africa”. The urban planning roles and responsibilities are constitutionally given to the local government to decentralise planning approaches and this type of decentralisation is not adequately employed in South Africa. This is based on the fact that the local government continues to struggle to include the public, civil societies and other stakeholders in decision making. The inability to engage various stakeholders despite the decentralisation of decision making from the upper echelon of government in planning and governance of the city demonstrates that the decision has been centralised at the local government level. Thus, the contemporary planning and management approaches to urbanisation continue to show fragments of the colonial discriminatory planning system.

3.5 URBAN PLANNING AND MANAGEMENT PRAXIS IN ADDRESSING URBANISATION

Urbanisation is characterised by the high consumption of non-renewable resources and being resource-intensive in meeting the energy demands of the growing urban population. In the United Kingdom (UK), the concept of sustainable development has been inculcated into urban planning and policy promulgation (Budd & Gottdiener, 2005) as a way to manage urbanisation. High consumption of non-renewable resources, high GHG emissions and pollution have threatened the attainment of sustainable development. Thus, planning and management approaches have the potential to ensure that the process of urbanisation is sustainable. Vasilevska *et al.* (2014) postulate that under continuous pressure of urbanisation and without a well-prepared institutional infrastructure to plan and manage this process, urban development has been influenced by a short-sighted vision, which provokes debates and criticism in the primitive stage of the democratic transition in South Africa. In South Africa, the current infrastructure such as road and transport systems, sewage systems and drainage systems provide a piece of pragmatic evidence that urban planning has failed to envisage the challenges accompanying the process of urbanisation. The complexity of rapid urbanisation has created multiple challenges such as traffic congestion, high production of wastes, informal settlements, land degradation, the changing weather patterns (Roy, 2009; Hao *et al.*, 2011; Shen *et al.*, 2011; Shen *et al.*, 2013) and intensive consumption of non-renewable resources (Balkaran, 2019; Mapitsa, 2019). Shen *et al.* (2013) state that the challenges

of rapid urbanisation include the powerlessness of municipalities to meet the infrastructural needs and enormous municipal services of the growing population while safeguarding the urban environment. The increasing proportion of the urban population resulted in high consumption of scarce resources, energy, high production of waste and higher GHG emissions. Local municipalities are paralysed by multifarious problems in the cities such as service delivery provision and the lack of capacity (expects) in planning and management of urbanisation.

Planning and management of urbanisation differ from country to country and from region to another. Countries such as China, India and Spain have promoted the concept of sustainable urbanisation towards climate change mitigation (Allen, 2009; Roy, 2009; Shen *et al.*, 2011; Shen *et al.*, 2013; Govindarajulu, 2014; Shafiei & Salim, 2014; Morris, Chan, Salleh, Ooi, Oozeer & Abakr, 2016), while others like South Africa are trying to implement the smart city (Balkaran, 2019). The increased urban environmental pollution associated with rapid urbanisation is due to the continuous incursion of rural people to urban areas (Morris *et al.*, 2016). The densification of the urban population fostered the increasing need for huge energy input and resources to maintain the urban metabolism (Morris *et al.*, 2016). The rising energy demand harms the usage of non-renewable resources. The rising energy demand and exploitation of non-renewable resources to meet these demands questions the sustainability of resources if the needs of the population continue to rise. Thus, cities are very important in the achievement of sustainable development and maintaining the current resources for the future generation to meet their own needs. However, years since the inception of the concept of sustainable urbanisation, countries are still battling to ensure its achievement in effectively managing urbanisation. Currently, the rise in consumption, usage of non-renewable resources, high wastes production and rising GHG emissions demonstrate the unsustainability of urbanisation. The incipient problems of a high urban population density for both economic activities and people, exert an enormous pressure on the land resources, which is already under stress (Roy, 2009; Ho & Rajabifard, 2012). The continuous expansion of urban centres has invaded urban agricultural land in many countries, thus resulting in the abatement of food production in urban areas.

Cities have become central features in order to achieve sustainable development. Although many scholars recognise the importance of cities to solve urban challenges, solutions to these problems

remain contested. Shen *et al.* (2011) and Shen *et al.* (2013) demonstrate that the achievement of sustainable urbanisation remains an important goal in addressing urban challenges. City planning should inculcate sustainability programmes, through the implementation rather than enforcement of laws, regulations, policies and the introduction of projects in line with sustainable development principles. Due to high waste products, which resulted from the densely populated urban centres, most municipalities are unable to collect or manage all the waste that is produced in urban areas, thus posing a serious threat to the environment. The ever-increasing urban population makes planning for and management of urbanisation a complex phenomenon.

3.5.1 Planning and management approaches

The complex nature of cities is explained succinctly by Chrysoulakis, Lopes, Jose, Grimmond, Jones, Magliulo, Klostermann, Synnefa, Mitraka, Castro, Gonzalez, Vogt, Vesala, Spano, Pigeon, Freer-Smith, Staszewski, Hodges, Mills & Cartalis (2013) through the concept urban metabolism, which connotes a system where many different parts within a city are working together for the achievement of a similar goal. Due to this complexity, cities resemble an ecosystem. An urban ecosystem has large non-linear metabolism with high input of energy and natural resources (Chrysoulakis *et al.*, 2013; Morris *et al.*, 2016). The rate of resource consumption and waste production beyond the assimilative capacity of the urban environment shows that the metabolic cycle of the urban ecosystem is both open and unsustainable (Chrysoulakis *et al.*, 2013). Despite the convolution of urban challenges, urban metabolism has been viewed as fundamental strategies to support urban planners in tackling the energy and environmental dilemmas (Chrysoulakis *et al.*, 2013). Urban metabolism provides an integrated platform for analysing both energy consumption and environmental sustainability; and the causal processes governing the contemporary city. It also provides urban planners with various practical applications to address urban problems such as evaluation of sustainability indicators, input to urban greenhouse gases accounting and providing design tools (Chen & Chen, 2012; Chrysoulakis *et al.*, 2013). Thus, from a metabolism perspective, it offers an integrated way of addressing urban challenges. Regardless of various attempts to mitigate urban environmental problems, the ever-increasing urban population makes the process of urbanisation a complex phenomenon to tackle.

Although sustainable urbanisation and urban metabolism are strategies to tackle these urban problems, planning and management remain the most important instruments to address the aftermath of urbanisation. Furthermore, different approaches were employed in addressing urbanisation. This is because, despite the technological advancement, filtering fuel composition and demand management (emission of heat, water and pollutants); vehicular traffic remains one of the major sources of contamination in urban areas (Roy, 2009; Shen *et al.*, 2011; Chrysoulakis *et al.*, 2013; Shen *et al.*, 2013). The increased reliance on private cars has remained emblematic of cities in developing countries causing huge traffic congestion (Balkaran, 2019) and thus, increasing the levels of GHGs emissions (Oteng-Ababio *et al.*, 2019). The dearth of integrative transport systems contribute to congestion and high GHG emissions, which demonstrate the powerlessness of urban planners to plan for urbanisation in addressing city challenges. Thus, different planning approaches are important in understanding the nature of urban planning in resolving urban challenges.

The manifestation of the top-down planning approaches in urban areas did not solve the problems associated with urbanisation processes. The top-down planning approach was very instrumental in limiting the influx of people into urban centres (Ogbazi, 2013; Robbins & Culwick, 2015). The application of a top-down approach in the democratic era has not yielded positive results. The top down approach ensured that the government is the sole decision-maker in the management of and planning for urbanisation processes. The continuous existence of top-down planning approaches during the democratic era in South Africa denotes that the fragments of colonial planning and apartheid philosophy remain entrenched within the contemporary societies in most developing countries. Furthermore, the local government continues to grapple with the challenge to integrate all stakeholders in the management of urbanisation and the environment. Ogbazi (2013: 110) posits that the “unplanned rapid expansion” of urban areas pose sustainable development challenges to many cities. The planning approaches were engineered to minimise the movement of black and coloured people into urban centres.

“The challenges of the recent rate of urbanisation are shown to have overwhelmed African cities’ capacity to manage urbanisation using the inherited and unreformed planning system of the colonial era” (Ogbazi, 2013: 110). Alongside Ogbazi’s (2013) notion of planning in the city, South

Africa's planning and management of urbanisation remain rooted in the colonial ideologies of urban planning (Robbins & Culwick, 2015) or is non-existent. The colonial planning and management of urbanisation continue to show its inability to address urban environmental issues. South Africa has promulgated multiple plans such as SPLUMA, IDP (Mapitsa, 2019), Integrated Urban Development Framework (IUDF) and Integrated Transport Plan to foster effective management and planning of urbanisation. The question is, does local government have effective strategies to plan for urbanisation or are they employing a legislative framework that they cannot implement to manage its aftermath? The democratic government through decentralisation wanted to promote people's voice in planning. Therefore, there is a call for a bottom-up approach in planning for and management of urbanisation to mitigate the adversities that cities are facing such as climate change. The integration of public opinion into planning and management is profound through IDP and SPLUMA (Mapitsa, 2019) in the quest to win the war against urban environmental problems. Therefore, it is important to understand the significance of urban planning approaches in the quest to address urban challenges such as traffic congestion and emissions.

3.5.1.1. Urban planning approaches

Planning for and management of urbanisation remains an important trajectory to address the urban environmental problems and the attainment of sustainable development. Caldeira and Holston (2015: 2001) state that the creation of urban policy that promotes citizen participation "is one of the best examples of the efforts of citizens to make planning work for democracy and democracy work in the space of every day to counter entrenched social inequality". Today, policies and legislations are used to plan and manage the process of urbanisation while protecting the environment. Despite the various urban planning frameworks, Ogbazi (2013) posits that orthodox planning and management practices have over the years proved ineffective in addressing the problems associated with urbanisation in the global South or they were never being effectively implemented. The manifestation of environmental problems in urban areas regardless of all planning and management philosophies employed provokes a deeper notion that calls for a paradigm shift. Furthermore, the manifestations of these environmental problems demonstrate the failure of planning theory to unlock and address the urban challenges.

Complexity theory describes cities as a complex system that is very complex (Cilliers, 1998; Poturgali, 2013) to plan and manage amid all these changes. The collaborative approach to planning affords the city to dislodge various urban challenges (Caldeira & Holston, 2015; Savini *et al.*, 2015). The collaborative planning approach connotes that local government is required to include all stakeholders including civil society, communities, business and private sector in the planning and management process. The collaboration between various stakeholders in planning helps to advance innovative ways of improving the contemporary planning philosophy of the city (Davids, Theron & Maphunye, 2009). Planners are no longer viewed as the master of city planning but as facilitators and learners in planning philosophy. The collaborative planning approach allows the locals to innovate and participate in planning. Participatory modes of governing the city require the involvement of the citizenry in the formulation of urban policy in alliance with the governments (Ogbazi, 2013, Caldeira & Holston, 2015; Savini *et al.*, 2015). In South Africa, the IDP is strategically implemented to foster a collaborative and participatory approach to planning (Mapitsa, 2019) However, participatory planning has been marked with failures and successes in urban areas. Ogbazi (2013) states that a central methodology for achieving the Sustainable Cities Programme (SCP) and Localising Agenda21, is a broad-based participatory approach that is structured to focus on the alliance of various stakeholders, actions, results and problem-solving. Hence, participatory planning is a tool used to overcome the current problems associated with the ever-increasing urban population (Ogbazi, 2013). It can be argued that planners are still confronted with the challenges of how to include the views of people in planning. The innovative power that cities hold remains unharnessed and untapped. Therefore, the innovative power of cities remains an elegant theoretical conception without any pragmatic evidence on the ground, particularly in developing countries.

Participatory approaches are viewed differently from region to region focusing on its applicability in an urban context. It should be considered that trans-active, deliberative, communicative and collaborative planning have numerous explanations that offer an important type of public participation in planning, which highlights various approaches in the accomplishment of the shared power (Ogbazi, 2013). These descriptions enable the citizenry's voices to be heard during the formulation of urban policy, hence creating a shared understanding between the citizens and government in planning for urbanisation. It can be argued that citizens have a critical role to play in

contributing to planning arguments and visions, negotiating issues, in the advancement of common interests and understanding (Bolton, 2005). Although participation improves collaboration and communication between stakeholders in urban areas, successive governments have over the years failed to address the planning and management challenges in the cities. Hence, cities continue to be the source of multifaceted environmental challenges.

According to Savini *et al.* (2015), planning through co-creation has become a priority for practitioners, researchers and urban activists. Within the presence of planning discourse, Savini *et al.* (2015) show the urban planning dilemmas that explain its failure to address the urban environmental problems such as climate variability. Planning for urbanisation must encompass not only effective but innovative strategies in combating environmental problems such as climate variability (Ogbazi, 2013). Savini *et al.* (2015: 298) “characterises the main discrepancy in the domain of urban and regional planning as its focus of the (usually explicit) assumption of predictability of development – codified in plans, laws and regulations – while current urban theory particularly complexity theories, suggested that cities are complex, self-organising and non-linear systems”. Thus, the complexity of planning for urbanisation creates great difficulty to address its aftermath. Various governments have continued to grapple to effectively plan for urbanisation to manage the emerging urban challenges. The unmatched rate of urbanisation and industrialisation in China resulted in urban challenges such as traffic congestion, high non-renewable resource-intensive, GHG emissions and urban villages and thus, provide an important case to understand its urban planning approaches.

China

Over the years, China has witnessed an unmatched rate of urbanisation coupled with high-level industrialisation and high economic growth (Wang, Xu & Li, 2015). The demographic, political, social and economic aspects have influenced the increment in urban challenges such as traffic congestions, urban villages, high production of wastes and increasing carbon emissions. The process of urbanisation requires effective planning and management approaches to circumvent its aftermath. China promulgation a five-year plan to ensure that development progress is sensitive to climate change mitigation (Cheshmehzangi, 2016; Li, Wang & He, 2016) amid the contemporary

human movement and the push towards industrialisation. This plan was first implemented back in 1983 as a planning system that guides the development process in China (Li *et al.*, 2016). China has always implemented medium plans that guide the development process. Some scholars support the implementation of short-scale plans or policies, which potentially yield positive results in managing the complex city (Li *et al.*, 2016), thus helping in the management of urbanisation. The factors responsible for the extraordinary economic growth in China are attributed to the continuous implementation of a five-year plan (Li *et al.*, 2016). The development and economic model in China have been extensive pollution and extraction of resources to achieve their developmental mandates (Wang, Xu & Li, 2015; Cheshmehzangi, 2016; Li *et al.*, 2016). This developmental mandate has resulted in a dichotomous landscape of high pollution and high economic growth. The growing developmental dichotomy connotes that the aim of the five-year plan is predominantly an economic plan rather than an environmental plan.

A review of the 12th five-year plan by Li *et al.* (2016) shown that the urban population has grown from 690.79 million to 749.16 million between 2011 and 2014 in China. This demonstrates a dramatic population increase in urban areas, which require new effective and robust planning and management approaches. Additionally, China promulgated a New-Type Urbanisation Plan (NUP) (Cheshmehzangi, 2016) as an attempt to effectively plan and manage urbanisation in order to circumvent problems associated with this process. This plan was put in place for the development of a new scientific urban development model by 2020. Of paramount importance, NUP aims to interface the ecological progress and urbanisation quality in China (Cheshmehzangi, 2016). Therefore, a conscious implementation of plans and management approaches in addressing urbanisation is important to manage environmental problems. In the same vein, Cheshmehzangi (2016) postulates that the most recent urbanisation plan in the face of urbanisation patterns has signalled a new planning and management approach in China. This plan focused on environmentally friendly approaches and social development. The recognition of an environmentally friendly approach offers a new dimension in China's developmental model, which is based on extensive pollution to achieve economic growth. It was recently stated that China's carbon emissions have surpassed the United States of America (USA), which makes it the highest polluter in the world. Thus, NUP offers a new side to planning for and management of urbanisation in China. Regardless of these plans, China remains one of the highest carbon emitters in the world.

Wang *et al.* (2015) argue that China's rate of urbanisation provides an important influence on the world's economy and the development of the human race in its entirety. The main principles of the planning approach were to promote coordination of cities and town development by shifting the developmental landscape from megacities towards small towns (Wang *et al.*, 2015) to reduce the densification of the urban population in already large cities.

According to Cheshmehzangi (2016), NUP outlines the notion of boosting the current urban population of China through increased resource consumptions. Furthermore, the notion of urban growth will increase carbon emissions into the atmosphere. NUP stipulates the decarbonisation plans, pollution control and climate change plans (Cheshmehzangi, 2016). Since the increasing densification of the urban population increases the consumption of resources and energy, which contributes to the increasing atmospheric carbon emissions. The plan that aims to promote urban growth without effective planning and management approaches of the dramatic human phenomenon will fail to address emerging urban environmental problems such as climate change. This calls for robust planning and management approaches, systems and capacitated institutions to effectively manage urbanisation.

Ghana

Ghana's successive government post-independence were confronted with a mammoth task of planning and managing the dramatic human phenomenon to ameliorate urban environmental problems. Korah *et al.* (2016) postulate that urban planning implies outlining the norms, strategies, principles and mechanisms on how they will be applied through state control. This form of planning has had some success in western countries, however, the implementation of this form of urban planning was confronted with limitations within the complex, uncertainty and rapid urban transformation in developing countries with distinct contextual grounding (Korah *et al.*, 2016). Concerning the distinct contextual grounding in African countries such as Ghana, Nigeria, Zimbabwe, South Africa and others; urban planning approaches that find their etymology in the colonial era (Raimi *et al.*, 2018; Ekemode, 2019; Mapitsa, 2019) and western societies will continue to demonstrate their inadequacy and inefficiency in planning for and management of urbanisation.

The African planning system remains entrenched in the colonial legacy of administration and the management of resources despite their efforts to decentralise governance.

After the realisation that the application of the planning system through centralisation failed to solve the contemporary environmental problems, the Ghanaian government shifted from centrality towards decentralisation of planning systems (Korah *et al.*, 2016; Cobbinah *et al.*, 2017). In 1988, a decentralised planning paradigm was introduced to solve the limitations that the centralised planning approach failed to address in urbanisation challenges (Cobbinah *et al.*, 2017). The new planning paradigm promoted the notion of inclusivity (involving all stakeholders in urban areas) and equity in the spatial development and management of urbanisation. The push towards decentralisation was through the promulgation of urban planning policies in Ghana. Amongst these policies is the Metropolitan, Municipal and District Assemblies (MMDAs), which perform the planning function at the district and community levels (Cobbinah *et al.*, 2017). Again, policies such as the National Development Planning Systems Act of 1994 (Act 480) and the National Regulation Act were promulgated to serve as supporting acts to planning practice in Ghana (Cobbinah *et al.*, 2017).

The enactment of legislative frameworks demonstrates the commitment towards solving the problems that cities are facing. Despite this commitment by the Ghanaian government to put in place planning systems and institutions, urbanisation in Ghana's big cities such as Accra and Kumasi remain uncontrolled and unmanaged. Yeboah and Shaw (2013) cited in Korah *et al.* (2016) argue that the transformation of the urban landscape and cities occurred without the influence of statutory or formal planning policies, which were attributed to the behaviour of private landowners. The fact that urban areas and city landscapes changed without the influence of the statutory planning systems, demonstrates some sort of mismatch between policy implementation and policy praxis in urban areas. This denotes that the policies promulgated to resolve urban problems are put in place for compliance without pragmatic realisation on the ground. The mismatch between policy formulation and implementation demonstrates the fragments of master planning, which finds its etymology in western countries. Therefore, it is in this context that it can be argued that under the elegant theoretical adoption of decentralisation in the planning and management approach in

most developing countries, the colonial and western forms of planning are re-emerging in the post-colonial era.

Ghana emerges under the auspices of the dearth of foresight and capacity in planning agencies to resolve the consequences of urban growth (Fuseini & Kemp, 2015; Cobbinah *et al.*, 2015; Cobbinah & Darkwah, 2016; Korah *et al.*, 2016; Cobbinah *et al.*, 2017; Cobbinah & Darkwah; 2017b). The incapability of urban planning to manage urban growth can be attributed to the piecemeal and reactive approaches to planning (Cobbinah *et al.*, 2017). Therefore, there is a lack of proactive strategies that help address envisaged urbanisation challenges such as traffic congestion, emissions, high consumption of energy and increasing waste production. The incapability to provide an effective management approach for urban growth using statutory planning was complicated by the fact that more than 80% of Ghana's land is owned by Chiefs and this loosely determines the land uses (Cobbinah *et al.*, 2017). However, the complexity of urban planning for urbanisation coupled with the incapability of planners to implement statutory or formal plans since more than 80% of the land is customarily owned paints a dire picture in pursuit to resolve the ramification of the urbanisation process. Cobbinah *et al.* (2015) assert that policymakers and urban planners have over the years recognised the complexity of managing rural-urban migration in the context of urbanisation and its challenges on Africa's urban development discourse. Furthermore, rapid urbanisation coupled with weak urban planning approaches and institutions are important factors contributing to the uncontrolled physical expansion of cities, thus changing the contemporary land uses and poor urban management (Cobbinah *et al.*, 2015; Fuseini & Kemp, 2015; Cobbinah & Darkwah, 2016; Korah *et al.*, 2016; Cobbinah & Darkwah; 2017b; Cobbinah *et al.*, 2017). This uncontrolled physical expansion fosters an increment in energy consumption. The increasing consumption of resources accounts for the rising levels of waste and carbon emissions. It can be argued that uncontrolled and unplanned urbanisation without capacitated institutions to resolve the aftermath of this human phenomenon threatens the attainment of sustainable development.

According to Cobbinah and Darkwah (2016), the reality is that the problems of urban planning in Ghana seem to be beyond the capacity of urban planning agencies to comprehend due to the lurch from policy to another policy without optimistic, realistic and sustainable systems and approaches

to cling to. According to Cobbinah and Darkwah (2016) and Cobbinah and Darkwah (2017b), urban challenges have become commonplace and emblematic of Ghanaian and other African cities that support the notion that urban planning agencies are incapable of comprehending the adversities associated with urbanisation. Therefore, the current trends of urbanisation in developing countries offer opportunities to urban planning to provide a proactive solution to development challenges. The opportunities are based on inclusivity and equity in the planning for urbanisation. The manifestation of urban problems post-independence and decentralised planning demonstrates that the planning systems within local governments remain centralised and without including the urban population.

3.5.1.2 Urban management approaches

The term “growth management” is often used to describe the policies and regulations that control and guide urban growth and development (Alnsour, 2016). Urban growth management can be understood as a set of actions to control the location, quality, scale, rate and timing of development (Alnsour, 2016). The global cities are a complex mixture of human formations that are interacting with each other through diverse social, environmental, economic and cultural factors (Cilliers, 1998; Poturgali, 2011; Haken, 2012; Alnsour, 2016; Crawford, 2016; Meerow *et al.*, 2016). In the pursuit to effectively manage cities, these interactions do not operate in a vacuum, however, their operation takes place under strict policies, social influence, institutional and legislative framework (Izvercianu, Seran & Branea, 2014; Alnsour, 2016). Thus, developing countries are facing serious challenges in improving the standard of living in urban areas amid an ever-growing urban population. To ensure proper management of urbanisation, Alnsour (2016) states that managing urban population growth occurs through the master plan, zoning ordinance and development plans.

The improvement of the quality of life and proper management of urbanisation are profound to improve environmental sustainability and curb climate change. The densification of the urban population perpetuates many problems associated with the process of urbanisation. Management of urbanisation has been enhanced through the technological and cultural transference that was experienced globally (Akhondzadeh-Noughabi, Alizadeh, Ahmadvand & Minaei-Bidgoli, 2013; Izvercianu *et al.*, 2014). According to da Silva *et al.* (2019), cities play an important role in the fight

against climate change and other environmental challenges. This takes place through the implementation of new and smart technology to reduce GHG emissions (Balkaran, 2019; da Silva *et al.*, 2019). Therefore, the cultural shift from rural areas into the city centre has made the global city to be complex to plan and manage. The lack of effective planning for and management of urbanisation resulted in various environmental problems in these complex cities (Izvercianu *et al.*, 2014; Alnsour, 2016; Balkaran, 2019; Oteng-Ababio *et al.*, 2019). The complexity of urban areas is fostered by its ever-changing character, which complicates urban planning and management approaches (Izvercianu *et al.*, 2014; Alnsour, 2016). In these complex changes, an organisation faces a tough battle for survival because it cannot provide adaptation, improvement or innovation as fast as the market requires it solely based on its internal resources.

Hao *et al.* (2011) argue that the policies, laws, legislation and institutional frameworks are important in shaping and managing the growing population in the cities. With the implementation of such an open approach to policy, co-creation resistance is encountered from administrations and government agencies as a result of a loss of control, labour intensity and difficulty in balancing access versus security (Izvercianu *et al.*, 2014). Thus, there is an urgent demand for the transferal of the approach from a command and control assertiveness to a more participatory approach, which is based on cooperation and collaboration, both internally and externally, for effective management of the growing urban population (Izvercianu *et al.*, 2014). The application of the participatory approach enables citizens to identify problems, thereby voting and commenting on those identified by others to ensure high levels of interactivity, participation and allowing for creative input (Akhondzadeh-Noughabi *et al.*, 2013; Izvercianu *et al.*, 2014). The participatory approach allows two-way communication between citizens and authorities, as the latter can respond to individual inputs, mark them as resolved or give explanations for not implementing them, as well as marking their proposals to ensure transparency, responsibility and accountability.

According to Akhondzadeh-Noughabi *et al.* (2013), local government is a fundamental sphere that is constitutionally mandated to include and improve their responsiveness, collaboration, accountability and transparency to citizens during policy formulation. Thus, the participatory approach in the management of urbanisation provides an important element of collaboration that allows innovative and effective ways of micro-managing cities to mitigate its environmental

problems. The involvement of local communities in the formulation of detailed plans offers municipal boards, politicians and all stakeholders the opportunities to create locally appropriate decisions about development (Alnsour, 2016) that is contextual and talks to the needs local community. The increasing involvement of local communities not only promotes accountability and transparency (Alnsour, 2016) but mitigates the co-creation resistance by the local community. Alnsour (2016) postulates that the regional plans deal with long-term issues in the context of creating an equilibrium between the present and future needs of an urban population. At the national level, laws about urban growth are more guided in terms of policies than regional and local levels, to ensure that both regional and local levels can produce their systems to manage urban growth effectively.

3.6 MANAGING URBANISATION THROUGH THE URBAN RESILIENCE MODEL

The emergence of resilient thinking in urban development discourse has changed the management of urbanisation in both developed and developing countries. The resilient theory has made serious inroads in planning and management, however, various scholars continue to critique its applicability in social science. The notion of resilience is an important theoretical discourse in the management of the city and ensuring that a system, in which a city is an embodiment of this characterisation, adapts post-disturbance (Komendantova, Scolobig, Garcia-Aristizabal, Monfort & Fleming, 2016; Rao & Summers, 2016; da Silva *et al.*, 2019). Thus, this enablement of a city to be operational during and post-disturbance denotes that the systems are adaptable. Urban resilience can be understood as the capacity of an “urban system to prepare, respond and recover from multi-hazard threats with minimum damage to public safety” (Komendantova *et al.*, 2016: 115). Since cities are not static but dynamic, resilient thinking in this context cannot be understood as a process of bouncing back to its original state, however, it should be viewed as a system with multiple equilibria. Therefore, the promulgation of all institutional systems to prepare, respond and recover post-perturbation gives cities new management principles to address the dramatic incursion of people into the city centre. The encroachment of the population into urban areas coupled with weak governance structures to guide urbanisation presents a dire picture. Therefore, the city as a complex system should demonstrate the ability to respond and recover from any perturbation.

The ability of a system to respond and recover from perturbation is entrenched in the capacity of a city to assess the potential risk (Komendantova *et al.*, 2016; da Silva *et al.*, 2019). Komendantova *et al.* (2016) posit that the assessment of the future risks in the urban setting is imperative for the abatement of risk exposure and vulnerability, which remain critical connotations to achieve resilience in the city. Komendantova *et al.* (2016) and Rao and Summers (2016) postulate that the densification of the urban population, rural-urban migration and the new form of urbanism deepen the critical significance of urban resilience in cities. These denote that countries should put in place systems to manage envisaged risk. In the pursuit to manage urbanisation, several scholars argue that the promotion of green infrastructure, which serves as a buffer post-perturbation (Gowda, Sridhara & Rajan, 2007; Adedeji & Fadamiro, 2015; Cobbinah & Darkwah, 2017b) provides a significant avenue for a resilience urban centre. However, many complexity theory scholars such as Portugali, Cilliers, Batty, Crawshaw and many others argue that the management of urbanisation remains very complex (Cilliers, 1998; Haken, 2012; Portugali, 2009; 2012; Crawford, 2016), unpredictable and clouded by a vast amount of uncertainties (Korah *et al.*, 2016). Furthermore, Korah *et al.* (2016) argue that short term plans may have the same influence as large scale plans in the management of urbanisation but large scale plans might offer ineffective strategies in addressing this incursion of people in urban areas due to these uncertainties. Korah *et al.* (2016) further state that management of complex urbanisation using short scale plans offers a chance to innovate and be adaptable, thus offering the potential to address the emerging challenges in more innovative ways.

3.6.1 Urban greenery as a new management approach

Globally, it was discovered that urban greenery is dramatically reducing (Adedeji & Fadamiro, 2015; Cobbinah & Darkwah, 2017b) as urban areas are continuously expanding because of the increasing number of industries, human settlements and business centres. Urban greenery performs various useful purposes ranging from ecological, social and environmental roles. The densification of the global urban population has been hailed to stimulate socio-economic development across global cities (Cobbinah & Darkwah, 2017b). Regardless of the significance of urbanisation, recently, this process is related to environmental degradation and ecological systems (Cobbinah & Darkwah, 2017b). The densification of the global urban population coupled with

industrialisation resulted in cities growing in all directions (Gowda *et al.*, 2007). This growth has drastically impacted the urban greenery or green spaces such as parks, trees and lawns (Adedeji & Fadamiro, 2015). The destruction of urban greenery poses a significant threat to the environment. Therefore, urban greenery can be used as an important strategy to plan for the aftermath of urbanisation. As part of the management of climate change, urban greenery helps in the absorption of GHG emissions and leaching of runoff into the surface. In managing urban places, Cobbinah and Darkwah (2017b) argued that developed countries have strong planning institutions, systems and policy direction which condition the citizenry engagement in the management of urbanisation as compared to developing countries. The management of urbanisation by integrating the urban populace offers advantages such as reduction in the consumption of non-renewable resources, managing urban greenery and consumption of energy.

With all the developments and uncontrolled urban growth, it is not fallacious to argue that the continued global decline in urban greenery has abated the absorption of GHGs, which increased atmospheric carbon concentrate. According to Cobbinh and Darkwah (2017b), there has been a decline of greenery due to the different land uses, which were 7.3% and 41% between the 1950s and 1990s of the entire urban setting (Cobbinh & Darkwah, 2017a; 2017b). However, with the lack of strong planning institutions, the gloomy conditions of urban greenery remain the character of the city. Urban greenery has been acknowledged as an ecological mechanism to reduce atmospheric carbon emissions through absorption during the process of photosynthesis (Adedeji & Fadamiro, 2015). Furthermore, urban greenery serves as a buffer to avoid environmental degradation through the abatement of soil erosion. This shows the importance of urban greenery in safeguarding the environment. Though urban greenery cannot explicitly be viewed as a management approach towards urbanisation, it can serve as a buffer or cushion for the reduction of the aftermath of this process. Therefore, it can be argued that implicitly, urban greenery serves as an effective management approach in planning for urbanisation and its environmental ramifications. Some scholars argue that the abatement of green places resulting from the encroachment of the population in cities poses dire scenery in pursuit to achieve sustainable development. Therefore, land-use planning plays an important role in the management of urbanisation.

3.6.1.1 Land use planning

The basis of any management of urban areas, cities and towns are based on an adequate and unambiguous land use planning system (King *et al.*, 2016). Thus, various environmental problems can be addressed through land-use planning. The unmatched process of urbanisation has dramatically changed the urban landscape in both developing and developed countries (Allen, 2009; Zhang, 2014; da Silva *et al.*, 2019; Roggema, 2019). Amid this dramatic human encroachment into the city centre, planning was later identified as a proactive instrument towards environmental and infrastructural protection (King *et al.*, 2016). King *et al.* (2016) assert that this planning approach presents the city with the opportunity to build urban resilience in pursuit of the attainment of effective management of environmental disasters. National legislative frameworks were urged to integrate the management of disasters through proper land use planning. The appropriateness of land use planning in cities is profound in the management of a growing city and the way it should grow. Proper legislative frameworks, planning institutions and systems on urban development in developing countries, where the encroachment of humans into the city remains dramatic, is profound to guide urban growth and urbanisation. The management of urban growth through land-use planning has been documented, however, its adequacy in managing this dynamic and dramatic human process like urbanisation remains to be seen.

Different countries throughout the world have implemented various distinct land use planning based on their desired objectives. The densification of the urban population has dramatically changed the landscape of the city completely. As a result of the land-use planning approach, the implementation of green infrastructure can enhance urban resilience and sustainability (Adedeji & Fadamiro, 2015; Cobbinah & Darkwah, 2017b; Meerow & Newell, 2017). In unpacking the notion of green infrastructure, Meerow & Newell (2017) describe it as a development that expands green spaces within a set locality such as parks, gardens, lawns, plantations and greenways to provide multifarious societal and ecological benefits. Regardless of its growing recognition, the expansion of green infrastructure in the city is confronted with changes that continue to be emblematic of the broader politics of resilience planning (Eren & Günay, 2015; Meerow & Newell, 2017). The inability to integrate various planning departments and institutions to harness the ecological, social and

environmental opportunities presented by green infrastructure continues to evade most planners. Furthermore, these challenges are deepened by the increasing construction (Zhou, Huang, Chen, Zhong, Xu & He, 2017) in cities that do not only restrict but worsen the abatement of green infrastructure and urban greenery. Green infrastructure offers an opportunity to create a resilient city post perturbation and change. Green infrastructure coupled with enormous permeable surface help in the abatement of urban heat islands and run-offs (Eren & Günay, 2015; Meerow & Newell, 2017). The abatement of heat island is through the provision of shade enable cooling of huge surface area, which can be seen as one of the climate change adaptation approach. Green infrastructure increases the potential urban resilience post perturbation.

The continuous construction of buildings and densification of the urban population in cities has resulted in the shrinkage of natural ecological spaces, which led to socio-economic and environmental deterioration (Meerow & Newell, 2017; Zhou *et al.*, 2017). This has led to traffic congestion, loss of arable land and soil erosion. Unfortunately, most cities in the world are covered with an impervious surface that increases the amount of run-off and the heat level. The impervious surface cover, which has been employed by many cities is very disadvantageous in the management and adaptation to the effects of climate change as compared to green infrastructure. The contemporary planning and management approaches in the city do not offer a buffer and resilience beyond global warming and climate change. Therefore, there is an urgent need for remodelling the conventional planning and management approaches in global cities to create an avenue for the abatement of the problems associated with urbanisation, particularly in developing countries that are most vulnerable to climate change. Resilient theory as a new theoretical discourse in the planning field offers urban planners a new and refreshed planning paradigm that focuses on the ability of the city to bounce back to a different but stable state while it remains operational.

3.6.1.2 City Development Strategy (CDS)

The encroachment of migrants into urban spaces signalled the emergence of multifarious changes confronting most cities in Africa. Many cities have adopted incalculable management strategies to address urbanisation (Allen, 2009; Roy, 2009; Ogbazi, 2013; Zhang 2014). In some cities, the CDS

was used to manage the ever-expanding urban landscape (Tilaki & Hedayati, 2015). The uncontrolled and unplanned rate of urbanisation and the densification of the urban population resulted in major challenges in urban management throughout the world. CDS is increasingly been used as a new approach to manage the expansion of the city by the Iranian government (Tilaki & Hedayati, 2015). This management approach provides an insight within the city context as it integrates strategic and cooperative planning in developing countries (Tilaki & Hedayati, 2015). This integrative management approach provides a piece of important information towards the attainment of a well-managed city and urbanisation. The application of CDS is done through the provision of an appropriate foundation, which helps to ameliorate the separation of rich cities in developed countries and poor cities in developing countries. In the pursuit to realise this goal, CDS focuses on the formulation of comprehensiveness of policy framework and plans, which foster integration and flexibility in urban planning (Eren & Günay, 2015; Tilaki & Hedayati, 2015; Meerow & Newell, 2017). Thus, various attempts to integrate the urban development approach such as comprehensive planning and collaborative planning failed because of the lack of coordination amongst various authorities.

City Development Strategy (CDS) has been reviewed and thus demonstrates efficiency in the management of urbanisation and urban growth (Meerow & Newell, 2017). The importance of the approach is based on its flexibility to make efficient responses to social needs whereas the compressive planning remains inflexible, linear, top-down and rigid (Tilaki & Hedayati, 2015). According to Tilak and Hedayati (2015: 126), the management of urban areas in developing countries is “not required to apply a CDS similar to the CDS of cities in other countries, especially in the developed countries due to the major changes and different aspects of the cities, including social, economic and environmental” changes. Therefore, the implementation of CDS in cities requires contextualisation to fit the approaches and context of the cities in developing countries. The difference that most city exhibits require a management approach that is contextual to address the challenges facing cities in developing countries. CDS provides urban planning with an integrative and flexible approach to the management of urbanisation. Even though this approach offers a new way of managing the city, it requires systems and personnel capacitated to implement the policy framework, policy and plans for urban management.

Tilaki and Hedayati (2015: 138) conclude that the implementation of CDS requires “urban planning process to be improved in the cities through decentralisation of the power mechanism to local authorities; strong institutional cooperation; the establishment of sustainable financial resources for municipalities; removal of the parallel laws and regulation and enactment of comprehensive law for urban planning; and the generation of the establishment of an appropriate basis for people’s involvement; and the generation of interactive opportunities among different urban stakeholders”. Therefore, the national government should make sure that local municipalities are capacitated and afforded systems and institutions for the enablement of effective management of urbanisation. This will result in the enablement of solving the contemporary urban challenges that continue to haunt many cities in developing countries.

3.6.2 Global Smart cities

The uncontrollable encroachment of people into the city centre has put enormous pressure on the current infrastructure and negatively affected spatial planning and land-use planning. The increasing pressure and the inability of urban infrastructure to support these new urbanites call for an innovative management approach towards the city. In the quest to provide an innovative management approach, an increasing number of cities around the world are implementing a ‘smart city’ model (Bifulco, Tregua, Amitrano & D`Auria, 2015; Graham *et al.*, 2015; Balkaran, 2019). The purpose of a smart city is based on the notion of addressing public issues using information and communication technology-based solutions in fostering partnership and multi-stakeholder engagement (Graham *et al.*, 2015). A smart city as a management approach encompasses the implementation of better transportation systems and innovative ways of saving energy (Graham *et al.*, 2015) through the employment of technology to enhance an overall liveable city (Balkaran, 2019). These innovative and creative management approaches help to abate traffic congestion, high consumption of energy and resources; thereby abating GHG emissions that the city continues to emit. Bifulco *et al.* (2015: 132) assert that the “integration of new aspects to take into account different and innovative factors in governance and management of urban areas and this process turned the focus on more complex conceptualisations such as the smart city”. The integration of human and social capital coupled with the traditional and modern communication systems play a major role in pursuit to achieve sustainable urbanisation and sustainable economic growth.

Underpinning the conception of a smart city is the notion of achieving sustainable development. Furthermore, the smart city fosters proper management of scarce available resources.

The conception of a smart city is based on the notion of an 'intelligent city' (Graham *et al.*, 2015; Balkaran, 2019). In an attempt to achieve a smart city as a management approach, Information and Communication Technology (ICT) must take a central role in the governance of the city (Das & Emuze, 2014; Bifulco *et al.*, 2015; Graham *et al.*, 2015). Therefore, for the smart cities concept not to be relegated to a mere elegant theoretical concept without any pragmatic evidence on the ground, the local government must have been equipped with ICT as enablement to manage urbanisation. Despite the drive towards smart cities, local government is continuously challenged by the lack of adequate capacity to implement policies. Furthermore, the implementation of ICT in the management of urbanisation presents a dire picture because of the multifaceted local government challenges. The use of integrative and modern technology, which encompass efficient innovative transport systems, infrastructure and the promotion of a green environment is an integral part of the conception of a smart city (Das & Emuze, 2014). The implementation of smart cities throughout the world holds the potential to resolve all the management problems that the city is facing in the era of urbanisation and the densification of the urban population. However, to provide enablement to realise a smart city, the following concepts should be the centrepiece of the city (smart economy, smart mobility, smart environment, smart people, smart living and smart governance) (Das & Emuze, 2014; Bifulco *et al.*, 2015; Graham *et al.*, 2015; Balkaran, 2019).

A smart city connotes that the city must be innovative, creative, flexible, economically competitive, accessible, sustainable in the usage of resources, high quality of life and good governance (Das & Emuze, 2014; Graham *et al.*, 2015). This conception connotes that the involvement of the urban population is important in fostering good governance and promoting inclusive management approaches. Theoretically, the conception of a smart city provides the potential to dismantle the dichotomous contemporary governance systems of good and elegant policy frameworks that are confronted with difficulties during the implementation processes. Regardless of the bright and elegant conception of this term, the smart city has been criticised as a concept that encompasses poor or fragmented inclusivity and splintering urbanism in which the usage of the word 'smart' is just a conceptual label (Bifulco *et al.*, 2015). Therefore, this criticism demonstrates a great caution

in the implementation of a smart city to avoid its relegation to just a documented elegant concept without pragmatic evidence of its effectiveness.

Graham *et al.* (2015) postulate that the implementation of smart traffic systems help predict traffic flow to reduce traffic congestion and improving vehicle routing and transportation planning. This system is ideal and elegant, however, its pragmatic realisation remains the largest part unknown. Furthermore, in a more extreme push towards an innovative transport system, some scholars provide the possibility of the automated transport system, suggesting the implementation of urban self-driving vehicles (Graham *et al.*, 2015). The question is, how are the urban self-driving vehicles going to provide solutions to contemporary urban problems such as congestion, emissions and environmental problems? If this innovation cannot provide smart solutions to the city, then how smart' is this smart city conception? According to Schiller (2014: 238) cited in Graham *et al.* (2015), "innovations like Uber and self-driving cars will reinvent how roads, transit systems, and freight and logistics networks function". Fact that these innovative transport systems do not solve congestion and traffic jams, the notion of a smart city remains an elegant concept without any pragmatic effects on the ground. Therefore, the acknowledgement of all the novel obstacles requires an innovative, integrative and participatory approach that close these gaps. The involvement of the community provides the potential to foster the use of a more environmentally friendly system. Therefore, improving the transportation system and pushing towards heavy reliance on public transport in that city provides a more useful management system to reduce congestion and emissions. The reason for the heavy emphasis on the transport system is on the basis that vehicles remain the highest polluters in the cities (Das & Emuze, 2014; Graham *et al.*, 2015). The smart city management approach offers urban planning and management new innovative ideas in the city. The multi-stakeholder engagement will allow the qualified citizenry to engage to bring a more and implementable option for the management of the city.

3.7 MANAGING URBANISATION BY EMPLOYING SYSTEM OF SYSTEMS APPROACH

Kasai *et al.* (2015: 154) argue that "the city is an artificial dynamic open giant complex system, who's multifunctional and interdisciplinary characteristics lead to significant complexity". This connotes that cities are not static systems but dynamic (da Silva *et al.*, 2019), thus requiring new

and innovative management approaches to address emergent challenges such as congestion, pollution and climate change. System-of-systems (SoS) can be understood as the collection of individual systems to solve emergent problems and achieving set objectives through communication (King *et al.*, 2015; Patorniti, Stevens & Salmon, 2017). SoS embraces the use of networks to integrate the multi-stakeholders into planning. The integration and the acknowledgement of fostering participation in the management of urbanisation seem to hold promising outcomes. In the pursuit to foster participatory systems that promote cooperation amongst different sectors and actors; the development of infrastructure that supports participatory planning and management approaches should be introduced at the local government. However, most municipalities are continuously paralysed by budgetary constraints in the implementation of basic services. Due to these changes, it questions the ability of municipalities to implement a new infrastructure that fosters effective communication. The Chilean government promoted decentralised institutions to foster effective and efficient communication amongst organisations in urban planning to solve a defined problem (King *et al.*, 2015; Graham *et al.*, 2015; Patorniti *et al.*, 2017). The improved collaborations amongst various distinct stakeholders such as civil societies, communities, the private sector and local government have the potential to contribute successfully towards efficient use of resources. The achievement of this notion requires “systemic thinking to treat a city as a whole” (King *et al.*, 2015: 159), which is based on the notion of holism rooted in the complexity theory. This is contrary to the employment of reductionism based on chaos theory and Newtonian thinking (Cilliers, 1998; Portugali, 2011; Batty, 2012, Portugali, 2012). SoS uses communication amongst stakeholders as the basis to improve the management of urbanisation within the municipality.

The basis of SoS in a city context does not only help solve defined problems (Patorniti *et al.*, 2017) but also provides an important and effective way of thinking in managing resource consumption. Therefore, with the ever-increasing rate of urbanisation continuously challenging development planners throughout the world, the expanding needs and problems are constantly evolving in the city (King *et al.*, 2015). The integrative, coordinated and collaborative planning in an urban context offers a focused plan to address urban challenges such as high resource consumption, traffic congestion and carbon emissions. Multi-stakeholder engagement helps to integrate the views of the community into planning. Municipalities continue to struggle to inculcate the local people in

planning. In South Africa, the successive government continues to battle with the effective inculcation of the public view into planning. The lack of coordination and fragmentation of various government departments deter the willingness to provide integrative planning in managing urbanisation. The complexity of managing urbanisation requires a coordinated, cooperated and integrated planning approach. Additionally, the SoS provides local government with the potential to enforce public participation. Participatory planning and management within local governments ensure good governance, thus fostering responsiveness, accountability and transparency. Therefore, it is important to probe the management and governance of this new urbanism.

3.8 MANAGEMENT AND GOVERNANCE OF A NEW URBANISM

The 21st century has witnessed an unprecedented rate of urbanisation that is coupled with high consumption of resources, which has created multiple problems such as high energy consumption, traffic congestion and climate change (Roy, 2009). The encroachment of people into the city centre has been associated with multifarious challenges coupled with poor planning institutions grappling with urbanisation. Over the years, the cities have grown both in population and physical expansion, which accounted for the loss of green places. Furthermore, the current urbanism has presented both opportunities and problems. The new type of urbanisation has contributed to the increment of unskilled and illiterate individuals in the city centre, particularly in developing countries. Thus, the envisaged potential that urbanisation seemed to offer was reduced to the densification of urban poverty, pollution and increased environmental problems (Keho, 2016). This is because scholars have argued that the encroachment of people into the city brings more skilled employees, which improve the planning and management praxis of the new urbanisation. Despite this picture characterising the current cities, effective management of urbanisation remains elusive.

In the pursuit to resolve the problems arising in cities, local government management and governance structure need to be improved. Therefore, the notion of 'business as usual' will deter good management and governance practices in cities (Korah *et al.*, 2016). The inclusion of the public in urban governance serves as enablement to harness the potential that urbanisation offer (Mogano & Mokoelé, 2019; Mokgotho & Mokoelé, 2020). The management of urbanisation that excludes the urban population represents a narrow-minded approach, which is not inclusive (Roy,

2009; Korah *et al.*, 2016). The exclusion of people in the management and governance of the city derail the efforts to address urban challenges and the public to hold the government accountable. The involvement of the people and various stakeholders in planning has the potential to shift public thinking within the climate change discourse to reduce the consumption of resources and traffic congestion (Roy, 2009; Mokgotho & Mokoele, 2020). The increasing heavily reliance on private cars, reduction of green places and pollution can be attributed to the lack of inclusivity in the management of urbanisation. Therefore, the participatory approach improves community awareness and their contribution to planning the framework which is implemented in the city and thus, improves the innovative capacity in the management of urbanisation (Mokgotho & Mokoele, 2020). It can be argued that, regardless of the legislative frameworks that demonstrate decentralisation in planning for and management urbanisation, the application of planning approaches remain centralised and is not inclusive.

In South Africa, there are a plethora of legislative prescripts that document the importance of participation in any municipal affairs (Constitution of the Republic of South Africa, 1996; Municipal Structured Act, 1998; Municipal Systems Act, 2000; Musanda-Nyamayaro, 2008). These legislations ensured that the local government is responsive and accountable. This shows that South Africa has put in place systems to improve governance within the municipality. However, regardless of these systems in place, the inclusion of the public in municipal affairs remains an elusive concept. The lack of participation within the local government abates municipal accountability, transparency and responsiveness towards people's needs (Mongala, Tema, Mokoele & Manamela, 2019; Mokgotho & Mokoele, 2020). Therefore, most local governments are still grappling to ensure good governance. The management of this new wave of urbanism requires a city that is capacitated with systems, institutions and personnel to foster good governance. The ability of the local government to foster public participation presents spinoffs in addressing the contemporary challenges facing the city. However, capacity alone is not sufficient for the enablement of addressing environmental problems.

Capacitated local municipalities have the potential to promote inclusive management and governance approaches towards urbanisation. The densification of the urban population directly impacts the energy demand due to the usage of high energy demand and types of machinery. The

increasing energy consumption in urban areas enables the increment in GHG emissions and thus, contributing towards global warming. It was discovered that 61.4% of the total GHGs are from the consumption of energy (Keho, 2016) like electricity, which in South Africa is generated through the combustion of fossil fuel. With the increasing rate of urbanisation, it is predicted that the amount of energy consumption will increase from 46% to 58% by 2040 (Keho, 2016). This projection of energy consumption will result in a significant increase in GHGs in the atmosphere. Furthermore, these projections connote that the fight against climate change is far from been won. However, the promotion of public participation provides the potential for learning and empowerment where people are capacitated with knowledge about resource conservation in the quest to fight against climate change. This can influence the abatement of energy consumption in urban areas by adopting infrastructure that does not require high energy input. In the same vein, the reduction of GHGs around the city can be abated or controlled through the promotion of green infrastructure.

3.9 COMPLEXITY AND UNCERTAINTIES OF PLANNING AND MANAGING URBANISM

The complexity in the management of urbanisation is fuelled by demographic, social, economic and cultural dimensions. The complexities of managing urbanisation can be attributed to the fact that this phenomenon is not static but rather dynamic. The acceptance of the concept complexity in urban studies (Portugali, 2006) qualifies that the contemporary realities in spatial conditions are continuously changing (Korah *et al.*, 2016). The growth of the city is not only contingent on the internal factors but subjected to external factors such as the encroachment of rural and migrant populations into urban areas, policy direction and climate change (Roy, 2009). Therefore, cities and urban areas can be understood as open systems, which exchange energy, information and matter with the environment (Korah *et al.*, 2016). Korah *et al.* (2016) assert that this exchange and interaction amongst different actors in urban areas make it difficult to establish direct causal relations among these distinct parts. Cities are continuously undergoing change and expansion. Urban growth and densification of the urban population are often prompted by the current conditions to initiate adaptation strategies and work towards a unified satisfaction. According to Haken (2012) and Korah *et al.* (2016), self-organisation can be attributed to the spontaneous emergence of new patterns (informal settlements) and uncertainties about the immediate future development patterns. Self-organisation connotes that a “city is always under construction but it is

never finished or completed as it responds primarily to current needs and opportunities in a just in time manner” (Korah *et al.*, 2016). Therefore, if cities are always undergoing continuous changes and never complete, it can be argued that the long term fixed planning and management approaches will fail to address the uncertainty presented by the new form of urbanism. The uncertainty of urban growth and management of urban areas require continuous innovativeness and policy interrogation to undergo unceasing adaptation and self-organisation.

Long term fixed plans and frameworks are considered ineffective and inefficient in managing the dramatic encroachment of people in the city, particularly in developing countries. Portugali (2006 cited in Korah *et al.*, 2016) argues that “in complex cities ... small-scale plans may be as effective and significant as large-scale plans, while large-scale may be powerless and have little influence on the city”. This confirms the notion that large-scale fixed plans are confronted with limitations in the management of urbanisation and cities. The reason why large scale plans are ineffective in the management of urbanisation is because of their rigidity and inflexibility of this dynamic process. This demonstrates the complexity of the growth of a city amid all this uncertainty. Therefore, continuous innovativeness, adaptation and self-organisation of a city provide insightful knowledge in understanding its dynamism and the ability of urban planners to manage urbanisation. To understand and plan for complex systems such as cities and uncertain future, the plans must always be more becoming and urban planners assuming the role of managers in the city context. With the incapacity to comprehend urban challenges by urban planners, the attainment of sustainable development will remain the largest part unknown. Currently, the most government still lacks effective and efficient approaches to manage urbanisation. The continuous encroachment of the population coupled with poor systems and institutions to manage urbanisation demonstrate the unsustainability of urbanisation.

3.10 CONCLUSION

Globally, the densification of the urban population continues to challenge most urban planners. This can be witnessed through the uncontrolled incursion of people into urban areas coupled with high energy consumption, urban expansion, traffic congestion, carbon emissions and the intensification of climate change. The multiplicity of urban challenges continue to challenge urban

planners in managing the dramatic human phenomenon. This shows that the orthodoxical planning and management paradigm needs to be rethought to provide a more innovative and creative approach to address challenges such as climate change. Consequently, with the incapacity of centralisation to yield positive management ramifications, countries like Ghana and South Africa moved towards decentralisation. The decision making power in planning was delegated to the local government which should foster a communicative and participatory planning system. The protection and implementation of green infrastructure offer a new light in the abatement of carbon emissions emitted in the city. The creation of parks and plantations around the city reduces the heat waves by cooling the surface and reducing the amount of runoff. Thus, the reduction of impervious surfaces can be used as adaptation stratagems in times of floods. Accordingly, green infrastructure not only provides shade and reduces heatwaves but allows the infiltration of water into the soil as compared to an impervious surface. Entrenched beneath green infrastructure is the potential to protect the environment and offer an avenue to the attainment of sustainable development. To effectively implement the green infrastructure, there is a need for participatory planning. The cooperation between various stakeholders in urban planning is important in the achievement of good governance, governance and management of urbanisation.

4 CHAPTER 4: CONTEMPORARY CLIMATE CHANGE MITIGATION STRATEGIES EMPLOYED IN DEVELOPING COUNTRIES

4.1 INTRODUCTION

As the world entered the third decade in the new millennium, humanity is confronted with dangerous environmental threats (Mokoele & Sebola, 2018; Mokgotho & Mokoele, 2020), which can potentially deter the attainment of sustainable development. Urban areas and suburban areas have been experiencing deteriorating water quality (Govindarajulu, 2014), major traffic congestion (Allen, 2009; Roy, 2009) and intensive industrialisation in pursuit of economic growth (Mokgotho & Mokoele, 2020). These issues are fuelled by two powerful human-induced forces that have been unleashed by development initiatives and manipulation of the environment in the new industrial age (UN-Habitat, 2011; Govindarajulu, 2014). According to da Silva *et al.* (2019), the heavy reliance on non-renewable resources has increased the level of GHG emissions, which account for the intensification of climate change. Scholars such as Wolf & McGregory (2013), Govindarajulu (2014), Moriarty and Honnery (2015) and Freeman and Yearworth (2017) argue that the effects of urbanisation and climate change are converging in dangerous ways. This convergence is threatening to have unprecedented negative impacts on the quality of life, economic and social stability (UN-Habitat, 2011). The majority of these urban areas and cities are less equipped to deal with the impact of climate change. The notion is supported by the fact that in most developing countries, urbanisation took place without proper institutions to plan and manage this process. Developing countries are characterised by profound deficits in good governance, infrastructure, and economic and social equity (UN-Habitat, 2011) to adapt to climate variability.

The past decades were characterised by the global rising of atmospheric temperature, drought, heatwaves, floods, rising sea levels and cities remain vulnerable (Govindarajulu, 2014; Moriarty & Honnery, 2015). According to Mashizha (2019), climate change has become a reality, the effects are threatening the attaining of sustainable urbanisation development. The vulnerability of cities towards climate change is fuelled by the abatement of green spaces, increased impervious surfaces and high population. The intensification of the changing climatic conditions are attributed to past carbon emissions that destabilised the atmospheric gas balance, thus, results in climate

change (Welborn, 2018). The intensive usage of non-renewable resources and the combustion of fossil fuel has increased the atmospheric carbon emissions over the years. Developed countries have always been blamed for the increase in carbon emissions into the atmosphere. However, the burning of fossil fuels is not the only factor that contributes to increasing GHG emissions. According to Chrysoulakis *et al.* (2013), pollutants from wastes have contributed to the increasing GHGs such as methane, which poses a serious threat to the atmospheric gaseous composition. Govindarajulu (2014) postulates that tropical regions like India are more prone to extreme events such as tropical cyclones and floods. Climate change effects such as floods, droughts, cyclones and heatwaves are more likely to intensify if cities are not managed in a more sustainable manner (Govindarajulu, 2014). Ramachandra and Kumar (2010) state that several cities around the world have witnessed a rise in temperature of about 2°C due to the occurrence of the urban heat island. In countries like India and Canada, heatwaves have resulted in an increased death toll. Newburger (2021) states that Oregon's state medical examiner said that the extreme temperatures that reach 46.67°C are responsible for the death of 63 people. Additionally, many people who died from this extreme heat was due to the lack of air-conditioning. The poor are always the vulnerable group towards climate change. Due to this changing climatic condition, other cities have witnessed floods that resulted in the water level rising to 0.5–1.5 m level in low-lying areas, thus causing tremendous economic losses and damage to infrastructure (Moriarty & Honnery, 2014). Various scholars have indicated that cities, particularly in developing countries, are more susceptible to the changing climatic conditions that occurred as a consequence of humankind (Welborn, 2018; da Silva *et al.*, 2019; Mashizha, 2019; Nhamo & Agyepong, 2019). Therefore, it can be argued that the changing climatic condition is labelled as a human-induced phenomenon.

The current human population has already been subjected to the occurrence of heatwaves, which continue to harm many people (Moriarty & Honnery, 2015) especially the vulnerable groups in the society. As a result of this human-induced environmental problem, many people in urban areas have lost their lives. Two approaches to dealing with climate change are mitigation (decreasing the harmful GHGs) and adaptation (learning to live with the effects) (Nartey, 2018; Mashizha, 2019; Nhamo & Agyepong, 2019). Although there is a need to be adaptable towards climate change, it is important to put measures in place to ensure climate change mitigation. In other words, adaptation deals with the coping strategies of the aftermath of climate change, while mitigation deals with curb

it from occurring. Globally, the processes that increase the amount of GHGs in the atmosphere are both complex and non-linear, which connotes that the current emissions will take a very long time to influence the changing climatic condition (Mukhopadhyay & Revi, 2009). However, to maintain and ensure that sustainable development becomes a reality, all countries whether rich or poor have a critical role to play in attaining climate resilience cities and mitigation of climate change. Most countries like South Africa are still dependent on the burning of fossil fuels for the generation of electricity. In most urban areas, there is perennial lighting of street lights, usage of electric appliances, emission of GHGs, office lights that are always on and energy-intensive infrastructure, which increases the pressure on both the environment and the energy source. The increasing electricity demand facilitates the increasing burning of coal, which has a tremendous effect on the increasing GHGs. Furthermore, the densification of the urban population has resulted in a rising pressure of coal extraction and use, which causes the rise in the levels of atmospheric carbon emissions. Therefore, this demonstrates that cities are very important within the current climate or environmental discourse.

Cities harbour various activities that resulted in the emissions of carbon dioxide and methane, which are the primary contributors to climate change. The continuous increment in the density of urban inhabitants coupled with the inability of urban planners to address the urbanisation process has resulted in increased traffic congestion (Mokgotho & Mokoetele, 2020). This is a major contributor to GHG emissions into the atmosphere around the city. Emissions from vehicles are ranked as the highest contributor to GHG emissions in urban areas (Mokoetele & Sebola, 2018). Therefore, the manifestation of traffic congestion achieves mitigating climate change in the cities impossible to achieve (Govindarajulu, 2014). There has been a contestation from developing countries that contemporary climate change is attributed to the burning of fossil fuels in developed countries. Despite this contestation, various countries have realised that they have a role to play whether big or small, in curbing this dangerous interference of climate change. To gain insight into climate change, the next section probes its characterisation within the global context.

4.2 THE CHARACTERISATION OF CLIMATE CHANGE

Over the years, climate change has increased both in frequency and severity across the globe (Kuo, Yu & Chang, 2015), however, developing countries remain more vulnerable to its effects. The global climatic conditions have been changing, with many countries witnessing the changing patterns of precipitation. Although there has been increasing temperature above 1°C, India has experienced rising levels of temperature, which approximate to 2°C (UN-Habitat, 2011; Moriarty & Honnery, 2015) in cities due to the occurrence of heat islands (Ramachandra & Kumar, 2010). The impacts of climate change are experienced through the change in precipitation patterns, extreme temperatures, drought, heat islands, warming oceanic water temperature and the rising sea levels, which has affected most cities (Moriarty & Honnery, 2015; Welborn, 2018; Nhamo & Agyepong, 2019). In India, cities such as Bangalore, Mumbai and Kolkata have witnessed a rise in city temperature, floods and other climatic conditions (Govindarajulu, 2014). Bangalore experienced a rising atmospheric temperature of approximately 2°C, which can be attributed to urban heat island; on the other hand, the most populated Indian city, Mumbai city; witnessed extreme rainfalls and floods that resulted in the city shutting down (Ramachandra & Kumar, 2010; Shackleton, Scholes, Vogel, Wynberg, Abrahamse, Shackleton, Ellery & Gambiza, 2011; Govindarajulu, 2014) causing tremendous damage to the infrastructure. South Africa, Ghana, Zimbabwe, Nigeria and other African countries are already experiencing the effects of climate change through changing rainfall variability, drought and extreme weather events (Welborn, 2018; Mashizha, 2019; Nhamo & Agyepong, 2019). Climate change can be characterised by increasing temperature (Moriarty & Honnery, 2015), heatwaves, drought, floods and extreme weather events. Welborn (2018) states that the continuation of carbon dioxide emissions resulting from human activities have already warmed the climate 1°C above the pre-industrial level and further increase remains inevitable.

The persistence of urban environmental problems requires a shift in the conventional urban planning approaches and principles towards climate change mitigation. During the Cop21 held in Paris, France from the 30th of November to 12th of December 2015 under the topic, '*Long-term temperature goals*', it was agreed that there is a scientific recognition that the most calamitous and irremediable impacts of climate change may take place within the temperature threshold below the 2°C. Govindarajulu (2014: 36) postulates that a city is "prone to frequent floods, because of its

geographical location in a tropical region that receives abundant monsoon rains, its risks to flooding gets more aggravated due to manmade interventions in its geography—especially due to the inhibition of natural runoff surface water and loss of a network of drains, rivers, creeks, and ponds that drain directly into the sea”. Unplanned rapid urbanisation in the past decades posed a sustainable development challenge (Ogbazi, 2013), which is evident in cities with the proliferation in rising temperatures, floods, drought, changing precipitation levels, high GHG emissions and consumption of resources in urban areas.

Recently, South Africa has been experiencing various extreme natural disasters such as floods, droughts, wildfire, and heatwaves in which the majority of the current generation might have never witnessed. It was recorded in the Kings (2017) that South Africa has witnessed a mother of all storms, the worst drought in a century, intense fire and hottest years, which provide a deeper analysis that these environmental problems are continuously becoming a new normal. In November 2016, Johannesburg was hit by floods that claimed many lives and left many people without shelter, various economic activities were halted and infrastructure was destroyed. In February 2020, Johannesburg in Gauteng Province experienced heavy rainfall, which resulted in fatalities and damage to infrastructures. Consequently, three people died and more than 200 people were displaced in the Soweto Township. The Knysna area in Western Cape Province was affected by a storm of fire, which was exacerbated by strong winds and dry grasses. Consequently, the fire destroyed over 600 houses, 7 people died and the cost of the entire disaster accounted for over R4 Billion (Kings, 2017). Due to this fire, over 100km of land ecosystems were destroyed. Additionally, South African coastal areas are now confronted with an immense challenge of sea levels rising and warming oceanic water temperature. One of the challenges that South African coastal areas are facing is the increasing frequency of floods (Mail & Guardian, May 27, 2017). It was discovered that the global sea levels are rising at a rate of 3 – 4 mm per year (Vitousek, Barnard, Fletcher, Frazer, Erikson & Storlazzi, 2017). Paying scrutiny on this sea-level rise, the coastal areas are facing a calamitous future if climate change is not mitigated as a matter of urgency.

The atmospheric temperature has been intensifying over the ages. This increasing atmospheric temperature continues to increase the ocean water temperature. The rising oceanic temperature

will result in the increased chances of the occurrence of hurricanes, cyclones and Typhoons. A comprehensive understanding of this characterisation of climate change will encourage various states to promulgate policies that explicitly target this environmental phenomenon and putting measures to attempt to mitigate and adapt it. The impacts of climate change are experienced through the change in precipitation patterns, extreme temperatures, the formation of heat islands, floods, drought, changing rainfall patterns and the rising sea level have hit many cities hard (Moriarty & Honnery, 2015) especially in developing countries. The understanding is that the characters embodied in climate change provide an avenue on how to deal with this phenomenon though not overlooking its complexity to implement mitigation approaches. Therefore, it is important to evaluate the operative strategies that can be employed effectively towards climate change mitigation.

4.3 THE OPERATIVE STRATEGIES S MITIGATE CLIMATE CHANGE

In order to win the fight against climatic change, the notion of low carbon emissions is profound. The reduction of carbon emissions in an attempt to mitigate climate change resulted in the governments' incapability to achieve economic development (Kuo *et al.*, 2015) and economic growth targets. Therefore, many governments around the world are challenged to balance the achievement of economic benefits while ensuring environmental protection. The efforts to develop a low carbon economy should be achieved within the contemporary levels of economic growth (Kuo *et al.*, 2015). Over the years, South Africa has been characterised by high resource input, intensive resources consumption, high energy consumption and high emissions, which contribute towards climate change. The application of this extensive production model contributed immensely to high levels of atmospheric carbon dioxide, which pose a serious threat to the changing climatic conditions. Globally, there is an urgent need to shift from intensive fossil fuel reliance on energy generation to more environmentally friendly sources of energy generation. However, balancing economic growth aspirations and environmental protection remains the greatest challenge facing most governments. The increasing frequency and intensity of climate change affect every country, regardless of their emission levels. According to Lawson (2015), Africa is set to experience an increasing intensity in the mean surface air temperature of 3-4°C for the period between 2080 and 2099 compared with 1980-1999. This connotes that Africa will experience the harshest effects of

climate changes even though it is amongst the lowest emitters of carbon in the world. Therefore, these require a concerted effort towards lowering atmospheric carbon emissions to mitigate climate variability. Climate change mitigation implies the reduction in carbon emissions resulting in future environmental damage (Kuo *et al.*, 2015; Spyridi *et al.*, 2015), which threatens the attainment of sustainable development. In an attempt to mitigate climate change, the adoption of a climate policy that inculcates the notion of mitigation and adaptation is urgently required (Wüstemann *et al.*, 2017). The reason to inculcate mitigation and adaptation in climate change policy application and formulation is that any goal (mitigation and adaptation) pursued alone might be derailed by another. This connotes that countries that are not adaptable might derail the ability to effective implementation of mitigation approaches to climate change and visa viz.

According to Wüstemann *et al.* (2017), an ecosystem-based approach to climate policy covers a wide gamut of climate change mitigation and adaptation, which is based on the natural ability of the ecosystem to absorb pollutants within its assimilative capacity. The ecosystem approach to environmental protection offers a profound ability of a natural system to abate emissions. In South Africa, a study was done in Cape Town regarding the formulation of a policy framework to mitigate and adapt to climate change (Taylor, 2015) demonstrates various challenges when formulating policies. It was found that successive policies were confronted with the lack of cooperation either from the political sphere or from citizen participation (Taylor, 2015). This lack of cooperation was fuelled by the gap within the policy framework about who is responsible for undertaking a certain task and what needs to be done (Taylor, 2015). Therefore, for the effective implementation of a climate change policy, this critical question needs to be answered. A climate policy framework that focuses on coordination, integrating various stakeholders and lowering carbon emission portrays the potential to mitigate climate change. However, the reduction of GHG emissions and climate change mitigation is not just a linear process.

4.3.1 Energy-saving and carbon abatement strategies in cities

The reduction of global carbon emissions is an important object towards climate change mitigation. However, Freeman and Yearworth (2017) state that the globe has witnessed a slow pace and insufficient progress towards climate change mitigation progress. The slow progress was attributed

to the reduction of human-induced GHG emissions below a safe level, as recommended by climate science (Freeman & Yearworth, 2017). By the year 2014, India became the fourth largest emitter in the world contributing approximately 7% of the carbon emissions (Busby & Shibore, 2017). The complexity of India's emissions is that the majority of the population still lives without electricity. In order to provide electricity to the growing population, the countries' emissions are set to grow in the coming years. Therefore, there is a need to abate upsurge carbon emissions globally.

The reduction of carbon emissions can be achieved through the promotion of green energy (hybrid solar system) and the shift from heavy reliance on fossil fuel for energy production. The enactment of policies that explicitly aim to abate emissions might fail if the energy consumption in urban areas remains the same. The collaboration between the local government and the local community is important for the shift in the usage of electricity to safer energy. Therefore, local municipalities around the cities must encourage their citizenry to use solar energy for household lighting and geysers (Hossain, 2017). The idea to harness solar energy has the potential to abate contemporary GHG emissions. Furthermore, the perennial lighting of city lights and those in buildings should be done through solar energy. The contemporary carbon emissions and the fear of its increase pose a serious threat towards mitigation of climate change (Kuo *et al.*, 2016). There is a need for a paradigm shift towards green science and green governance (Busby & Shibore, 2017; Hossain, 2017). The promotion of green infrastructure is important to mitigate climate change. However, due to the budgetary challenges faced by local government in providing basic services, this questions the feasibility to implement green infrastructure to reduce carbon emissions and, thus provide green governance.

4.3.2 The global carbon emissions abating strategies

The notion of developmentalism for many has been prioritised over environmentalism, thus the idea of growing the economy has been the ultimate goal for development. Recently, climate change attracted the attention of most scholars and environmental practitioners in the quest to achieve sustainable development (Bodansky, 2016; Bubsy & Shidore, 2017; Dung & Sharma, 2017). Successive conferences of parties continue to state that GHG emissions need to be abated if climate change is to be successfully mitigated. There are many opposing arguments between

developing and developed countries. Most developing countries have argued that developed countries have over the years emitted a vast amount of GHGs that currently are causing a major change in the climate conditions (Kuo *et al.*, 2016). Other scholars have argued that India's current and projected population should be of most concern within the climate change discourse (Bubsy & Shidore, 2017). As stated earlier, India has a small proportion of its population with access to electricity. The country has embarked on a process to ensure that the majority of its population have access to electricity as a developmental need. Therefore, the increasing proportion of people receiving electricity will dramatically increase the carbon emission into the atmosphere. There is a need to reverse the inertia of climate change in fighting this human-induced phenomenon.

According to Roy (2016), the peril of climate change and increasing global temperature are increasingly affecting humanity and the availability of natural resources. Therefore, there is an urgent need to reduce global GHGs. Bioenergy can be seen as the most robust climate change mitigation strategy (Leimbach *et al.*, 2016). This is because bioenergy is independent of the availability of carbon-capturing storage technology (Leimbach *et al.*, 2016), which can be seen as a robust climate change mitigation strategy. The change in the sources of energy for the major proportion of countries can reduce carbon emissions. The integration of energy models and land use planning models provide an innovative advantage in the abatement of uncertainties in mitigating climate change (Leimbach *et al.*, 2016).

4.4 FORMULATION OF CLIMATE CHANGE MITIGATION POLICY

The adoption of the notion of sustainable development during the late 1980s signalled a new ideology in addressing environmental challenges. At the crust of the achievement of sustainable development is urbanisation, which is blamed for most global environmental problems (Thorne, Santos, Bjorkman, Soong, Ikegami, Seo & Hannah, 2017). The importance of urbanisation in achieving sustainable development is because over 54% of the global population is located in the cities (Thorne *et al.*, 2017). Urbanisation has resulted in the increase of resource consumption and subsequently, GHGs, which contribute to the increasing global temperature, warming climate, changing precipitation patterns and natural disasters. Thus, it is imperative to formulate policy frameworks that explicitly target climate change mitigation (Di Gregorio, Nurrochmat, Paavola, Sari,

Fatorelli, Pramova, Locatelli, Brockhaus & Kusumadewi, 2017; Thorne *et al.*, 2017). Globally, the climate change policy objective is dominated by adaptation as compared to mitigation. This connotes that it is important to prepare for the effects of climate change to ensure that the cities are operational post-disaster, thus making them adaptable. However, the intensification of climate change effects around the world derails the application of mitigation and adaptation objectives. Developing countries are continuously demonstrating their inability to adapt well to the intensification of the effects of climate change. Therefore, developing countries are the most vulnerable to climate change. In contrast, the increasing atmospheric carbon emissions will intensify the effects of climate change to a point that even developed countries are unable to adapt to it. Therefore, there is an urgent need to promulgate climate policy in pursuit to mitigate this undying phenomenon.

The climate change framework is built on ensuring that there is policy coherence in various policy objectives (Di Gregorio *et al.*, 2017). Due to the complexity of mitigating climate change, countries should enact a policy framework that promotes integration. According to Di Gregorio *et al.* (2017: 36), policy coherence “refers to policy output and outcomes, or the consistency of multiple policy objectives and associated with implementation arrangements, and policy integration (administration and organisational structures) and policy-making processes”. Climate change policy objectives are mitigation and adaptations (Leimbach *et al.*, 2016; Di Gregorio *et al.*, 2017; Thorne *et al.*, 2017; Mashizha, 2019). Climate change integration can be understood explicitly as the integration of the two climate change objectives (Di Gregorio *et al.*, 2017), which are mitigation and adaptation. Therefore, the formulation of any climate change policy should embrace these objectives. The main reason for the integration is based on the inertia of climate change. Climate change cannot be reversed overnight but it will take many decades to attain its reversal. Hence, countries need to put aside budgets for mitigation and adaptation strategies so that they can continue to be operational post-disturbance.

The weakness of most policies in developing countries, not limited only to climate change policy, is the lack of integration and coherence, which makes it difficult to achieve their intended objectives. The agricultural sector has been seen as one of the sectors responsible for the production of nitrogen from fertilisers and their energy-intensive irrigation system results in carbon emissions.

Thus, promoting adaptation through soil conservation can help sequester carbon emissions (Di Gregorio *et al.*, 2017). On the other hand, the promotion of mitigation measures through strategies such as fast-growing tree monocultures aimed at maximising carbon sequestration may hinder adaptation (Di Gregorio *et al.*, 2017). Thus, cities should be able to provide a balance between adaptation and mitigation. The existing linkages mean that it can be advantageous to integrate into two climate change objectives. Promoting policy integration while devising climate change policies in the land-use sector can avoid incoherence in policy design and lead to more effective outcomes (Di Gregorio *et al.*, 2017). There is a plethora of pragmatic evidence that supports the assertion that urbanisation is a complex phenomenon. Thus, mitigating climate change from its greatest sources requires the coherence of different departments to foster the integration of climate change objectives. The many South African departments need to be embraced in the quest to address climate change. The integration of these various departments (agriculture, transport, forestry, and energy) in reducing carbon emissions provide an important ideology in mitigating climate change. Di Gregorio *et al.* (2017) assert that climate change policies are integrated when a policy or action is explicitly intended from the outset to contribute to the mitigation of climate change. Thus, coordination amongst various departments in the city is important in addressing this undying phenomenon.

4.5 CLIMATE POLICY INTEGRATION

The increasing rate of urbanisation is a growing stressor in the attainment of sustainable development (Thorne *et al.*, 2017). This is mainly because it is projected that there will be approximately more than 2.5 billion added people living in urban areas globally by the year 2050 (UN-Habitat, 2011). Since urbanisation has been blamed for the contemporary climatic conditions, the projected urban growth poses a serious problem to the attainment of sustainable development. There is an urgent need for policy formulation that explicitly targeted climate change mitigation and adaptation. However, the creation of atmospheric carbon imbalance that resulted in the contemporary changing climatic conditions can be attributed to carbon dioxide emitted many years ago. The object to mitigate climate change will take many years before it is attained, due to climate change inertia. Di Gregorio *et al.* (2017) assert that in Indonesia, the absence of strong overarching governance systems that explicitly focussed on climate change policy integration will pose a serious

problem for key ministries; challenges to effectively collaborate, integrate and manage multiple climate change and development objectives. This shows that policy integration to mitigate climate change is imperative. Due to climate change inertia, the integration of the two climate change objectives (adaptation and mitigation) (Mashizha, 2019) and other sectors (transport, energy, industries, land use, and housing) is imperative during climate policy formulation (Locatelli *et al.*, 2015; Di Gregorio *et al.*, 2017; Thorne *et al.*, 2017).

The importance of integrating climate change objectives towards mitigating climate change is to ensure that countries continue to be functional post perturbation. Therefore, in Indonesia, Di Gregorio *et al.* (2017) demonstrate that the country has few adaptation policies aimed at addressing climate change and thus, acknowledges the importance of integrating climate change policy objectives. Globally, most countries are committed solely to adapt to climate change without putting measures to mitigate the future changing climatic conditions. Contrary to the sole idea to adapt to the contemporary changing climatic condition by countries, the intensification of climate change presents serious problems in the ability of countries to adapt to this phenomenon. This is because the continuous increment of carbon emissions will increase the intensity of climate change. In India, there is a two-dimension of feasibility that has been identified from a structural perspective to reduce emissions, which are political/organisational and technical/economic (Busby & Shidore, 2017). The notion of feasibility is attributed to the possible actions to significantly abate carbon emissions and importantly, to avoid future emissions growth in other sectors (Busby & Shidore, 2017). This can be achieved by ensuring that the climate change objectives and other sources of emissions are integrated into policy formulation. The political will is very important during the implementation of climate change policies. Politics has the potential to contribute positively to the reduction of GHG emissions. During Cop21 held in Paris, France in December 2015, amongst other agreements was the commitment by 169 countries to reduce the carbon emissions to certain standards in order to mitigate climate change (Bodansky, 2016).

To ensure that countries are adaptable and committed to climate change mitigation, policy integration remains imperative. During the promulgation of climate change policy, various stakeholders must be involved in the quest to abate the levels of emissions. Transport, energy, industries and housing sectors should be involved during the promulgation of climate change policy.

Contrary to the notion of integrating climate change objectives, Locatelli *et al.* (2015) argue that without clear consideration of adaptation, various initiatives aimed at the abatement of emissions are likely to underperform due to the contemporary climate hazards (flooding and droughts), increasing vulnerability and reduced capacity to adapt to the current changing climatic conditions. Therefore, in pursuit of climate change policy formulation, it is imperative to ensure that the two climate change objectives are integrated during policy enactment.

4.5.1 Industrial and transportation sectors

The contestation of whether or not the developed countries are responsible for the contemporary changing climatic conditions is currently irrelevant. Davis, Caldeira and Mathews (2010) assert that if the current GHG emissions are not addressed, the world would be committed to many centuries of increasing global mean temperature, extreme weather events and sea-level rise. This increasing global mean temperature and sea level rising indicate that the contemporary adaptations strategies will be insignificant and insurmountable in the future changing climatic condition. The global object to integrate climate change objectives is important. In the pursuit to integrate these objectives and other sectors, the industrial sector is very integral in the abatement of carbon emissions. In various countries, the industrial sector contributes to a huge proportion of GHG emissions in the atmosphere (Davis *et al.*, 2010). Globally, the industrial sector continues to produce an overwhelming amount of GHGs, if uncontrolled, the future changing climatic conditions might be too severe for humanity to adapt to. This is becoming evident as Canada witnessed high temperatures, which resulted in hundreds of people losing their lives in June 2021 (Newburger, 2021). The upsurge of carbon emissions poses a serious threat to the object to attain sustainable development. The heavy reliance on private cars in most cities has increased carbon emissions. The emissions statistics in various cities demonstrate that transportation accounts for a huge proportion of carbon emissions into the atmosphere. To comprehensively address the changing climatic conditions, the enactment of a policy that explicitly targets climate change should integrate a focus on the abatement of emissions from the transport system (Davis *et al.*, 2010). The promotion of public participation during the enactment of climate change policy holds the potential to change people's views about the use of public transport. However, the energy sector is not the

only one important during integration, because the agriculture, forestry and land-use sector is equally significant.

4.5.2 Agriculture, forestry and land-use sector

Agriculture, forestry and land use were discovered to have contributed immensely towards climate change. The carbon emissions from agriculture are attributed to the intensive usage of fertilisers. Dodman (2009) states that globally, agriculture and forestry account for over 31% of GHG emissions. Therefore, various sectors must be integrated into policy formulation and implementation when attempting to mitigate climate change. The integration of sectors and climate objectives demonstrates the complexity of mitigating climate change. Greening of the city and urban agriculture is important to ensure long terms sustainability, which helps in curbing the effects of global warming (Klimas & Lideika, 2018). Greening of the city and urban agriculture as a way to address climate change was stated in the Paris Agreement (Klimas & Lideika, 2018). Non-urbanised Areas (NUA) are an important part of urban agriculture and green infrastructure that provides ecosystem services around the city (Klimas & Lideika, 2018). This area is currently in danger due to the increasing urban sprawl. Therefore, the regulation to manage urban sprawl is a key issue to land use planning. The non-linearity and complexity of mitigating climate change require a concerted and singlemindedness of policy frameworks that explicitly foster the integration of various sectors and climate change objectives. Furthermore, the infrastructure around the city becomes another important factor in abating emissions.

4.6 CONFERENCE OF PARTIES AND CLIMATE CHANGE MITIGATION

The United Nations Framework Convention on Climate Change (UNFCCC) was adopted in 1992 by governments participating in the Conference of Parties (COP) as a decision making body on issues of climate change (UN Habitat, 2011; Asadnabizadeh, 2019; Harou, Matthews, Smith, McDonnell, Borgomeo, Sara, Braeckman, Matthews, Dalton, Young & Ovink, 2020). The first COP meeting was held from 28 March to 7 April 1995 in Berlin Germany to create a focus for all countries to follow in addressing climate change. The main object of the meetings was to ensure that there is a global commitment towards the abatement of global GHG emissions to limit global temperature

increases (UN Habitat, 2011). According to Schinko (2020), the crisis of climate change will inevitably intensify and have the greatest threat to humanity if the atmospheric temperature is not kept below 2°C above pre-industrial. Twenty-six (26) years since the first meeting in 1995, the world continues to experience an increase in global carbon emissions. This is despite the successive COP meetings that attempt to reduce the amount of GHG emissions. The idea to promote decarbonisation was done to maintain the same economic efficiency while reducing the levels of carbon emissions. The signing of the Paris Agreement on the 17th of April 2017 signalled the commitment of countries towards climate change mitigation. According to Asadnabizadeh (2019), the 194 members of the UNFCCC, under the Paris Agreement, show their commitment towards changing the global emission trajectory to attain sustainable development. This helps in making sure that the global temperature remains below 2°C above the pre-industrial level (Asadnabizadeh, 2019). There has been a prediction that the current emission trajectory without any mitigation will result in a global temperature of about 3.7°C–4.8°C, which will be associated with catastrophic climate change effects. Schinko (2020: 20) postulates that “despite this dire prognosis, the political will for the consequent implementation of the 2015 Paris Agreement is still lacking, confirmed once again by the failure of the 25th Conference of Parties (COP) in Madrid to deliver on the implementation of the Paris Agreement”. Therefore, without a strong political will towards the formulation of the countries’ climate change targets and policies, the world is heading to a catastrophic future coupled with its inability of humanity to withstand these dire climate change effects.

4.7 INSTITUTIONAL AND CLIMATE CHANGE INERTIA WITHIN THE DEVELOPMENT DISCOURSE

Over the years, developing countries have blamed developed countries for emitting a vast amount of carbon dioxide, which resulted in the current climate change condition. It was discovered that climate change did not take place simultaneously with carbon emissions. The continuous carbon emissions resulted in the distraction of the troposphere, consequently, the climatic conditions started to change, which was characterised by the global warming up. Since climate change did not take place overnight, even its reversal is confronted with climatic inertia (Hossain, 2017; Mokgotho & Mokoele, 2020). This means that the effects of the current emissions will be felt in the

coming decades from now. The economic model that countries employ in fostering economic growth is very important to ensure that climate change is mitigated in the future. Taylor (2014) states that climate change is one of the fundamental sustainable development challenges confronting cities in developing and developed countries. Globally, countries that witnessed high economic growth have done so with no regard for environmental protection. Thus, countries continue to grapple with balancing environmentalism and developmentalism (Mokoele & Sebola, 2018). For the successful mitigation of climate change, countries need to reduce their high levels of emissions and protect the environment while growing their economy. However, many countries are confronted with institutional and political challenges such as budgetary constraints, lack of capacity to implement policies and political will. At the COP23 held in Bonn, Germany, from 6-18 November 2017, it was stated that many developing countries have demanded finance for the Adaptation Fund committed to funding climate change initiatives post-2020 under the Paris Agreement (Dröge, & Rattani, 2018). In developing countries, the funding will enable the implementation of climate change mitigation and adaptation initiatives and thus foster the reduction in atmospheric carbon emissions.

It was noted that to ensure climate change mitigation, there is a need for reducing the level of emission and behavioural change (Dröge & Rattani, 2018; Harou *et al.*, 2020; Schinko, 2020) from the political to the public orientated. Political leadership is very important in the promulgation of climate change policies and fostering behavioural change. This incapability to provide proactive policies to mitigate climate change is because of institutional inertia. Most organisations are unable to change from the old routine to new and innovative ways of doing things. Therefore, global organisational inertia remains a huge developmental problem in the quest to reduce atmospheric carbon emissions. Organisations continue to practice the 'business-as-usual ideology (Taylor, 2014). Within the contemporary environmental discourse, the idea to abate emissions and mitigate climate change calls for the notion of 'business unusual'. Taylor (2014) asserts that South African cities are confronted with barriers of departing from business as usual for effective formulation and implementation of policies in an attempt to mitigate climate change.

The organisational inertia confronting South African cities is not a unique case in an attempt to curb climate change. In this case, organisational and climate change inertia create convoluted and

twisted developmental problems that challenge the object of mitigating climate change. If countries and industries do not depart from the 'business as usual ideology' to business unusual, climate change will never be reversed but its ramification will continue to intensify. This requires a shift in conventional energy sources and production to more environmentally safe energy. To address the climatic inertia, there should be an intensive abatement of atmospheric carbon emissions (Mogano & Mokoete, 2019; Mokgotho & Mokoete, 2020). COP21 agreements in Paris state that countries should depart from their heavy reliance on the combustion of fossil fuel for generating energy to renewable resources such as solar power, wind, hydropower and nuclear power generation. However, it should be noted that to mitigate climate change, all countries should strive to abate their GHGs. Furthermore, not all countries in the world form part of the COP that explicitly strive to address climate change and achieve sustainable development. Thus, this has created a disjuncture in addressing climate change.

4.8 GREEN GROWTH: NEW ECOLOGICALLY FRIENDLY APPROACH TO CLIMATE CHANGE MITIGATION

It is worth noting that building consumes over 40% of energy (Hossain, 2017). Buildings contribute significantly towards carbon emissions and climate change due to the high consumption of electricity that is currently generated mainly from the burning of fossil fuels (Hossain, 2017). The change from heavily relying on the combustion of fossil fuel for energy generation has always been confronted with institutional and organisational inertia. Thus, the notion of business-as-usual continues to characterise the governance and management approaches of many organisations in developing countries such as South Africa. According to Kuo *et al.* (2015), the perception of many businesses about environmental management is that it is unnecessary and it obstructs cooperate development. The idea that environmental management is unnecessary and obstructive can be coined to the trade-offs between business performance and environmental law (Kuo *et al.*, 2015). The ecologists have always argued that the ecosystem is self-regulatory and offer various environmental benefits. Klimas and Lideika (2018) posit that greening has in recent years played a major role in urban planning. These self-regulatory systems have been destabilised by the rapid population growth coupled with continuous deforestation. Greening schemes for cities are included in the agricultural elements, which play a vital role in climate change mitigation and adaptation

strategies (Klimas & Lideika, 2018). Greening should not only be understood in terms of green places such as parks and plantations but also as an environmentally friendly strategy.

In the pursuit to reduce global carbon emissions, there is a need for the implementation of a new and innovative idea. Hossain (2017) argues that green science can be used as the most innovative building technology to mitigate climate change. Green science technology tries to harness the solar for electrification, use groundwater to avoid surface water sources and use the sludge as a source for biofuel for energy generation (Hossain, 2017). This is the most innovative technology, which creates a building that is independent and self-sustained. The fact that buildings consume over 40% of energy, means that it is important to ensure that there is an abatement of carbon emissions associated with building. The lights of most buildings in cities are always on, which increases energy consumption. Therefore, the buildings should be designed to harness solar as renewable energy. “Interestingly, light emitted by the sun that reaches the earth is one of the most plentiful renewable energy resources” (Hossain, 2017: 695). Additionally, Hossain (2017) argues that a building can be able to produce energy (solar and gas) and water to make it independent and thus can be used as a model for the abatement of carbon emission. The building should be fitted with technology that makes the walls or roofs to absorb solar energy. This shows that the reduction in carbon emissions is not the sole responsibility of companies and the government but it should be by all citizenry in a country. Environmental management and green innovation can be viewed as part of green governance (Kuo *et al.*, 2015) that is important for mitigating climate change.

The promotion of a green and low carbon economy is one fundamental route to achieve sustainable development (Kuo *et al.*, 2015). Scientifically, there is an estimation of 402ppm carbon dioxide currently in the atmosphere, which is causing global warming (Hossain, 2017). Interestingly, to achieve global cooling, atmospheric carbon dioxide must be abated to less than 300ppm (Hossain, 2017). Therefore, the building provides the potential to abate atmospheric carbon dioxide by over 40%. Due to the inertia of climate change, Hossain (2017) argues that it will take 61.2 years to cool the earth if green science is implemented, therefore it is estimated that it will take 62 years to reverse the inertia of climate change. This global cooling as a result of green science does not take into account the reduction of emissions from industries and other factors of the economy. The technology advocate for onsite treatment of wastewater to produce biogas, tapping into

groundwater and using the technology they harness solar energy (Kuo *et al.*, 2015; Hossain, 2017). However, the technology is very catchy and provides interesting strategies for the reduction of carbon emissions but it may prove impractical in most cities and urban centres. The impracticality may be attributed to space, unavailability of onsite conversion of sludge into biofuel and depletion of water in the aquifers and it may prove to be too expensive for the most middle-classed population in developing countries. This technology provides an interesting theoretical solution but it may confront various application barriers. Due to poverty in developing countries, the acquisition of such solar technology may be too expensive (Hossain, 2017) for ordinary citizens to procure.

The integration of green science and green governance can be used as a new and innovative idea to address climate change. The promulgation of environmental policy that obligate business to conform to environmental management is very imperative in climate change discourse. The disclosure of most businesses about their climate change action and green management, which include the abatement of GHG emissions is very imperative (Kuo *et al.*, 2015). Thus, it is the prerogative of the government to promulgate a policy that explicitly targets climate change mitigation and the abatement of GHGs. This commitment to reduce GHGs is a basis for climate change mitigation. The complexity of reducing GHG emissions is due to their multifarious sources such as transport, energy, manufacturing industries, agriculture and deforestation. Therefore, the reduction of GHGs is not a linear and simple process, hence in many cases, it is confronted with a barrier of organisational inertia.

4.9 INFUSING URBAN RESILIENCE IN CLIMATE CHANGE PLANS

Hossain (2017) suggests that even if green science technology is implemented, it will take at least 62 years for the reversal of climate change to global cooling. Hypothetically, because it will take over 62 years to mitigate climate change if green science is adopted, it then means that globally there are 62 years of adaptation. Therefore, cities must provide adaptation strategies coupled with the reduction of GHGs from other sources such as transport and industries to moderate the harm of climate change by adjusting human activities (Lee & Lee, 2016) while reducing the climate change inertia. The reasons behind adaptation in cities are to enhance the absorption of disturbance to retain the primary function and structure of urban areas. However, many cities

around the world continue to be challenged by the adverse effects of climate change. Coastal cities are most vulnerable to the rising sea level (Mukhopadhyay & Revi, 2009; Wolf & Gregory, 2013; Moriarty & Honnery, 2015) and other effects of climate change. Various coastal cities around the world have built infrastructure along the coast to reduce the encroachment of seawater inland (Mongala et al., 2019; Mogano & Mokoete, 2019). However, the encroachment of seawater into the inland is not the only problem facing coastal cities but also the increase in oceanic water temperature, which potentially disrupts the oceanic ecosystem (Wolf & Gregory, 2013; Moriarty & Honnery, 2015). The rising oceanic temperature increases the risk of natural disasters such as cyclones, floods and negative effects on aquatic life. Therefore, during the process of devising strategies to mitigate climate change, adaptation is an important objective that ensures that cities become adaptable to these environmental problems.

Urban climate adaptation can be viewed as the adjustment of urban systems to actual climatic conditions in a way to moderate the harm and thereby exploiting the opportunities (Taylor, 2015). On the other hand, Lee and Lee (2016: 598) postulate that climate resilience should be understood as the “capacity of an individual, community or institution to dynamically and effectively respond to shifting climate circumstances while continuing to function at an acceptable level”. This term demonstrates some level of similarities in terms of the ability of the system or city to respond to post perturbation. Thus, the terms resilience and adaptation have always been used interchangeably within the climate change adaptation plans. In urban areas, agents, systems and institutions can be seen as components of urban climate resilience (Lee & Lee, 2016) to demonstrate that cities are adaptable. Therefore, the effectiveness of urban planning coupled with the political will to promulgate climate change adaptation plans is determined by the ability of the city to implement measures to address the future changing climatic condition. It can be argued that mitigation without present adaptation measures for the contemporary changing climatic conditions will be confronted with various barriers. Countries that promote adaptation without plans to mitigate climate change demonstrate a short-sighted vision that has the potential to promote urban resilience shortly, which is not sustainable. This is attributed to the increasing levels of carbon emissions, which intensify the adversities of climate change. “Climate resilience systems provide robustness and redundancy, ensuring linked functions of water, ecosystem, energy, transport, and communication under climate change risks” (Lee & Lee, 2016: 600). It is important to ensure that

formal rules and frameworks are promulgated in the quest to attain climate resilience. Developing countries must put in place adaptation measures to ensure that cities remain functional beyond any natural disaster (Dodman, 2009; Kuo *et al.*, 2014; Lee & Lee, 2016; Pineda, 2016).

Lee and Lee (2016: 600) asserts that “to enhance urban resilience, formal rules like ordinances constrain or promote planning and implementing relevant policies” is required. Within this policy direction, other scholars have put forward the components of urban resilience, which can be understood as follows: redundancy, flexibility, capacity to recognize and capacity to learn (Lee & Lee, 2016). On contrary to those components, the World Economic Forum (WEF) suggests robustness, redundancy, resourcefulness, response, and recovery with vulnerability assessment and resilience building. These two sets of components offer an important dimension to ensure that cities are resilient and adaptable to the changing climatic condition. The set of components put forward by WEF provides an imperative ideology in promoting urban climate resilience. Cities must be robust, resourceful, have to ability to respond and recover post perturbation. However, the notion of resilience has not been welcomed by all scholars within urban planning discourses. Other scholars have argued against resilience in favour of the capacity of the city to be resourceful (Mehmood, 2016) in a way to plan and manage climate change. Contrary to this argument, the notion of resourcefulness is one of the components of urban climate resilience. Although the city’s ability to command adequate resources, it does not provide a comprehensive idea to effectively address climate change. Therefore, to ensure that cities are resilient to the contemporary changing climatic condition, a comprehensive strategy must encompass all the components of urban climate resilience.

According to Lee and Lee (2016) and da Silva *et al.* (2019), the notion of urban resilience is not only linked to adaptation but also the idea of sustainability. During urban planning and management, the policies should be able to demonstrate the 3R (Recognition, readiness, and response). Mehmood (2016) takes it further than just the 3Rs but indicates the idea that all cities should prepare, plan, respond, and recover from perturbations. Most of the plans are confined to the Prepare–Plan–Respond–Recover (PPRR) model of resilience, which is largely based on emergency “planning and recovery approaches that strive for ‘preparing’ for potential crises, ‘planning’ measures for such contingencies, ‘responding’ in time to such situations and ‘recovering’

the urban systems back into their original state” (Mehmood, 2016: 409). It is recognized that when scrutinizing 3Rs, the PPRR model, and the notion of urban climate resilience, it is important to note that they all embody similar features in adapting to climate change (Mehmood, 2016). Therefore, a comprehensive understanding of effective strategies coupled with the capacity to implement those policies that indicate the preparedness, robustness, redundancy, planning, response and recovery is important in ensuring that urban climate resilience is achieved.

The degree of climate change impacts on various city systems and rapidity to recover all depend upon the readiness, robustness, recognition and effective response (Lee & Lee, 2016). To ensure that cities are resilient and adaptable to climate change (da Silva *et al.*, 2019), urban planning must take robust actions in the promulgation of policies that stipulate the readiness, robustness, recovery and response. The readiness of cities to climate change adaptation is not dependent on the policy framework only but also on putting in place or upgrading infrastructures such as drainage, sewage systems and improved transportation system to ensure climate change resilience. The enforcement of policies by the central government to ensure that cities are adaptable and embody characteristics of urban resilience is important in adapting to climate change. Mehmood (2016) argues that resilience is one problematic concept to comprehend with yet showing promising signs in city planning and the ability to operate post disasters. Urban resilience assists with the management of the contemporary changing climatic conditions and ensures that the city bounces back to its normalcy (da Silva *et al.*, 2019). According to Lee & Lee (2016), the notion of revolutionary urban resilience seeks to initiate a system to evolve to better sustainability and quality.

4.10 STATE OF BINARY PARALYSIS IN MITIGATING CLIMATE CHANGE IN DEVELOPING COUNTRIES

Theoretically, the attainment of mitigating climate change seems very easy and linear, which is through the reduction of global atmospheric carbon emissions. Pragmatic evidence on climate change mitigation has demonstrated that in many developing countries such as South Africa, (Nhamo & Agyepong, 2019) Ghana and India continue to struggle to reduce the levels of carbon emissions meanwhile ensuring growth in their economic aspirations. Most developing and developed countries have devoted their time to ensure that they promote economic growth in

pursuit to improve their economic development and create job opportunities. Furthermore, 194 countries signed the Paris accord agreement to limit or abating the levels of carbon emissions to acceptable standards. This demonstrates the commitment of the global village to fight climate change. However, countries are confronted with the problem of the balancing act to maintain economic growth while abating the levels of GHGs emissions. In this regard, there is no pragmatic evidence of countries with high economic growth that managed to reduce their level of emissions. The densification of the urban population in most developing countries like India increased the need to provide electricity for all citizenry (Moriarty & Honnery, 2015) and grow the economy. The increasing need to provide electricity for all citizens will increase the combustion of fossil fuel to meet the energy demand. Therefore, the need for electricity coupled with the object to accelerate economic growth left most states in binary paralysis in the quest to reduce their carbon emissions and meet the climate change objectives. Developing countries like South Africa are confronted with the institutional and organisational inertia in promulgating policies to address climate change objectives (adaptation and mitigation). Furthermore, countries lack capacitated personnel and political will to plan and manage urbanisation in such a way as to reduce the effects of climate change. Developing countries are further confronted with the inability to provide adequate and sustainable basic service to their constituency. Therefore, added responsibility to implement climate change objectives without funding directly dedicated to attain these objectives derail the global village to address climate change especially in developing countries.

Most states are caught between a rock and a hard surface in balancing the abatement of carbon emissions and economic efficiency. Saytos and Sari (2009) argue that with the increasing combustion of fossil fuel for the generation of electricity within the climate discourse, the reduction of consumption energy can be seen as the direct way of dealing with carbon emissions. Developing countries are confronted by many developmental challenges including unprecedented levels of biodiversity loss, service delivery backlog, economic inefficiency, land degradation, water scarcity and rapid urban growth just to name a few (Asadnabizadeh, 2019; Harou *et al.*, 2020; Schinko, 2020). An economist will argue pro the promotion of economic growth against environmental protection. On the other hand, environmentalists are always advocating for environmental protection when development projects are initiated. The reduction of consumption of energy has always resulted in economic inefficiency. Therefore, due to the possible negative ramifications on

economic growth, cutting back from energy use is unlikely to be a trajectory to be traversed (Saytos & Sari, 2009). Economic inefficiency and environmental protection continue to paralyse most governments' ability to reduce carbon emissions in the quest to mitigate climate change. This state of binary paralysis leaves most government in a state of 'business as usual' in pursuit to address this undying human-induced phenomenon, which is climate change.

4.11 EFFECTIVE PLANNING AND MANAGEMENT OF URBANISATION TOWARDS CLIMATE CHANGE MITIGATION

The complexity of managing urbanisation continues to challenge most developmental and environmental planners throughout the world, particularly in developing countries. Ogbazi (2013) argues that conventional planning for and management practices in the cities have proved to be ineffective towards mitigating climate change. The failure of planning for and management of urbanisation in mitigating climate change in urban areas (Mongala *et al.*, 2019; Mokgotho & Mokoetele, 2020) calls for the rethinking of the planning and management paradigm practised in urban areas. The inability to plan and manage urbanisation has resulted in traffic congestion, high GHG emissions, air pollution, high production of wastes and unsustainable levels of electricity consumption (Allen, 2009; NUDF, 2009; Moriarty & Honnery, 2015; Zhang, 2015). The ever-increasing population growth, consumption of resources and increasing waste production have consequently resulted in the high levels of atmospheric carbon emissions, which led to the changing climatic conditions (Moriarty & Honnery, 2015; Shen *et al.*, 2016) in the present time. The occurrence of heatwaves and heat islands has increased the atmospheric temperature in urban areas (NUDF, 2009; Moriarty & Honnery, 2015), especially in South Africa. Moriarty and Honnery (2015) state that the vulnerability of climate change has been deepened by the densification of the urban population and physical assets in the cities. Allen (2009) acknowledges that planning for and management of urbanisation remain tricky and complex to comprehend and implement in pursuit to mitigate climate change.

Commissions during the United Nations Conference on Environment and Development (UNCED) in the early 1990s showed that sustainable development is not simply a new way to describe environmental protection but is a new concept of economic growth which provide fairness and

opportunities for all people in the world without destroying the world's natural resources and without further compromising the carrying capacity of the globe (Shen *et al.*, 2015). However, the application of sustainable development in the cities has challenged urban planners in finding innovative ways to mitigate climate change (Shen *et al.*, 2015). Urban planning is one of the few professions with a specific remit to encompass the areas of need such as economic, environmental and social factors in understanding climate change. Thus, urban planning becomes very instrumental in finding new innovative ways to ensure the adaptation and mitigation of climate change. However, a closer scrutiny at the nature of the developmental discourse reveals that problems do not simply imply that most of the population will be located in cities of developing countries, but that urbanisation does and will continue to have a profoundly significant impact on the carrying capacity of the earth (Allen, 2009).

Despite the notion that cities have to promote green growth, the brown agenda remains important in the operation of the city and generating economic growth. Urban planning must integrate these two different sets of concerns (brown agenda and green agenda) (Allen, 2009; Roy, 2009). The over-reliance on motor vehicles in South Africa contributes to the increasing levels of GHG emissions, which will contribute towards climate change. The improvement in the transport sector such as roads and public transport has the potential to reduce the over-reliance on private cars. Integrated transport planning connotes that the transport system must integrate not only motorised transport but only side walking and cycling to reduce traffic congestion. However, the spatial setup of most cities in developing countries does not effectively allow for the usage of cyclic and walking as a mode of transport to work and city. This is because of the fragments of colonial spatial planning that segregated people based on their race. The current trends of urbanisation demonstrate that it is unsustainable. Urban planning has failed to envisage the catastrophic problems associated with the urbanisation process. In South Africa, small streets, waterlogging in the city, inefficient sewage systems and traffic congestion demonstrate the inability of urban planning to envisage the challenges associated with urbanisation. Despite the important role urbanisation plays in the economy, it remains a "good evil" in most countries around the world.

Often, the wastes produced in urban areas are transported to a distant location for disposal (Mokoele & Sebola, 2018). This means that the origin of food, energy and the destination of wastes

remain invisible amongst the urban population, thus, result in the creation of dependencies that might not be ecologically or geographically stable, secure and sustainable (Allen, 2009). Allen (2009) noted that the problem is that the limits imposed by the expansion of the ecological footprint do not become evident until they are translated into local impacts such as increased environmental diseases, energy price hikes and high food prices as the results of climate change. The environmental induced challenges show that the increasing proportion of humanity in a defined location poses deleterious effects on their own lives. Since urbanisation is the contributing factor towards climate change, urban planners have a responsibility to plan to manage urbanisation to mitigate these challenges. It has been argued that if the fight against climate change is to be won, it will surely be won in the cities of developing countries (Allen, 2009; Moriarty & Honnery, 2015).

4.11.1 Effective Planning and Management of Urbanisation

The growth of the urban population has resulted in multiple challenges, thus proper planning and management of urbanisation are profound in the pursuit to mitigate climate change. Unplanned rapid urbanisation (Mokoele & Sebola, 2018) in the past decades posed a sustainable development challenge (Ogbazi, 2013; Mongala *et al.*, 2019; Mokgotho & Mokoele, 2020), which is evident in cities with the proliferation of rising temperatures, floods, drought, high emission and consumption of resources in urban areas. However, planning for urbanisation has not gone at the same pace with the challenges that cities are continuously facing challenges such as traffic congestion (Govindarajulu, 2014), the proliferation of slums, informalities, environmental degradation and climate change (Ogbazi, 2013; Mokoele & Sebola, 2018). The proliferation of all these urban problems provokes a deeper analysis of the urban planning systems. The conventional urban planning system has failed to resolve the problems entrenched in the cities, thus ensure a clear trajectory in the achievement of sustainable development.

UN-Habitat (2011) notes that even though urbanisation poses a serious threat to humanity in cities, it presents some advantages as well. Un-Habitat (2011) posits that the increasing density of people population increases the potential of innovative people such as shifting the sources of energy, green places, rainwater harvesting and generating biofuel from wastes. In the pursuit to effectively plan and manage urbanisation, innovation becomes the missing link in mitigating climate change.

The benefits of urbanisation must be harnessed effectively to afford the city with various approaches to plan for urbanisation. However, decades have passed, urbanisation remains the major contributor to catastrophic environmental phenomenon like climate change. The increasing density of the urban population remains less innovative to plan and manage the process. Another reason for the failure of urban planning in addressing challenges associated with urbanisation is attributed to the top-down, bureaucratic and techno-centric approach to planning (Ogbazi, 2013). Watson (2009) argues that the prime consequence of the inadequacy of addressing the complexity of climate change cannot be blamed only on planning. In most developing countries, the inadequacy of addressing urban problems is attributed to the fact that many countries have inherited a failing system of planning from the colonial system (Watson, 2009).

After the failure of the top-down, bureaucratic and techno-centric planning approaches, this compelled a shift in planning paradigm from central planning to a more decentralised type of planning approach. The participatory planning approach was now seen as an important factor in improving the effectiveness of addressing urbanisation and climate change. The improvement of participation in cities enhances good governance that is profound in addressing climate change (Ogbazi, 2013). Although participation is important in planning for the city, the concept of urban green became more profound in addressing climate change. The importance of green spaces is for the sequestration of carbon and mitigation of the impact of climate change (Nowak & Crane, 2002; Govindarajulu, 2014; da Silva *et al.*, 2019). Green spaces act as a buffer during extreme events like floods and thus, acting as a natural water basin thereby reducing the climate-related risk. In low-income countries, green spaces are profound in the mitigation of climate change, thus acting as a soft engineering strategy (Govindarajulu, 2014). Furthermore, policies have been recognised as vital elements to ensure proper management of urbanisation. In South Africa, the promulgation of policies and plans such as the Constitution of the Republic of South Africa, 1996, IDP, SPLUMA, Municipal System Act, 2000, Municipal Structures Act, 1998 and IUDF involves a participatory approach used to manage the areas with the jurisdiction of the municipality. The participation of the community within the municipal planning system is vital in managing and planning for urbanisation.

4.12 DEVELOPING INFRASTRUCTURE TOWARDS CLIMATE CHANGE MITIGATION

The process of urbanisation has contributed to the densification of the urban population, industries, better infrastructure and densified settlements. This new urban landscape has intensified the consumption of resources such as land, water and energy. Therefore, it is imperative to use the building as a panacea towards reducing GHG emissions. According to Shahid, Pour, Wang, Shourav, Minhans and Ismail (2017), over 80% of urban buildings life-cycle are dependent on the availability of water and energy. There is a need to construct buildings that are designed to ensure climate resilience (Shahid *et al.*, 2017). This means that the current buildings need to be renovated and fitted with the technology that helps to harness solar energy for lights and rainwater harvesting. According to Hossian (2017), buildings are responsible for approximately 40% of the global energy consumption and thus account for over 40% of emissions. The technology that ensures that buildings are climate-resilient holds the potential to reduce emissions and energy consumptions by at least the same proportion. This means that the current infrastructure needs to be upgraded to improve their efficiency in mitigating climate change. Additionally, to ensure that cities are adaptable to climate change, Shahid *et al.* (2017) state that there is a need to relocate populations that are located in extremely vulnerable settlements. The relocation of the population to a safer place is important for the city to be adaptable to climate change. The basis of this notion can be coined to the policy frameworks that integrate into two objectives of climate change, which are adaptation and mitigation.

To ensure that the fight against climate is won, countries like Malaysia have committed themselves to reduce the GHG emission levels by at least 45% by the year 2030 compared with the 2005 levels (Shahid *et al.*, 2017). Additionally, Malaysia has put in place policies that promote adaptation, which not only deals with the continuous functionality of the city but also the potential to reduce GHG emissions (Shahid *et al.*, 2017). This demonstrates that the enforcement of plans provide for innovative ways of harnessing the opportunity that urbanisation presents. This notion coincides with the commitment to integrate climate change policies to be adaptable at the same time addressing the mitigation objective. The construction of infrastructure in the cities has resulted in environmental degradation and deforestation. One of the major sources of GHG emissions is deforestation and forest degradation activities. According to Obergassel, Arens, Hermwille,

Kreibich, Mersmann, Ott, and Wang-Helmreich (2016), deforestation is responsible for approximately 10% of GHG emissions. Therefore, it can be noted that forests have the potential to store large amounts of carbon (Obergassel *et al.*, 2016). Therefore, the notion of deforestation ensures that there is carbon absorption, which serves as a way of limiting carbon emissions.

4.13 CONCLUSION

During the previous century, global GHG emissions have been rapidly increasing and successive strategies have failed to reduce the emission levels. The upsurge of carbon emissions has resulted in the intensification of climatic change. However, the successive Conference of Parties from 1992 have put out agreements about the abatement of GHG emissions and shift from relying on the combustion of fossil fuel for electricity generation. The conference of parties that was formed in 1992 is a global movement towards climate change mitigation. Globally, climate change is a prime example of an irreversible challenge facing cities. The persistence of urban environmental problems requires a shift in conventional urban planning approaches and principles to mitigate these problems. Urban centres are the prime emitters of GHGs, thus become the major drivers of climate change. Although cities are prime emitters of GHGs, they are most vulnerable to the impact of climate change. The vulnerability of cities to climate variability is experienced through the loss of economic benefits as a consequence of loss of production in the agricultural sectors. The urban expansion resulted in wide deforestation in pursuit to accommodate the urbanising city. Thus, green places that help in mitigating climate change have been reduced. The inability of urban planners to plan towards maintaining an equilibrium between improving the economy and protecting the environment has resulted in the intensification of climate change.

5 CHAPTER 5: URBAN RESILIENCE AND THE COMPLEXITY OF CLIMATIC RISK MANAGEMENT WITHIN THE SOUTH AFRICAN CONTEXT

5.1 INTRODUCTION

Urbanisation has changed the South African urban landscape with many people located in urban areas, thereby complicating the management of the cities. It was projected by UN-Habitat that the levels of urbanisation would increase significantly in the coming decades. Due to urbanisation, cities have increased both in size and population that resulted in the transformation of their morphology. According to Hossain (2017), buildings consume about 40% of energy and thus, responsible for a high proportion of emissions. Since electricity is mainly generated from the combustion of fossil fuel in South Africa, cities are responsible for the increasing levels of GHG emissions, which pose deleterious effects on climatic conditions. In terms of global carbon emissions, South Africa is currently ranked within the top 20 high emitters in the world (Cobbinah *et al.*, 2015, Cobbinah & Nimminga-Beka, 2017a). It is widely recognised that even if there are stringent global emission reduction and mitigation efforts towards the next decades, the occurrence of climate change is inevitable. Despite the continuous occurrence of climate change, countries have the responsibility to promulgate policies and legislations in an attempt to mitigate climate change.

South Africa has promulgated various pieces of strategies and policies in an attempt to reduce carbon emissions. In South Africa, policies and acts such as the Constitution of the Republic of South Africa, 1996 as the supreme law, National Development Plan (NDP), Integrated Development Plan (IDP), Spatial Planning and Land Use Management Act (SPLUMA) and the National Environmental Management Act (NEMA) coupled with the Sustainable Development Goals (SDG) are used as guiding instruments that provide direction to ensure environmental protection. The Constitution of the Republic of South Africa, 1996 states that all citizens have a right to an environment that is safe and is not harmful to them. Mapitsa (2019) states that the Constitution of the Republic of South Africa, 1996 in section 152 provides the local municipality and district municipality with clear roles and responsibilities of the local government.

Regular floods in Johannesburg, veld fire and drought in Cape Town (Nhamo & Agyepong, 2019) and other cities around South Africa demonstrate a lack of adaptability and resilience. The inability to adapt to climate change happens within the legislative prescripts that provide a clear approach towards climate change adaptation. This can be attributed to the challenges such as lack of capacity, lack of clear roles and responsibilities between local and district municipalities (Mapitsa, 2019) and lack of political will. The incapacity of the local government to implement adaptation and mitigation approaches to climate change results in the South African populace not realising their constitutional right. It has been acknowledged that the action to address the causes and impacts of climate change by a small group of countries especially developing countries will not be successful (National Climate Change Response White Paper, 2011). This is because developing countries are the least emitters of GHGs when compared to developed countries.

There is a need for concerted efforts between the developed and developing countries to mitigate climate change. The climate change policy stresses the fact that South Africa is contributing relatively low levels to the current global GHGs emissions (Mokgotho & Mokoelé, 2020). Despite this fact, South Africa remains very susceptible to climate change than some of the developed countries. Currently, the South African local government continues to struggle to provide its constituencies with basic services, due to their budgetary constraints, lack of capacity to implement policies and political will (Mapitsa, 2019; Mongala et al., 2019; Mogano & Mokoelé, 2019). Therefore, these multifaceted challenges confronting local government paint a dire picture in the quest to address climate change objectives (Mapitsa, 2019). Concerning the multifarious challenges confronting the city such as lack of political will, budgetary constraints and capacity; it is important to ask whether South Africa has the will and the capacity to effectively and efficiently plan and implement climate change objectives to address this environmental problem? There is a need for a shift in thinking patterns towards mitigating and adapting to climate change.

5.2 SOUTH AFRICAN POLICY CONTEXT

The global community has ventured into the fight against climate change through successive COP agreements such as COP21 (Paris, France in December 2015), COP23 held in Bonn in Germany (November 2017), COP24 held in Katowice, Poland (December 2018) and COP25 held in Madrid,

Spain (December 2019). However, the implementation of the agreements has been confronted with resistance from some developed countries with literature stipulating that they remain high carbon emitters. The adoption of the Sustainable Development Goals (SDGs) was part of the commitment to ensure the provision of affordable and clean energy (goal 7), sustainable cities and communities (goal 11) and climate action (goal 13). This shows a robust commitment by the United Nations (UN) in the fight against climate change. South Africa has promulgated various plans such as the IDP, SPLUMA and National Climate Change Response White Paper (2011) to address climate change.

The National Environmental Management: Air Quality Act (2004) in its preamble states that the atmospheric emissions of Ozone-depleting substances, GHGs and other substances have deleterious effects on the environment both locally and globally. The object of the Act is to enhance measures to protect the environment through the provision of reasonable strategies to ensure the enhancement of the quality of air. Section 2(a) (iv) states that the Act must give effect to section 24 (b) of the Constitution to enhance the quality of ambient air to secure the environment that is not harmful to the health and wellbeing of the people. The Act provides the local governments, which are the policy implementers, with a great avenue to reduce the level of GHG emissions in the country. Furthermore, the COP developed the Kyoto Protocol in 2015 that provides a mandate that all countries must aim at reducing greenhouse gas emissions from their respective sources (United Nations, 2015). This commits the international commitment to climate change mitigation and adaptation. However, the Kyoto protocol agreements were confronted with resistance from countries such as the USA. In South Africa, despite the promulgation of acts and policies on climate change, the implementation remains elusive. South Africa is not only confronted the problem of lack of capacity at the local government level but also coordination between departments, political will, lack of knowledge and budgetary constraints (Taylor, 2015).

5.2.1 The Constitution of the Republic of South Africa, 1996

Climate change is a notable reality affecting humanity in the 21st century (Dung & Sharma, 2017). It can be noted that climate change will be the greatest environmental challenge if GHG emissions remain unmitigated (Harou *et al.*, 2020). The increasing temperature, changing precipitation patterns, drought, floods and rising sea levels are some of the environmental problems facing

countries, however, developing countries like South Africa are most vulnerable to these natural disasters (Roy, 2009) associated with climate change. Chapter 2 of the Constitution of the Republic of South Africa, 1996 enshrines the rights of all people in the country and affirms the democratic values of human dignity. Furthermore, section 24(a) of the Constitution, 1996 states that all citizenry has the right to an environment that is not harmful to their health or well-being. However, the intensification of climate change that humanity is currently experiencing defeats this Constitutional right afforded to all people of South Africa. As a developing country, South Africa is most vulnerable to climate change effects such as drought, floods, heatwaves, heat island and seawater rising. The occurrence and severity of climate change in South Africa present a serious threat to the attainment of sustainable development. Poverty, food security and water provision are some of the developmental objectives that most developing countries are continuously struggling with and climate change poses deleterious effects on the attainment of these goals. To achieve the notion of sustainable development, there is an urgent need for environmental protection in all sectors of the economy in South Africa.

Section 24(b) of the Constitution of the Republic of South Africa, 1996 affords everyone the right to an environment that is protected, not only for the benefits of the present generation but also for the future generation. The notion of sustainable development is entrenched in the Constitution, 1996 (Mapitsa, 2019) to protect the environment and fight against climate change. Although the Constitution, 1996 affords people with the right to a development that is sustainable, South Africa continues to experience rising carbon emissions, rising temperature, changing weather patterns, rising sea levels, drought, floods and low rainfall levels (Balkaran, 2019; Mapitsa, 2019; Nhamo & Agyepong, 2019). All these effects demonstrate an environment that is not protected or sustainable for the future generation. Section 24(b)(iii) states that everyone has the right to a protected environment through reasonable legislative frameworks and policies to secure ecologically sustainable development and the use of natural resources while promoting justifiable economic and social development. However, 25 years since the adoption of the Constitution of the Republic of South Africa, 1996 as the supreme law of South Africa, the country continues to be confronted with environmental problems that have the potential to deter the achievement of sustainable development. Accordingly, Dung and Sharma (2017) argue that the belief that policies will eventually reduce climate change becomes problematic due to a large number of policy statements

that do not receive deserved attention. Therefore, great policies and legislations that aim to address climate change without capacitated personnel and proper actions on the ground threaten the achievement of sustainable development.

The former President of the Republic of South Africa Mr Jacob Zuma, on 18 September 2017, attended the Meeting of the Committee of African Heads of State and Government on Climate change at the UN Headquarters in New York, USA. He stated that climate change is an environmental problem that requires concerted efforts by all states to effectively adapt and mitigate this phenomenon (Mail and Guardian, 2017). However, the withdrawal of the USA from the Kyoto Protocol and Paris Agreement Accord demonstrates the lack of commitment and political will in fighting against climate change. Section 152(d) of the Constitution of the Republic of South Africa, 1996 states that the object of the local government is to promote a safe and healthy environment. This means that local government as the policy implementers must ensure that the levels of carbon emissions are abated in an attempt to mitigate climate change. However, the levels of carbon emissions from industries, motor vehicles and waste continue to rise. The concentrated sources of GHGs provide a focal point within which large emissions abatement can possible (Busby & Shidore, 2017). To provide a healthy environment, the local government should identify the major sources of GHG emissions and air quality monitoring systems. However, most local municipalities are confronted with the problem of providing a healthy environment while achieving healthy economic growth. According to Busby and Shidore (2017), in a country with fewer firms responsible for GHG emissions in a sector, the changes in their behaviour will radiate throughout the market quicker. Therefore, in cases where many actors are spread across a wide geographic area, the ability of the state to impose climate change mitigation regulations is very challenging (Busby & Shidore, 2017). Despite South Africa's commitment to afford citizenry a healthy environment, the multiplicity of emitters hampers the country's fight against climate change. Within the local government, cities as complex systems are among the greatest emitters in South Africa. Thus, to effectively combat climate change, planning for and management of urbanisation is imperative.

5.2.2 National Frameworks for Environmental Protection

The Department of Environmental Affairs (DEA) in South Africa has reported on the climate change mitigation policy and produced various reports that holistically intend to mitigate the harmful effects of climate change (DEA, 2014). This document provides a policy gap that analyses the alignment of the existing legislation, policies, strategies, plans and frameworks in all five key sectors such as agriculture, forestry and other land use (AFOLU), energy, transport, wastes, and industry - with the National Climate Change Responds Policy (NCCRP) (DEA, 2014). The NCCRP was developed as a policy framework that helps guide the commitment to fight against the increasing effects of climate change that South Africa is currently facing. Furthermore, the DEA analysed a national climate change monitoring and evaluation system of the AFOLU sector (DEA, 2015). This is because the AFOLU was accepted to be a sector that has the potential to play a meaningful role in South Africa towards a lower-carbon economy. This demonstrates the commitment of the South African government towards climate change mitigation and upholding the Paris Accord (DEA, 2015; Mokoale & Sebola, 2018). Therefore, it was recognised that there is no unequivocal understanding and synthesis between government and the private sector in terms of data collection, praxis or mandate about climate change mitigation. Consequently, this leads to the fragmentation of data collection practices that are not formally structured. This fragmentation between governments and the private sector continues to be visible through bad governance.

Climate Change Mitigation Policy Mainstreaming recognised that the effectiveness in the mitigation of climate change can be realised through the implementation of the Climate Change Sector Plan (CCSP) and the guidelines for the development of Spatial Development Frameworks (SDP). The CCSP was classified as a high-level policy document, which indicates the factors that must be considered in the subsequent implementation of plans to improve the chances of mitigation. Despite these national analyses of climate change mitigation plans and opportunities, this knowledge does not cascade down to the lower echelon of government (Mongala *et al.*, 2019). Furthermore, this data remains locked within the department's website without being shared with ordinary people to improve knowledge about climate change. The improvement of knowledge about climate change by the local people can help improve meaningful participation within local government. Therefore, the collaboration between the local, provincial and national governments

(Multilevel governance) (Mogano & Mokoee, 2019) holds the potential to nullify some of the persisting local government challenges in the implementation of climate change objectives such as capacity, knowledge sharing, political will and funding (Mongala *et al.*, 2019).

Table 5.1: South Africa's climate change priorities

NCCR WHITE PAPER	PRIORITIES
Risk reduction and management	Near-term adaptation interventions that address immediate and observed threats to the economy, ecosystem services and the health and well-being of the people. Research and develop short, medium and longer-term climate resilience, risk and vulnerability management policies and measures.
Mitigation actions with significant outcomes	Cost-effective and beneficial mitigation policies to reduce the GHG emissions trajectory, so that GHG emissions peak between 2020 and 2025, plateau for approximately a decade and begin declining in absolute terms thereafter.
Sectoral responses	Prioritise, following the provisions of this policy, the requirement for all key actors, organisations or participants in relevant sectors or sub-sectors. This includes preparing, submitting, implementing, monitoring and reporting on the implementation of detailed climate change response strategies and action plans. These plans would need to clearly articulate their roles, responsibilities, policies, measures and interventions or actions that would contribute to the achievement of the National Climate Change Response Objective measurably.
Policy and regulatory Alignment	Prioritise interventions already envisaged by national policies, legislation, or strategies that have climate change co-benefits. Particularly those that also contribute towards the national priorities of job creation and poverty alleviation or have other positive socio-economic benefits. Review existing national policies, legislation or strategies, to optimize and maximise the climate change co-benefits of the interventions. Integrate into the relevant existing or new policies, legislation or strategies with climate change response interventions that stimulate new economic activities, as well as those that improve the efficiency and competitive advantage of existing activities.
Integrated planning	Mainstreaming of climate change considerations and responses into all relevant sectors, and national, provincial and local planning regimes.
Informed decision-making and planning	Prioritise research, systemic observation, knowledge generation, information management, and early warning systems. These will increase our ability to measure and predict climate change and the implications of its adverse effects on the economy, society and the environment.
Technology research, development and Innovation	Prioritise cooperation and the promotion of research. Including investment in the acquisition of adaptation, lower-carbon and energy-efficient technologies. As well as practices and processes for employment by existing or new sectors or subsectors.
Facilitated behaviour change	Use of incentives and disincentives, including regulatory, economic and fiscal measures. This is to promote behaviour change towards a lower-carbon society and economy.

Behaviour change through choice	Prioritise education, training and public awareness programmes to build general public awareness of climate change. Empowering all South Africans to make informed choices that contribute to an economy and society that is resilient to climate change.
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Source: Department of Environmental Affairs, 2015

Table 5.1 demonstrates that the National Climate Change Response White Paper (2011) tries to capture the vulnerabilities that South Africa is confronted with in terms of climate change. Furthermore, the White Paper stipulates that there is a need for research to develop short, medium, and long terms goals in the quest to mitigate climate change. Cost-effective and beneficial mitigation policies must be developed to reduce the GHG emissions trajectory, particularly from its sources (industry, agriculture and energy). This is to ensure that the GHG emissions peak between 2020 and 2025, and thereafter, emission plateau for approximately a decade and begin declining in absolute terms (DEA, 2015). This is because climate change is an imminent threat confronting South Africa in the 21st century (Madzwamuse, 2010). Over the years, South Africa has developed adaptation strategies to adapt to rising sea levels (Taylor, 2015). In Durban, the adaptation strategy was implemented through the construction of walls at the seashores to avoid seawater intrusion into the inland (Taylor, 2015). However, South Africa continues to struggle in terms of developing strategies to adapt to other effects of climate change such as floods, droughts and heatwaves. Madzwamuse (2010) in the climate change vulnerability and adaptation preparedness in South Africa stated several factors that undermine the adaptive capacity of small-scale farmers, which are attributed to social, governance and economies. The factors that undermine this adaptive capacity are gender, land tenure and user rights, governance, poverty and to some extent, culture and indigenous knowledge (Madzwamuse, 2010). Prioritisation of research and the development of low-carbon emission and energy-efficiency technologies are important in the development of smart cities (Balkaran, 2019). According to Balkaran (2019), city planners are increasingly shifting technology to address some of the challenges facing the city such as traffic congestion, enhancing liveability and high consumption of non-renewable resources.

South Africa continues to emit more GHGs into the atmosphere despite having documented strategies and policies to mitigate and adapt to climate change. Therefore, this indicates that there is a mismatch between the development of policy, legislation and strategic frames to mitigating

climate change and its implementation at the local level. Multilevel governance tries to bridge this development gap (Mogano & Mokoeele, 2019; Mongala *et al.*, 2019) in terms of bringing all affected stakeholders into planning for climate change mitigation and adaptation. A National Climate Change Response Strategy for South Africa (2004) in its executive summary states that the object of this strategy is mainly to support the policies and principles stipulated in the Government White Paper on Integrated Pollution and Waste Management and other pieces of legislations that aim to address climate change.

South Africa has developed various pieces of legislation that attempt to address the effects of climate change, however, the country continues to witness these effects. In December 2017, the City of Cape Town, South Africa experienced the worst drought with the dam water levels at their lowest in 19 years (Muller, 2019; Nhamo & Agyepong, 2019). It was during this time that it was widely published that the city might reach day zero. Day zero simply means that the day when the city will be absolute without water. Surprisingly, the current droughts and water shortages in Cape Town were envisaged before 2018 but the country continues to witness these effects. According to Makelane (2020), South Africa is approaching physical water scarcity by the year 2025, which will hamper the socio-economic development of the country. South Africa is expected to face a 17% water deficit by the year 2030 with the drought attributed to climate change (Makelane, 2020). Therefore, despite its strategies and policies, South Africa continues to face challenges due to its lack of adaptive capacity towards climate change. This inability of the local government to implement climate change mitigation and adaptation measures is because of the fragmentation of urban governance and poor urban planning in the country (Mogano & Mokoeele, 2019). Koch, Vogel and Patel (2007) assert that climate change is a cross-cutting issue and one where all spheres of government and other stakeholders need to collaborate in addressing this phenomenon.

The South African government has two formal bodies (Government Committee on Climate Change (GCCC) and National Committee on Climate Change) that coordinate the implementation of the response strategy across the departments and the coordination of climate change (Koch *et al.*, 2007). These two formal bodies exist at the national level where policy formulation takes place but are absent at the local level where implementation must take place. The absence of these bodies that are responding to climate change policy formulation creates multiple problems during

implementation. The idea of adaptation is contextual, which connotes that cities are confronted with various effects of climate change. This requires different approaches to climate change adaptation. Notwithstanding this notion, scholars argue that the implementation of climate change is done at the local level by the local government (Mapitsa, 2019). According to Koch *et al.* (2007), it is worth noting that there is a dearth of commitment from various departments in sending representation to these bodies or committees. The reason for this could be the constitutional mandate to deliver service to the entire population while climate change is a secondary objective. The lack of coordination between the central and local governments deter the implementation of climate change policies at the local level.

Koch *et al.* (2007) stipulate that the South African government operates as a hierarchy that assumes that climate change objectives should cascade down to the local level to foster implementation. According to Koch *et al.* (2007: 1331), the Chief Director of DEAT commented that “government operates as a hierarchy and with such a top-down method of working, climate change should trickle down” from the upper to the lower echelon of government. The Chief Director acknowledged that climate change requires to be integrated into the government’s day to day planning processes and further be incorporated into the business plan of each department to enforce implementation at all departments. This “fails to take into account the importance of local-scale governance, other stakeholders, and the links between these different levels and institutions” (Koch *et al.*, 2007: 1331). The continuous failure to adapt and mitigate climate change can be attributed to the lack of coordination and alignment from the central to the local government. Multilevel governance increases the link and coordination between various departments and governments in an attempt to address climate change (Mogano & Mokoetele, 2019; Mongala *et al.*, 2019). NCCRS (2004) states that to adapt to climate change and embrace the ability to respond to various impacts, there should be capacity building within local government. This helps to ensure that the policies and legislations promulgated will adequately address climate change mitigation and adaptation (NCCRS, 2004). The central government must make sure that various departments at the local government do not prioritise some services over climate change. Therefore, climate change needs to be addressed in such a way that assists departments to achieve their service delivery objectives, which can be done through the so-called win-win or no regrets measures.

5.2.3 National Development Plan

Scholars have documented that developing countries such as South Africa are most vulnerable to climate change (Taylor, 2015; Mapitsa, 2019; Nhamo & Agyepong, 2019). The vulnerability to the impact of climate change has the potential to derail the attainment of various development goals such as food security, poverty reduction, provision of potable water and other basic services. Therefore, the South African government formulated a document that directs the country's development trajectory. In the pursuit to attain some of the development goals, the National Development Plan (NDP) vision 2030 was formulated as a guiding principle for the country's development trajectory. The NDP promotes a collective responsibility to address the complex problems confronting South Africa. It is a "plan for the country to eliminate poverty and reduce inequality by 2030 through uniting South Africans, unleashing the energies of its citizens, growing an inclusive economy, building capabilities, enhancing the capability of the state and leaders working together to solve complex problems" (National Planning Commission, 2012: 1). South Africa has promulgated policies to address climate change adaptation but the country remains vulnerable to climate change. Currently, the Western Cape, Gauteng, Limpopo, and Kwa-Zulu Natal Provinces have been experiencing climate change effects such as floods, wildfire, drought, and heatwaves.

The inability of the country to implement measures to adapt and mitigate climate change will make the realisation of these goals impossible to attain. Complexity theory has demonstrated that climate change is one of the most complex problems to mitigate. Therefore, to mitigate climate, the reduction of GHGs is an eminent goal. Climate change mitigation and adaptation are not linear and simple processes but embody non-linearity, which is an embodiment character of complexity theory. The NDP notes that GHG emissions have changed the atmospheric gaseous composition. This has influenced the changes in the climatic conditions and potentially imposing significant global costs, which will fall disproportionately on the poor, particularly in developing countries such as South Africa. Developing countries still lack the capacity at the local level in terms of skilled personnel and funds directed to climate change, thus, derailing the commitment to achieve these climate change objectives. During the 19th century, South Africa exploited mineral resources with no regard for the environment (NPC, 2012). However, the country is committed to building and

fostering the enhancement of the resilience of people and the economy to climate change (NPC, 2012). Currently, South Africa has demonstrated a commitment to address climate change and ensure that its people and economy are adaptable. This has been done through the promulgation of policies, construction of high volume drainage systems around the city, and construction of structures along the coast to circumvent the encroachment of seawater into the inland (Busby & Shidore, 2017). Despite these plans, the drainage systems around the city remain inadequate to deal with floods. Furthermore, the country is committed to the reduction of GHG emissions and improve energy efficiency (NPC, 2012; Busby & Shidore, 2017; Dung & Sharma, 2017). The reduction of GHG emissions in the atmosphere is one effective way of mitigating climate change. Therefore, this shows that climate change has made inroads into the development discourse.

South Africa is still behind concerning the provision of electricity to its population. The country is still relying on burning coal for electricity generation. The current consumption of energy has resulted in the burning of more fossil fuels to cater for the growing demand. Therefore, the increasing proportion of people with electricity will result in an increment in carbon dioxide emissions, which is one of the contributors to climate change (NPC, 2012). The Department of Energy formulated an Integrated Resource Plan 2010-2030, which lays out options in policy to move towards more climate-friendly sources of energy generation (NPC, 2012). The plan calls for the generation of electricity through renewable energy capacity by the year 2030. This is an important development trajectory to combat climate change. The NDP calls for the implementation of an energy mix (solar, petroleum, nuclear, water and limiting the use of coal) in South Africa in the quest to address climate change. However, years since the adoption of the NDP, the country remains heavily dependent on fossil fuel (coal) for energy generation and the path towards renewable energy remains to be seen. Although South Africa recognised climate change as an imminent threat to development, the path to addressing its ramification without hampering economic growth remains complex. Therefore, Lawson (2015) argues that climate change decision making is complicated by various scientific uncertainties, its long time frame for the emergence of the effects to occur and the global nature of the problem. On the other hand, all climate change mitigation frameworks and policies are confronted with climate change inertia, which deters the commitment of many countries to addressing this problem.

The promulgation of legislations and policies by the South African government to address the nature of climate change was confronted with challenges. In most cases, South Africa is confronted with problems such as lack of capacity to implement policies, funding problems and the inability to foster the integration of policies. The complexity of climate change is not only found in the scientific uncertainty but it is further confronted with a lack of funding, lack of capacity, lack of communication and coordination of the existing climate-related initiatives as well as deepening stresses of poverty and health issues (Lawson, 2015). Since the adoption of NDP, South Africa has committed itself to low-carbon emissions. In pursuit of the low-carbon emitting power sector, there is a need to balance higher costs with a variable supply that accompanies new and renewable energy sources. The NPC (2012) in the NDP argues that although the costs of implementing renewable energy technologies such as solar panels are falling; they remain higher than the conventional power technologies in South Africa. Thus, the country is faced with the problem of costs versus environmental sustainability. Lawson (2015) indicates that stakeholder participation typically involves the usage of participatory processes to integrate different opinions to ground the decisions into relevant, feasible and implementable pieces of advice. Therefore, the notion that the costs of implementing renewable-energy technology should be based on the top-down approach where stakeholders are not included in decision making has the potential to derail the objective. Since climate change affects all people, there is a need to foster stakeholder participation when approaching environmental challenges. Furthermore, NPC does not recognise the indirect emissions that buildings account for in terms of electricity consumption. Therefore, incorporating stakeholders into planning will increase the personal usage of solar energy to reduce the dependence on conventional energy technology. The usage of solar energy from the buildings will reduce the cost of generating energy by the Department of Energy and Mineral Resources.

5.2.3.1 Nuclear power

Globally, the use of uranium as a source of generating electricity has been declining over the years. However, in pursuit to achieve low carbon-emitting power stations, South Africa aims to commission nuclear plants for electricity generation (NPC, 2012). Although nuclear power does provide an alternative low-carbon emitting power station, "South Africa needs a thorough investigation on the implications of nuclear energy, including its costs, financing options,

institutional arrangements, safety, environmental costs and benefits, localisation and employment opportunities, and uranium enrichment and fuel fabrication possibilities” (NDP, 2012: 172). The pronouncement of the adoption of nuclear power in parliament by former President Jacob Zuma was confronted with resistance from different opposition parties even from some of the African National Congress (ANC) Members of Parliament. This resistance was based on the financial implications and the safety of the implementation of nuclear power during the financial crisis, which South Africa found itself in. On the other hand, nuclear power has been characterised by various environmental disasters, which might have catastrophic intergenerational ramifications on the people of South Africa.

The Integrated Resources Plan states that South Africa should provide an alternative electricity generation should nuclear energy prove too expensive, lack sufficient financing and/or tight timelines. The NDP indicates that South Africa must implement an alternative energy mix, which includes gas, hydropower and solar power systems. Gas could provide alternative and reliable base-load power generation through combined-cycle gas turbines (NDP, 2012). The generation of electricity through gas has the potential to reduce carbon emissions into the atmosphere. However, it was discovered that the operational costs of implementing gas power stations was much higher than that of nuclear power. Despite the higher operational cost of gas stations, the unit capital costs are cheaper, easily financed and can adjust their output to make up for the shortfall from variable renewable energy sources.

5.3 INTEGRATION OF CLIMATE CHANGE RESPONSE WITHIN LOCAL GOVERNMENT

According to IPCC (2013 cited in Cottrell, 2016), contemporary natural disasters such as tropical cyclones, heatwaves, landslides, bushfires, surges and floods; are envisaged to increase in quantify and intensity as a result of the intensification of climate change. A city like Cape Town in South Africa continues to experience intensifying bushfires and drought that threaten both the ecosystems and humanity (Nhamo & Agyepong, 2019). Therefore, planning has been recognised as the protection of local infrastructure to build urban resilience and reduce risk post-disaster (Cottrell, 2016; da Silva *et al.*, 2019). Furthermore, this will encourage the provision of safe land and more hazard resilient structures, thereby enhancing the reduction of an underlying risk factor.

In South Africa, the Department of Environmental Affairs and Tourism (DEAT) is responsible for integrating the climate change objectives within the sector and other departments. Despite the DEAT's environmental responsibilities to safeguard the environment, the implementation of climate change mitigation and adaptation are still without a designated person or portfolio. After the recognition that climate change is a cross-cutting issue that poses adverse ramifications even in other government departments (NCCRS, 2004), there is a need for concerted efforts to address these environmental problems. Many government departments and other stakeholders should work together in order to integrate efforts on climate change into planning. Therefore, during planning for climate change, various departments and other stakeholders must be integrated from the inception until the implementation stage. Koch *et al.* (2007) argue that within the South African context there is a continued gap of knowledge, understanding and evaluation of how the institutional networks operate within a climate change discourse. The dearth of knowledge and understanding from the local government in terms of how the institutional network operator is not limited only within local government but also within local communities.

If local government is to adapt to the adverse effects of climate change and to adequately prepare for the impacts, all the stakeholders need to be capacitated in terms of these issues. NCCRS (2004) states that this capacity building helps to ensure that policies that aim to address climate change mitigation and adaptation adequately are not only formulated but are implemented. Capacity building in terms of climate change remains the biggest challenge that most local governments are facing. Koch *et al.* (2007) state that South Africa's policy and its position at the international level in terms of climate change lack synergy. The Chief Director of the DEAT argued that the strategy in the international negotiations seem to be reactionary, whereas South Africa is pushing for a more proactive approach towards climate change mitigation and adaptation (Koch *et al.*, 2007; Dannevig *et al.*, 2012). Despite the push towards more proactive strategies on climate change, local government is still confronted with multifarious challenges such as budgetary, capacity and aligned policy formulation. The local government is still facing a mammoth task to reduce the basic service delivery backlog bequeathed by the apartheid regime. Therefore, the balance between the provision of basic service and the implementation of climate change policy presents a daunting challenge to the South African local government. Along this line of thinking, the collaboration between different government departments become very difficult to implement.

Challenges such as budgetary constraints, political will, capacity, policy alignment and accountability remain the greatest impediments towards the achievement of climate change integration (Mogano & Mokoele, 2019). Therefore, the application of multilevel governance towards addressing climate change mitigation and adaptation (Mongala *et al.*, 2019) can offer a profound solution in bridging the budgetary constraints, political will and capacity within local government and the community. Multilevel governance provides an avenue that enables different skills and competencies to be adequately harnessed within the government (NCCRS, 2004; Koch *et al.*, 2007; Dannevig *et al.*, 2012). Furthermore, Bifulco, Tregua, Amitrano & D'Auria (2015) state that to integrate development initiatives in urban and metropolitan municipalities effectively, it must be done through the efforts of different stakeholders. This means that for the effective implementation of multilevel governance, other stakeholders must be willing to address this persistent environmental problem. The engagement of citizens in the decision-making processes (Bifulco *et al.*, 2015) in the planning and management of urbanisation has the potential to ensure adaptability and mitigation of climate change. This is because the urban population is responsible for high electricity consumption (Hossian, 2017) as they use electricity-intensive appliances such as geysers, pool pumps, stoves and heaters. The involvement of the urban population will enable the reduction in electricity consumption, thus making an impact on climate change mitigation and adaptation. This means that individualism within the climate change discourse will find it difficult to effectively and efficiently provide solutions to these problems. Therefore, Bulkeley & Betsill (2005) argue that within the climate change discourse, the focus on urban areas has meant that the analyses tend to detach the local from others in terms of the environmental governance and ignores the important changes in the ways in which local areas and economies are governed. This type of thinking reflects a broader tendency within the literature of environmental politics where their decision making has been examined as though they are independent (Bulkeley & Betsill, 2005). Therefore, within the politics of environmental management and governance, decision making needs to be widely decentralised to the lowest level such as the community level. This has the potential to reduce the level of resource consumption at the local level.

5.4 MULTILEVEL GOVERNANCE AND CLIMATE CHANGE MITIGATION

Many scholars have recognised climate change as a multidimensional and complex concept to address in terms of adaptation and mitigation in which numerous states and non-state actors are involved stretching from the global, national and local scale of government (Bulkeley & Betsil, 2005; Koch *et al.*, 2007; Dannevig *et al.*, 2012). Many countries in the world have promulgated policies and legislations that aim to improve their adaptive capacity (Koch *et al.*, 2007). In terms of mitigation and adaptation to climate change, it has been argued that the responsibility for its implementation has been discharged at a local level (municipal level) (Mapitsa, 2019). Thus, the local government is confronted with a mammoth challenge to ensure compliance with global and national aspirations in terms of climate change mitigation and adaptation. However, the achievement of climate change goals at the city level has been pursued through the implementation of the sustainable city, which is embodied in the NDP. Bulkeley and Betsill (2005) postulate that although a sustainable city is recognised as a desired policy goal, its meaning in practice remains less certain and to a greater extent elusive.

According to Bulkeley and Betsill (2005), the implementation of a sustainable city was reduced to a more technical matter of institutional restructuring, traffic management, architectural design and the development of green technology. However, this does not nullify the importance of the technical matter of climate change mitigation and adaptation. Bulkeley and Betsill (2005) argue that analysing sustainable cities in terms of the introduction of the techno-centric models and wish lists has meant that critical questions concerning political struggles confronted in defining what is entailed in the meaning in the concept have been neglected (Mokoele & Sebola, 2018). Therefore, the inability of the local level to succinctly and unambiguously clarify the meaning of the sustainable city meant that the ability to mitigate and adapt to climate change will remain elusive and without pragmatic evidence to support it.

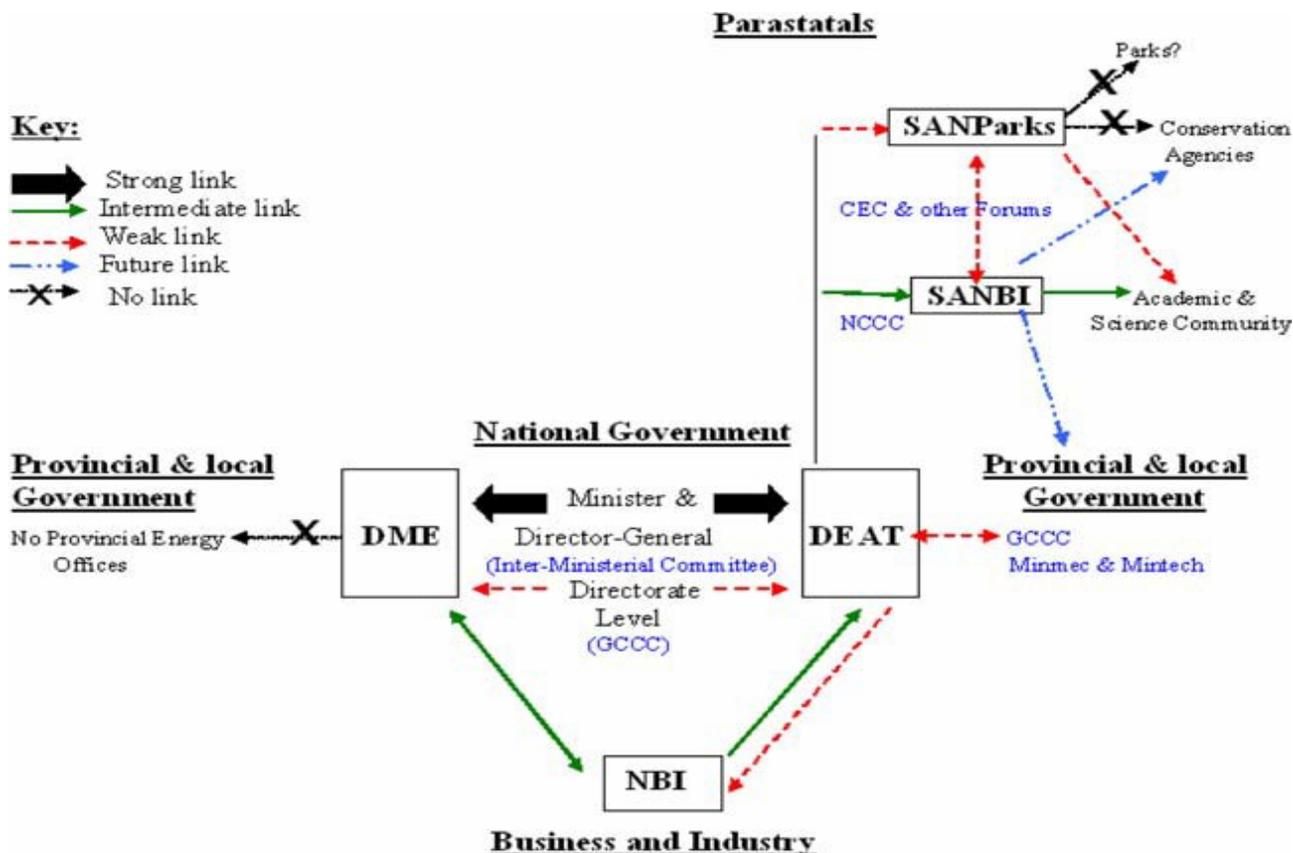
In South Africa, the implementation of climate change objectives has been confronted with multifaceted challenges such as lack of political will, lack of capacity, service delivery problems and budgetary constraints. Koch *et al.* (2007) argue that climate change challenges the conventional analysis of international, national policies and power. This is because climate change is a

multidimensional problem where the traditional separation between global and domestic politics and policy processes is inappropriate in addressing these environmental problems at various scales (Koch *et al.*, 2007). Due to its multidimensionality, climate change requires concerted effort from the global, national and local levels (Mogano & Mokoete, 2019; Mongala *et al.*, 2019). Therefore, this multidimensionality of climate change requires multiple actors, this collaboration can be described as multilevel governance. Dannevig, Rauken and Hovelsrud (2012) posit that it has been widely recognised that vulnerabilities unfold and adaptations are discharged at the local level of government. Studies have shown that the adaptation of countries to climate change is determined by a range of institutional, economic and social factors (Bulkeley & Betsill, 2005; Koch *et al.*, 2007; Amundsen, Berglund & Westskog, 2010; Dannevig *et al.*, 2012). Institutional factors, organisational structures and administrative routines have been identified as the most important determinant of the local government's adaptive capacity (Dannevig *et al.*, 2012).

The question is, do developing countries like South Africa create capacitated institutions that have the capacity to address climate change? Despite the acknowledgement of institutional factors as being crucial and necessary to ensure adaptive capacity at the local government, it is not sufficient for adaptation and mitigation of climate change. This can be attributed to the multidimensional nature of climate change and the lack of funds to implement climate policies. Thus, the implementation of climate change policies cannot be achieved by local government alone but the application of a multilevel governance model (national, provincial, local government, civil society, local communities, private sectors, business and academics) provides an enhanced ability to adapt (Mongala *et al.*, 2019). Multilevel governance in addressing climate change helps to close the gaps that most commentators and policymakers have frequently associated with the dearth of local knowledge or experience among local officers and councillors about climate change (Bulkeley & Betsill, 2005). Multilevel governance connotes that various actors need to be inculcated in planning for and implementation of climate change objectives to upscale the odds of success. However, in most developing countries, the involvement of various actors (national, provincial, local level, local communities, academics, and conservation parks) are confronted by the lack of political will (Mongala *et al.*, 2019). The lack of political will in terms of climate change mitigation and adaptation has resulted in a huge challenge of non-adaptive nature of the cities. South Africa just like other developing countries, is confronted with a lack of capacity and knowledge about climate change at

the local government level (Koch *et al.*, 2007), which creates a problem in the implementation of climate change goals. The collaboration between various government levels, Non-Governmental Organisations (NGOs), Non-Profitmaking Organisations (NPO), communities and conservation parks have the potential to bridge the knowledge and capacity gap that continues to characterise the local government level.

Figure 5.1: Institutional networks in the climate change arena



Source: Koch *et al.* (2007: 1332)

Multilevel governance helps to bridge the challenges such as knowledge gaps, political will and lack of research to increase new innovative ways in an attempt to address climate change. Koch *et al.* (2007) have created a multilevel governance framework to indicate the connections between government levels, businesses, industries and academics within the institutional network in the climate change arena. Figure 5.1 indicates that there is no integration or alignment in terms of addressing the adverse effects of climate change and no link between provincial, local governments

and the Department of Minerals and Energy (DME). In other cases, there are weak links between departments and other involved parties. This means that the fight against climate change will continue to lose traction due to the inability to implement a collaborative approach. For the local government to gain traction in the implementation of climate change goals, there is a need to consolidate linkages between government departments, academics, NGOs, communities, private sectors and conservational parks (Mongala *et al.*, 2019). The involvement of various stakeholders has the potential to bridge the challenges such as capacity, knowledge gap and funding, which continue to characterise local government across various developing countries (Koch *et al.*, 2007; Mongala *et al.*, 2019). Although the South African government continues to struggle to integrate departments in addressing the adaptive capacity of cities and communities; this is not sufficient but a necessary condition to address climate change. Therefore, the implementation of climate change policy provides an imperative condition in addressing climate change goals.

In most developing countries, the promulgation of climate change policy was affected by the lack of clear roles indicating who is responsible to implement the policy and without a clear mandate from the central government to carry out the duties. In other countries like Norway, the central government has a role to enforce the implementation of climate change policy on local government. Furthermore, Amundsen *et al.* (2010: 277) argue for the combination of local and national government activities, “in which local level organise their planning, which is their areas of expertise, while the national governments prioritise the policy foci”. Therefore, the national government is given a role to identify areas of prioritisation, which the local government is obligated to implement (Amundsen *et al.*, 2010). On the contrary, in national governments that are not entirely focused on adaptation and mitigation of climate change, most municipalities have not included them within the risk and vulnerability plans. The absence of climate change implementation efforts at local government is owed to lack of prioritisation from the national government (Amundsen *et al.*, 2010). Ideally, this means that the coordination between local, provincial and national government coupled with the central government prioritising implementation of climate policy goals provides an important avenue to the successful implementation of climate change goals (Mongala *et al.*, 2019). However, different communities and cities differ in terms of what they are vulnerable to? What do they need to adapt to? How do they adapt? This relegates the conventional state-centric ideology in addressing climate change to just a policy discourse without any pragmatic evidence on the

ground (Mongala *et al.*, 2019). Therefore, the local knowledge by the locals is important to capture the climate context of an area without the central government imposing adaptation and mitigation strategies that might not apply in another context. The top-down approach to planning and management creates a problem during the implementation of climate change mitigation and adaptation. The national government's involvement in the mitigation and adaptation to climate change will increase the political will and thus, ensure concerted efforts towards policy implementation.

5.5 CREATING STAKEHOLDER NETWORKS IN ADDRESSING CLIMATE ISSUES

A network of stakeholders in the climate change discourse can be viewed as one of the most important dimensions in the quest to mitigate and adapt to this phenomenon (Mongala *et al.*, 2019). Scholars have argued that local governments as implementers of policy are faced with various challenges such as budgetary constraints, lack of integration of climate change issues into local plans (IDP and Integrated Transport Plan) and lack of political will (Koch *et al.*, 2007; Mongala *et al.*, 2019). Furthermore, literature has demonstrated that this approach of local government as the sole implementer of climate change mitigation and adaptation fails to gain traction due to the multifaceted local challenges (Mogano & Mokoetele, 2019; Mongala *et al.*, 2019). However, the involvement of stakeholders (Mongala *et al.*, 2019) offers municipalities a unique approach when addressing climate change. Stakeholder involvement from planning through to the implementation helps the municipalities to embrace the indigenous knowledge or community knowledge. The engagement of various people from different sectors increases the technical expertise, capacity and efficiency that South African local municipalities like other local governments have been lacking, thereby increasing the potential to implement climate change mitigation and adaptation policies.

The point of departure in multilevel governance is its ability to embrace the significance of the local communities and both the provincial and national governments in planning for climate change mitigation (Mongala *et al.*, 2019). In South Africa, there has been a serious concern about the high consumption of electricity and it was popularised through various media channels but its effectiveness in getting the national populace buy-in remains the largest part unknown. An effective

shift in thinking from overreliance on electricity towards the embracement of different technologies such as solar, petroleum, nuclear and gas to generate energy can be done through the buy-in of the local communities. This can be achieved without local government using its constrained budgets to fund the change in the type of technology that helps to reduce electricity consumption. Furthermore, the ability and willingness of the local government to influence and engage the community about this shift have the potential to reduce the consumption of electricity, which will, in turn, abate production. The abatement of electricity production from fossil fuels will result in the lowering of the level of GHGs emissions. Therefore, the creation of a stakeholder network is important for formulating and implementing climate change policies and making South Africa to have an adaptive capacity towards climate change.

The local government should create a network of all stakeholders within a climate change discourse to try to circumvent some barriers that are entrenched or characterise this lowest echelon of government. This can be linked to Juhola's (2015) question on whether there is a misconception that the barriers can be addressed adequately at the local level. Juhola (2015: 341) argues that the barriers of "clear roles and responsibilities of the local government and the absence of statutory obligations and the interplay of other policies constrain the local sector more than its capacity". The argument shows that there is a need that all levels of government must be involved to address this barrier. Due to the complexity of climate change, the local government must embrace all stakeholders to circumvent some of the problems entrenched within the local municipality. Multilevel governance offers the South African local government the potential to be adaptive, thereby enhancing the ability towards climate change mitigation.

5.6 GOOD GOVERNANCE AT THE LOCAL LEVEL

Numerous studies have demonstrated that developing countries are most vulnerable to extreme weather events attributed to climate change, therefore, the local level is the one that continues to feel the brunt of these weather events (Mirza, 2003; Filho, Platje, Gerstlberger, Ciegis, Kääriä, Klavins & Kliucininkas, 2016). Mirza (2003) points that developing countries spend US\$35 million a year in damages due to natural disasters associated with climate change. To address the problems of climate change, local government remains imperative to the implementation of

mitigation and adaptation policies. Local government is constitutionally mandated to promote deeper democracy and thus ensures environmental protection. Furthermore, Bulkeley and Betsill (2005) argue that local government has considerable practical experience in addressing environmental issues. Many local governments have undertaken steps to put in measures for the reduction of the effects of climate change. However, it can be argued that despite the experiences that local governments have towards addressing environmental issues, in many cases there is nothing much that has been done to address the effects of climate change. Therefore, the local government continues to struggle to implement an environmental policy that helps in mitigating climate change.

Mongala *et al.* (2019) argued that the incorporation of local knowledge is profound during planning and policy implementation. However, the implementation of community participation in the local government is important to promote good governance and deepen democracy at the local level. Good governance is important within local government in the implementation of climate change policy. Filho *et al.* (2016) note that governance is imperative for the successful implementation of policy and sustainable development. It is widely acknowledged that effective planning and management in cities is imperative for the achievement of sustainable development. This means that governance is an important factor during the implementation of climate change policy. During the implementation of government policies, collective processes of monitoring, debate, reflection and decision making establish an orientation for policy (Filho *et al.*, 2016). This means that all the stakeholders within the local municipality are important in the implementation of climate change policy. However, fostering collectivism or stakeholder engagement during the implementation of the policy is not a linear process within the local government.

The process is confronted with both internal (lack of capacity, political will, lack of clear roles and responsibilities during planning etc.) and external factors (lack of interest from the community to participate and lack of knowledge) within the local government. Therefore, there is pragmatic evidence in South Africa that supports the fact that local government continues to fail to incorporate the community and other stakeholders into planning. Consequently, most local governments do not account for their constituencies. The absence of collaboration between the local, provincial and national governments compounds this challenge. The inability of the local government to engage

stakeholders derails the efforts to improve good governance. Therefore, within the climate change policy discourse, the inability to engage the local people during planning, management, implementation, monitoring and evaluation of environmental policies derails the efforts to mitigate climate change. Hence, the concept of sustainable development will remain an elegant concept without pragmatic evidence to support it. Collaboration between various actors or stakeholders at a local level, especially in the city, has the potential to reduce resource consumption, conserve energy, and change their attitude towards the use of public transport and the usage of methods that protect the environment. This is the basis of multilevel governance (Mongala *et al.*, 2019) which provides local government with the potential to address environmental issues particularly, climate change mitigation and adaptation. The basis to foster adaptation policy into mitigation plans is important because the goal to mitigate climate change can be derailed by the inability of a country to be adaptable.

At the local level, Bulkeley and Betsill (2005: 45) contend that the reduction of GHGs in the urban arena is imperative for four reasons:

“First, given the increasingly urban nature of the global population, cities are sites of high consumption of energy and production of waste. Moreover, local authorities have a degree of influence over these emissions, through energy supply and management, transport, planning, and waste management, in ways that are more or less independent of the central government. Secondly, the proliferation of the Local Agenda (LA21) has shown that local authorities are both willing and able to take on board the complex sustainable development agenda. Thirdly, local authorities are key actors in the urban arena in terms of coordinating action between different partners and facilitating community involvement with policy programmes. Finally, some local governments have considerable experience in addressing environmental issues, and many have undertaken innovative measures and strategies to reduce their impact on climate change which can act as demonstration projects or form the basis for new experimentation”.

The LA21 was developed explicitly by the United Kingdom (UK) central government to address environmental issues and the achievement of sustainable development (Bulkeley & Betsill, 2005). Amundsen *et al.* (2010) advance the argument beyond the development of LA21 to the importance of budgets within local government in an attempt to mitigate climate change. Amundsen *et al.* (2010) argue that “budgetary constraints have been put forward as important considerations in the implementation of adaptive measures”. Therefore, local government is confronted with challenges

such as capacity, budget, political will and stakeholder engagement, which derail the efforts to implement climate change mitigation and adaptation policies.

5.7 IMPLEMENTING CLIMATE CHANGE ADAPTATION AT THE LOCAL GOVERNMENT LEVEL

Globally, many countries have promulgated strategies and legislations to ensure that they mitigate and are adaptable to the adverse effects of climate change. In South Africa, these plans and strategies remain only a policy framework at the national government without any pragmatic evidence on the ground. On the other hand, some countries promulgate these plans but they remain at the national or provincial level, which fails to cascade down to the local level where implementation takes place. Some scholars argue that the absence of a legislative framework or a drive to implement climate change mitigation and adaptation measures is due to the lack of the national government's commitment to enforcing compliance (Taylor, 2015). The local government is confronted with a mammoth challenge to provide basic services to their constituencies while implementing climate change policies within a constrained budget (Taylor, 2015). According to Dannevig *et al.* (2012), adaptation and mitigation to climate change have been put into the agenda in all municipalities albeit with wide differences in terms of implementation levels and efforts. However, one of the most important hindrances towards the implementation of climate change policies has been identified as the lack of capacity within the local government.

Some municipalities in the world have commissioned very expensive disaster management and assessment plans and developed different methodologies to assess climate risks (Dannevig *et al.*, 2012). The danger of applying such type of costly assessment might lead to a municipality been discouraged if it does not meet its desired outcomes. Furthermore, poor municipalities will not be able to afford such costly climate risk assessments while still grappling with the provision of basic services to ordinary citizens. Thus, some scholars are proponents of integrating climate change aspirations with the constitutional obligations by the municipalities, which are at the level of provision of basic services (Bulkeley & Betsill, 2005; Moser & Ekstrom, 2010). However, Bulkeley and Betsill (2005) argue that the global, national and local environmental politics within climate change discourses take place in isolation. Consequently, this lacks adequate questioning of the

geographical imaginations, which underpins the notion of nested and discrete scales of those who are mandated as political authorities over the environment. Therefore, an alternative approach to climate change was through an understanding of the important roles that planning plays in the pursuit of climate protection. An important role of planning in order to protect the climate change blurs the boundaries by meshing the global and local spheres. It can be argued that climate change cannot be addressed in isolation but requires concerted efforts from the global, national, local and other stakeholders if any success has to be made within these discourses. Moser and Ekstrom (2010) further postulate that the barrier to implementing climate change mitigation and adaptation are those malleable ones that can be overcome with efficient and effective political will, social support, resources and concerted efforts. In South Africa, resources such as budgets, human resources and infrastructure remain the major barriers towards the implementation of climate change mitigation and adaptation coupled with other developmental responsibilities at the local level.

To effectively address climate change, Dannevig *et al.* (2012) developed four steps that can be used to implement climate change adaptation. These steps are considered as indicators for measuring the implementation of climate change adaptation and provide a thorough assessment of climate change adaptation implementation measures from problem formulation until the implementation stage (Dannevig *et al.*, 2012). Despite the development of these various indicators for the implementation of policy, the idea of the multilevel approach towards climate change should not be neglected. Firstly, the assessment of the need to implement policy in some sectors: the achievement of this indicator requires a municipality to formally decide on the desire and the commitment to assess the risk and vulnerability to climate change and plan to adapt (Dannevig *et al.*, 2012). Therefore, the formal decision and commitment to assess these risks and vulnerabilities help to provide a goal-directed plans and condition the concerted efforts to mitigate climate change. The municipality can make these decisions during their council meetings; the declaration from the mayor or the statement in the municipal plan (Dannevig *et al.*, 2012). The dearth of climate change policy implementation can be attributed to the absence of national policy and legislative framework that mandates the municipality to implement such policies.

Secondly, qualitative risk and vulnerability assessments and/or adaptation measures are identified in municipal plans. According to Dannevig *et al.* (2012), the achievement of this indicator can be done either through carrying out a thorough qualitative assessment of climate change and/or by identifying adaptation and mitigation measures in the municipal plan. This shows the importance for the municipalities to have unambiguous plans that indicate the risks and vulnerabilities to climate change. Furthermore, since adaptation is context related, there is a need for the municipality to provide a detailed plan on how to adapt to climate change. Dannevig *et al.* (2012: 8) has defined a qualitative vulnerability assessment as an “evaluation of information and data (such as climate scenarios, hydrological or geological data) by specialists in the municipality or external experts”. Within the climate change discourse, the implementation of adaptation and mitigation should go beyond just unpacking and understanding data but must embrace plans on how to implement adaptation policies. However, some municipalities, especially the poor ones, lack the capacity in terms of specialists to assess and interpret climate change risk and vulnerability assessment. Dannevig *et al.* (2012) postulate that the general risk and vulnerability assessment that does not explicitly aim to address climate change do not qualify in this stage.

Thirdly, quantitative vulnerability assessment, adaptation measures identified in plans and adaptation measures implemented in regulations should be considered. According to Dannevig *et al.* (2012), a quantitative vulnerability assessment can be referred to as an assessment that includes modelling of climate change impacts such as drought, floods, sea-level rise, surface water accumulation or avalanches. The municipality should be able to quantify the risks to climate change. To achieve this stage, it requires that adaptation measures be identified in municipal plans and that various municipalities account for adaptation and mitigation in the regulations. The national and provincial governments must take responsibility to ensure that the municipality goes past this stage through the enforcement of policy to adapt and mitigate climate change. Therefore, multilevel governance enables (Bulkeley & Betsill, 2005; Koch *et al.*, 2007; Mongala *et al.*, 2019) the implementation of qualitative and quantitative vulnerability assessment to reduce some of the challenges that municipalities are confronted with on a day to day basis. Lastly, structural measures and/or adaptation should be mainstreamed in the regular planning process. Municipalities must at all times embrace that commitment to adapt and mitigate climate change in planning at all levels. Therefore, the achievement of the climate change adaptation will be realised when the municipality

has completed all these stages and then mainstream climate change into the day to day planning processes (Dannevig *et al.*, 2012). To address climate change at all levels, this subject must be a continuous discourse to enhance knowledge and understanding of the risks and vulnerabilities that humanity is facing, thereby providing proactive measures to address it.

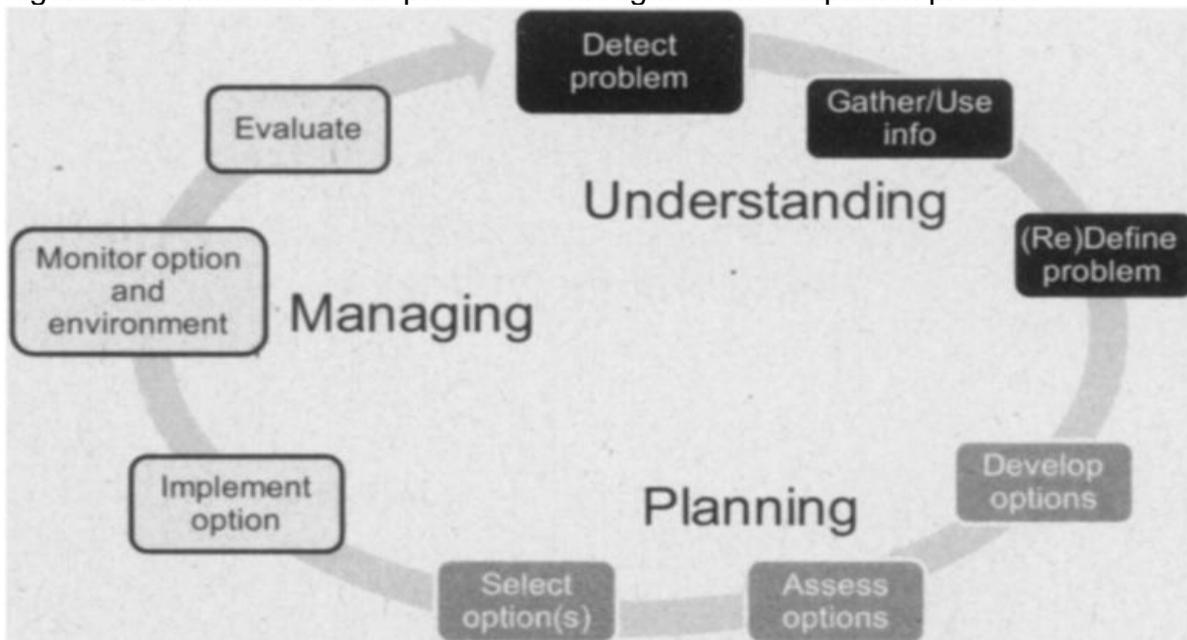
The categorisation of all these adaptation achievements becomes unambiguous and enables a better understanding in explaining various degrees of implementation. The application of these indicators is divorced from the challenges that municipalities are continuously confronted with. Therefore, multilevel governance can be used as a model to help bridge the gap between the implementation of climate change policies (Mongala *et al.*, 2019) and the challenges municipalities face by bringing the national, provincial, local government and other stakeholders around the same table on climate change discourses (Bulkeley & Betsill, 2005; Koch *et al.*, 2007; Bifulco *et al.*, 2015). Due to the multifaceted challenges that the municipality is facing, it is important to explore the barriers in the implementation of climate change objectives.

5.8 BARRIERS TO IMPLEMENTING CLIMATE CHANGE ADAPTATION

Dannevig *et al.* (2012) provided indicators towards the implementation of climate change adaptation and the requirements to achieve climate change objectives. However, the implementation of climate change mitigation and adaptation policies within municipalities is not a simple, unambiguous and straightforward process. Urban areas are key players in addressing this unprecedented environmental change and the provision of a clearer understanding of climate change objectives. The notion of the barrier refers to the obstacles that can be overcome through numerous means, and this includes the shift in thinking and management culture, prioritisation, creative management, concerted efforts, political will or social support, resources, land uses and institutions (Moner & Ekstrom, 2007; Juhola, 2015). The social barriers that are malleable with increased political will and accessibility of resources (Moner & Ekstrom, 2007) are related to the social and cultural processes that govern how communities respond to climate change stimuli (Juhola, 2015). These barriers include normative and institutional determinants amongst others such as denial, helplessness, values and caste (Juhola, 2015).

Literature continues to indicate that barriers can be divided into various categories, which are institutional, social, international and financial constraints (Juhola, 2015). All municipalities must put in place plans to address all the barriers within their ability and capacity. Those barriers beyond the local government’s ability and capacity to deal with require concerted efforts between national, provincial, local levels and all stakeholders (Mongala *et al.*, 2019) to circumvent all the malleable problems. The inculcation of all affected stakeholders into planning through multilevel governance holds the potential to address climate change adaptation barriers. However, Moser and Ekstrom (2010) argue that the ability of local municipalities to address all the climate change barriers does not necessitate the successful implementation of the policy. A hypothetical smooth and barrier-free municipality is not a sufficient condition to guarantee the successful implementation of climate change adaptation (Moser & Ekstrom, 2010). The local level of government continues to face lack of different types of capacities such as political will, human resources, expertise, knowledge and information, which deter the ability to adapt (Juhola, 2015). Another important barrier towards the implementation of climate change adaptation and mitigation is the application of ‘business as usual’ attitude, which limits the commitment to be adaptive. Therefore, there is a need for a change in ideology in the way governments think and address climate change.

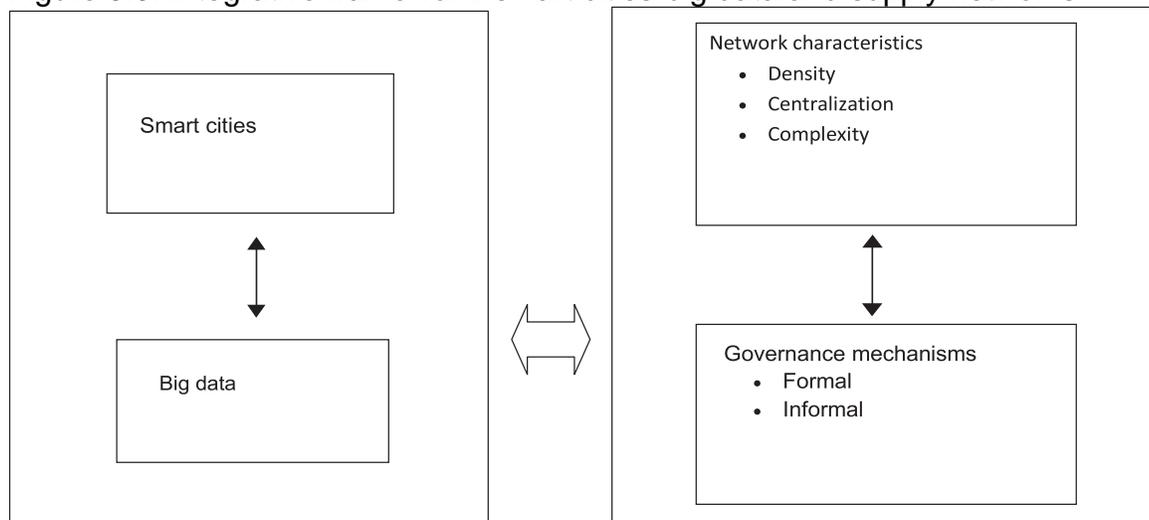
Figure 5.2: Phases and sub-processes throughout the adaptation process



Sources: Moser & Ekstrom, (2010: 22027)

The promulgation of policies without capacitated personnel to implement them deters the capacity of cities to adapt. Moser and Ekstrom (2010) developed phases through which the implementation of climate change adaptation and mitigation can be achieved. Figure 5.2 demonstrates that adaptation to climate change is not a project but a never-ending process that goes through continuous phases such as understanding, planning and managing processes. A thorough understanding of climate change adaptation and mitigation, which takes place through problem detection, gathering information and the ability to define a problem is imperative (Moser & Ekstrom, 2010). Since climate change adaptation is context-based, the understanding stage is important to be able to derive what is needed and what municipalities are adapting to. Figure 5.2 shows that the local municipalities should follow the stages, due to the potential that they provide in ensuring that climate change policies are implemented. Though these phases do not take place without the presence of barriers, the involvement of the national, provincial, local government and other stakeholders will assist to limit and control budgetary and capacity constraints that municipalities are confronted with. Furthermore, this climate change adaptation process requires municipalities at the local level to have adequate capacitated personnel at every phase to foster the effective implementation of the policy. The inculcation of national, provincial and local governments within climate change discourses will assist to bridge the capacity challenges at the local level (Mongala *et al.*, 2019). Therefore, municipalities must create networks of stakeholders to gain traction when addressing climate change issues.

Figure 5.3: Integrative framework: smart cities-big data and supply networks



Sources: Graham *et al.*, (2015: 240)

Integration within climate change discourses has always offered the potential to deal with complex phenomena. Therefore, the integrative framework in cities or urban areas tries to explore the opportunities that big cities offer (Graham *et al.*, 2015). This framework was proposed by Graham *et al.* (2015) to analyse the interplay between big-city data and networks. Figure 5.3 shows that the integrative framework encompasses two components, which are network characteristics and governance mechanisms that are both linked to big-cities data. The provision of data within cities is important to gather and keep abreast with the contemporary climate change discourses. This helps the municipality to continue to be adaptive through time. It is argued that the use of big data in the current technological sphere assists to ensure the use of technology to solve the contemporary problems confronting societies. The concept of big data has been used in marketing to ensure that the market keeps abreast with the current market trends. However, within urban planning and management, Artificial Intelligence (AI) or big data has not been fully utilized to address societal problems. Though the notion of a smart city has been debated by various scholars (Graham *et al.*, 2015; Balkaran, 2019), its implementation especially in developing countries remains a pipe dream. The components of smart cities are the introduction of the smart economy, smart mobility, smart environment, smart people, smart living and smart governance (Das & Emuze, 2014; Bifulco *et al.*, 2015; Graham *et al.*, 2015; Balkaran, 2019). Therefore, big data can be used as an important source of data that can be used to ensure that urban planning is kept abreast with current trends. However, the implementation of smart cities is not a straightforward process. In developing countries, the multiplicity of challenges within the local government have a huge potential to derail the implementation of smart cities. Lack of adequate financial resources, capacitated employees and infrastructure can derail the implementation process. Although it cannot be denied that big data in the modern era is important, its implementation in urban planning in developing countries remains a large grey area.

5.9 CONCLUSION

Climate change has been one of the greatest challenges that humanity confronted with, particularly during the 21st century. Countries like South Africa have implemented mitigation and adaptation approaches to circumvent the harsh realities of climate change. The quest by the South African government to implement an energy mix and reduce the heavy reliance on coal for energy

generation remains an envisaged reality. The NDP acknowledges the importance of the energy mix in an attempt to mitigate climate change. Although it is important to implement the energy mix, it has been argued that the implementation of solar panels is too expensive for local governments to procure. The triple challenges that are confronting South Africa deter the implementation of the energy mix. Although it can be acknowledged that the procurement of solar panels to generate electricity can be expensive, this approach should not be left without exploring ways to implement it. The public should be involved during public and management processes of climate change mitigation and adaptation campaigns to ensure good governance. The local government should encourage their constituencies to stall solar geysers, use gas stoves and heaters to reduce electricity consumption. Some of the private hospitals are currently install solar panels as a backup in cases of electricity blackouts.

Scholars have argued that local government does not have the financial resources to carry out climate change mitigation and adaptation policies. Local government alone will find it difficult to address climate change. Therefore, the introduction of multilevel governance is an important model to ensure that climate change is addressed in a more coordinated and collaborative manner. Since multilevel governance aims to ensure collaboration amongst civil societies, communities, the private sector, the public sector and other departments, present the potential to circumvent some of the problems that local governments continue to face. However, it is worth noting that multilevel governance is not without challenges. Lack of local knowledge and unwillingness to participate in climate change mitigation and adaptation can be a serious predicament in the implementation of multilevel governance. The local government should ensure that the public is aware of climate change and its potential impacts on South Africa; to ensure full and effective public participation. It can be concluded that the promulgation of climate change policies and legislations without an appropriate way to integrate various sectors in planning will remain ineffective and inefficient to solve the complexity of climate change mitigation and adaptation. Therefore, multilevel governance serves as an approach that helps various departments and sectors to coordinate, collaborate and cooperate to address climate change.

6 CHAPTER 6: RESEARCH DESIGN AND METHODOLOGY OF THE STUDY

6.1 INTRODUCTION

The notion of research has been understood as a systematic investigation towards adding value to scientific knowledge (Kothari, 2004; Bless, Higson-Smith & Sithole, 2013). This can be done through the application of different research methods and methodology to enable the researcher to determine the effective approaches which municipalities can employ to plan and manage urbanisation. Research methods can be understood as methods or techniques such as questionnaires, interviews, sampling techniques (simple random sampling and purposive sampling) and analysis techniques that are used to undertake research. According to Kothari (2004: 8), “research methodology is a way to systematically solve the research problem. It may be understood as a science of studying how research is done scientifically”. Research methodology provided various methods that are important to undertake the study during the planning stage and the execution stage (Sarantakos, 2005; Bless *et al.*, 2013) to evaluate the effectiveness of planning for and management of urbanisation towards climate change mitigation in the City of Polokwane. The study adopted a mixed methods approach to investigate the perception of both the local communities and municipal officials about planning and management in the City of Polokwane. Therefore, the City of Polokwane is the most urbanised and populated in Limpopo Province, South Africa. The City of Polokwane is the economic hub of the Limpopo Province and thus, attracting people from various parts of the province and neighbouring countries.

The economic activities, traffic congestion, population and urbanity were key considerations during the selection of the study area. The study was undertaken in the City of Polokwane, which is located under the Polokwane Local Municipality. The data were collected from areas around the City of Polokwane (Legae la Batho, Emdo Park, Serala View and Flora Park) and officials in Polokwane Local Municipality and Capricorn District Municipality. For many years, research has been very important in exploring and uncovering the truth and, thus takes place in two stages: the planning stage and the execution stage (Sarantakos, 2005). A detailed plan is constructed on how to conduct the whole research from the planning stage to execution stage, which entails data collection (both secondary and primary data) until the analysis of data. According to Kothari (2004: 31), “research

design is the arrangement of conditions for the collection and analysis of data in a manner that aims to combine relevance of the research purpose with economy in procedure. The research design is the conceptual structure within which research is conducted; it constitutes the blueprint for the collection, measurement and analysis of data.”

6.2 RESEARCH DESIGN, APPROACHES AND METHODS OF THE STUDY

To precisely answer the research questions and ensure that the collected data are valid and reliable, a detailed plan and appropriate research design are very important. Research design is a guiding plan that helps to direct the research activities, which assist rationalise the usage of time and resources; thereby reducing the costs during execution of the research (Sarantakos, 2005). The study adopted a normative research design to explore and examine the effective planning and management of urbanisation in mitigating human-induced environmental problems such as climate variability and climate change. Under the normative design, the study adopted correlational research. Correlational research entails that during the inception, the research makes a statement that predicts the relationship between at least two concepts and the results obtained offer more than just a clear description of the reality. Correlational research helped to evaluate the correlations between urbanisation and climate change.

The study employed both qualitative and quantitative approaches to comprehensively provide a clear evaluation of the effectiveness of planning for and management of urbanisation towards climate change mitigation. Qualitative and quantitative approaches are important research approaches in uncovering and exploring the reality and existing laws that define the world humanity resides in (Bless *et al.*, 2013). The qualitative approach emerges as a result of philosophical beliefs that the truth is a relative concept and that “knowledge is constructed” by human beings (Bless *et al.*, 2013). This connotes that the conceptualisation of truth and knowledge is constructed. Therefore, the application of qualitative approaches in research enabled the researcher to be inventive and create new ideas. On the other hand, the quantitative approach emerged from the philosophical beliefs based on the notion rooted in the understanding that the world runs according to natural laws and these pre-existing laws need to be explored and uncovered by scientists (Bless *et al.*, 2013). Quantitative data predominantly relies on numbers and statistics for analysing and

interpreting the research findings that can be generalised to the entire population. Bless *et al.* (2013) assert that numbers are exact and have a fixed meaning. The use of quantitative data is profound in that the meaning of the data collected will remain the same from person to person and from context to another. The interview was used to solicit qualitative data. Furthermore, quantitative data were collected through the use of a questionnaire.

6.3 DESCRIPTION OF THE STUDY AREA

The City of Polokwane was chosen as the study area, which is located in the Polokwane Local Municipality, Capricorn District Municipality, Limpopo Province in South Africa. The City of Polokwane is geographically located at the centre of Makhado, Tzaneen and Mokopane towns. The rate of urbanisation has been increasing over the years, with people from rural areas and external migrants coming in large numbers into the city. The densification of urban inhabitants has resulted in traffic congestion, informal settlements, high consumption of electricity and natural resources; the reduction of productive land in urban areas and increasing waste production. There is an increasing level of traffic congestion in the City of Polokwane, particularly during peak hours, which is early morning and late afternoon. Emissions from vehicles are a major source of pollution in urban areas (Rautenbach, Walton & van Nierop, 2006) and the City of Polokwane is no exception. Thus, urbanisation has increased the density of urban dwellers, resulting in air pollution, which has affected the climatic conditions. Although the City of Polokwane is small as compared to many other cities in India like Mumbai and Bangalore, which emit a lot of pollutants and also affected by heatwaves and floods; proper planning for and management of urbanisation in mitigating climatic change remains important to achieve sustainable development.

Despite the densification of the urban population, the City of Polokwane is surrounded by manufacturing industries and a mine that contribute to the increasing levels of GHG emissions. The city has different manufacturing industries that produce various products, thus responsible for the proportion of the Greenhouse Gas (GHG) emissions. The main sources of pollution in the City of Polokwane include informal settlements, the Polokwane Industrial Area that is situated 1.5 km north of the Polokwane City centre, the Witkop Silica Mine, Witkop Kiln, Witkop Tailings Dump and the Polokwane smelter (Murray, 2004; Rautenbach *et al.*, 2006). Thus, to reduce the level of pollution

facing the City of Polokwane, the Capricorn District Municipality is currently using the ambient air monitoring system around the city to monitor the levels of emissions, which emanate from various sources of pollution such as the Anglo Platinum and Silicon smelters (Rautenbach *et al.*, 2006). The City of Polokwane is the economic hub of the Limpopo Province.

Figure 6.1: The geographic map of the City of Polokwane



Sources: Map data, 2020

6.4 KINDS OF DATA REQUIRED

The study adopted a theoretical discourse on the complexity of urbanisation and used empirical data based on the planning and management approaches employed in cities. The data that were required for the study were the typologies and methodologies of planning employed in the cities. Furthermore, the study required the methods that urban planners use in the management of urbanisation. Factual data that were needed for the study were the methods employed to reduce GHG emissions to mitigate climate change. Opinion data were solicited on the current planning and management praxis in pursuit to address the environmental problems emanating in the city. Furthermore, to promote inclusivity in planning and management of urbanisation, community participation is very important in cities. The study needed data about public inclusion in planning for urbanisation and the emergence of environmental problems in the cities. The data on the approaches to planning and management provided a profound insight into understanding

urbanisation in South African cities. The study required data on the disjuncture between policy and practice in planning for and management of urbanisation in mitigating climate change.

6.5 TARGET POPULATION

According to Bless *et al.* (2013), the target population refers to a set or subset of elements that the research focuses on to solicit valid empirical data. The target population of the study was the City of Polokwane, which is located within the Polokwane Local Municipality. The City of Polokwane is the capital city of Limpopo Province, which continues to attract many citizens both from rural areas and other countries. The target population was based on the planning practitioners and departments around the city. This target population included officials responsible for Integrated Development Plan (IDP), environmental planning and the Director of Development and Planning. However, during the process of data collection, the Director of Development and Planning in the Polokwane Local municipality was sought including people in IDP and urban and spatial planning. However, these people were not reachable during data collection while others did not understand aspects relating to planning and management in the Polokwane local municipality. The urban residents formed an integral part of the target population in exploring the levels of participation during planning for and management of urbanisation.

6.6 SAMPLING PROCEDURES

The study employed both probability and non-probability sampling designs to solicit pertinent data from the respondents. Probability sampling refers to the chance or probability of including every element of the population into the sample (Sarantakos, 2005; Bless *et al.*, 2013). The application of probability sampling enabled the researcher to estimate the accuracy of the generalisation of research findings to the entire population using the sample. The sample size of the study was 185 respondents. In Legae la Batho and Emdo Park, a total of 67 and 71 respondents were sampled respectively. Furthermore, there were 27 respondents in Serala View while 20 respondents were sampled in Flora Park. The total number of males sampled were 86 while females were 99 in the study.

Table 6.1: Participants in the study by location and gender

		Villages				Total
		Legae la Batho	Emdo	Serala View	Flora Park	
Gender	Male	26	31	16	13	86
	Female	41	40	11	7	99
Total		67	71	27	20	185

Non-probability sampling was based on the non-random selection of the sample. On the other hand, Bless *et al.* (2013: 166) describe non-probability sampling succinctly as a case where “the probability of including each element of the population in a sample is unknown”. This means that not every element in the population has an equal probability of being included in the sample. The application of both probability and non-probability sampling increased the possibility of the results being both representative and valid.

6.6.1 Stratified Sampling

Based on probability sampling, the study adopted a stratified sampling design to solicit data from the target population. Stratified sampling design involved the classification of groups or elements and thereafter selecting a sample from the strata. According to Bless *et al.* (2013), the principle of stratified sampling is to divide a population into groups that are referred to as strata. Furthermore, one important factor to be considered is that each element of the population belong to one stratum only. Therefore, each stratum contained homogeneous characters. Thus, the communities around the City of Polokwane within Polokwane Local Municipality were used as strata due to their distinct characters. The characteristics that differentiate Legae la Batho, Emdo Park, Flora Park and Serala View is their location in relation to the city, experiences, challenges and experiences of traffic congestion. The study used Legae la batho, Emdo Park, Serala View and Flora Park for collecting empirical data. As mentioned above, the application of stratified sampling required a selection of the sample within each stratum. Therefore, simple random sampling was used to solicit data to sample respondents from each stratum. Bless *et al.* (2013: 167) describe simple random sampling as “a sampling procedure that provides an equal opportunity of selection for each element in the population”.

6.6.2 Purposive sampling

Based on non-probability sampling, the study adopted purposive sampling for the study. Purposive sampling is the selection of participants based on the researcher's judgment about the type of data required to answer the research questions (Bless *et al.*, 2013). One of the disadvantages of purposive sampling is that the results lead to non-representativeness and thus, cannot be generalised to the whole population. Furthermore, the sample was chosen based on the judgment of the researcher for what is considered typical units (Bless *et al.*, 2013). Regardless of this disadvantage that purposive sampling presents, it offered some advantages too. Due to the purposive nature of this sampling design, only those people who were knowledgeable about the particular subject under investigation formed part of the sample. This contributed immensely to the development of a new theoretical discourse.

6.7 DATA COLLECTION METHODS

The study employed both qualitative and quantitative methods to solicit data to examine the planning and management praxis of the urbanisation process towards climate change mitigation. The study used a theoretical discourse of the complexity of urbanisation in laying out the context (secondary data) and the collection of empirical data (primary data). According to Bless *et al.* (2013), secondary data can be understood as the utilisation of collected data from other scholarly documents and reports, to address different research problems. These types of data were important in providing a theoretical context (international, national and local context), statistics and the status of urbanisation and climate change. Secondary data were collected from academic journal articles, reports, statistics and the United Nations Habitat publications. On the other hand, primary data can be described as the data that are collected by a researcher specifically for a particular study (Bless *et al.*, 2013). These types of data are most appropriate for addressing a particular aim and objectives of the study, particularly because the data are collected towards answering specific research questions. For this study, structured questionnaires and semi-structured interview schedules were used to collect data.

6.7.1 Questionnaire

The questionnaire involves the establishment of a set of ordered questions that are structured sequentially to demonstrate the sequence of answering the questions (Bless *et al.*, 2013). According to Kothari (2004: 100), a “questionnaire consists of several questions printed or typed in a definite order on a form or set of forms”. The questionnaire consisted of close-ended questions to solicit quantitative data. The questionnaire was completed by the respondents themselves. A total number of 185 questionnaires were completed by respondents from the selected four areas. The usage of the questionnaire presented both advantages and limitations during data collection. According to Kothari (2004), the application of the questionnaire is less expensive even when applied in a widely spread geography. Due to its fixed form and sequential questioning, it avoids a vast amount of biases in the answers as compared to the interview schedule. Furthermore, unlike the interview schedule, respondents have ample time to give a well thought answer, which improves the pertinence of data. Regardless of these advantages, questionnaires have their limitations. A mailed questionnaire has a low rate of return during the answering of questions. It is very difficult to control the questionnaire from being lost once sent. The questionnaire collected only quantitative data.

6.7.2 Interview schedule

Kothari (2004) describes an interview schedule as the presentation of questions through verbal interaction and the terms of reply are through oral-verbal responses. Thus, the interview schedule involved a direct personal interaction between the researcher and the participants who were asked to answer systematic questions that help to close a research gap or answering research questions (Bless *et al.*, 2013). The direct interaction with the participants allowed the researcher to gain in-depth knowledge about the perceptions of the participants in the study. This is because an interview schedule is a qualitative data collection instrument. One important feature of the interview is that the researcher may intercede to request clarification in cases where there is a lack of understanding and clarity, thus making sure that the context is understood and the meaning is kept. However, while the interviewer’s presence has the potential to enhance the comprehensiveness and objectivity of the answers, on the other hand, it may limit the participants’ ability to express their

true feelings. A structured interview was administered with the Director of Development and Planning and environmental planners. A total number of 4 participants were interviewed for the study.

6.8 DATA ANALYSIS TECHNIQUES

Qualitative data were analysed qualitatively through various steps. The data collected through the interview were manipulated through a series of steps such as emersion, coding, classification, and then analysed through a thick description. The data from the interview were read and re-read to establish the meaning; cleaned to avoid identifying individual people and then coded. According to Kothari (2004: 123), coding connotes “the process of assigning numerals or other symbols to answers so that responses can be put into a limited number of categories or classes”. The creation of these codes was pertinent and appropriate to the research questions under investigation. The codes were used to classify data looking at the uniqueness and homogeneous character that they portray. Such classes should be appropriate to the research problem under consideration. After coding the data, coding definitions (Bless *et al.*, 2013) was the next important step in the analysis of qualitative data. The definition of codes entailed the title and a thorough description of what data were included, and which types were excluded within the code. This provided a thorough understanding of the data and how the data were interpreted. Furthermore, through data coding and definition of codes, the systematic pattern of data that were appropriate to answer the research questions emerged, thus giving an in-depth correlation between urbanisation and climate change.

The data collected through the questionnaire were manipulated quantitatively and then analysed qualitatively. Analysing and interpreting quantitative data in this study followed four steps of analysis. The first step was that the data from the questionnaires were edited and cleaned to ensure quality and completeness. Secondly, data were coded and captured into Statistical Package for Social Sciences (SPSS) and Microsoft Excel for manipulation. Thirdly, the study used SPSS and Microsoft Excel to manipulate the data into frequencies, charts and graphs. Lastly, the findings from the manipulated data were presented.

6.9 VALIDITY AND RELIABILITY

Validity and reliability are amongst the most important components of research that ensure that the data collected address the set objectives. According to Bless *et al.* (2013), validity in research asks questions concerning what the instrument employed measures. This means that unless the research can validate that the measurement techniques are measuring the elements that they are set to measure, the validity of the interpretation will be difficult to qualify. Thus, validity ensures that errors are minimized during data collection and analysis to help answer the research questions pertinently. Validity refers to a situation where the instruments used to collect data give information concerning the acceptable meaning of a particular concept (Babbie & Mouton, 2001). Thus, to ensure validity, the study adopted various methods of collecting data. A pilot study was employed in this study to refine and adjust the data collection instruments (interview and questionnaire) to ensure the validity of the collected data. Furthermore, the use of different instruments such as the interview schedule and questionnaire involved running them through a pre-test which helped to improve the validity of the data.

Reliability is concerned with measuring consistency in research (Bless *et al.*, 2013). Reliability is a measure of an instrument to reproduce equivalent results when applied repeatedly (Babbie & Mouton, 2001; Bless *et al.*, 2013) over time. However, in social sciences where the truth is contingent on participants' opinions about the world they live in, reliability becomes difficult to accomplish. The researcher read and reread the data and transcripts to minimize the errors that could have occurred. Furthermore, coding and pertinently defining codes of data were used as another strategy to minimize the errors and ensure the reliability of the data.

6.10 CONCLUSION

Research design and methodology is an important component of every scientific research. Research methodology has provided and enhanced the validity and reliability of scientific research. This has assisted in the data collection from the respondents and analysis of data to draw the findings of the study. The research methodology helped to pre-test the questionnaire and interview schedule. The pre-test on the data collection techniques was conducted to ensure the validity and

reliability of the data collected. This helped to solicit data on the effectiveness of planning and management of urbanisation in an attempt to mitigate climate change.

7 CHAPTER 7: DATA ANALYSIS AND PRESENTATION OF FINDINGS OF THE STUDY

7.1 INTRODUCTION

This chapter provides an analysis of primary data that were collected through the questionnaire and interview schedule. The study used a structured questionnaire to collect quantitative data within households in the urban areas around the City of Polokwane (Legae la Batho, Emdo Park, Flora Park and Serala View). The questionnaire was constructed to collect the perceptions of the respondents about the effective ways of planning and managing urbanisation to mitigate climate change. Furthermore, the role of the public in planning is important to harness the benefits of urbanisation to ensure collaborative planning. The interview schedule solicited qualitative data from the municipal officials within Polokwane Local Municipality and the person responsible for climate change in the Capricorn District Municipality. The interview schedule was constructed in an unstructured manner to collect comprehensive qualitative data about the contemporary planning on urbanisation and the strategies employed to mitigate and adapt to climate change.

Chapter 7 established various themes to evaluate effective strategies for planning and management of urbanisation to mitigate climate change. The first section of this chapter provides the biographical information of the respondents. This section presents the composition of the respondents in terms of their gender, educational level, age and years of experience, which are important in integrating public participation in the planning and management of urbanisation. The next section probed the indicators for effective management of urbanisation within the Polokwane Local Municipality. The themes examined the practical methods used to plan and manage urbanisation and the characterisation of climate change within the City of Polokwane. It was important to explore the strategies that are employed within the municipality to mitigate climate change. This chapter presents results on the level of public participation in planning within the municipality. The results of the study demonstrated that many people were still not included within municipal planning, which was coupled with non-functional ward committees in the City of Polokwane. The results of the study demonstrated that the City of Polokwane continued to experience traffic congestion, waterlogging after heavy rainfalls, heatwaves and drought. Therefore, the themes are important to inform comprehensive debates about the effectiveness of

planning for and management of urbanisation in the City of Polokwane in an attempt to mitigate climate change.

7.1 ANALYSIS AND PRESENTATION OF QUANTITATIVE DATA

The questionnaire was constructed solely to solicit quantitative data from households around the City of Polokwane. The households were selected from the following areas around the City of Polokwane: Legae la Batho, Emdo Park, Flora Park and Serala View. The questionnaire was aimed at unravelling the role of the communities in the planning and management of urbanisation and their contribution towards climate change mitigation. Literature has demonstrated that the people around the city are important in the planning and management of urbanisation. Therefore, the questionnaires were constructed to examine the collaborative planning and their contribution towards improving green places and electricity consumption around the city, which are important strategies for effective management of urbanisation. Furthermore, the questionnaire was constructed to explore the perceptions of the community towards the usage of public transport as a way to reduce traffic congestion and thus, reduce the amount of greenhouse gas emissions around the city. This is very significant if the City of Polokwane is to contribute significantly towards climate change mitigation. The results from the questionnaires were that most people aspire to use solar geysers as a way of reducing the level of electricity consumption. The reduction in electricity consumption has the potential to reduce the combustion of fossil fuel (coal).

7.1.1 Biographical Information of the Respondents

This section presents the biographical information of the respondents in terms of gender, educational level, age and years of working experience. Biographical information of the respondents is significant in exploring the involvement of communities within municipal planning and governance in Polokwane Local Municipality. Educational level and years of experience in working within different fields are important to help in ensuring the interdisciplinary form of planning for and managing a complex phenomenon such as urbanisation.

7.1.1.1 Gender of the respondents

Table 7.1 shows the gender of the respondents in the study. Table 7.1 demonstrates that 53.5% of the respondents that took part in this study were female. On the other hand, Table 7.1 shows that only 46.5% of the respondents were males. It is clear that the majority of the respondents in this study were females. Within the South African political and social landscape, women have always been left out in decision making. Thus, it is important to ensure that women are included in urban governance, planning and management in the Polokwane Local Municipality.

Table 7.1: Gender of the respondents

Gender	Percentage
Male	46.5%
Female	53.5%
Total	100%

7.1.1.2 The educational level of the respondents

Table 7.2 shows the educational level of the respondents. Table 7.2 shows that 33.5% of the respondents had a diploma as the highest educational level while those with matric only constituted the second-highest proportion of 23.8%. Table 7.2 shows that those respondents with degrees constituted 21.6% while those with postgraduate degrees accounted for only 21.1%. Cumulatively, 76.2% of the respondents had post-matric qualifications in terms of their educational level. The respondents were educated in various fields of study, which could be harnessed to improve planning around the City of Polokwane.

Table 7.2: Educational level of the respondents

Level of education	Percentage
Grade 12	23.8%
Diploma	33.5%
Degree	21.6%
Post Graduate	21.1%
Total	100%

7.1.1.3. The age groups of the respondents

Table 7.3 demonstrates that 30.8% of the respondents are between 40 and 49 years old in terms of their age categories. Furthermore, Table 7.3 shows that 25.4% of the respondents are 50 years old and above while those who are between the ages of 30 and 39 years old constitute 24.3%. Table 7.3 shows that only 17.3% of the respondents have ages ranging between 20 and 29 years old. The minority (2.2%) of the respondents are in the age group of 19 years and less. The table shows that the majority of respondents are still active enough to be able to participate within the municipality during the planning and management of urbanisation.

Table 7.3: The age groups of the respondents

Age in years	Percentage
19 or less	2.2%
20 – 29	17.3%
30 – 39	24.3%
40 – 49	30.8%
50 and Above	25.4%
Total	100.0%

7.1.1.4 Years of experience of the respondents

Table 7.4 shows that 35.1% of the respondents have 5 years or less of work experience in their respective fields while 28.1% have between 6 and 15 years of work experience. Furthermore, Table 7.4 demonstrates that 21.6% of the respondents have 16 to 25 years of working experience while only 13.0% have between 26 and 35 years of experience. A minority (2.2%) of respondents have more than 36 years of work experience. The years of experience in multiple fields is important to provide a multidisciplinary perspective in planning and management of urbanisation towards climate change mitigation.

Table 7.4: The years of experience of the respondents

Work experience in years	Percentage
5 of less	35.1%
6 - 15	28.1%
16 - 25	21.6%
26 - 35	13.0%
36 and above	2.2%
Total	100%

7.1.2 The Indicators of Effective Management in Urbanisation

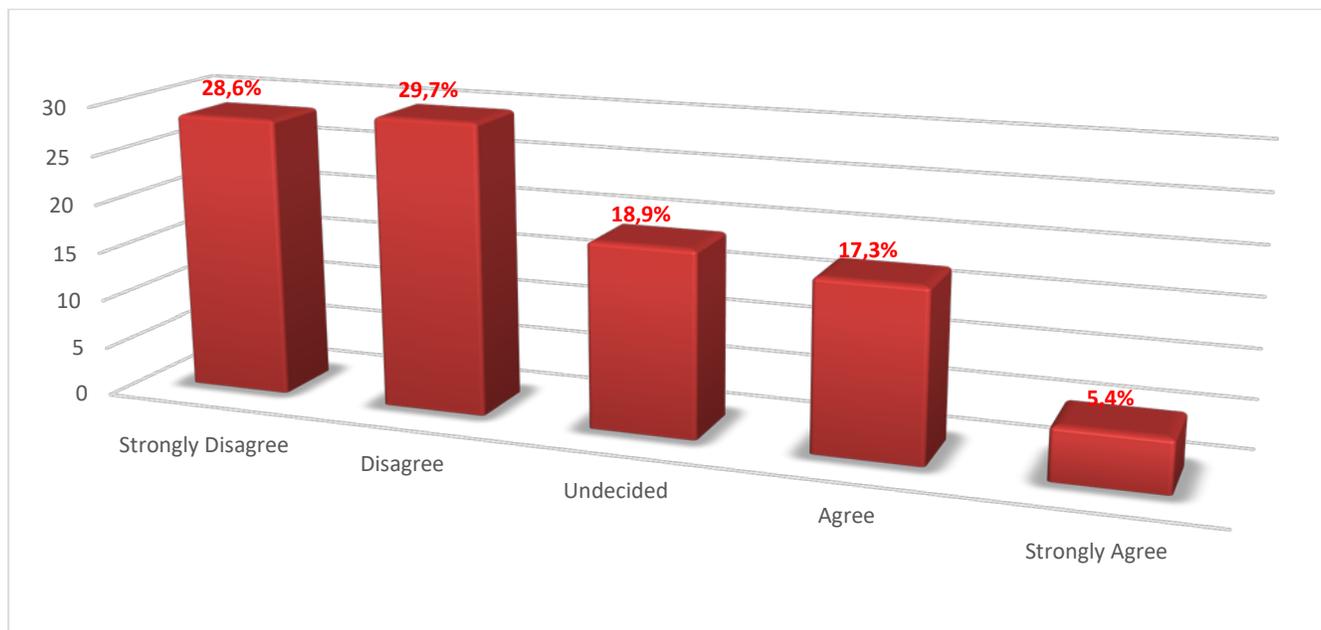
This section explored the indicators that can be employed to effectively manage urbanisation around the City of Polokwane. There are various approaches such as plans, policies, green spaces and transport; which municipalities can employ in managing urbanisation. Literature has demonstrated that the inadequacy of transport infrastructures such as broad roads, traffic lights and traffic circles around the city and urban centres leads to high traffic congestion (Roy, 2009; Mokgotho & Mokoetele, 2020). Thus, it is significant to probe the adequacy and effectiveness of these infrastructures in addressing traffic congestion. Public participation, personnel capacity, green spaces, plans and participatory planning are important indicators of managing urbanisation.

7.1.2.1 Public involvement in municipal planning on urbanisation plans

Figure 7.1 focuses on the involvement of communities by municipalities during the planning and management of urbanisation. It is indicated in Figure 7.1 that 28.6% of the respondents strongly disagreed that they were involved in municipal planning while 29.7% disagreed. Only 18.9% of the respondents were undecided on whether or not they were involved in municipal planning. On the other hand, Figure 7.1 shows that 17.3% of the respondents agreed that the municipality involves the community in planning. Figure 7.1 shows that a minority (5.4%) of the respondents strongly agreed that there is community involvement within the municipal planning. It is clear from Figure 7.1 that the majority of the respondents stated that they were not included within the municipality during planning, which means that there is no collaboration between the municipality and the

communities in planning. The finding is that although numerous legislative frameworks stipulate that municipalities should promote public participation, in actual sense communities continue to be left out in municipal planning affairs. This affirms the assertion put forward within the literature that municipalities continue to grapple to promote public participation within municipal planning. This means that communities are not included during the IDP forum. Although the majority of the respondents stated that they are not included within the Polokwane Local Municipality, a small proportion stated that they do participate in municipal planning. This might indicate a shift in the right direction towards the promotion of public participation in municipal planning. Therefore, lack of public involvement within the municipality derails the potential to manage urbanisation effectively.

Figure 7.1: Public involvement in municipal planning



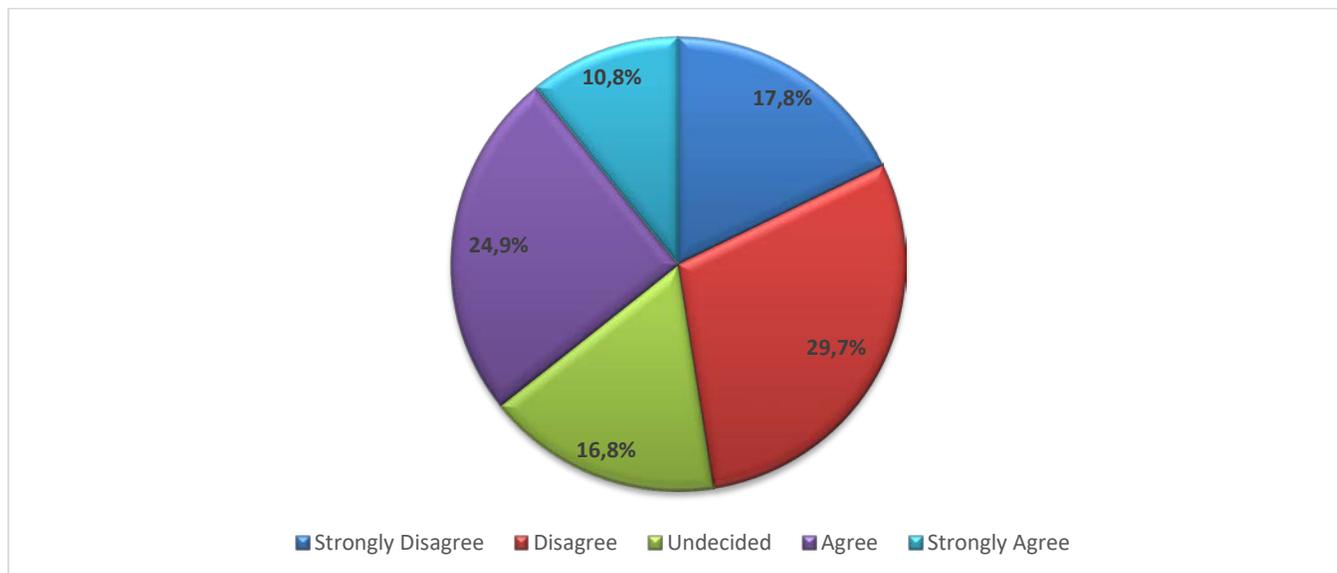
7.1.2.2 The provision of information on the plans to manage urbanisation

Figure 7.2 focuses on the lack of provision of information about plans to address urban problems associated with urbanisation to enable the implementation of effective strategies to plan and manage this process. Figure 7.2 shows that 17.8% of the respondents strongly disagreed that the municipality does not provide the public with information regarding plans to address urban environmental problems. Figure 7.2 shows that 29.7% of the respondents disagreed that the

municipality does not provide them with information regarding plans to address urban problems within the City of Polokwane. Only 16.8% of the respondents were undecided on whether or not Polokwane Local Municipality provides the public with information about plans to manage urbanisation. On the other hand, Figure 7.2 shows that 24.9% and 10.4% of the respondents strongly agreed and agreed respectively that they were not provided with information on the plans to address urban problems associated with urbanisation. Literature has demonstrated that to foster public engagement in municipal planning and governance, there must be an efficient provision of information, awareness campaigns and public education within the municipality.

The majority of the respondents stated that they were provided with information about the plans to address urban problems, which are associated with urbanisation. The provision of information on urban problems such as traffic congestion, pollution, deforestation and GHG emissions associated with urbanisation provides an important avenue towards planning and managing this process. The complexity of planning for urbanisation requires collaboration between planners with other stakeholders. However, some of the respondents stated that they are not provided with information about plans on how to address these urban problems. Therefore, it is clear that the majority of respondents stated that the municipality does provide information about plans that are employed to address urban problems such as traffic congestion, waste disposal and emissions. This demonstrates that some respondents around the City of Polokwane are provided with information about the management of urbanisation to address problems associated with this process. This might suggest that some of the urban areas around the City of Polokwane are provided with information about the management of urbanisation. The few respondents who indicated that they are undecided might suggest they do not believe that the provision of information has the potential to address the challenges associated with urbanisation. Additionally, a few indicated that due to the type of employment they have, they are always away from their homes so they cannot state if the information is provided to the community or not.

Figure 7.2: The municipality does not provide the public with information regarding urbanisation

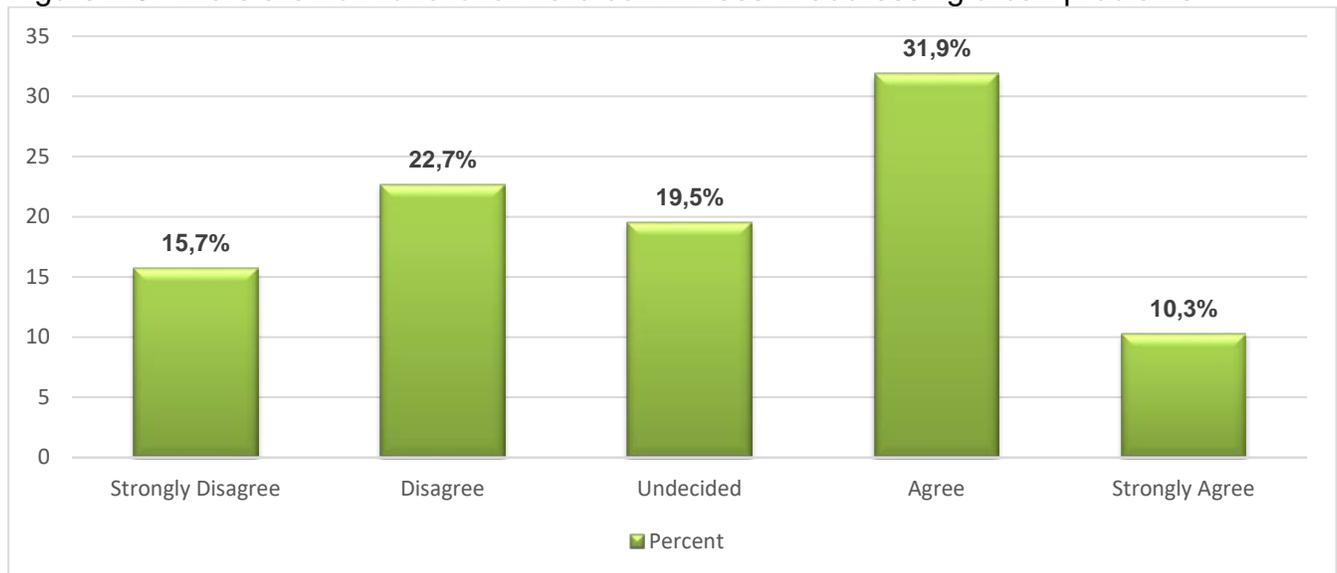


7.1.2.3 There are non-functional ward committees in addressing urban problems

Figure 7.3 focuses on the non-functionality of ward committees in addressing urban problems such as traffic congestion, land pollution, illegal dumping of waste and reduction of urban greening. Figure 7.3 shows that 15.7% of the respondents strongly disagreed that there are non-functional ward committees to address the urban problem while 22.7% only disagreed. This means that the respondents perceived that the municipality has functional ward committees that raise questions on the inability of the municipality to promote public participation. However, 31.9% and 10.3% of the respondents agreed and strongly agreed respectively that there are non-functional ward committees within the municipality. Cumulatively, it is clear that many (42.2%) respondents felt that the Polokwane Local municipality continues to have non-functional ward committees to address urban problems, which disrupts the effective planning for urbanisation. However, other respondents stated that the ward committees are functional in addressing urban problems such as land pollution and illegal dumping of waste. This suggests that some of the ward committees are functioning while others remain as non-functional in other communities. The non-functionality of the ward committee within the municipality derails public participation as demonstrated in Figure 7.1, which deters collaborative planning. This demonstrates that the management of urbanisation is not a linear process but involves multiple players. The non-linearity of managing urbanisation is rooted on the

notion of complexity theory, which connotes the interrelation of multiples elements operating together. However, Figure 7.3 shows that 19.5% of the respondents were undecided on whether or not there were functional ward committees to address urban problems. This might suggest that many people around the city are apolitical and show no interest in the functioning of the ward committees. Additionally, those who are undecided might be attributed to the fact that some of the people work outside the City of Polokwane and they are not abreast with the functioning of the Ward committees within Polokwane Local Municipality.

Figure 7.3: There are non-functional ward committees in addressing urban problems

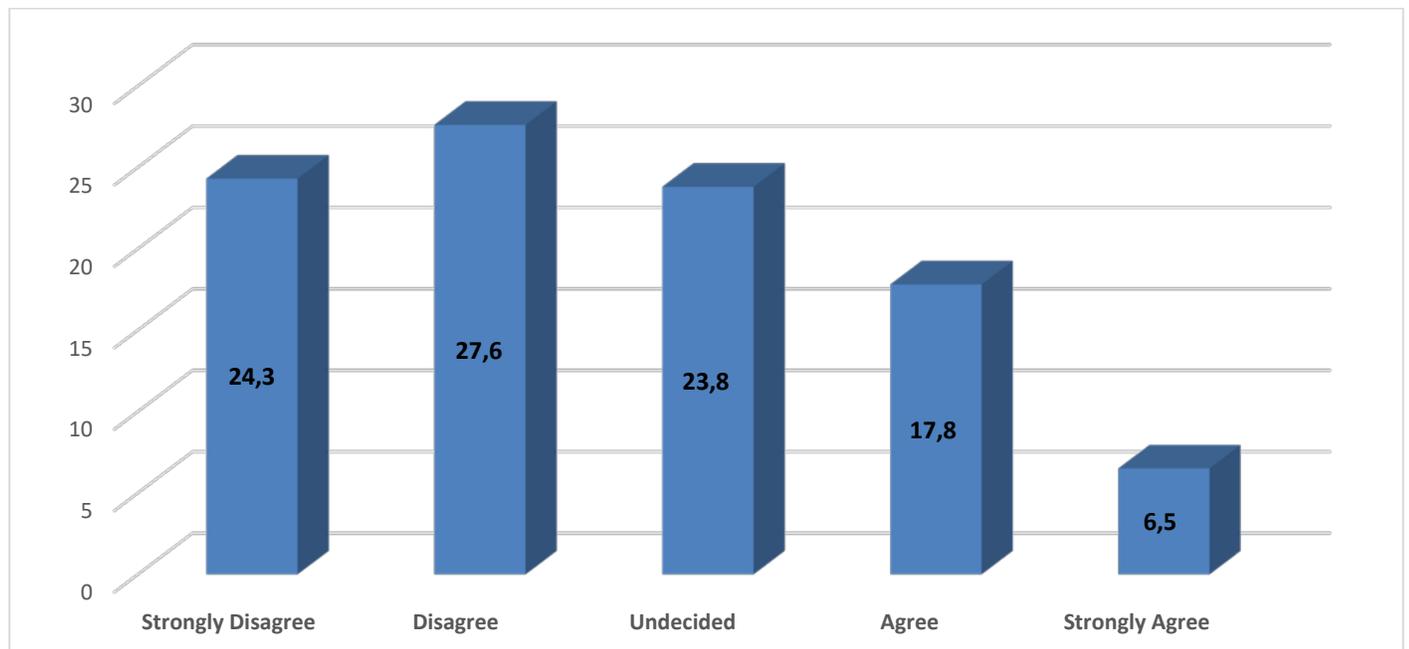


7.1.2.4 The community is consulted in the formulation of plans in the city

Figure 7.4 shows the perceptions of respondents about public consultation during the formulation of plans to manage urbanisation within the city. Figure 7.4 shows that 27.6% of the respondents disagree that communities are consulted in the formulation of plans to manage urbanisation while 24.3% strongly disagree with this notion. On the other hand, only 17.8% and 6.4% of the respondents agree and strongly agree that there is community consultation around Polokwane Local Municipality during the formulation of plans to manage the city. Figure 7.4 shows that 23.8% of the respondents were undecided on whether or not they are consulted during the formulation of plans around the city. This suggests that the respondents do not have full comprehension of the plans to manage the city, which is coupled with lack of interest in municipal affairs. Furthermore,

Table 7.4 shows that many respondents are the working class who might not have time to engage in municipal affairs. The persistence of urban challenges might suggest that the plans are not working, which made the respondents to remain undecided. Many respondents feel that they are not consulted during the formulation of plans to manage the city. This is corroborated by literature that local governments continue to struggle to integrate the public in municipal planning. This further connotes that there is limited or no community consultation in the formulation of plans to manage the city. Despite the multiplicity of documentations including the Constitution of the Republic of South Africa, 1996 that advocates for community consultation within the municipality, the current reality affirms the evidence from the literature that most public institutions continue to grapple to foster community consultation in municipality affairs. The inability of the municipality to involve the community in planning and management of the city poses a serious ramification to make the city resilient post perturbation. However, there is a small proportion of respondents who feel that they are consulted during planning around the city. Although there are signs that the Polokwane Local Municipality does engage the committee, many people are still not consulted in the formulation of plans.

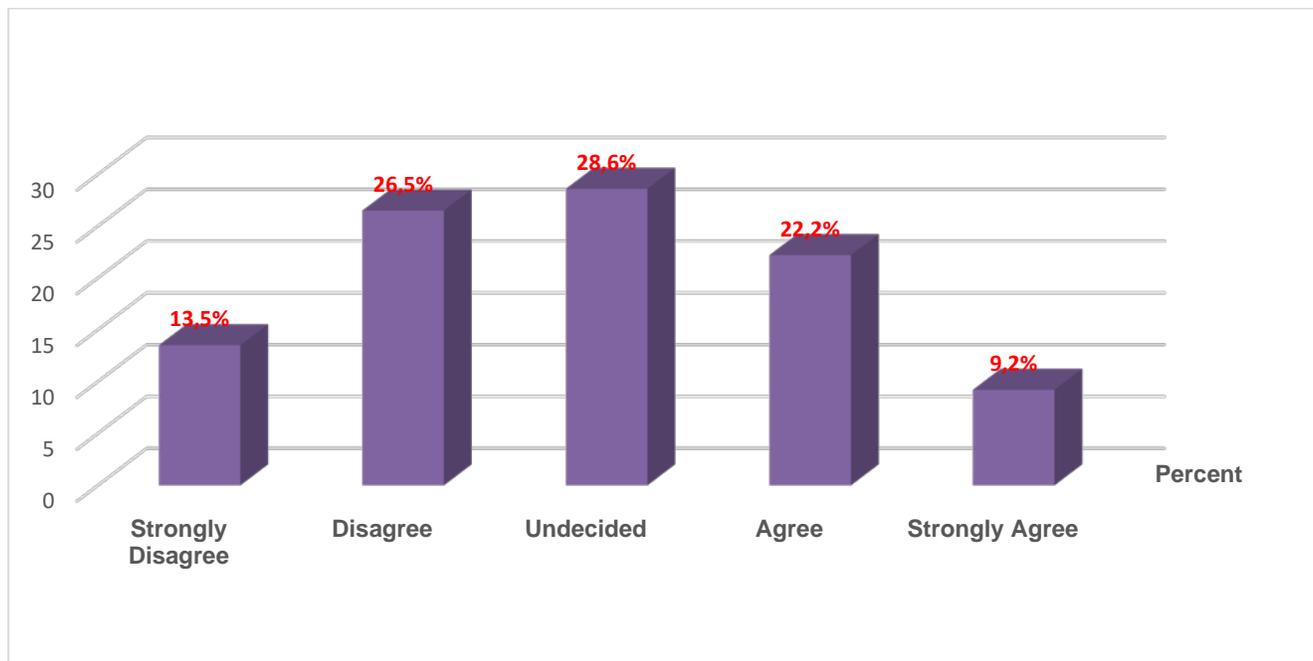
Figure 7.4: The community is consulted in the formulation of plans to manage the city



7.1.2.5 There is municipal capacity to plan and implement urban policies

Literature has demonstrated that plans and policies are important indicators for the management of urbanisation. Figure 7.5 focuses on the perceptions of the respondents about the municipal capacity to enable the implementation of plans and policies to effectively manage urbanisation. Figure 7.5 shows that 13.5% of the respondents strongly disagree that there is the capacity to plan and implement urban policies in Polokwane Local Municipality. Figure 7.5 shows that 26.5% of the respondents disagree that the municipality can implement policies to manage urbanisation. It is indicated that 28.6% of the respondents were undecided on the notion that the Polokwane Local Municipality has the capacity to implement municipal plans and policies. On the other hand, Figure 7.5 shows that 22.2% of the respondents agree that there is a capacity to plan and implement policies within the municipality while 9.2% strongly agree. This shows that the majority of the respondents (40%) have the perception that the Polokwane Local Municipality lacks adequate capacity to implement policies to manage urbanisation. This perception can be attributed to the inability to provide proper services to the communities. This is corroborated by the literature that local government still lacks capacitated personnel to manage urbanisation. However, some respondents believe that Polokwane Local Municipality has capacity to effectively implement plans and policies to plan and manage urbanisation. This might suggest that the communities perceive the municipality to have the capacity to implement plans and policies to manage urbanisation. Due to the complexity of planning for and managing urbanisation, the increasing capacity to implement urban policies demonstrates a significant factor in the management of this process. However, a high proportion of the respondents were undecided on whether the Polokwane Local Municipality has the capacity to implement plans to manage urbanisation. This suggests that many people around the city do not know if the municipality possesses capacitated personnel and their ability to implement plans to manage urbanisation.

Figure 7.5: There is capacity to plan and implement urban policies by the municipality

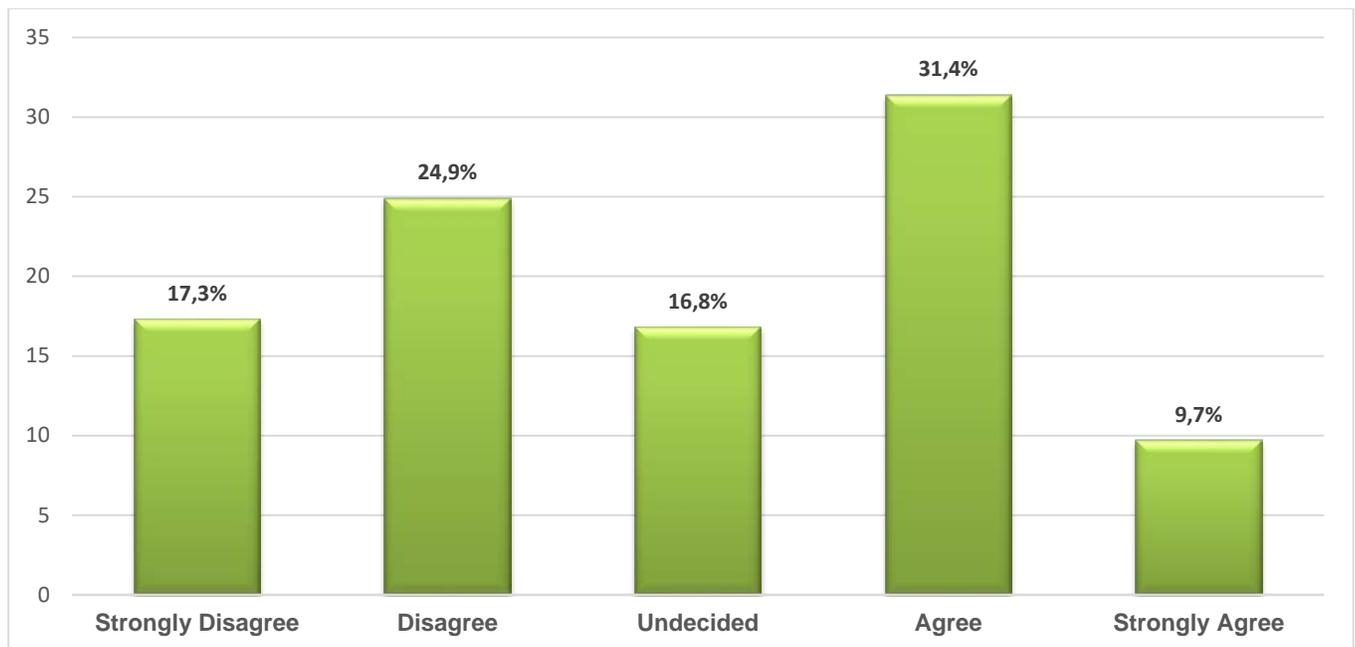


7.1.2.6 Limited capacity is affecting the municipality in addressing urban challenges in the city

Figure 7.6 focuses on how limited capacity to implement plans is affecting the municipality in addressing urban challenges in the city. Figure 7.6 shows that 17.3% of the respondents strongly disagree that the limited capacity is affecting the Polokwane Local Municipality in addressing urban challenges such as traffic congestion, illegal waste disposal, declining green spaces, land pollution and increasing GHGs in the city. Figure 7.6 indicates that 24.9% of the respondents disagree that limited capacity does affect the Polokwane Local Municipality in addressing the urban challenges. On the other hand, Figure 7.6 shows that 31.4% of the respondents agree that limited capacity has the potential to derail the municipality' plan to address urban challenges while 9.7% strongly agree with this notion. The finding is that the proportion of respondents who agree and those who disagree (whether they disagree or agree strongly) are almost equal. These high proportions might be attributed to the location and the developmental level of the area. Legae la Batho and Emdo Park are still experiencing illegal dumping, land pollution and traffic congestion. However, Flora Park and Serala View are middle-income areas located close to the work place without such problems. Flora Park and Serala View do not have pockets of land used for illegal dumping sites and they are

not adversely affected by traffic congestion due to the multiple roads to the city centre. This demonstrates an awareness from the public about the deleterious effects that limited capacity poses on the municipality. Figure 7.6 shows that 16.8% of the respondents were undecided on whether or not the limited capacity affects the Polokwane Local Municipality in managing urbanisation. This means that there lack of interest by the people towards municipal affairs. This has been corroborated by various scholars that many citizens have continued to show apathy towards municipal affairs, which potentially affects public participation.

Figure 7.6: Limited capacity is affecting the municipality in addressing urban challenges in the city

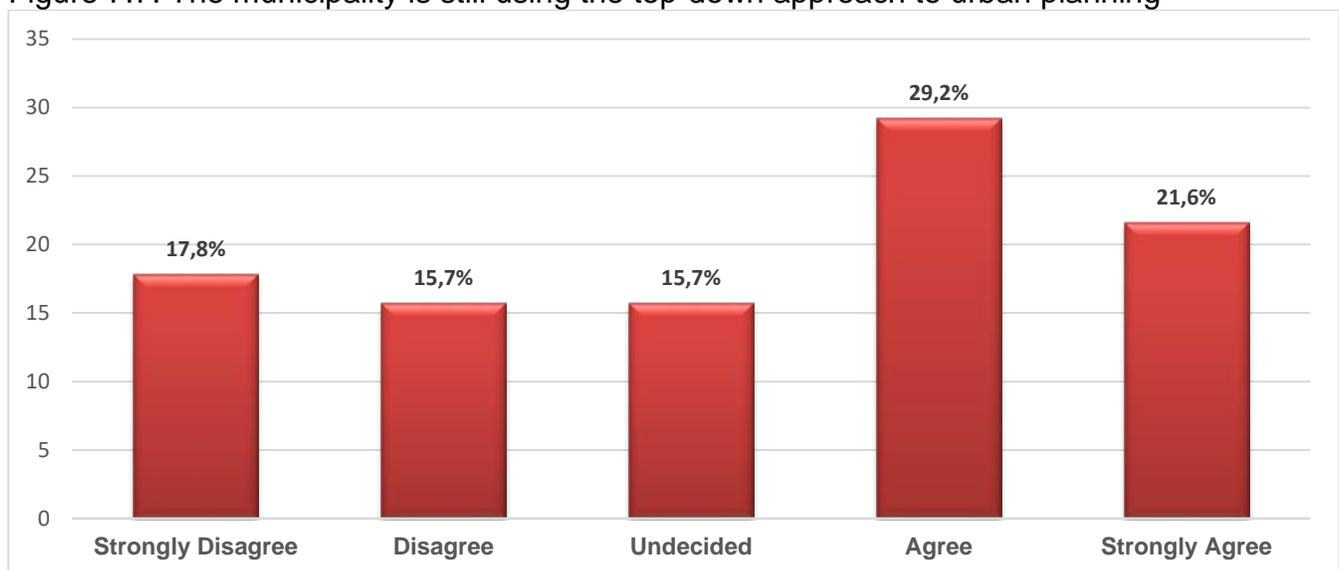


7.1.2.7 Top-down approach to urban planning by the municipality

Figure 7.7 focuses on the perceptions of the respondents about the application of the top-down approach to urban planning where the decisions are taken without public involvement. Figure 7.7 shows that 17.8% of the respondents strongly disagree that the Polokwane Local Municipality is still using a top-down approach to urban planning while only 15.7% disagree. This shows that 33.5% of the respondents believe that the municipality is using a bottom-up approach to urban planning. On the other hand, Figure 7.6 shows that 29.2% and 21.6% of the respondents agree and strongly agree respectively that urban planning remains top-down while only 15.7% have

remained undecided on this notion. The finding is that a majority of the respondents believe that the municipality continues to grapple with the inclusion of the communities in urban planning, hence, resorting to a top-down approach to planning (planning without the consent of the public). This means that many people around the City of Polokwane are excluded from participating in municipal planning. Literature on urban planning in Africa argues that urban planning remains unreformed from the colonial planning approach, which is characterised by a top-down approach to planning. Therefore, the perception of the communities regarding urban planning within Polokwane Local Municipality is that it remains unreformed and operates on a top-down approach. The complexity of promoting public participation can be derailed by the lack of interest from the urban populace in municipal affairs. There is a small proportion of respondents who remained undecided on whether the municipality is still using a top-down approach to urban planning. This means that some people do not see the influence of public involvement in urban planning. Additionally, the current political landscape might influence people to lack interest in municipal affairs because even if they are consulted, the aspiration will not be met. However, a small proportion of respondents who disagree with this notion suggests that there is a shift from heavy reliance on a top-down approach towards a bottom-up approach (planning with the people).

Figure 7.7: The municipality is still using the top-down approach to urban planning

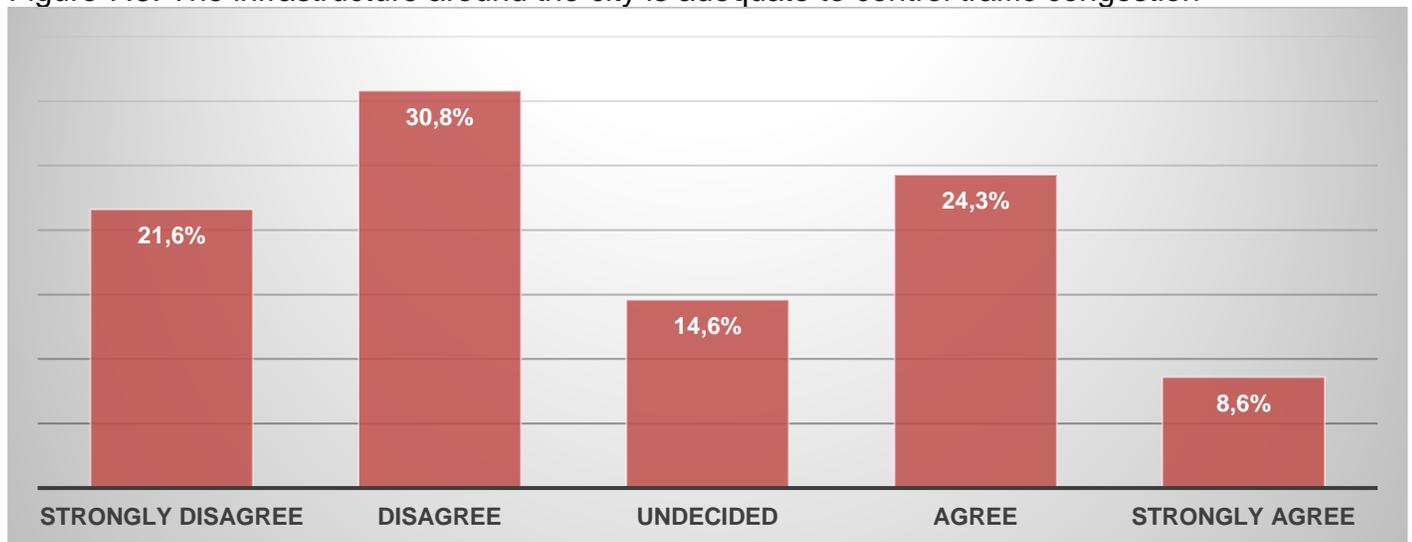


7.1.2.8 The adequacy of infrastructure to manage traffic congestion

Figure 7.8 focuses on the adequacy of transport infrastructure around the city in managing traffic congestion. Proper and adequate road infrastructure such as broadness of the roads, traffic lights, and traffic circles coupled with traffic officials around the city are imperative to manage traffic congestion and allow free-flowing traffic, which potentially reduces the amount of GHGs emissions from motor vehicles. Figure 7.8 shows that 21.6% of the respondents strongly disagree that there is adequate infrastructure to control traffic congestion around the City of Polokwane. It is indicated in Figure 7.8 that 30.8% of the respondents disagree that there is adequate infrastructure to manage traffic congestion. On the other hand, 24.3% and 8.6% agree and strongly agree respectively that there is adequate road infrastructure around the city. However, only 14.6% of the respondents remained undecided regarding the adequacy of road infrastructure around the city.

It is important to note that respondents from Serala View and Flora Park constitute only 25% (47 of 185) of the sampled respondents. Additionally, Serala View and Flora Para have multiple routes into the city, which shows that they are the least affected by traffic congestion. Therefore, Serala View and Flora Park, as middle-income areas, have adequate infrastructure that does not allow traffic congestion. Furthermore, traffic officers help in controlling traffic congestion in the morning. However, a major proportion of the respondents indicated that there is an inadequacy of road infrastructure to manage traffic congestion. Legae la Batho and Emdo Park are confronted with traffic congestion especially during peak hours (early morning and late in the afternoon). This connotes that the city continues to experience traffic congestion especially around Legae la Batho and Emdo Park during peak hours, which increases the level of GHGs emissions, hence, contributes towards climate change in the distant future. Therefore, the combination of road infrastructure and traffic officers has the potential to address traffic congestion around Polokwane city and help in the reduction of GHGs emissions. The finding is that different areas around the City are affected by traffic congestion differently due to the location and adequacy of road infrastructure. 14.6% of the respondents remained undecided on the adequacy of infrastructure to manage traffic congestion. This might suggest that the respondents mostly go to the city later in the morning when there is no traffic congestion.

Figure 7.8: The infrastructure around the city is adequate to control traffic congestion

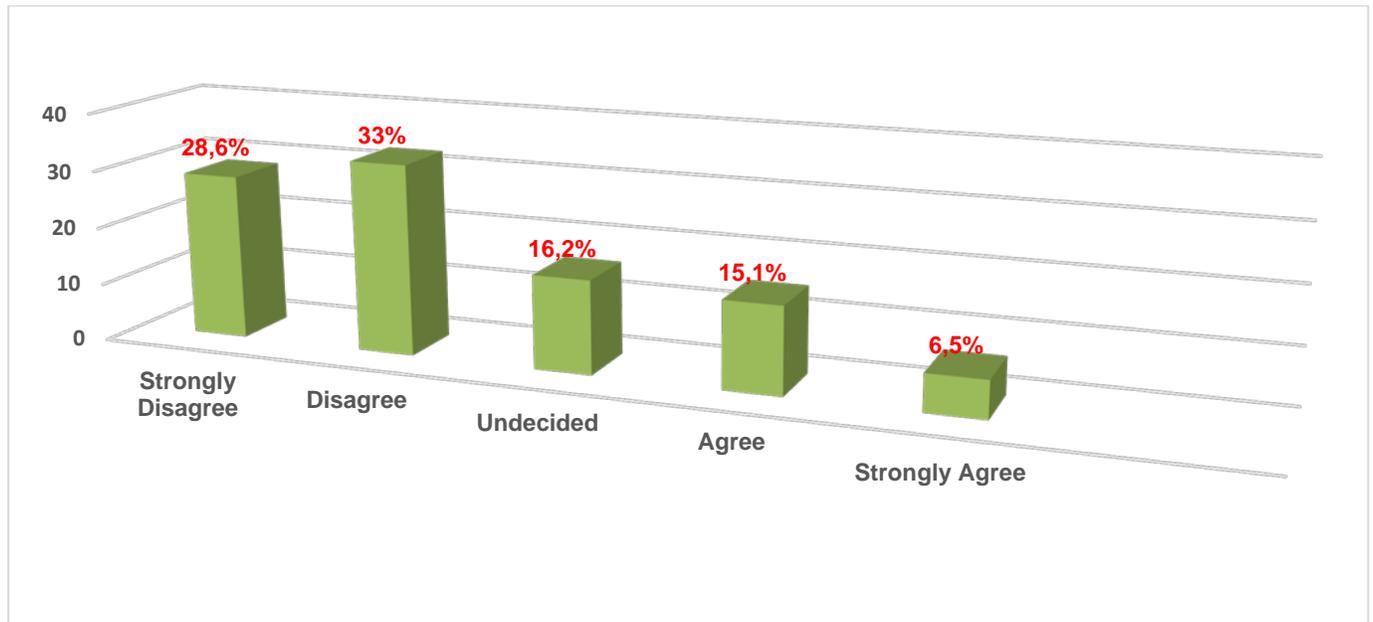


7.1.2.9 Encouraging the plantation of green spaces within households

Figure 7.9 focuses on the perception that the Polokwane Local Municipality encourages planting of green spaces as opposed to the pavements. Figure 7.9 indicates that 28.6% and 33.0% of the respondents strongly disagree and disagree respectively that the municipality encourages the plantation of green spaces and avoids pavements within the households. It is indicated in Figure 7.9 that 16.2% of the respondents remained neutral on this notion. This might suggest that respondents never had an engagement with the municipality concerning the plantation of the lawn as opposed to pavements. Figure 7.9 shows that only 15.1% and 6.5% of the respondents agree and strongly agree respectively that they are encouraged to plant green spaces. The majority of the respondents feel that they are discouraged to plant green spaces such as lawns due to the water problem around the city. The finding is that the perception of communities is that the municipality discourages the plantation of green spaces (lawn) to reduce the amount of water used for irrigation. To conserve water, the municipality encouraged the public to opt for pavements as opposed to green spaces. This has resulted in declining levels of green spaces around the city. The literature on urban planning postulates that green plantation is an important management approach to urbanisation and addressing the issues of climate change. Therefore, encouraging the use of pavements to conserve water has an unintended consequence of the decline in the level of green spaces, which is very important to absorb GHGs and foster infiltration of running water. The

advocates of complexity theory argue that managing urbanisation is not a linear process and the implementation of one strategy might have unintended consequences around the city. Therefore, there is a need for a balance of development where the public reuse water and harvest rainwater for irrigation to promote the plantation of green spaces.

Figure: 7.9: The municipality encourages the plantation of green spaces to prevent soil erosion

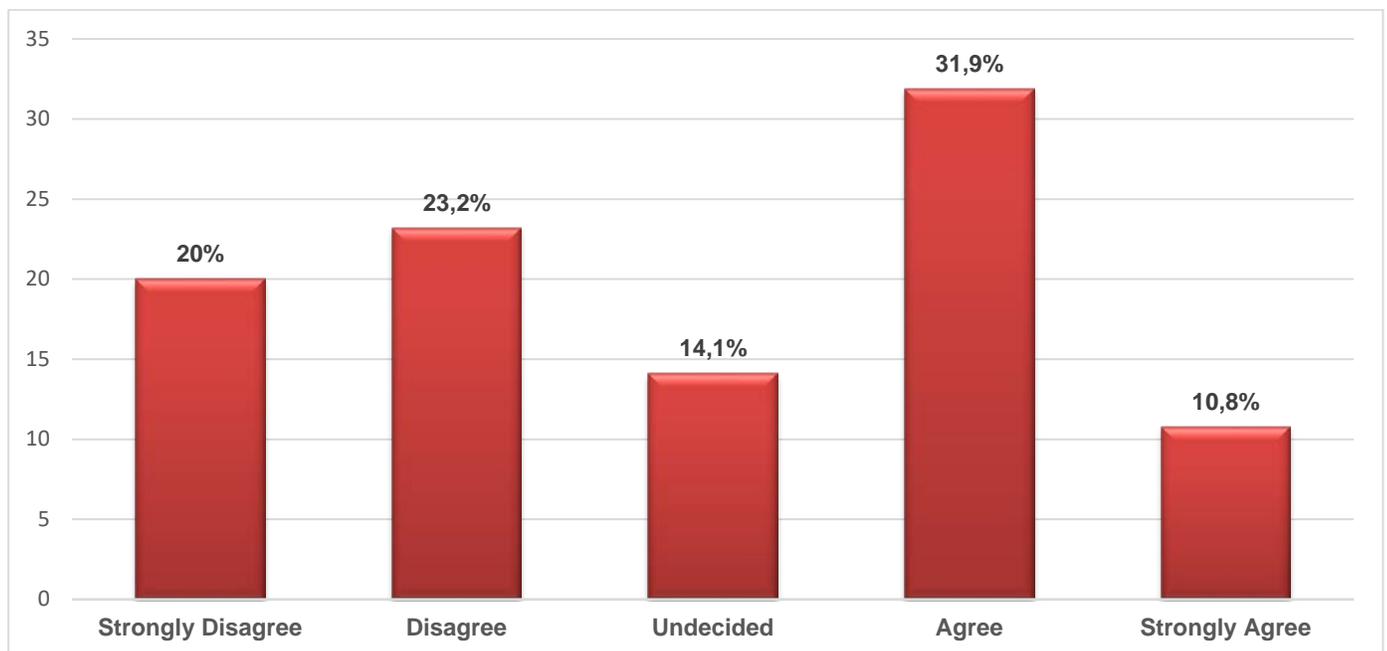


7.1.2.10 The use of technology to improve communication with the communities

The notion of the smart city advocates for the use of technology in the management of urbanisation. Figure 7.10 focuses on the implementation of technology to communicate with the public by the municipality. Figure 7.10 indicates that 20.0% of the respondents strongly disagree that there is technological infrastructure such as SMS, Facebook page and Twitter used to improve communication between the municipality and the communities. It is indicated in Figure 7.10 that 23.2% of the respondents disagree while 14.1% were undecided on the idea that the municipality use technology to communicate with the community. On the other hand, 31.9% and 10.8% of the respondents agree and strongly agree respectively that the municipality adopted technology to communicate with the communities. The finding is that some respondents feel that the municipality does not use technology such as SMS, Facebook page and Twitter as a mechanism to communicate with the community. On the other hand, respondents stated that the Polokwane Local

Municipality uses technology to communicate with the community regarding the load-shedding schedules and water cuts. Some respondents stated that “the municipality uses social media and SMSes to inform the community about the problems of water and electricity around the city”. This means that although SMSes are used to communicate with the community, the platform is not employed as a tool to foster public participation. Other respondents disagree that the municipality uses technology to communicate with the communities. This suggests that they have never gotten an SMS from the municipality regarding municipal affairs. Those respondents who remained undecided might suggest that they do not know about any technology that the municipality employs to communicate with the communities. Therefore, Polokwane Local Municipality is beginning to employ technology for communication with the communities and there is a need for awareness of these technological sites so that everyone will be informed.

Figure 7.10: The municipality uses technology to improve communication with the communities



7.1.3 The Contemporary Planning Praxis for Effective Management of Urbanisation

This section focuses on the contemporary planning approaches for the effective management of urbanisation. Literature has demonstrated that urban areas are producing a lot of wastes, which are responsible for emitting a lot of methane gas into the atmosphere that contributes to climate

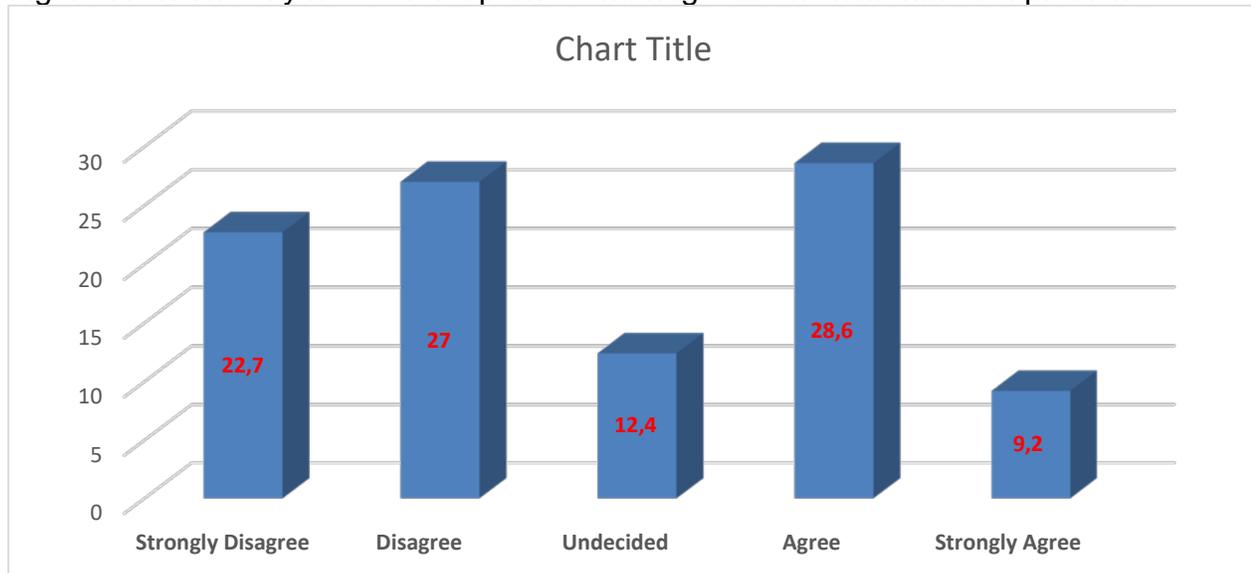
change. Therefore, the practical planning approaches for managing urbanisation can be done through the expansion of green spaces, collection of wastes, planning for efficient transport systems and the involvement of various stakeholders in planning (collaborative planning approach). These issues are done to reduce the amount of GHG emissions into the atmosphere. Therefore, urbanisation must be managed in such a way that is explicitly aimed at protecting the environment. Green spaces such as parks, trees and lawns are very important in the management of urbanisation. Urbanisation has accounted for many people located around the city, which reduces green spaces. Green places serve an important role in the management of urban environmental problems. Urbanisation can be effectively planned and managed if there is a collaboration between various stakeholders and the wastes are disposed of safely.

7.1.3.1 The city has several parks to manage urban environmental problems.

Figure 7.11 focuses on the perceptions of the respondents about the presence of parks around the city to manage urban environmental problems. It is indicated in Figure 7.11 that 22.7% of the respondents strongly disagree that there are several parks around the city to manage urban environmental problems while 26.5% disagree with this notion. Figure 7.11 shows that only 12.4% of the respondents were undecided on whether or not the presents of parks around the city to manage urban environmental problems. This suggests that the people do not comprehend the value of parks as a management approach towards environmental problems. Additionally, there might be a lack of interest regarding the environmental problems that the city is facing. On the other hand, 28.6% of the respondents stated that they agree that various parks around the city can help in managing urban environmental problems. Figure 7.11 shows that only 9.2% strongly agree that the city has several parks that are important for managing urban environmental problems. Many people feel that the city does not have several parks as a management approach towards environmental problems such as emissions, pollution, wastes, climate change and runoff. The reduction in green spaces can be attributed to urban growth around the City of Polokwane. Some respondents indicated that there is one small park in the City of Polokwane, which is not adequate to serve as a management approach to environmental problems. Therefore, the finding is that the parks around the city are not adequate to help in the management of urban environmental

problems. On the other hand, there are parks around the city, though not adequate, to manage or help to circumvent urban environmental problems.

Figure 7.11: The city has several parks to manage urban environmental problems

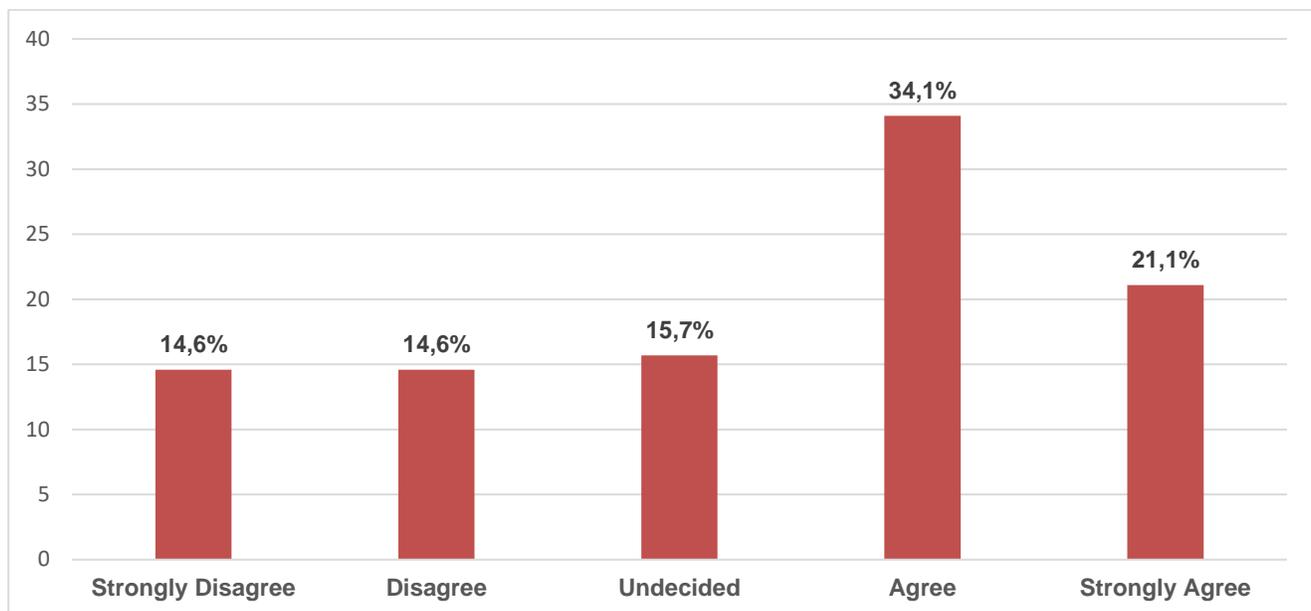


7.1.3.2 The reduction of green spaces attributed to the rate of city growth

Figure 7.12 focuses on the idea that the rate of city growth is contributing to the reduction of green spaces around the City of Polokwane. Figure 7.12 demonstrates that 14.6% and 14.6% of the respondents strongly disagree and disagree respectively that the growth of the city results in the reduction of green spaces. This might suggest that the growth of the city should be accompanied by the plantation of green places within the households. This will ensure the continued existence of green spaces around the city to manage environmental problems. It is indicated in Figure 7.12 that only 15.7% were undecided while 34.1% of the respondents agree that the level of green spaces has reduced due to the growth of the city. Figure 7.12 shows that 21.1% of the respondents strongly agree that the growth of the city reduces the amount of green spaces. The majority of the people feel that the green spaces have been reducing as the City of Polokwane continue to grow. It is clear that the growth of the City of Polokwane has resulted in the reduction of green spaces such as lawns, trees and parks. Green places are pivotal towards the reduction of GHGs in the

atmosphere and managing other environmental problems. However, a small proportion of respondents stated that the growth of the city does not necessarily result in the reduction of green spaces. The reduction of green places is attributed to the perception that the municipality continues to discourage the planting of trees and lawns around their yard. The increasing of plantations around the city has the potential to increase the resilience of the city post perturbation. Resilient theory connotes that cities should develop strategies to bounce back post perturbation. The reduction in the level of green spaces derails the ability of the city to be resilient post perturbation such as heavy rainfalls and heatwaves. However, 15.7% of the respondents remained undecided on the reduction of the green spaces around the city. This means that there should be a continuous plantation of green spaces as the city grows. Therefore, the growth of the City of Polokwane has resulted in the reduction of green spaces.

Figure 7.12: The rate of growth is reducing the number of green spaces around the city

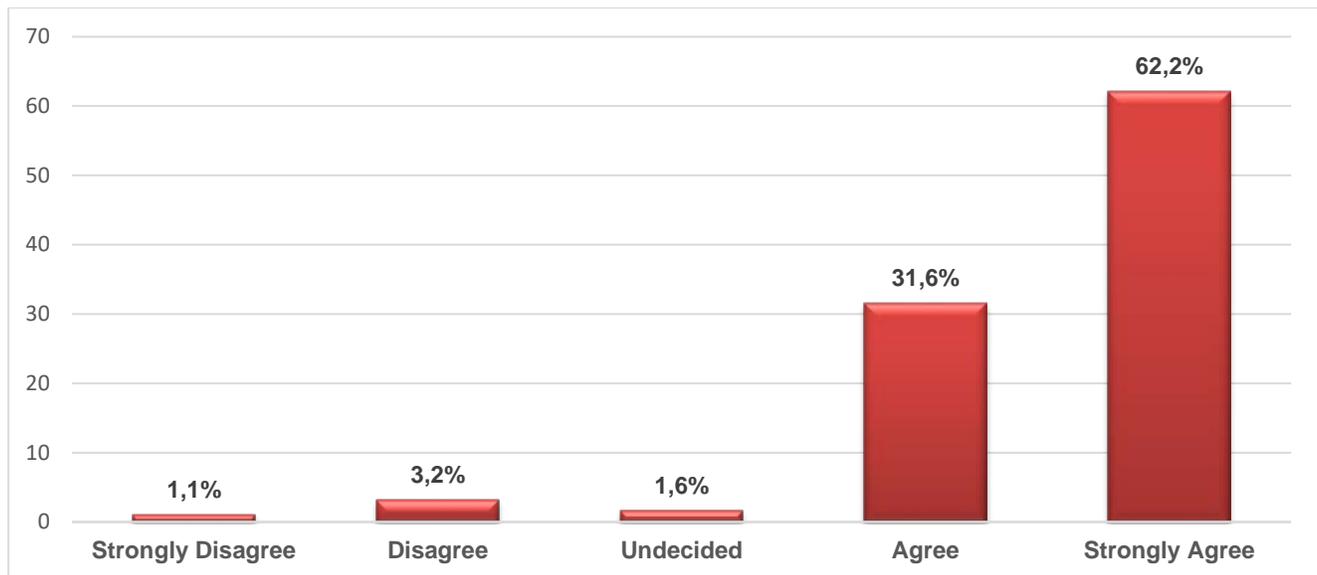


7.1.3.3 The collection of refuse by the municipality

The collection of refuse for disposal is very important to reduce the emissions such as methane gas. Figure 7.13 shows that only 1.1% and 3.2% of the respondents strongly disagree and disagree respectively that the wastes are regularly collected around the communities. On the other hand, the majority (62.2%) of the respondents strongly agree that the wastes are collected regularly.

Figure 7.13 demonstrates that 31.9% of the respondents agree that the wastes are collected regularly by the municipality. The finding is that Polokwane Local Municipality collects refuse regularly for proper disposal at the municipal landfill. Therefore, proper disposal of the wastes can reduce the emission of methane as mentioned in chapter 3. Although the municipality does collect wastes around the communities, other respondents have stated that some people dispose of their wastes at clearly demarcated areas as illegal dumping sites. The illegal disposal of wastes derails the commitment to reduce GHG emissions and environmental protection around the city. Legae la Batho and Embo Park are the two areas in this study that have problems of illegal dumping sites as opposed to Flora Park and Serala View. There is a plethora of literature that suggests that wastes emit a lot of methane, which has the potential to destroy the Ozone layer. Therefore, the finding is that although refuse is collected regularly around the City of Polokwane, some residents continue to dispose of refuse in an unsafe manner which creates a problem in addressing environmental problems.

Figure 7.13: The municipality collects refuse regularly

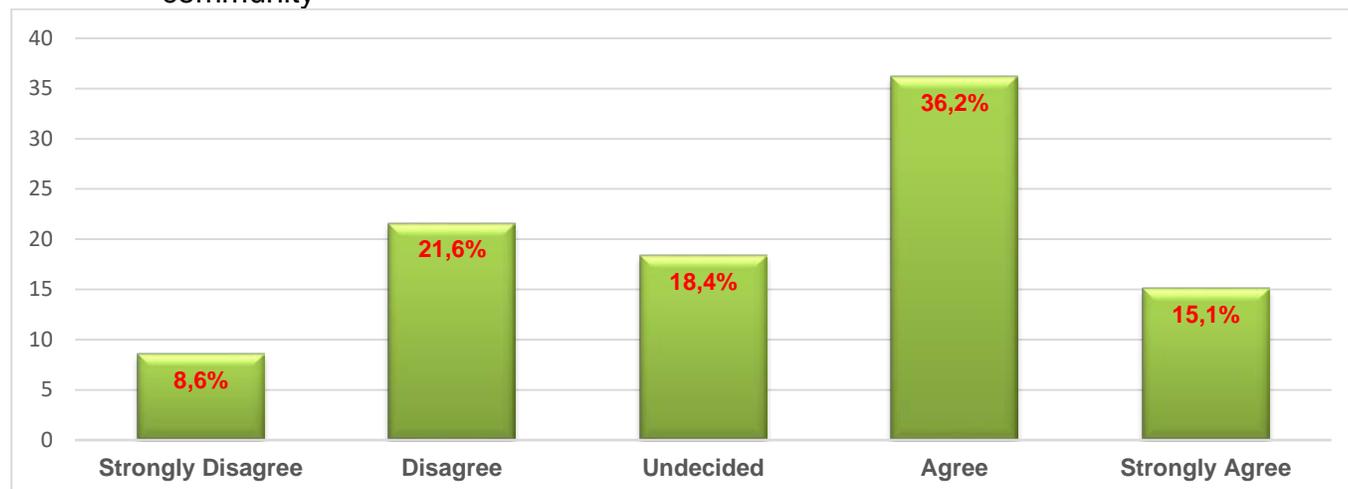


7.1.3.4 Communication of the planning systems with the communities

Figure 7.14 focuses on the communication of the municipal planning systems to the communities around the city. The communication between the municipality and the public improve trustworthiness and enhances greater participation within the municipal planning system. Figure

7.14 shows that 8.6% and 21.6% of the respondents strongly disagree and disagree respectively that the planning system within Polokwane Local Municipality is not communicated well with the communities. This means that some respondents feel that the municipal planning systems are communicated to the communities around the city. It is indicated in Figure 7.14 that 18.4% of the respondents remained neutral on this aspect. On the other hand, 36.2% of the respondents agree that there is a lack of communication in terms of the municipal planning systems to the communities around the city while 15.1% strongly agree. Therefore, the finding of the study is that there is no communication between the municipality and the majority of the populace around the city in terms of municipal plans. It is worth noting that many people around the city demonstrate their limited interest in municipal affairs. This is demonstrated by 18.4% of the respondents who were undecided on whether or not the municipality is not communicating its municipal planning systems with the communities around the city. Additionally, this suggests that the people are not aware of any communication of municipal planning systems within the Polokwane Local Municipality. Therefore, there is a need for a reorientation of the communities about the significance of the communities to participate in municipal affairs. On the other hand, a small proportion of people states that the planning systems are communicated to the community. The notion suggests that there is a move towards improving communication about the municipal planning system with the communities around the city. Furthermore, it can be argued that the people who stated that the municipality communicates with the communities might be those who took interest in municipal affairs.

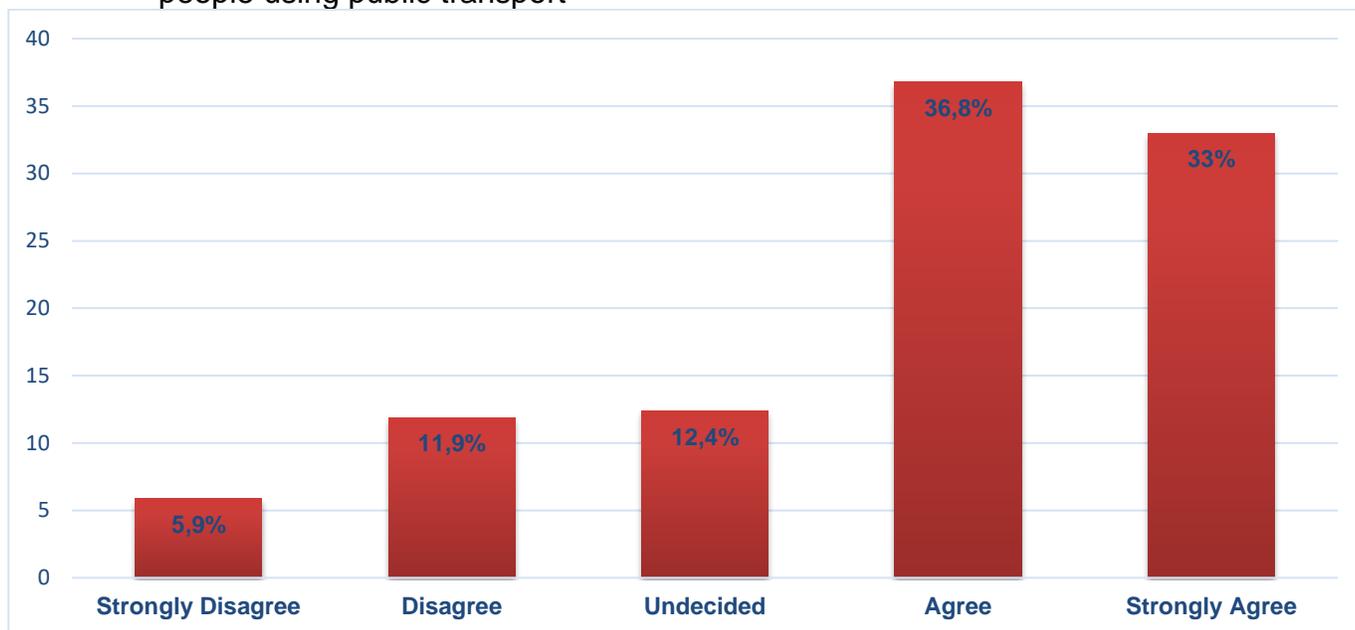
Figure 7.14: The planning systems at the local government are not communicated well with the community



7.1.3.5 The improvement in transportation systems can help increase the number of people using public transport

Figure 7.15 focuses on the perception of the respondents about the improvement in transportation systems such as rapid bus transit, bicycle routes, walkways, Uber, minibuses and Taxify to increase the number of public transport users to reduce traffic congestion. Figure 7.15 shows that a small proportion of the respondents strongly disagree and disagree (5.9% and 11.9% respectively) that the improvement of the transportation system around the city will assist to increase the usage of public transport. On the other hand, 36.8% of the respondents agree that an improved transport system can help increase the usage of public transport while 33.0% strongly agree with this notion. Table 7.3 shows that only 12.4% of the respondents remained neutral concerning the usage of public transport due to an improved transportation system. The finding is that the respondents believe that the improvement in the transportation systems (improved buses, Uber, Bolt, Taxify and taxis and their efficiency) will increase the usage of public transport thereby reducing the traffic congestion around the City of Polokwane. Therefore, there is a need for the municipality to improve the transport systems around the city. The increase in the usage of public transport will reduce traffic congestion and GHGs emissions. On the other hand, cumulatively, 17.8% of the respondents disagree that the improvement in the transport system will increase the usage of public transport. This means that some people are still relying on their private cars and still holding the view that those who use public transport are poor. Therefore, there is a need for the reorientation of the public about the significance of using public transport around the city in an attempt to reduce congestion and mitigate climate change. 12.4% of the respondents remained undecided on the notion of the improvement of the transport system to increase people using public transport. This shows a lack of interest or loss of hope about the municipality's ability to implement strategies that will improve transport systems.

Figure 7.15: The improvement in public transportation systems can help increase the number of people using public transport

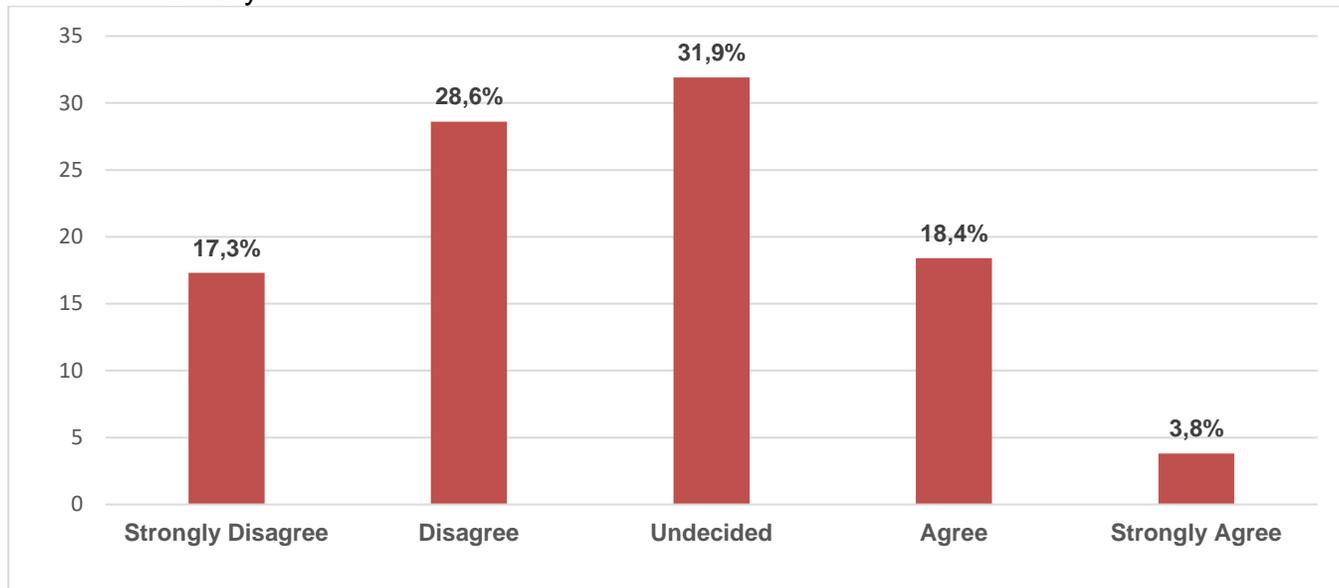


7.1.3.6 Stakeholder engagement in the planning and management of urban challenges around the city

The involvement of various stakeholders around the city is very important in the planning and management of urban challenges. Figure 7.16 shows that 17.3% of the respondents strongly disagree that various stakeholders such as communities, community organisations, civil societies, and the private sector are involved in the planning and management of urban challenges. Figure 7.16 shows that 28.6% of the respondents disagree that there is stakeholder engagement within the municipality. On the other hand, 18.4% and 3.8% of the respondents agree and strongly agree respectively that there is stakeholder involvement in planning for and management of urban challenges. However, many respondents (31.9%) were undecided as to whether or not the various stakeholder is engaged within the municipality. This might suggest that the respondents are not interested in municipal affairs. Additionally, this might be attributed to a loss of trust in the ability to engage various stakeholders in municipal affairs. The perception of the majority of the respondents is that the Polokwane Local Municipality does not engage various stakeholders in planning for and management of urban challenges around the city. The finding is that many people around the city

are not participating during stakeholder engagement, while others have lost interest and trust in the municipality.

Figure 7.16: Stakeholder involvement in the planning and management of urban challenges around the city



7.1.3.7 Attitudes towards participation in municipal planning systems

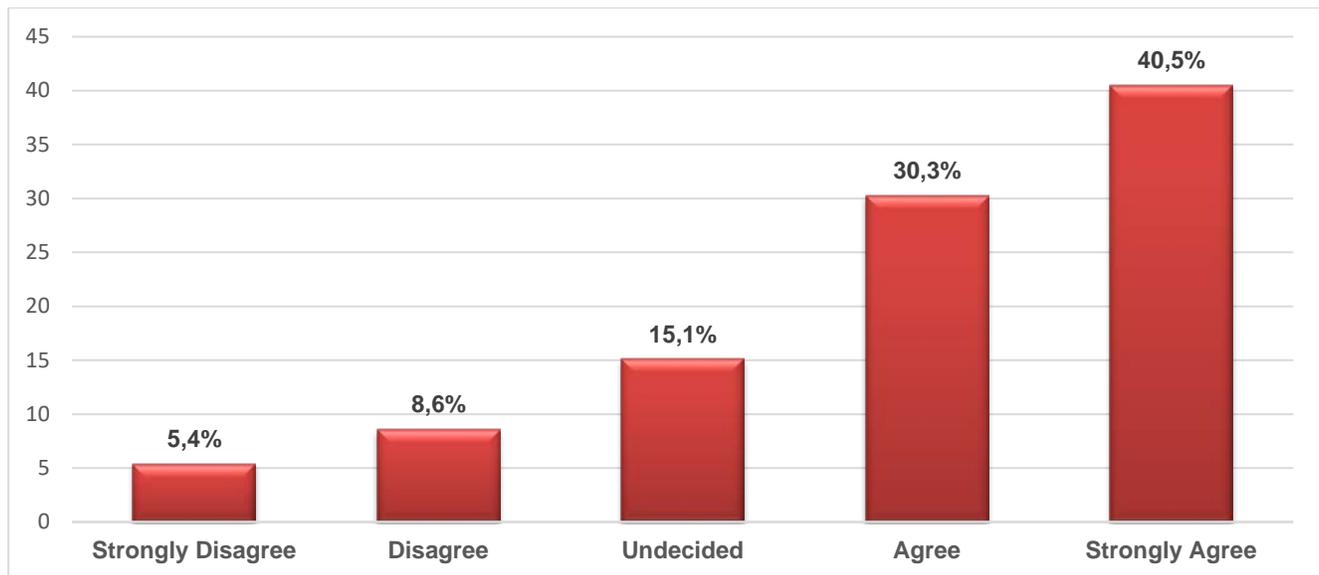
The results have shown that there is a lack of public participation in municipal planning to manage urbanisation in the City of Polokwane. This section is aimed at exploring the attitudes and perceptions of the public about participating in the municipal planning systems. The attitudes can be captured through their willingness to participate and spend their time engaging within the municipal planning systems. Public participation is very important in the planning and management of urbanisation.

i Feeling good about participation within the municipal planning system

Figure 7.17 focuses on the perception of the respondents on how they feel about participating in the municipal planning system. Figure 7.17 shows that 5.4% and 8.6% of the respondents strongly disagree and disagree respectively that participating in the municipal planning system will make them feel good. Only 15.1% of the respondents were undecided about their perception or feeling

about participating in the municipal planning system. It is indicated in Figure 7.17 that 30.3% of the respondents agree that they will feel good if they participate in municipal plans while 40.5% strongly agree with this notion. The finding is that people would feel good and positive if they are included in planning within the municipality. This suggests a positive attitude towards public participation in municipal planning. On the other hand, a small proportion of people show a negative attitude towards public participation in planning within the municipality. This demonstrates that there are people who are not interested in participating in municipal affairs. Therefore, the municipality must ensure that they educate the public about the significance of public participation in municipal affairs. 15.1% of the respondents remained undecided on this aspect. This shows that some people around the city do not see the significance of participation within the municipal planning systems. Additionally, this demonstrates a lack of interest and trust in the planning systems of Polokwane Local Municipality. Although it was discovered that many people are interested in participating with the municipality, some do not see the need to participate within municipal planning systems.

Figure 7.17: Participating in the municipal planning system makes me feel good

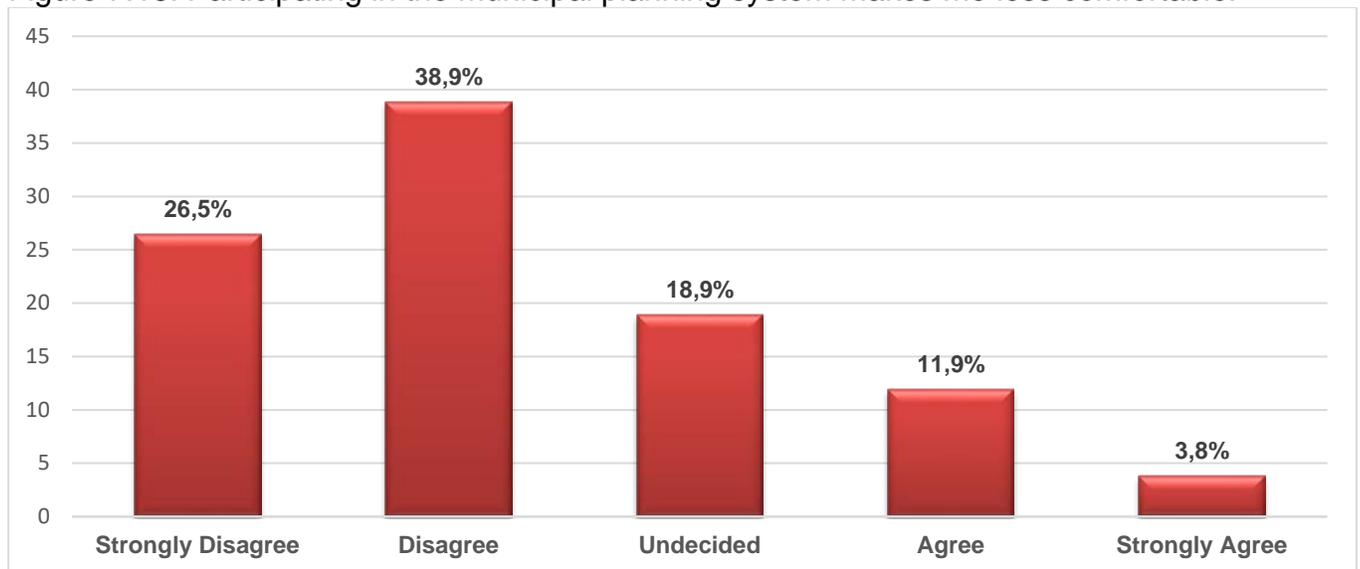


ii Participating in the municipal planning system makes me less comfortable

Figure 7.18 focuses on whether the respondents are comfortable when participating in municipal planning systems. Figure 7.18 shows that 26.5% of the respondents strongly disagree that they do

not feel comfortable when participating in the municipality. The majority (38.9%) of the respondents disagree that they will feel less comfortable when participating in the municipal planning systems. This connotes that the majority of the respondents (65.9%) believe that they will be comfortable in participating in municipal affairs, which demonstrates a positive attitude towards their involvement in municipal planning systems. On the other hand, 11.9% and 3.8% of the respondents agree and strongly agree respectively that they will feel less comfortable when participating in municipal planning systems. Figure 7.18 shows that 18.9% of the respondents were undecided about their feeling or perception about participating in the municipality. Those people who are undecided and feeling uncomfortable in participating within the municipality suggest a lack of interest in participating within municipal affairs. The finding is that the majority of the public demonstrated their willingness to participate in municipal planning systems. Most people believe that participation in the municipal planning system is very important. Therefore, there is a positive attitude from the people towards participation in the planning and their willingness to contribute within the municipal planning.

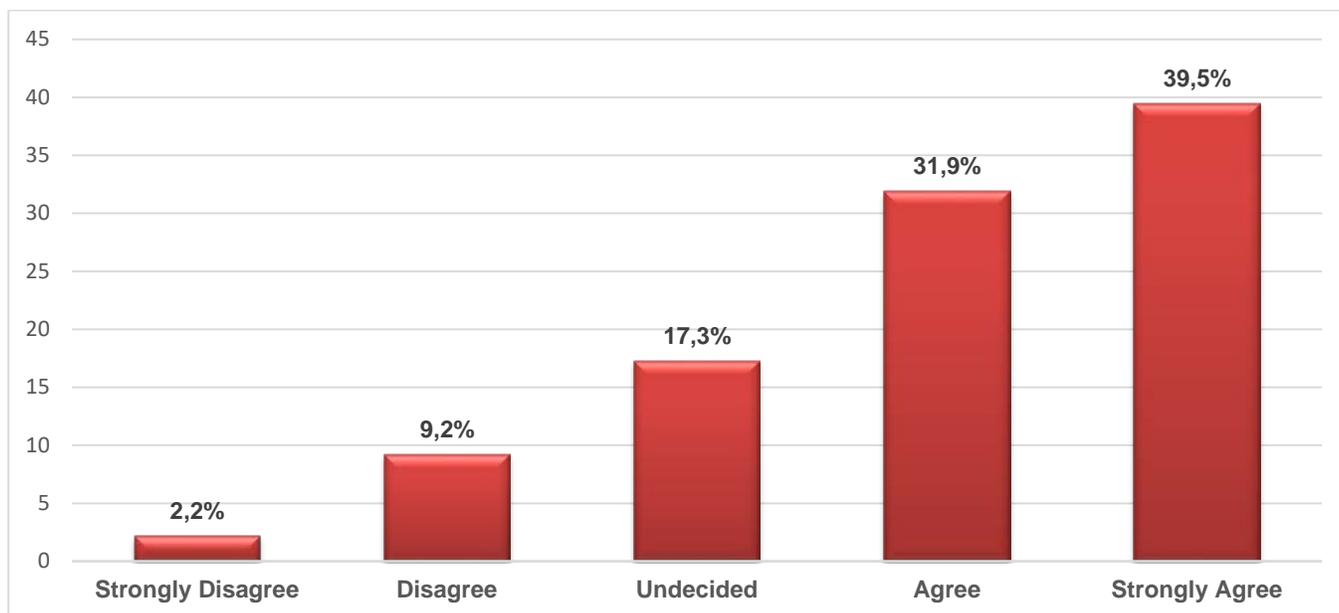
Figure 7.18: Participating in the municipal planning system makes me less comfortable.



iii Participation will improve the municipal planning system

Figure 7.19 focuses on the perceptions of the respondents on their contribution to the quality of planning when they are involved in municipal planning. Figure 7.19 shows that the majority (39.5%) of the respondents strongly agree that the quality of planning within the municipality will improve if they participate in the municipal planning system. It is indicated in Figure 7.19 that 31.9% of the respondents agree that they can improve the quality of planning within the municipality. Cumulatively, there is a strong agreement (71.4%) that the engagement of the public has the potential to improve the quality of planning within the municipality. On the other hand, a small proportion (2.2% and 9.2%) of the respondents strongly disagree and agree respectively that their contribution within the municipality can improve the quality of planning. Figure 7.19 shows that only 17.3% of the respondents were undecided on whether or not they can improve the quality of municipal planning within Polokwane Local Municipality. The majority of the people feel that the quality of municipal planning will improve through their participation within the municipality. This suggests that the majority of the people around the City of Polokwane are willing to participate in the municipal planning systems. Engagement of the public is very important to foster good governance. However, some people show little interest in the municipality. The 17.3% of respondents who remained undecided demonstrates that they do not have interest in the municipal planning systems. This can be attributed to the continued unfulfilled promises by the municipality and their political orientation.

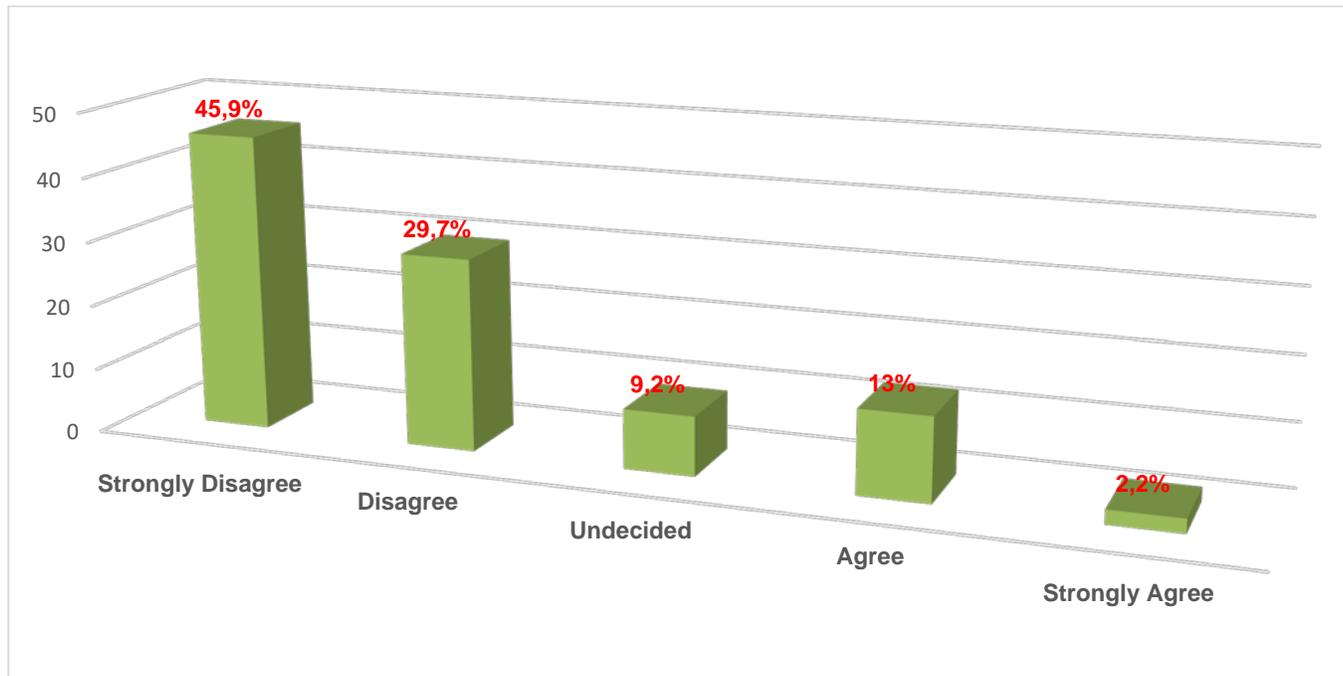
Figure 7.19: The quality of planning will be improved if I participate in municipal planning



iv Participating in the municipal planning system is a waste of time

Figure 7.20 focuses on the perceptions of the respondents on whether or not participating in the municipal planning system is a waste of time. Figure 7.20 indicates that the majority (45.9%) of the respondents strongly disagree that the participation of the public in the municipal planning system is a waste of time. Additionally, figure 7.20 shows that 29.7% of the respondents disagree that participating in the municipal planning system is a waste of time. Thus, the majority (75.6%) of the respondents feels that participating in the municipality in terms of planning is not a waste of time. On the other hand, 13.0% and 2.2% of the respondents agree and strongly agree respectively that participating in planning is a waste of time while only 9.2% were undecided. The finding is that people have realised the importance of participating in municipal planning systems, and thus, they believe that engaging in the municipality is not a waste of time. Therefore, the majority of the populace is taking an interest in participating in the municipality. However, a small proportion of respondents believes that participation within the municipality is a waste of time. This shows that there are people who lack interest in participating in municipal affairs. A plethora of literature on local governance attested that people have shown apathy towards participation within the municipality due to the continued limited communication with the public, corruption and poor service delivery.

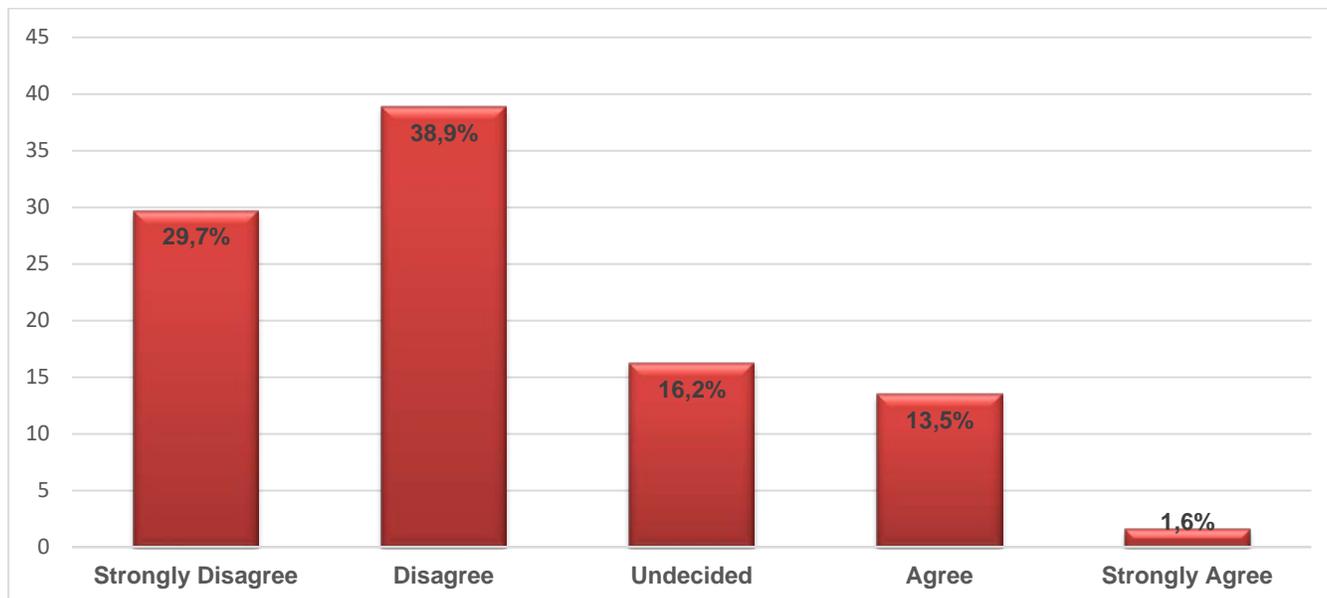
Figure 7.20: Participating in the municipal planning system is a waste of my time



v Participating in the municipal planning system is not enjoyable

Figure 7.21 presents data on the willingness of the public to participate in the municipal planning system. Figure 7.21 shows that 29.7% of the respondents strongly disagree that participating in the municipality is not enjoyable. Additionally, Figure 7.21 shows that 38.9% of the respondents disagree that participating in the municipality is not enjoyable. On the other hand, only 13.5% and 1.6% of the respondents agree and strongly agree that participating in the municipal planning system is not enjoyable while only 16.2% were undecided on this notion. The finding is that people view their participation in the municipal planning system as important and enjoyable. Therefore, people are willing to participate in municipal affairs to improve municipal planning. On the other hand, a small proportion of people who state that it is not enjoyable to participate in a municipality can be attributed to the notion that they have lost trust and hope in the municipality to include them in planning. To a greater extent, the lack of participation can be attributed to the notion that despite their engagement, nothing will be done by the municipality, which is a sign of loss of hope and trust.

Figure 7.21: Participating in the municipal planning system is not enjoyable



It is clear from the analysis above that there is a positive attitude from the public around the City of Polokwane towards participation in the municipal planning system. This positive attitude is very important to understand the willingness of the public to engage with the municipality to improve the planning system. The level of education and experience can as well add significant value to planning within the municipality.

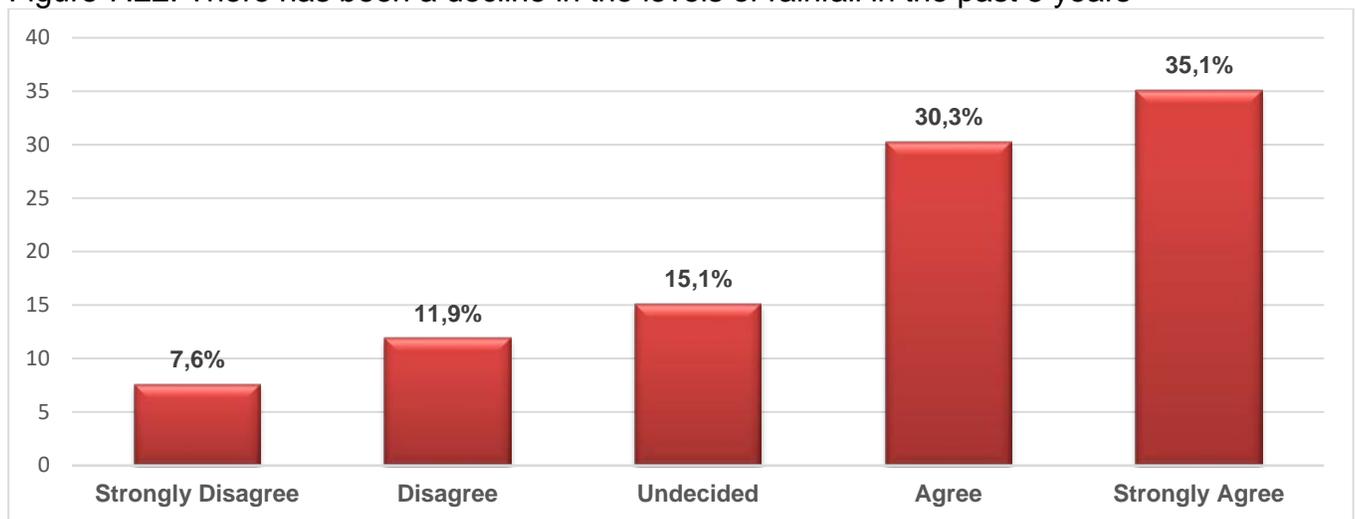
7.1.4 The Characterisation of Climate Change

This section provides a clear characterisation of the concept of climate change in terms of its effects that are predominantly experienced in the City of Polokwane. This section explores the occurrence of climate change effects in the City of Polokwane in the past 5 years. The characterisation of climate change will be depicted through the occurrence of effects such as floods, drought, heatwaves, levels of rainfall and extreme temperature in the city of Polokwane.

7.1.4.1 There has been a decline in the levels of rainfall in the past 5 years

Figure 7.22 provides an analysis of the perceptions of the respondents on whether or not the levels of rainfall has been declining in the past 5 years. Figure 7.22 shows that 35.1% of the respondents strongly agree that the rainfall level has been declining in the past 5 years around the City of Polokwane. It is indicated in Figure 7.22 that 30.3% of the respondents agree that there has been a decline in the level of rainfall around the city. On the other hand, 7.6% and 11.9% of the respondents strongly disagree and disagree respectively that the rainfall has been declining over the years while only 15.1% remained neutral on this notion. The finding is that there is a perception that the intensity of rainfall has been declining around the City of Polokwane in the last years. This is attributed to the intensification of the changing climatic condition that continues to affect the majority of the people throughout the world, especially in developing countries. Thus, this demonstrates that the City of Polokwane is vulnerable to the effects of climate change such as a decline in rainfall. On the other hand, only a small proportion of people believe that the rainfall around the city has not been declining over the years. This finding is corroborated by literature that South Africa has been experiencing a decline in the levels of rainfall. However, Figure 7.22 shows that 15.1% of the respondents remained undecided on the decline in rainfall intensity around the city. This might suggest that the people do not know if the rainfall has been declining or not. This is because this measure of rainfall intensity is done annually by the municipality, which needs to be shared with the local communities.

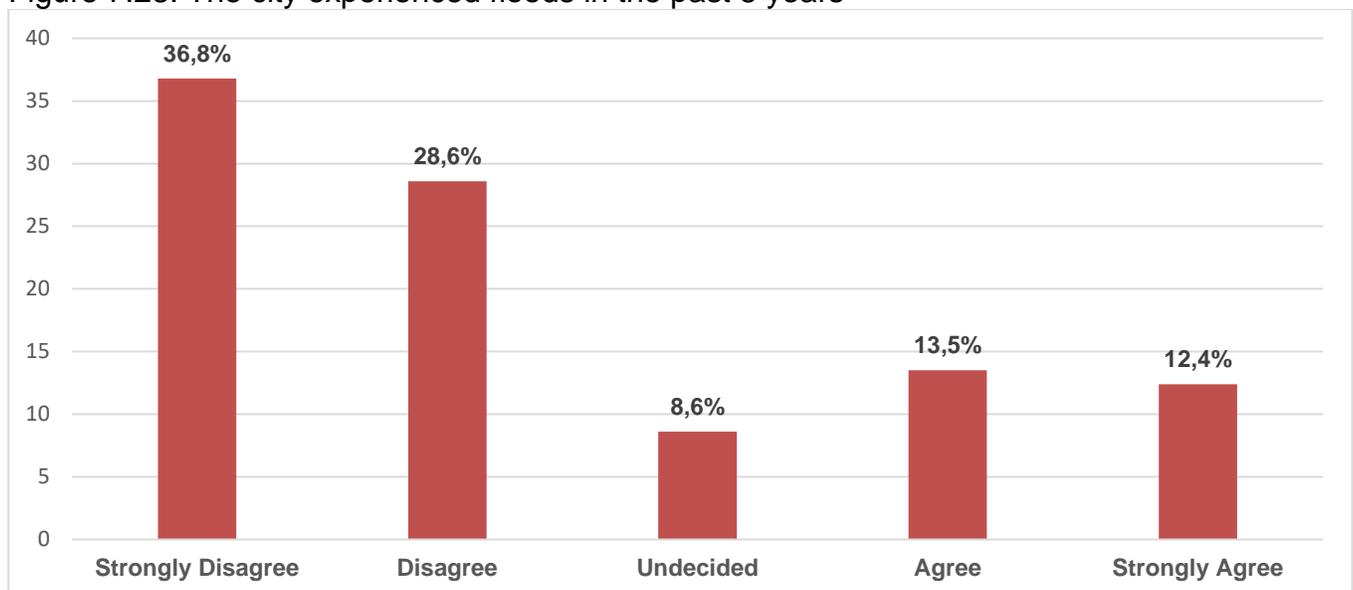
Figure 7.22: There has been a decline in the levels of rainfall in the past 5 years



7.1.4.2 The City of Polokwane has experienced floods in the past 5 years

Figure 7.23 shows that 36.8% of the respondents strongly disagree that the city has experienced floods in the past 5 years. It is indicated in Figure 7.23 that 28.6% of the respondents disagree that there were floods around the city. This shows that the majority of respondents believe that the city has not experienced floods for the past 5 years. On the other hand, 13.5% of the respondents agree that there were floods around the city. Figure 7.23 shows that only 12.4% of the respondents strongly agree that the City of Polokwane has experienced floods in the past 5 years while only 8.6% remained undecided. The finding suggests that the City of Polokwane has not experienced floods in the past 5 years. Therefore, it can be said that Polokwane City does not show any signs of vulnerability to floods. This can be attributed to the decline in rainfall intensity and the landscape of the city. However, few respondents believe that the City of Polokwane has experienced floods in the past 5 years. Some people have cited various incidences such as in Savannah Mall where water flowed into the shops and damaged people's stock and cars. However, these incidences are attributed to poor drainage systems, which resulted from a lack of maintenance and poor planning. Therefore, waterlogging as a result of lack of maintenance of the drainage systems around the city

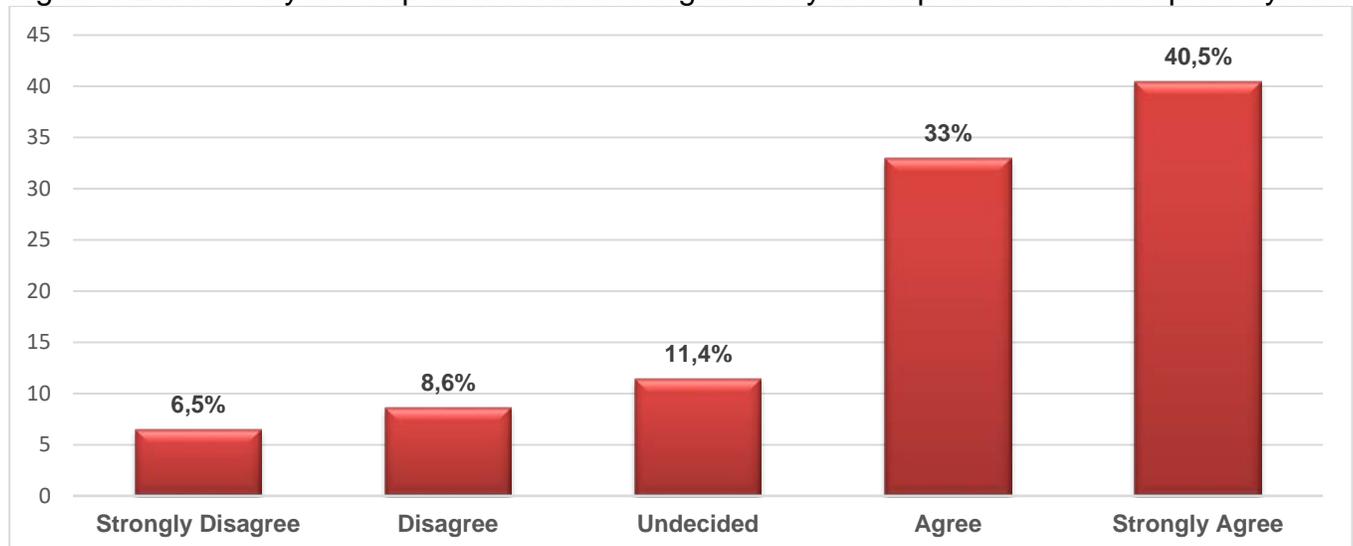
Figure 7.23: The city experienced floods in the past 5 years



7.1.4.3 The area has been experiencing increasing intensity in temperature over the past 5 years

Figure 7.24 presents data on the occurrence of high temperatures around the city in the past 5 years. Figure 7.24 shows that 6.5% of the respondents strongly disagree that the city has experienced increasing intensity in temperature in the past 5 years while 8.6% disagree with this notion. It is indicated that only 11.4% of the respondents were undecided on whether or not the city has been experiencing high temperatures in the past 5 years. On the other hand, Figure 7.24 shows that 33.0% of the respondents agree that in the past 5 years, there has an increasing intensity in temperature in the City of Polokwane. Figure 7.24 shows that a huge proportion (40.5%) of the respondents strongly agree that there has been an increasing intensity in temperature around the city. The finding suggests that there is a perception that the City of Polokwane has been experiencing the intensification of temperatures. This might further suggest that the City of Polokwane is vulnerable to the effects of climate change such as high temperatures, which have the potential to affect people's health and food production. Consequently, climate change has a damaging impact on the lives of ordinary citizens around the City of Polokwane. However, few respondents were undecided on whether or not the city has experienced high temperatures. This might suggest that there is a lack of knowledge regarding the intensity of temperature around the city.

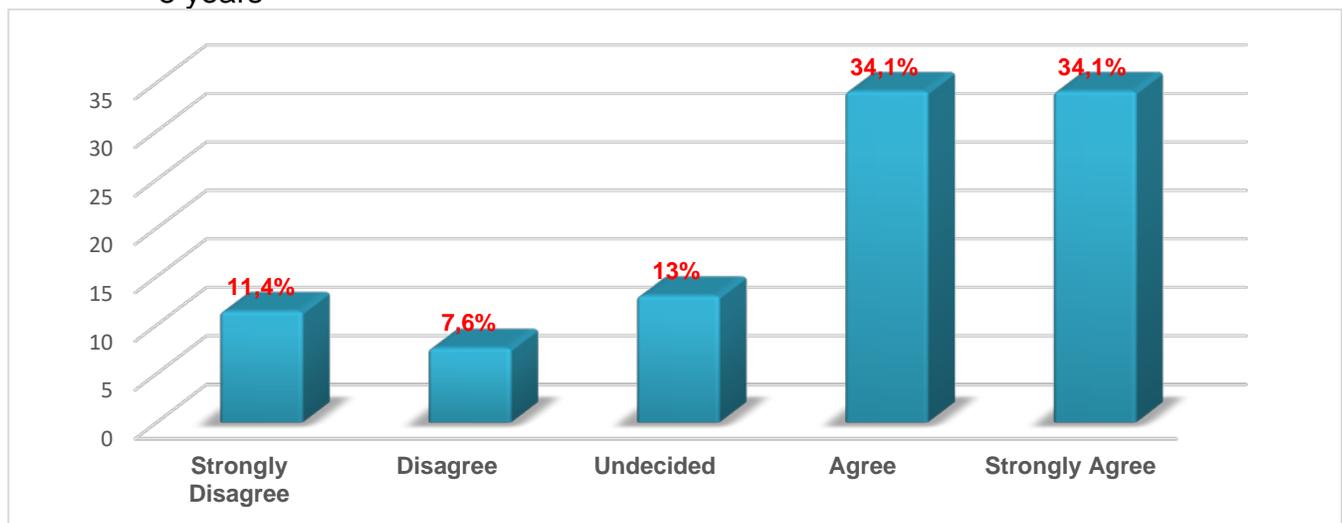
Figure 7.24: The city has experienced increasing intensity in temperature over the past 5 years



7.1.4.4 The city has experienced heatwaves resulting in extreme temperatures

Figure 7.25 presents the perceptions of the respondents on the occurrence of heatwaves, which resulted in extreme temperatures around the City of Polokwane in the past 5 years. Figure 7.25 shows that 34.1% of the respondents strongly agree that the City of Polokwane has experienced heatwaves that resulted in high temperatures. It is indicated that 34.1% of the respondents agree with the notion that the city has experienced heatwaves in the past 5 years. On the other hand, 11.4% and 7.6% of the respondents strongly disagree and disagree respectively that the city has witnessed heatwaves that resulted in high temperatures in the past 5 years. However, only 13.0% of the respondents remained undecided on whether or not the city has experienced heatwaves. The majority of the respondents believe that the city has been experiencing heatwaves that increased the intensity of temperature over the past 5 years. Therefore, the effects of climate change are being felt around the city. Few respondents believe that the city has not experienced heatwaves. Some of the respondents have argued that the City of Polokwane is naturally hot, thus, it has not been experiencing heatwaves that increase the intensity of temperature in the past 5 years. However, others have remained undecided on the occurrence of heatwaves around the city. This might suggest that the respondents do not know the characterisation of a heatwave. The finding suggests that the City of Polokwane has demonstrated its vulnerability towards heatwaves in the past 5 years, which resulted in high temperatures.

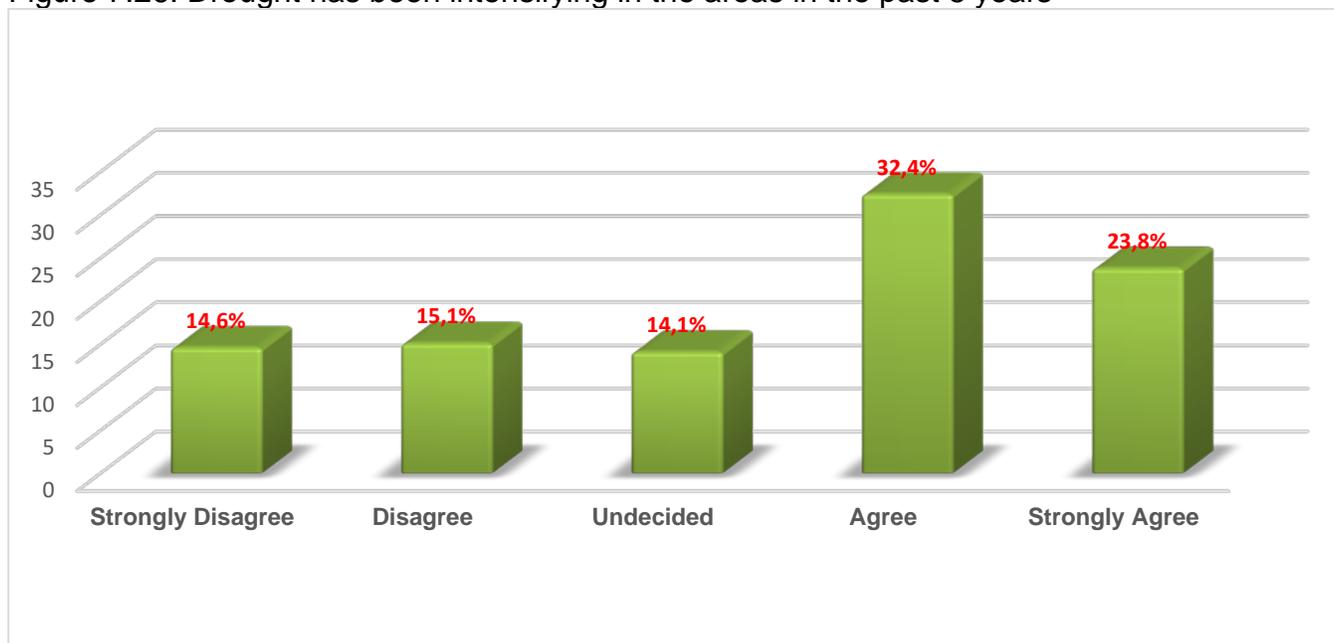
Figure 7.25: The city has experienced heatwaves that resulted in extreme temperatures in the past 5 years



7.1.4.5 Drought has been intensifying in the area in the past 5 years

Figure 7.26 presents data to assess the occurrence of drought around the City of Polokwane in the past 5 years. Figure 7.26 shows that 14.6% of the respondents strongly disagree that drought has been intensifying in the past 5 years. In addition, only 15.1% of the respondents disagree that the city has been experiencing drought over the past 5 years. Figure 7.26 shows that 32.4% of the respondents agree that the city has witnessed drought in the past 5 years. Figure 7.26 shows that 23.8% of the respondents strongly agree that drought is a reality in the City of Polokwane. Figure 7.26 shows that 14.1% of the respondents have remained undecided on the occurrence of drought around the city. This suggests that there is a lack of knowledge regarding the effects of climate change such as drought and its characteristics. The majority of the respondents believe that the city has been experiencing drought over the past 5 years. The finding suggests that the City of Polokwane is vulnerable to the occurrence of drought that has the potential to reduce the production of food and resulting in water cut around the city. This is further validated by the continuous water problems around the City of Polokwane. The literature has demonstrated that the City of Polokwane and Cape Town have been experiencing water shortages due to drought. In 2017 the City of Cape Town implemented water cuts and day zero (a day when there would not be water dripping from the taps around the city). Furthermore, areas such as Emdo Park, Serala View and Legae la Batho have been without water for over a month due to low water levels at the Ebenezer dam. Therefore, there is a perception the City of Polokwane is vulnerable to drought.

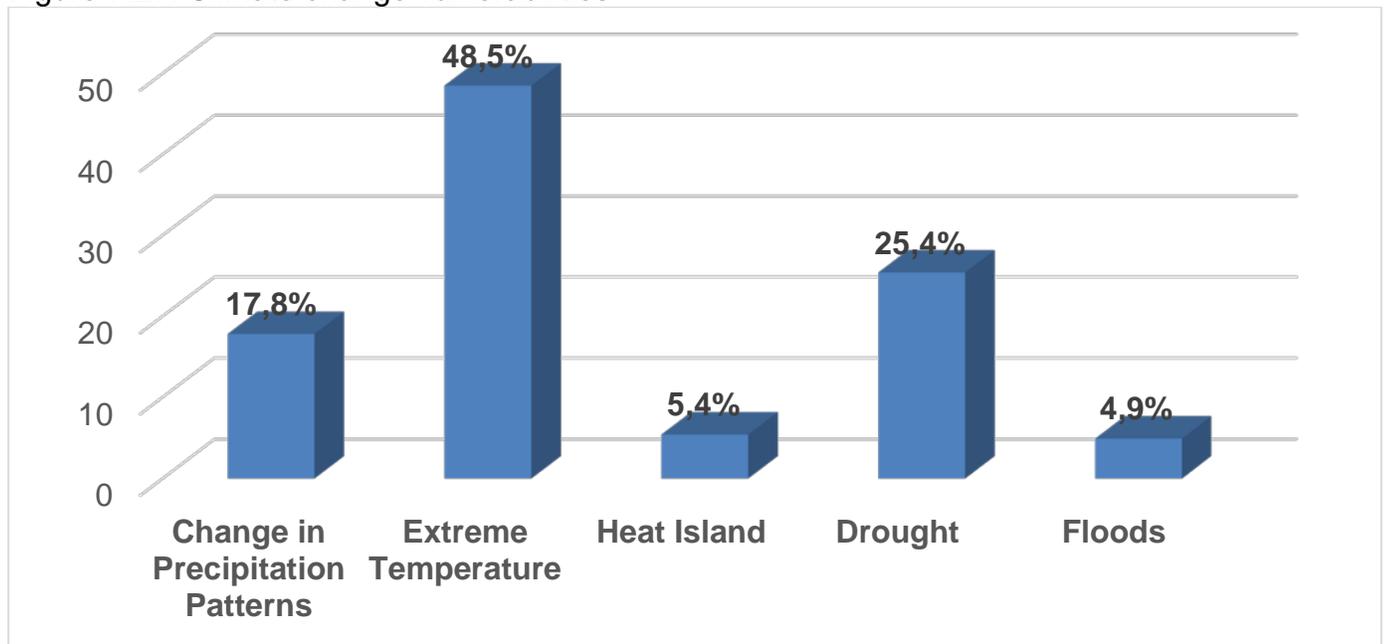
Figure 7.26: Drought has been intensifying in the areas in the past 5 years



7.1.4.6 Climate change vulnerabilities in the City of Polokwane

Figure 7.27 shows the vulnerability of the City of Polokwane to the effects of climate change. It is indicated in Figure 7.27 that the majority (48.5%) of the respondents stated that the city is most vulnerable to extreme temperature as one of the effects of climate change. Figure 7.27 shows that 25.4% of the respondents stated that the City of Polokwane is more vulnerable to drought. Figure 7.27 shows that 17.8% of the respondents believe that the city is more vulnerable to the change in the patterns of precipitation. Only 5.4% of the respondents stated that the City of Polokwane is most vulnerable to heat islands or heatwaves while 4.9% stated that the city is affected by floods the most. The finding suggests that the City of Polokwane is vulnerable to the multiple effects of climate change such as a change in precipitation patterns, extreme temperature and droughts. However, the respondents perceive that the City of Polokwane is mostly vulnerable to extremely high temperatures when compared with other effects of climate change such as drought, heatwaves, changing precipitation patterns and floods. On the other hand, the City of Polokwane is least vulnerable to heat island and floods. However, other respondents stated that although the city is not vulnerable to floods, it is affected by waterlogging, which is attributed to the blockage of drainage systems. Therefore, lack of maintenance of the drainage system around the city poses serious problems towards ensuring that the city is resilient post any perturbation.

Figure 7.27: Climate change vulnerabilities



7.1.5 Operative Strategies Employed to Mitigate Climate Change

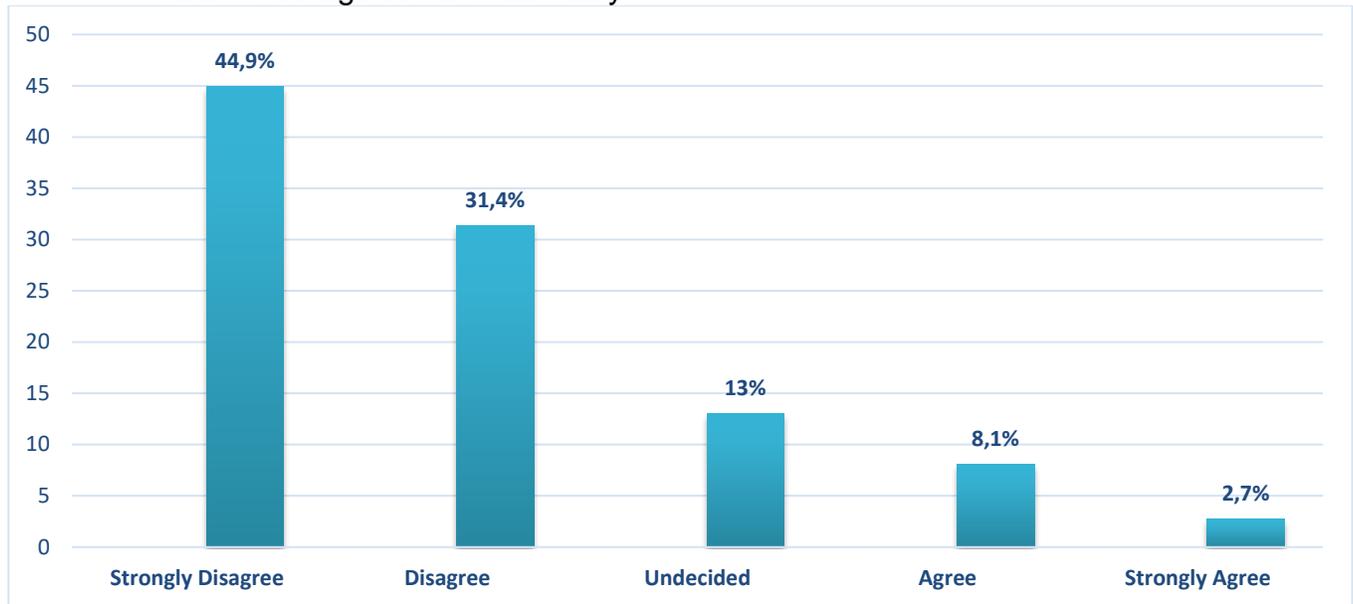
The section focuses on the perceptions of the communities about the strategies that can be employed within the Polokwane Local Municipality in an attempt to mitigate climate change. An attempt by the municipality to contribute towards South Africa's target to mitigate climate change is through the reduction of GHGs. This can be explored through the provision of information to the communities about climate change in order to contribute towards the reduction in energy consumption and overreliance on private car usage around the city. It was demonstrated in the literature that the provisions of information about climate change are important to ensure the involvement of the community within the municipality. This will enable the community to shift towards the usage of public transport (to avoid traffic congestion), solar systems and gas appliance.

7.1.5.1 The provision of information to the local communities about the effects of climate change

Figure 7.28 presents data to assess the perceptions of the respondents concerning the provision of information about the effects of climate change on the local communities by the Polokwane Local Municipality. It is indicated in Figure 7.28 that a huge proportion (44.9%) of the respondents strongly disagree that the municipality provides the local communities with information about the effects of climate change. Figure 7.28 shows that 31.4% of the respondents disagree that local communities are provided with information about the effects of climate change on their lives. On the other hand, Figure 7.28 shows that only 8.1% and 2.7% of the respondents agree and strongly agree respectively that the municipality provides local communities with information about the effects of climate change.

Figure 7.28 shows that only 13.0% of the respondents remained undecided on whether or not the municipality is providing the communities concerning the information about climate change. This suggests that some of the people around the city lack interest regarding issues that relate to the municipality. The majority of respondents believe that the municipality does not provide the local communities around the City of Polokwane with information about the effects of climate change. The finding suggests that there is a lack of municipal involvement in the provision of information about the effects of climate change to the local communities. This is supported by literature that there is a huge disconnect between local municipalities and the local communities in terms of climate change. The lack of knowledge from the local communities about climate change prevents them to be adaptable and contribute towards planning within the municipality. However, a small proportion of people agree that the municipality does provide local communities with information about climate change. This connotes that the municipality is beginning to provide the community with information about climate change which is very important towards galvanizing them to address these effects. Therefore, there is a need for the municipality to provide the local communities with information regarding climate change effects.

Figure 7.28: The municipality provides the local communities with information about the effects of climate change in our community

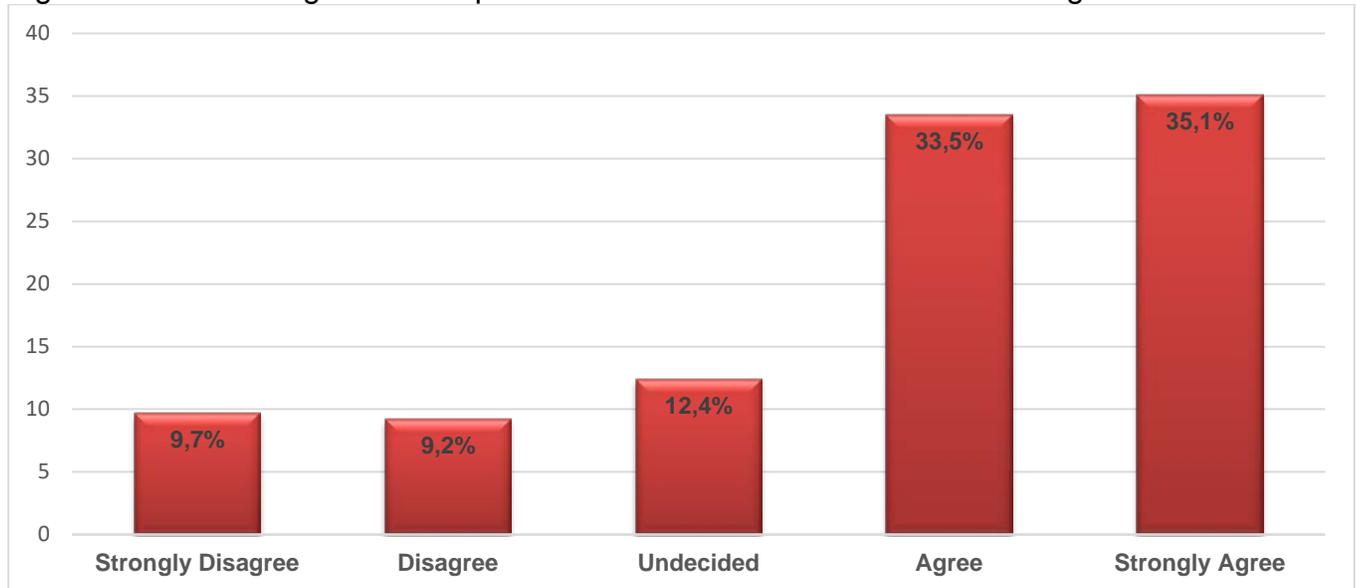


7.1.5.2 Reducing the use of private cars can be a solution to traffic congestion around the city

Figure 7.29 presents data on the reduction of overreliance on private cars around the city as a solution to traffic congestion, which is important in reducing GHG emissions. Figure 7.29 shows that 9.7% of the respondents strongly disagree that reducing the usage of private cars can be a solution to traffic congestion in the City of Polokwane. It further shows that 9.2% of the respondents disagree that reducing the usage of private cars is the solution to traffic congestion. It is indicated in Figure 7.29 that 33.5% of the respondents agree that the reduction of overreliance on private car usage towards public transport can reduce traffic congestion in the City of Polokwane. Furthermore, 35.1% of the respondents strongly agree that reducing the use of private car usage towards the use of public transport can be the solution to traffic congestion. It is indicated in Figure 7.29 that 12.4% of the respondents remained undecided on this aspect. This suggests that the people do not see the possibility of people shifting from using their private cars towards public transportation. This is important to note because it assists in bringing innovative planning to change this embedded ideology. The finding suggests that there is an overwhelming awareness that the shift from overreliance on private cars to public transport can be the solution towards traffic congestion within the

City of Polokwane. Therefore, there should be a shift in thinking among the residents from overreliance on private cars towards the public transportation system. Few respondents indicated that the reduction in the usage of private cars is not a solution to traffic congestion in the City of Polokwane. This might be attributed to the fact that some people still do not want to use public transport.

Figure 7.29: Reducing the use of private cars can be a solution to traffic congestion around the city

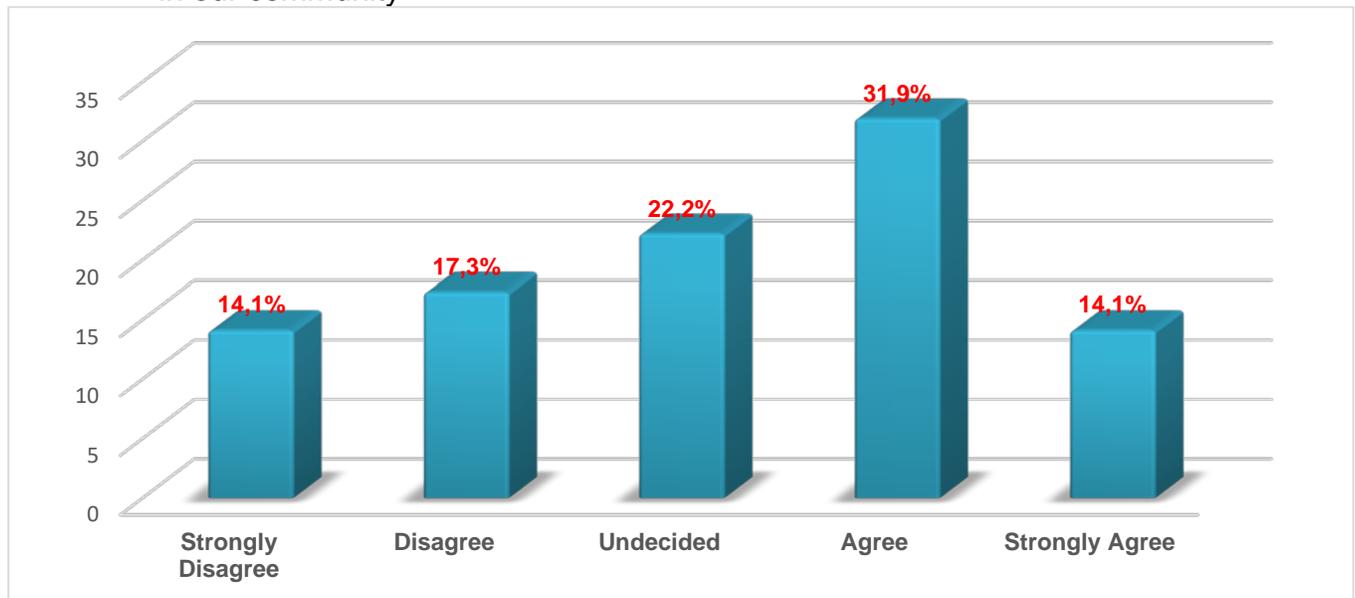


7.1.5.3 The adequacy of knowledge regarding the effects of climate change in the community

Figure 7.30 shows that 14.1% of the respondents strongly disagree that they have adequate knowledge about the effects of climate change. Figure 7.30 shows that 17.3% of the respondents disagree that they know the effects of climate change. On the other hand, 31.9% of the respondents agree that they do possess adequate information about the effects of climate change while 14.1% strongly agree with this statement. However, 22.2% of the respondents have remained undecided on whether or not they possess adequate knowledge about the effects of climate change in their community. The finding suggests that there is an awareness of the effects of climate change around the community. This is very important in planning to ensure that they are adaptable to these effects. However, a small number of people strongly disagree that they possess adequate knowledge about the effects of climate change. This can be attributed to the fact that the majority of the respondents

stated earlier that the municipality does not provide information about the effects of climate change on the community. Therefore, the Polokwane Local Municipality needs to initiate awareness campaigns, which aim at educating the public about climate change and the effects associated with it.

Figure 7.30: The adequacy of knowledge regarding knowledge about the effects of climate change in our community

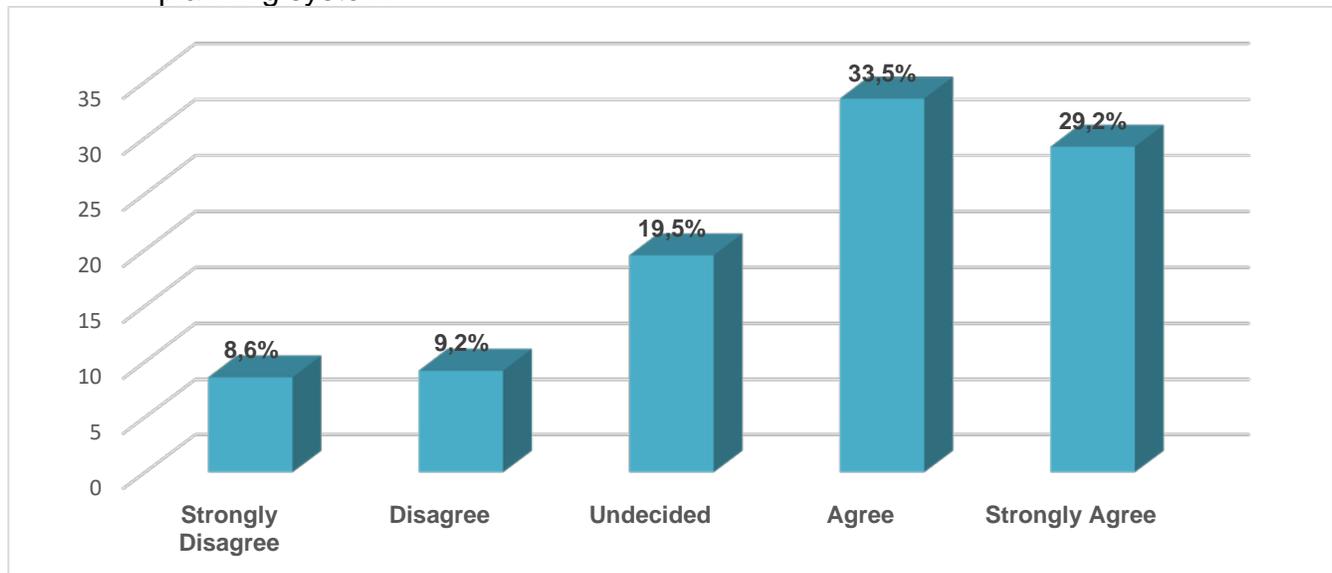


7.1.5.4 The community's contribution to the municipal planning system

Figure 7.31 presents data to assess the perceptions of the communities on their knowledge about urbanisation as a valuable contribution to the municipal planning system, thereby helping to address climate change. Figure 7.31 shows that only 8.6% of the respondents strongly disagree that they can contribute towards the municipal planning system while 9.2% disagree with this statement. On the other hand, 33.5% of the respondents agree that their knowledge about urbanisation can enable them to add value to the municipal planning system. Figure 7.31 shows that 29.2% of the respondents strongly agree that they can add a valuable contribution to planning. However, it is indicated in Figure 7.31 that 19.5% of the respondents remained undecided about their knowledge of urbanisation. This suggests that the lack of knowledge regarding the association between urbanisation and climate change. Furthermore, the lack of knowledge about the processes of addressing climate change might be the reason people stated that they are undecided. The finding

is that many people believe that they can add value to the municipal planning system concerning urbanisation in order to address climate change. Due to the complexity of managing a city, the engagement of multiple players in planning has the potential to address climate change. On the other hand, some respondents stated that they do not have the potential to add value to municipal planning. This can be attributed to the lack of knowledge about climate change and urbanisation.

Figure 7.31: Knowledge about urbanisation enables the community to add value to the municipal planning system

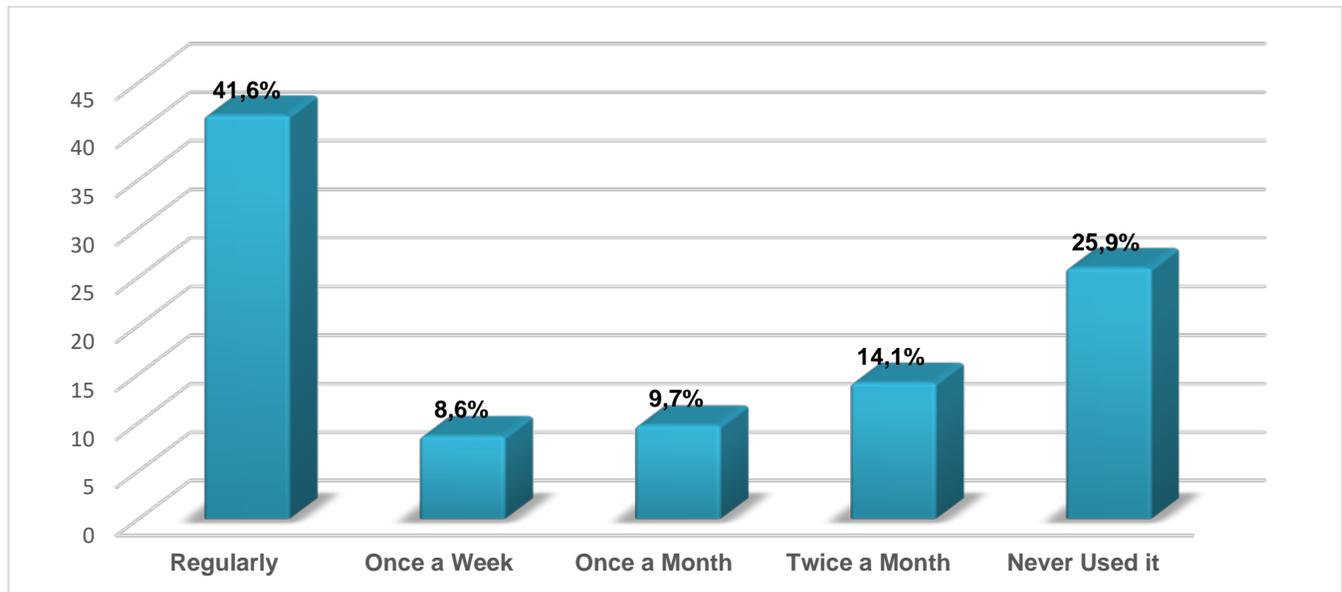


It is clear from the figure above that the majority of people strongly believe that they can contribute to municipal planning. People believe that a shift from over-reliance on private cars can reduce traffic congestion, which is very important in reducing GHGs emissions. This is very significant because the reduction in traffic congestion can help in the abatement of the level of GHGs emissions. Therefore, the reduction in GHGs emissions will contribute significantly towards climate change mitigation. An attempt towards climate change mitigation is based on the fact that no individual city or nation can adequately address climate change. This requires collaboration between municipalities and communities to help manage the city more efficiently and effectively.

7.1.5.5 The frequency of using public transport

Figure 7.32 shows that the majority (41.6%) of the respondents around the city regularly use public transport. Figure 7.32 shows that only 8.6% of the respondents use public transport at least once a week. Furthermore, 9.7% of the respondents stated that they only use public transport once a month while 14.1% use it at least twice a month. However, Figure 7.32 shows that 25.9% of the respondents have never used public transport in the recent past. People who use public transport regularly outnumber those who are using it once a week, once a month, twice a month and those who never used it. Therefore, this suggests that people continue to rely on their private cars as opposed to the usage of public transport for their daily duties. Thus, the City of Polokwane continues to be confronted with traffic congestion during pick hours (early morning and late afternoon). Therefore, traffic congestion has the potential to increase the amount of GHGs emissions. The increment in the GHGs emissions around the city has the potential to intensify climate change in the near future. This is based on the fact that the current climatic conditions are a result of a vast amount of emissions that were produced some years ago.

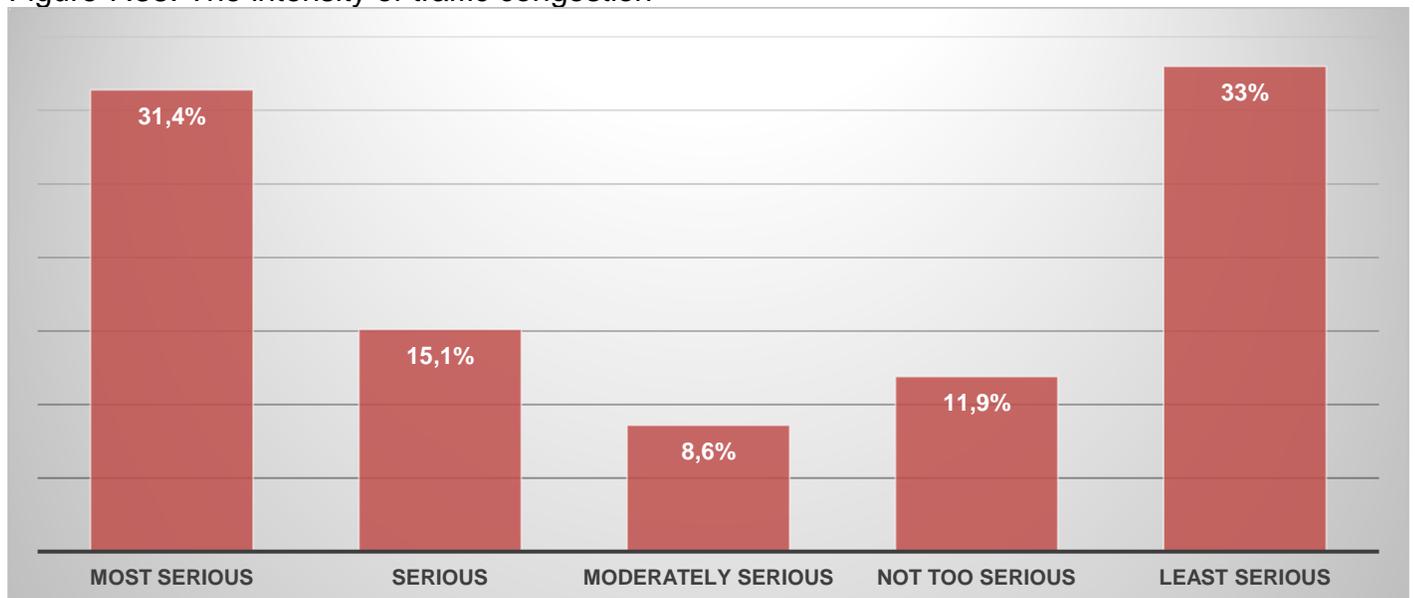
Figure 7.32: The frequency of using public transport



7.1.5.6 The intensity of traffic congestion in the City of Polokwane

Figure 7.33 shows the intensity of traffic congestion around the City of Polokwane. Figure 7.33 shows that 31.4% of the respondents stated that traffic congestion is most intense around the City of Polokwane. Figure 7.33 further shows that 15.1% of the respondents stated that traffic congestion is serious. On the other hand, only 8.6% of the respondents stated that traffic congestion is moderately intense while 11.9% believe that it is not too serious. Lastly, Figure 7.33 shows that 33.0% of the respondents stated that traffic congestion is the least serious around the city. The analysis demonstrates that many respondents believe that traffic congestion is not a huge problem around the City of Polokwane. However, this might be attributed to the location of the respondents. People from Legae la Batho and Emdo Park are more likely to state that they are experiencing serious traffic congestion as opposed to those from Serala View and Flora Park. Other respondents believe that traffic congestion is a problem around the city. This suggests that people state their views based on the time they usually travel during the day and their area. Those who travel mostly in the morning consider traffic congestion to be a problem while those travelling during the day consider it as not being a problem. Therefore, the finding suggests that traffic congestion around the City of Polokwane is intense during pick hours (morning and afternoon around 16h30) especially for those people from Legae la Batho and Emdo Park.

Figure 7.33: The intensity of traffic congestion



7.1.5.7 Attitude towards electricity conservation to reduce GHGs emissions

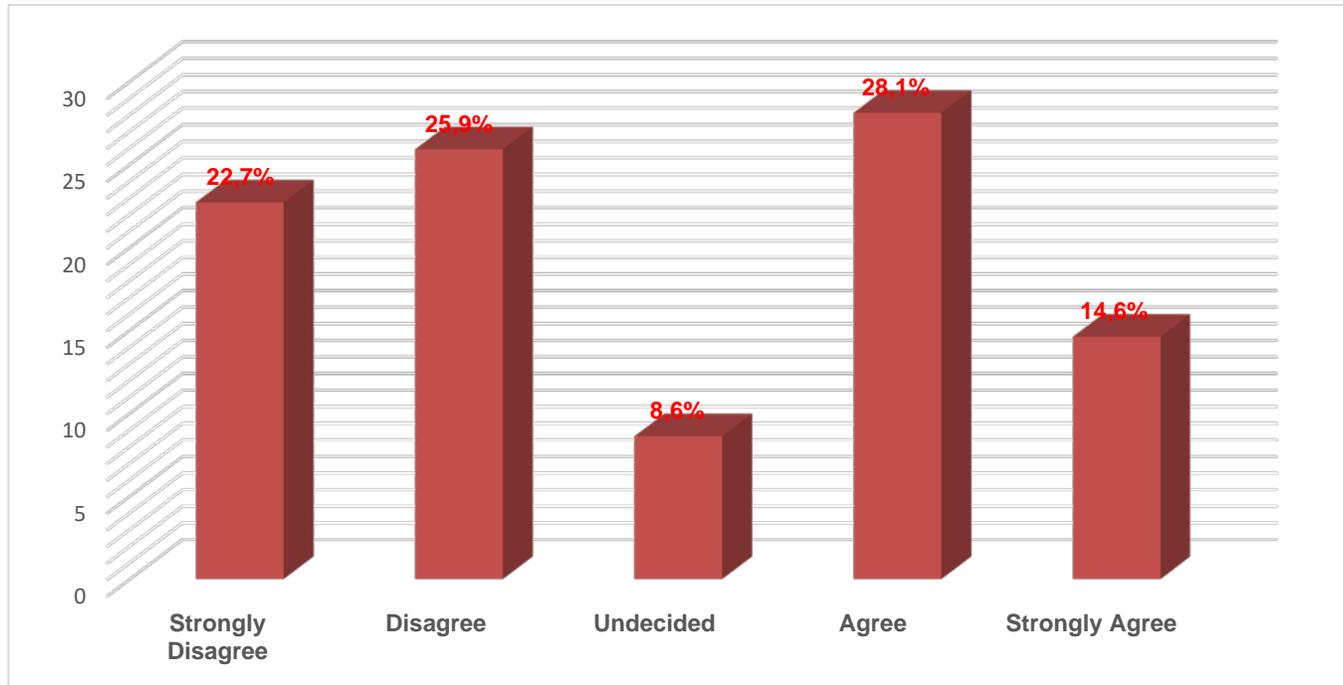
This section focuses on assessing the attitudes of the respondents towards reducing the consumption of electricity within households. Literature has demonstrated that buildings consume about 40% of the energy and are responsible for 40% of the GHG emissions. This is based on the fact that electricity is generated from the burning of fossil fuels (coal) that emit GHGs, which impacts negatively on the Ozone layer and consequently, results in climate change. Therefore, the reduction of GHGs, which are attributed to the households can contribute significantly towards the attainment of South African GHGs emission targets and thus, contributing towards climate change mitigation.

i) Reducing my electricity usage within the household bothers me

Figure 7.34 shows that 22.7% of the respondents strongly disagree that they are bothered by reducing electricity consumption within the households while 25.9% disagreed. It is indicated in Figure 7.34 that only 8.6% of the respondents remained undecided on whether or not they were bothered by reducing electricity. On the other hand, 28.1% of the respondents agree that they are bothered when reducing their electricity consumption within their households. Furthermore, 14.6% of the respondents strongly agree that the reduction of electricity usage within households is too much of a bother. A major proportion of respondents believe that they are not bothered when reducing electricity. This suggests that many respondents are not bothered when reducing electricity consumption within households. Other people have indicated that the reduction in electricity is a bother but very necessary. Despite this belief, there is a high number of people who still believe that reducing electricity is a bother. The finding is that there is a positive attitude towards that reduction of electricity consumption within the households. This is very significant in an attempt to reduce the overall GHGs in an attempt to mitigate climate change. This demonstrates that cities hold the potential to address the overall GHGs in South Africa in an attempt to mitigate climate change. However, it is concerning to realise that 42.7% of the people demonstrate a negative attitude when it comes to the reduction of electricity within the households. The negative attitude towards reducing electricity has the potential to derail efforts towards the reduction of GHGs

emissions. The negative attitude can be attributed to the lack of knowledge about the effects of climate change on the communities.

Figure 7.34: Reducing my electricity usage is too much of a bother

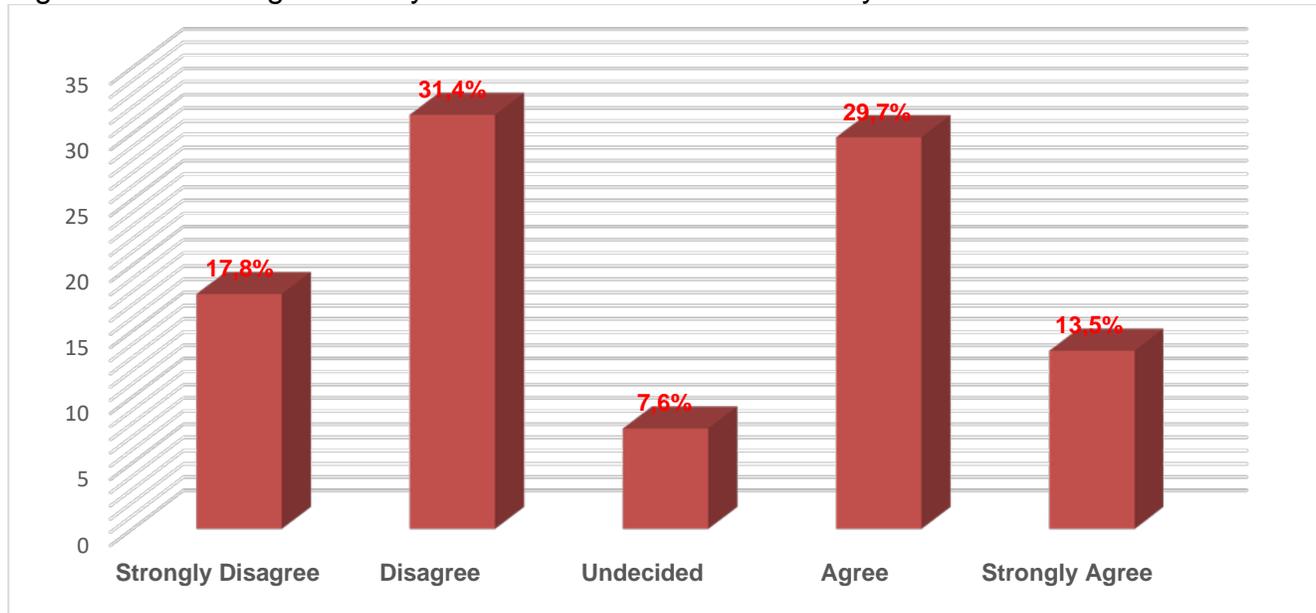


ii) Saving electricity makes me live less comfortably

Figure 7.35 indicates that 17.8% of the respondents strongly disagree that saving electricity makes them less comfortable while 31.4% disagree. Figure 7.35 shows that 29.7% of the respondents agree that they feel less comfortable when saving electricity. Furthermore, 13.5% of the respondents strongly agree that saving electricity makes them live less comfortably. Figure 7.35 shows that 7.6% of the respondents have remained undecided on whether or not they are comfortable about saving electricity within their households. The majority of the respondents believe that they are comfortable when they save electricity. The majority (49.2%) of the respondents disagree that the reduction of electricity makes them live less comfortably. The finding suggests that there is a positive attitude towards saving electricity within the households, which holds the potential to reduce the GHGs emission in the City of Polokwane. This finding is on the basis that one city cannot adequately address climate change but concerted efforts by all the cities

have the potential to mount a bigger impact on mitigating the changing climatic conditions in the distant future. However, the negative attitude that some people are demonstrating towards reducing electricity poses a serious problem towards climate change mitigation. Therefore, there is a need for the municipality to undertake awareness campaigns on the significance of reducing electricity usage in an attempt to mitigate the intensification of changing climatic conditions.

Figure 7.35: Saving electricity makes me live less comfortably

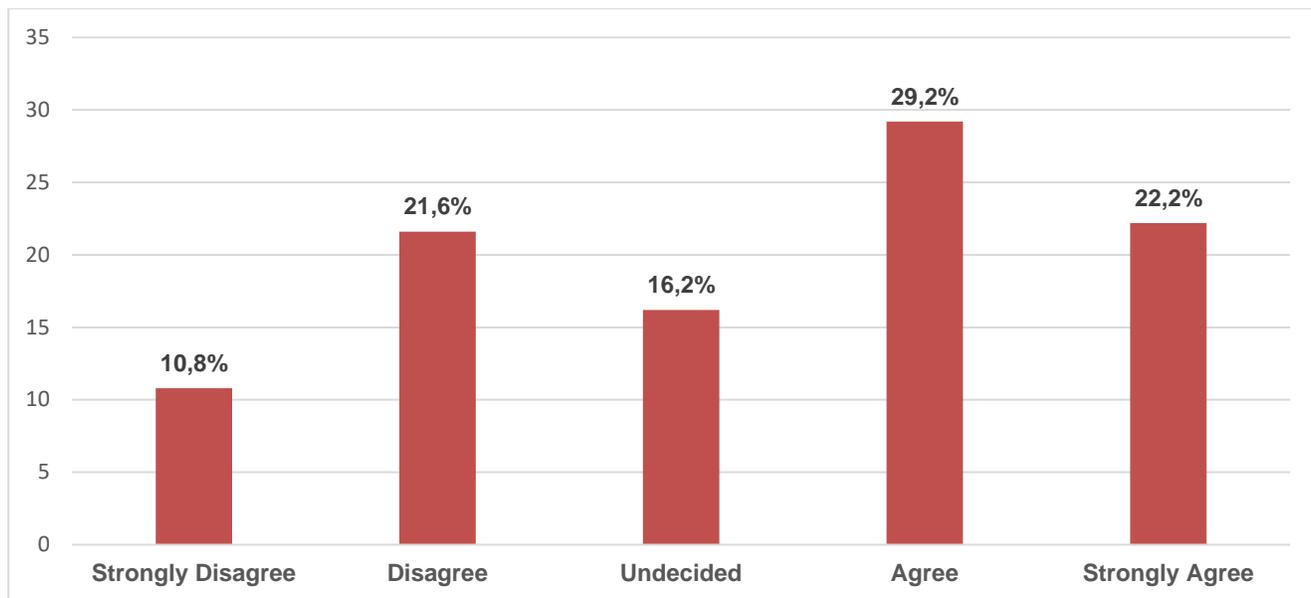


iii) The quality of my life will improve when I reduce electricity usage

Figure 7.36 shows that 10.8% of the respondents strongly disagree that the quality of life improves when they reduce electricity consumption within their households. Figure 7.36 shows that 21.6% of the respondents disagree that the quality of their lives will increase if they reduce electricity consumption. On the other hand, Figure 7.36 shows that 29.2% of the respondents agree that their quality of life will improve if they reduce electricity consumption. Furthermore, Figure 7.36 shows that 22.2% of the respondents strongly agree that the reduction in electricity consumption will improve their quality of life. On the other hand, only 16.2% of the respondents remained undecided on whether or not their quality of life will improve if they reduce their household electricity consumption. This suggests that the people do not understand how the reduction of electricity has as the impact on their lives under the auspices of the climate change discourses. It is clear that the

majority of the respondents believe that their quality of life will improve within the households when they reduce electricity. The finding is that the majority of people have demonstrated a positive attitude towards the reduction of electricity use within their households. However, many respondents believe that their quality of life will decline if they reduce their electricity consumption. This demonstrates a negative attitude towards the reduction of electricity use in an attempt to mitigate climate change. Therefore, there is a need to make communities aware of the importance of reducing electricity consumption under the auspices of climate changes mitigation aspirations.

Figure 7.36: The quality of my life will improve when I reduce electricity usage

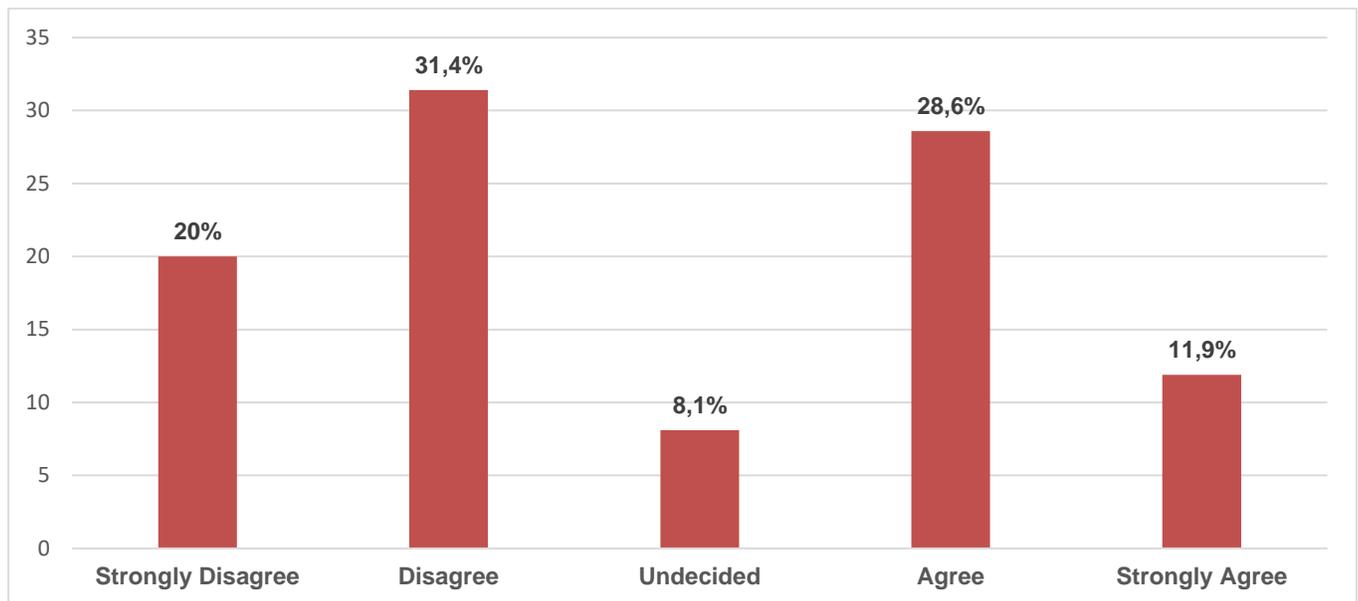


iv) Saving electricity will restrict my freedom

Figure 7.37 assesses the perceptions of the respondents on whether or not saving electricity will restrict their freedom within their households. Figure 7.37 shows that 20.0% of the respondents stated that they strongly disagree that saving electricity will restrict their freedom within the households while 31.4% disagree with the notion. It is indicated that only 8.1% of the respondents remained undecided on whether or not that saving electricity will restrict their freedom. Figure 7.37 shows that 28.6% of the respondents agree that saving electricity will restrict their freedom while only 11.9% agree. The finding is that the majority of the respondents believe that saving electricity does not restrict their freedom within households. The majority of people have a positive attitude

towards saving electricity, which is very significant in an attempt to mitigate climate change. This is very important in reducing the burning of fossil fuels when generating electricity. Therefore, this has the potential to reduce GHG emissions in an attempt towards mitigating climate change. However, some of the respondents believe that saving electricity will restrict their freedom within their households. This demonstrates a negative attitude towards reducing electricity. This has the potential to derail the commitment toward climate change mitigation.

Figure 7.37: Saving electricity will restrict my freedom

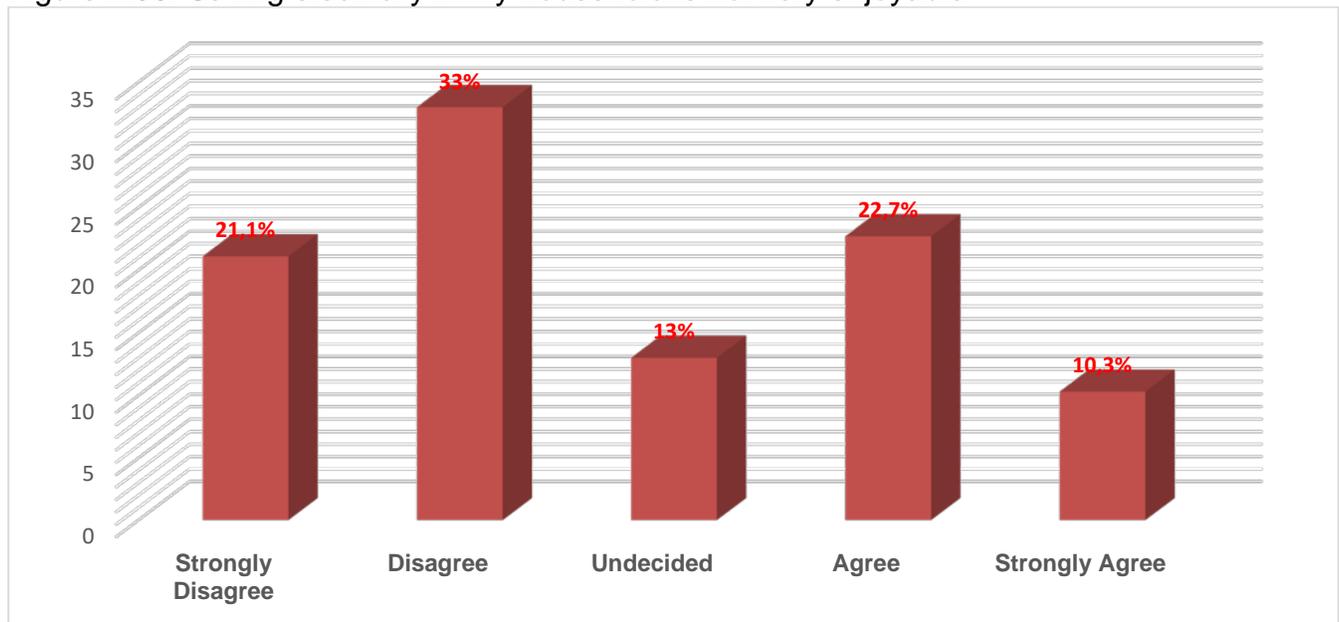


v) Saving electricity in my household is not very enjoyable

It is indicated in Figure 7.38 that 21.1% of the respondents strongly disagree that saving electricity within households is not very enjoyable. Furthermore, 33.0% of the respondents stated that they disagree that saving electricity is not enjoyable. On the other hand, 22.7% of the respondents agree that saving electricity is not enjoyable while only 10.3% strongly agree with the notion. However, Figure 7.38 shows that only 13.0% of the respondents remained undecided on whether or not saving electricity within the households is enjoyable. It is clear from the analysis that the majority of people disagree that saving electricity within households is not very enjoyable. The finding suggests that people have a positive attitude towards saving electricity within households. However, a minority of the people around the city believe that saving electricity within households

is not enjoyable. Thus, some people are not aware of the impact of high electricity generation from the burning of fossil fuels (coal) on the environment. The lack of awareness of people about the impact of electricity generated from the burning of fossil fuel has on the environment can also be attributed to a developmental and environmental ideology that people hold. This means that the conservatives will push towards enjoying life at the expense of the environment. This demonstrates the complexity of an urban system where the management of the urban system is infiltrated by contrasting ideologies.

Figure 7.38: Saving electricity in my household is not very enjoyable



The majority of the people demonstrated a positive attitude towards the conservation of electricity within their households. This positive attitude is important within a municipality that has the responsibility to reduce the level of GHGs in an attempt to mitigate climate change. However, many respondents have demonstrated a negative attitude towards saving electricity within their households. Due to these contrasting attitudes, there is a need for awareness campaigns about the impact of high electricity consumption on the environment. The negative attitude towards reducing electricity can be attributed to the lack of provision of information about climate change to the community as mentioned earlier.

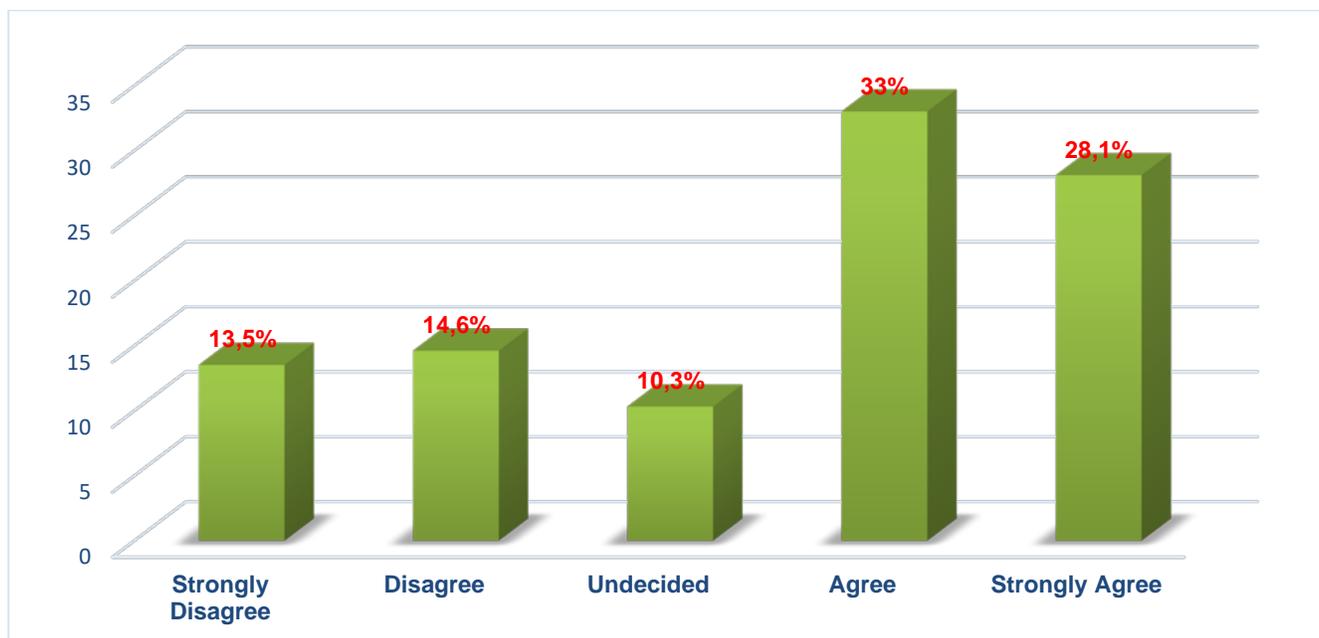
7.1.5.8 Feeling guilty about the high consumption of electricity

This section assesses the perceptions of the respondents about their feelings regarding the high consumption within their households. The section explores the compliance to the measure to reduce electricity consumption within households. Since South Africa is relying on burning fossil fuel (coal) in generating electricity, their feelings about reducing high electricity consumption are very important in an attempt to reduce GHGs emissions.

i) Feeling guilty for using more electricity than necessary within the household

It is indicated in Figure 7.39 that 13.5% of the respondents stated that they strongly disagree that they feel bad when using more electricity than necessary within the households while 14.6% disagree with this notion. This suggests that a small proportion of people do not feel bad when consuming a lot of electricity within households. On the other hand, 33.5% of the respondents agree that they feel bad about using a lot of electricity within households. It is indicated in figure 7.39 that 28.1% of the respondents strongly agree that they feel bad when consuming a lot of electricity within the households. Figure 7.39 shows that only 10.3% remained undecided on whether or not regarding their feelings about saving electricity within their households. The finding suggests that the majority of respondents stated that they feel bad about using a lot of electricity within their households. The finding is that many people advocate for the reduction of electricity within these households. Electricity reduction within the households demonstrates that there is a potential for the city to reduce the overall electricity consumption, which contributes towards GHG emissions reduction. This will result in a decline in the generation of electricity, which has the potential to reduce GHGs emissions in an attempt to mitigate climate change. On the contrary, there is a small proportion of people who still believe in the consumption of a lot of electricity within households.

Figure 7.39: I feel bad about using more electricity than necessary in my house

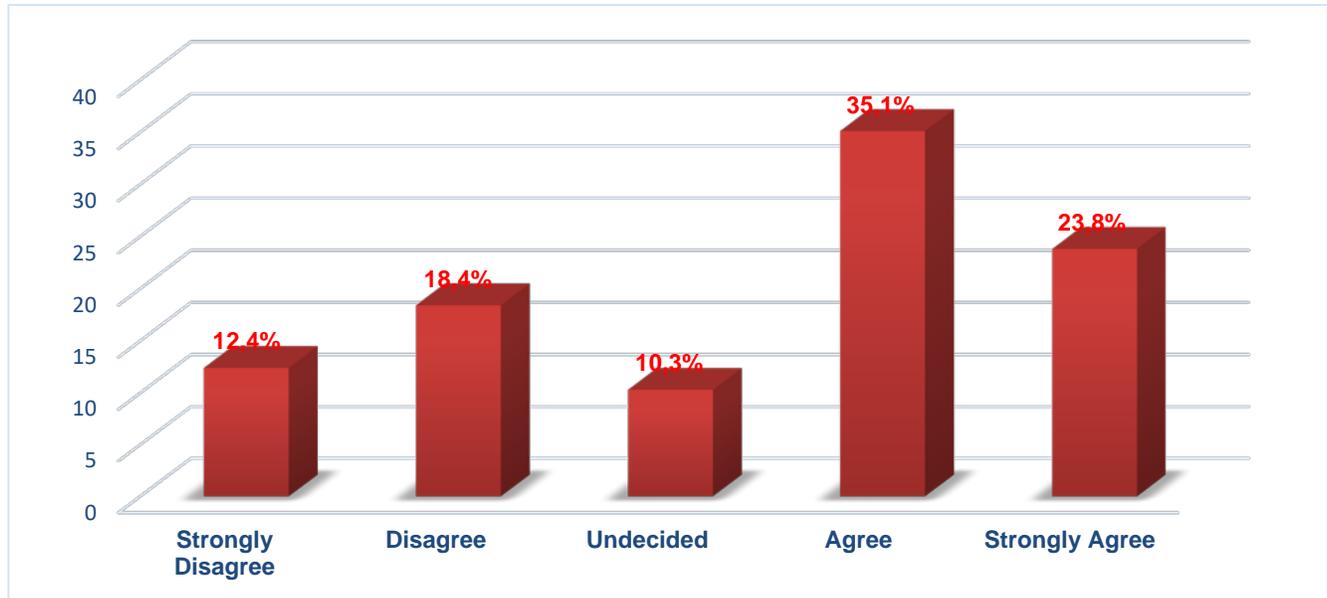


ii I feel bad about not following the measures to save electricity in my house

Figure 7.40 shows that 12.4% of the respondents stated that they strongly disagree that they feel bad about not following measures such as switching off geysers and lights in unoccupied rooms to save electricity while 18.4% disagree with this notion. Figure 7.40 shows that 10.3% of the respondents remained undecided with regards to their feelings about not following measures to save electricity within the households. This might be attributed to those people who have money and they do not see the need for safe electricity. Figure 7.40 indicated that 35.1% of the respondents agree that they feel bad about not following measures to save electricity. It is indicated in Figure 7.40 that 23.8% of the respondents strongly agree that they feel bad when they do not follow measures to save electricity. The majority (58.9%) of the respondents have stated that they feel bad when they do not follow measures to save electricity. It is clear that the majority of the respondents believe that they feel bad when they do not follow measures to save electricity within the households. The finding suggests that the majority of the people around the City of Polokwane feel good when following measures that are put forward to save electricity. Some people still do not want to follow the measures to save electricity. This means that there are still people who do not

have a positive attitude towards saving electricity in an attempt to reduce the amount of GHG emissions.

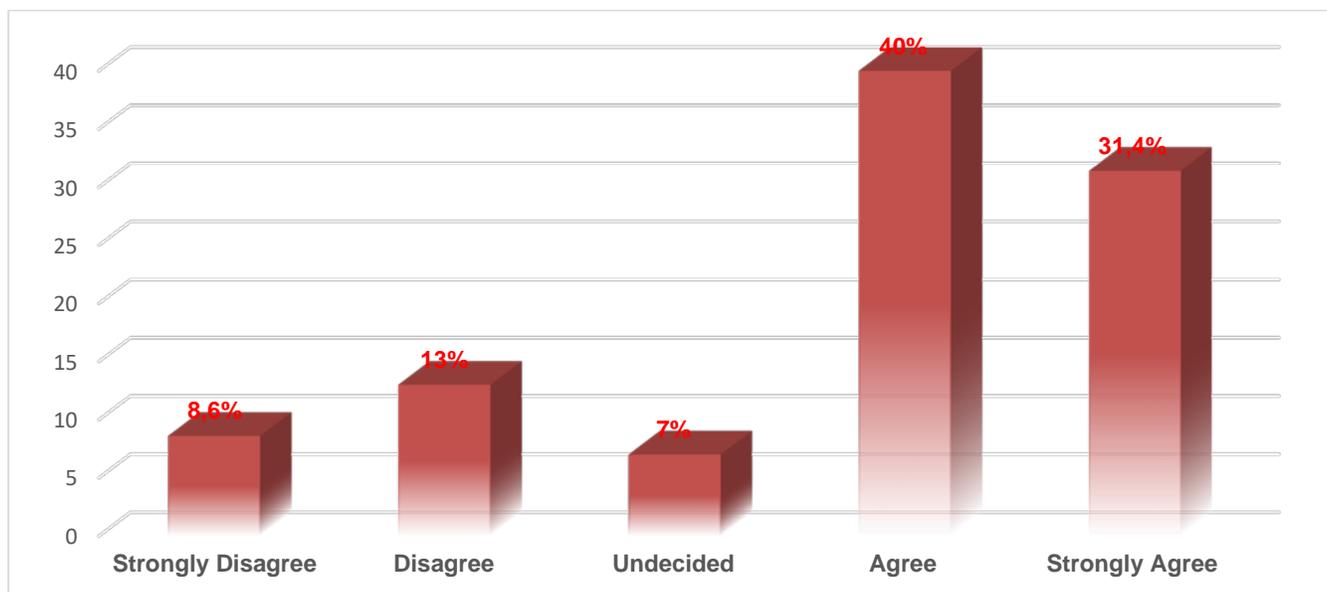
Figure 7.40: I feel bad about not following the measures to save electricity in my house



iii It makes me feel like a better person when I save electricity in my house

Figure 7.41 presents the perceptions of the respondents about their feelings in terms of saving electricity within the household. It is shown in Figure 7.41 that indicates that only 8.6% of the respondents strongly disagree that it makes them like a better person when saving electricity within the households. Furthermore, only 13.0% of the respondents stated that they disagree that they feel like a better person when they save electricity. On the contrary, Figure 7.41 shows that 40.0% of the respondents agree that they feel like a better person when saving electricity. It is stated in figure 7.41 that 31.4% of the respondents strongly agree that saving electricity makes them a better person. Cumulatively, it is clear that the majority (71.4%) of the respondents agree that they feel like better people when saving electricity. The finding suggests that the majority of people feel good about saving electricity within their households. It is worth noting that there is a small proportion of people who have a negative feeling towards saving electricity.

Figure 7.41: It makes me feel like a better person when I save electricity in my house

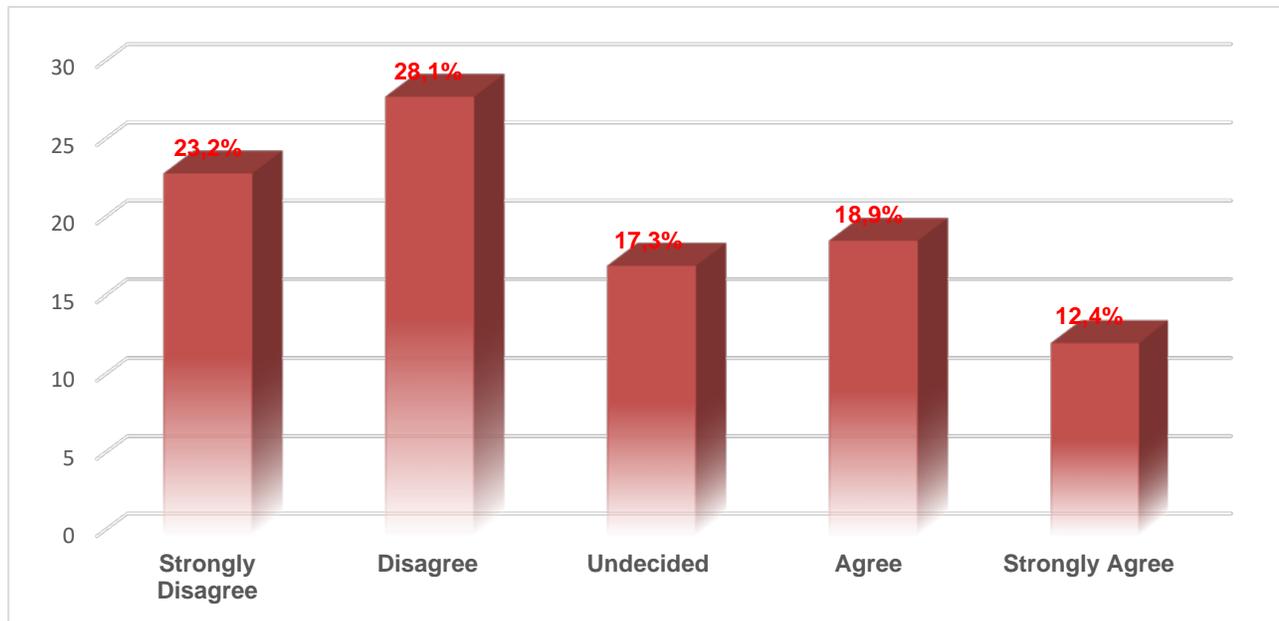


iv The electricity shortages caused by high electricity use, do not make me feel guilty

Figure 7.42 shows that 23.2% of the respondents stated that they strongly disagree that they do not feel guilty when there are electricity cuts due to high electricity consumption. Figure 7.42 shows that 28.1% of the respondents disagree that they do not feel guilty when there is a power cut due to high electricity consumption. On the contrary, 18.9% of the respondents agree that they do not feel guilty when there are power cuts due to high electricity consumption while 12.4% strongly agree with this notion. Only 17.3% have remained undecided on whether or not they feel guilty when there are power cuts due to higher electricity consumption within their households. This might suggest that some people do not understand their contribution towards overconsumption of electricity and power cuts. The majority of people have stated that they feel bad when there are power cuts (load shedding - which is a South African term meaning power outages) due to the high level of electricity consumption within households. The finding suggests that many people around the City of Polokwane feel good about saving electricity within their households. This is very significant in an attempt to reduce the usage of coal for the generation of electricity; thus harbour the potential to mitigate climate change in the distant future. However, a small proportion of people do not feel guilty about power outages (load shedding) due to high electricity consumption. This might suggest

that people are still not conscious of the effects of higher electricity consumption that amount to GHGs emissions, which hold the potential to intensify climate change.

Figure 7.42: The electricity shortages caused by high electricity use, do not make me feel guilty



It is clear from the analysis that people continue to demonstrate good or positive feelings towards saving electricity within households. The majority of the people around the City of Polokwane feel good about saving electricity within their households. This is very important within environmental planning discourses regarding the reduction of GHGs emissions in South Africa. Thus, the reduction in electricity consumption, which is mostly generated from burning fossil (coal) fuels, will result in the decline in GHGs emissions in South Africa, which plays a great deal in an attempt to mitigate climate change. This demonstrates that local communities around the city play an important role in the reduction of GHG emissions through the reduction of electricity consumption within their households. Therefore, the collaboration between the local communities and local municipalities in urban areas plays an important role in an attempt to mitigate climate change.

7.1.6 Planning for and Management of Urbanisation for Effective Mitigation of Climate Change

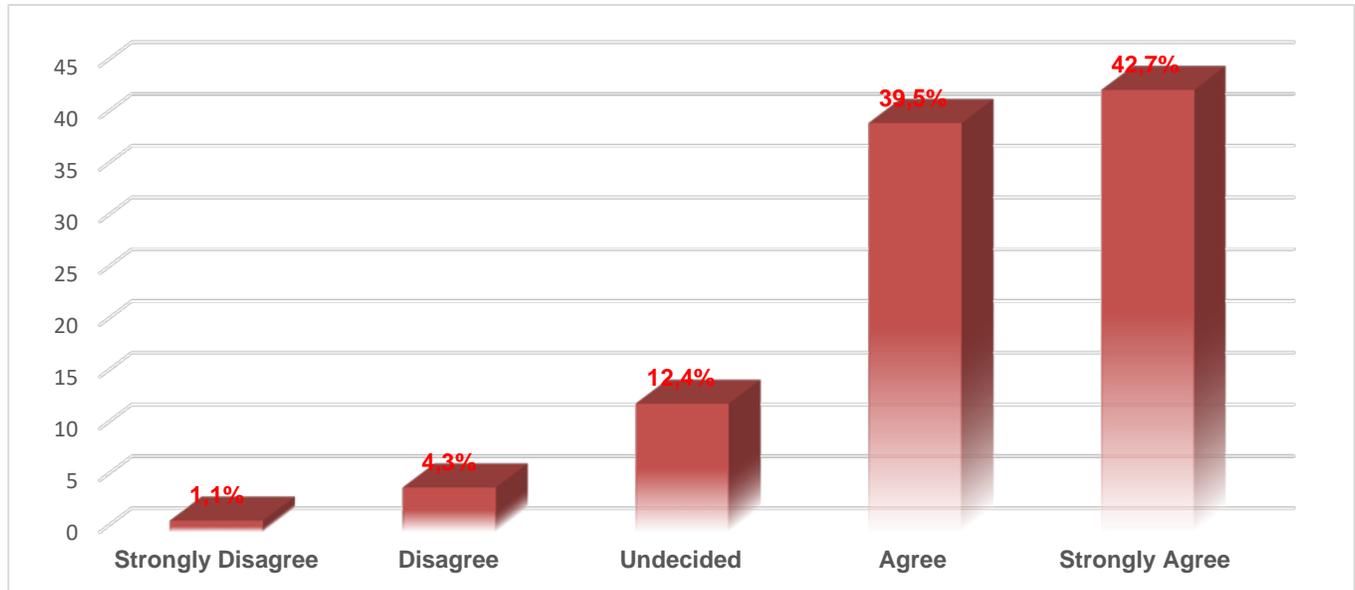
The section explores the contemporary planning and management of urbanisation in an attempt to mitigate climate change. This section will be focusing on the awareness of the local communities around the City of Polokwane about urbanisation in an attempt towards mitigating climate change. The reduction of traffic congestion, reducing electricity consumption, solar systems and using renewable resources to generate energy is very important in an attempt to mitigate climate change. Multilevel governance has been recognised as a model to enhance collaboration between various stakeholders around the city in an attempt to mitigate climate change.

7.1.6.1 High electricity consumption and traffic congestion increase the burning of fossil fuel (coal) that contributes to climate change

Figure 7.43 presents the perceptions of the respondents about high electricity consumption and traffic congestion, which will increase the burning of fossil fuel (coal); thereby contributing to climate change. Figure 7.43 shows that only 1.1% of the respondents strongly disagree that high electricity consumption coupled with traffic congestion contributes towards the changing climatic condition while only 4.3% disagree. Figure 7.43 shows that only 12.4% of the respondents remained undecided on whether or not higher electricity consumption and traffic congestion contributes to climate change. This suggests that the people do not understand how electricity is generated and its impact on the climate. Figure 7.43 shows that the majority (42.7%) of respondents strongly agree that the high consumption of electricity and traffic congestion results in the increment in the burning of fossil fuels, which increases GHGs emissions. Figure 7.43 shows that 39.5% of the respondents agree that the high consumption of electricity and traffic congestion increases the combustion of fossil fuel (coal), which results in the increment of GHGs. The finding suggests that the respondents perceive the increasing electricity consumption to have deleterious effects in an attempt to mitigate climate change. There is an overwhelming awareness of the effects that high consumption of electricity and traffic congestion on climate change. This awareness is significant in reducing electricity consumption within the municipality and the shift from over-reliance on private cars towards the usage of a public transport system. This demonstrates the potential to address the

persistent effects of climate change. However, the minority of people disagreeing with this notion demonstrates that there is a need for awareness and workshops about climate change.

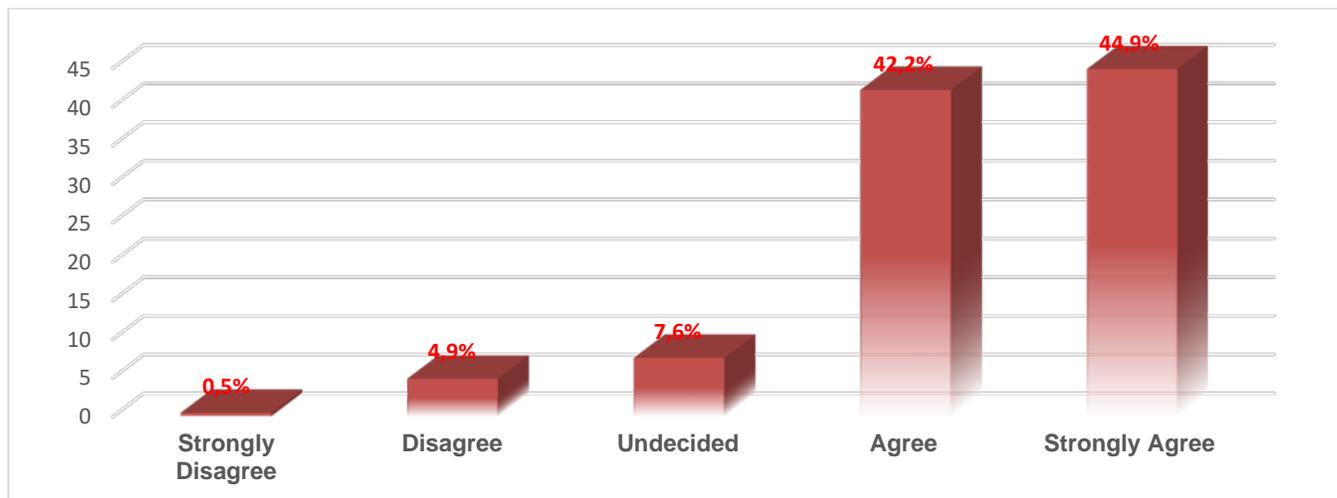
Figure 7.43: High electricity consumption and traffic congestion contribute to climate change



7.1.6.2 Climate change is affecting people's lives around the city.

Figure 7.44 shows that only 0.5% and 4.9% of the respondents strongly disagree and disagree respectively that climate change continues to affect people around the City of Polokwane. Only 7.6% of the respondents remained undecided on whether or not that climate change is affecting people's lives around the City of Polokwane. This might suggest that the people do not understand the effects of climate change on their lives. Figure 7.44 shows that 42.2% of the respondents agree that climate change is affecting people around the City of Polokwane. It is indicated in Figure 7.44 that 44.9% of the respondents strongly agree that climate change is affecting people's lives around the city. This is based on the fact that there has been an intensification of extreme temperature, heatwaves, drought and declining rainfall around the city as mentioned earlier. The majority of the respondents believe that the lives of people around the City of Polokwane are affected by climate change. The finding suggests that climate change continues to negatively affect people's lives around the city.

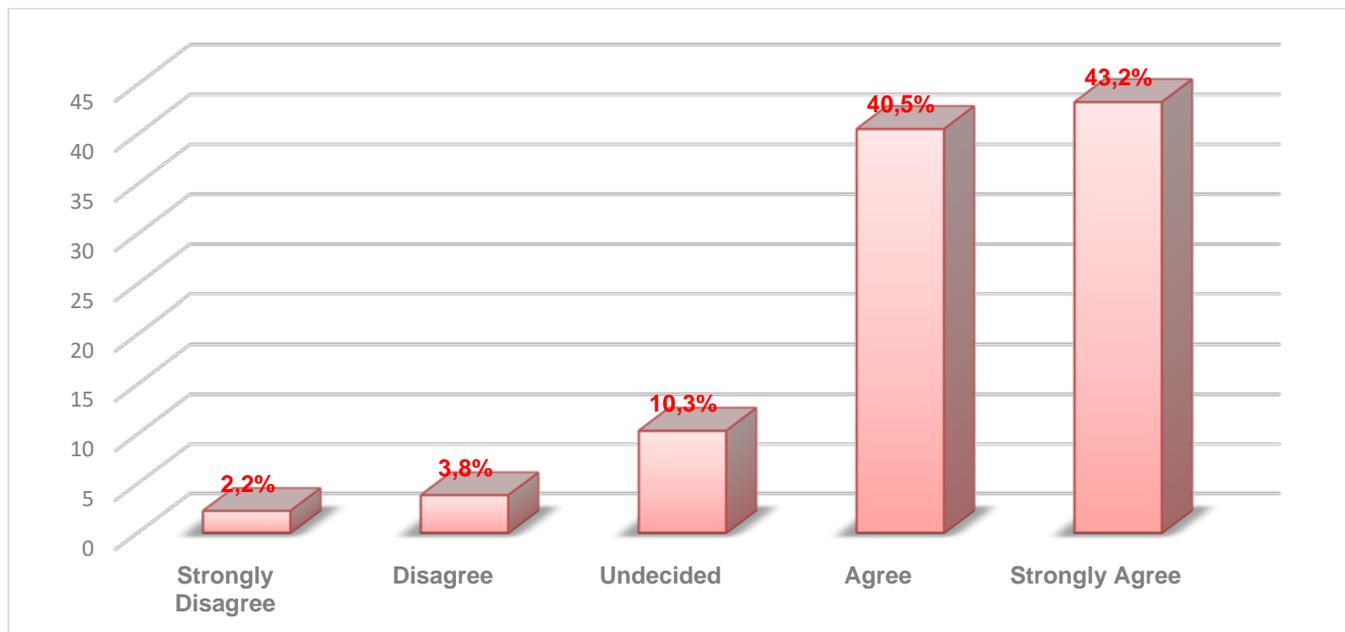
Figure 7.44: Climate change is affecting people's lives around the city



7.1.6.3 There have been increasing levels of temperature in the past 5 years

Figure 7.45 shows that 2.2% of the respondents strongly disagree that there has been an increase in temperature around the city in the past 5 years. Figure 7.45 shows that 3.8% of the respondents disagree that there has been an increase in temperature around the city while only 10.3% remained undecided. Figure 7.45 shows that 40.5% of the respondents agree that they have experienced an intensifying temperature over the past 5 years. Figure 7.45 shows that 43.2% of the respondents stated that they strongly agree that the temperature has been increasing in the city over the past 5 years. This shows that an overwhelming majority (83.7%) of people believe that the temperature has been intensifying over the past 5 years. The finding suggests that the increasing temperature as one of the effects of climate change continues to affect the people around the city. This demonstrates that climate change effects have become a reality in the City of Polokwane. On the other hand, a small proportion of people believe that the temperature has not been increasing around the city. This might connote that the high temperature is attributed to the notion that Limpopo province has been characterised as very hot. However, there have been successive heatwaves that hit the city over the years and this has been intensifying.

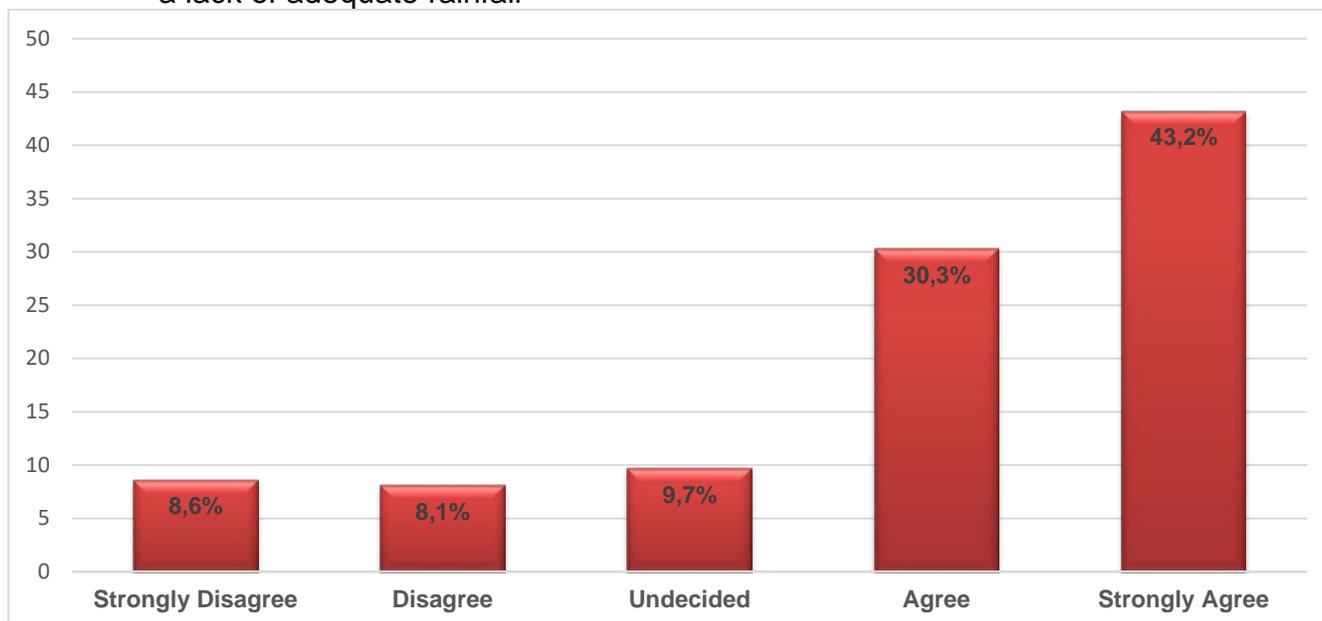
Figure 7.45: There have been increasing levels of temperature in the past 5 years



7.1.6.4 The city has experienced serious water (drought) shortage in the past 5 years due to a lack of adequate rainfall.

Figure 7.46 indicates that 8.6% of the respondents strongly disagree that the city has experienced drought in the past 5 years. It is indicated in Figure 7.46 that 8.1% of the respondents disagree on the occurrence of drought around the city. Only 9.7% of the respondents were undecided on whether or not there has been a drought in the past 5 years. Figure 7.46 shows that 30.3% of the respondents stated that they agree that there has been a shortage of water (drought) around the City of Polokwane in the past 5 years. Figure 7.46 shows that the majority (43.2%) of the respondents strongly agree that the city is confronted with a shortage of water (drought). The majority (73.5%) of people believe that the city is confronted by water shortages that resulted from the lack of adequate rainfall. The finding is that the City of Polokwane has experienced a shortage of water which demonstrates its vulnerability towards drought. On the other hand, few people believe that there has not been any shortage of water (drought) in the City of Polokwane.

Figure 7.46: The city has experienced serious water (drought) shortage in the past 5 years due to a lack of adequate rainfall

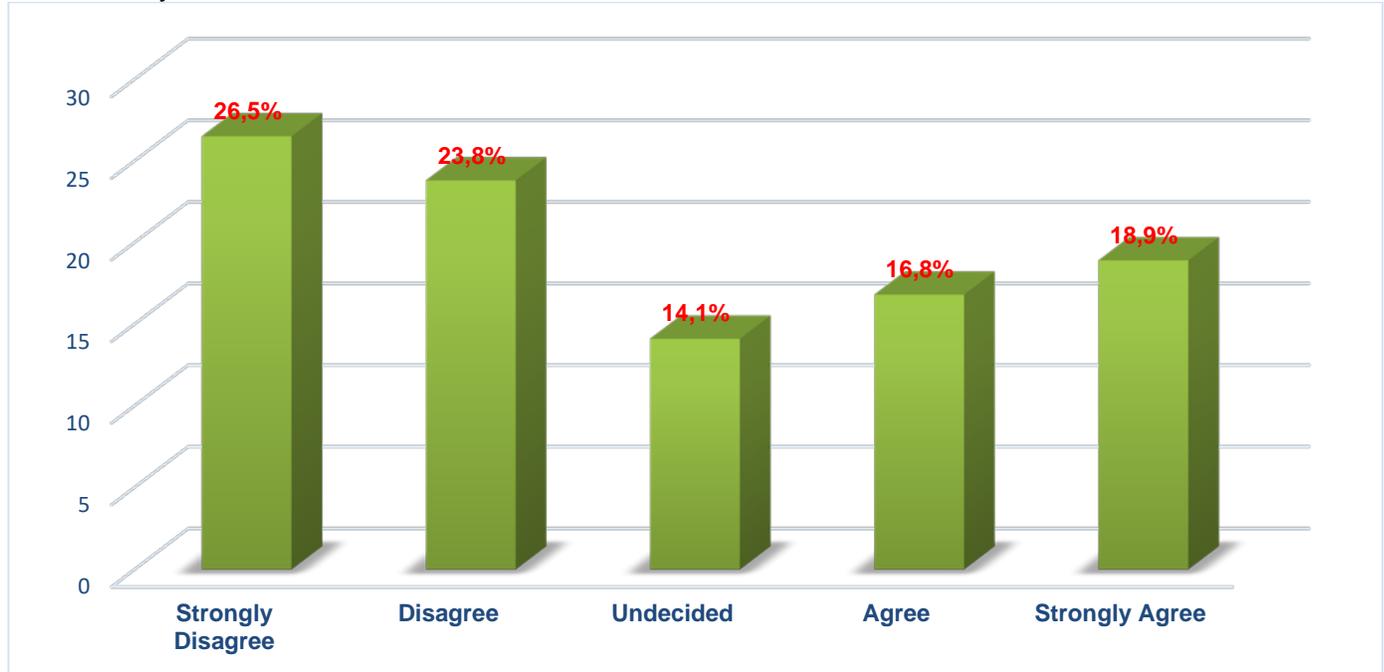


7.1.6.5 The city has experienced floods that resulted in damage to infrastructure in the past 5 years.

Figure 7.47 shows that 26.5% of the respondents stated that they strongly disagree that there have been floods around the city in the past 5 years. Further, 23.8% of the respondents disagree that there have been floods around the city while only 14.1% were undecided. It is indicated in figure 7.47 that 16.8% of the respondents agree that the city has experienced a flood in the past five years that damaged infrastructure. Figure 7.47 shows that 18.9% of the respondents strongly agree that there has been the occurrence of floods. The majority (50.3%) of people believe that the city has not experienced floods that damaged infrastructure around the City of Polokwane over the past 5 years. The finding is that the city has not experienced floods that damaged infrastructure. The City of Polokwane is not vulnerable to floods which have the potential to damage the infrastructure. However, few people believe that there has been flooding around the City of Polokwane. This can be attributed to the heavy runoff around the city which encroached into many stores especially at Savannah mall. However, the heavy runoff around the City of Polokwane is a result of inadequacy or a blocked drainage system that does not allow all the rainwater to flow through it. Consequently,

the inefficiency of the drainage system deters the ability of the city to be resilient post any heavy rainfall.

Figure 7.47: The city has experienced floods that resulted in damage to infrastructure in the past 5 years

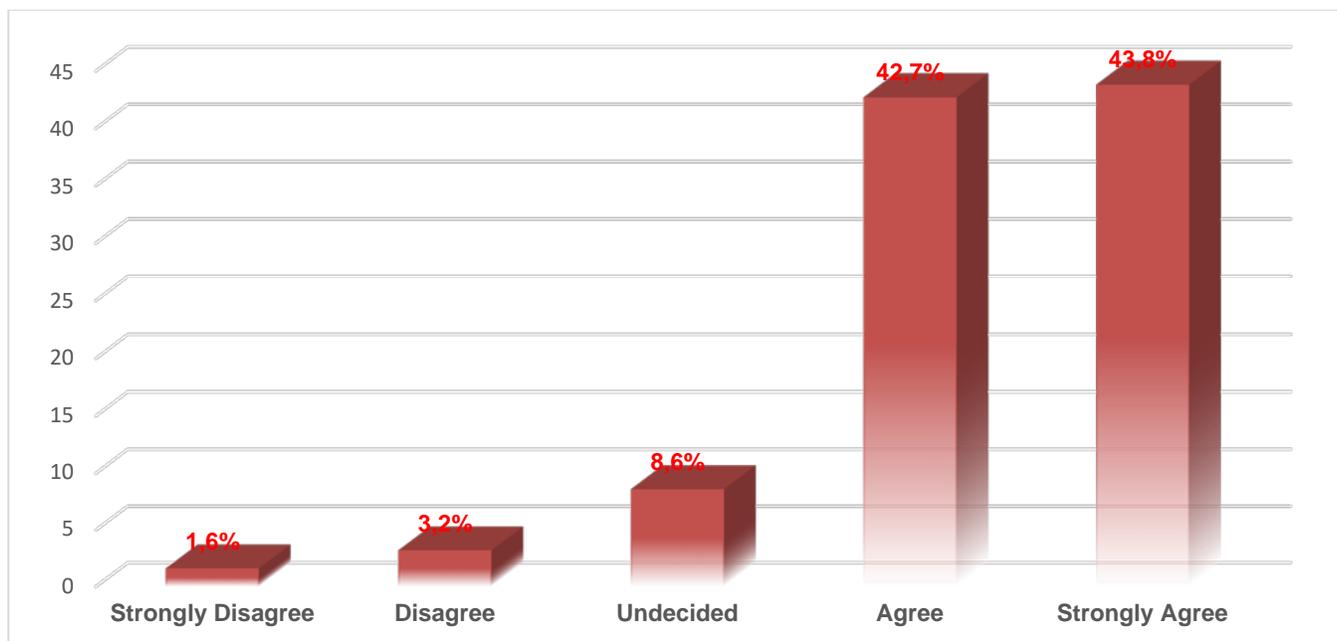


7.1.6.6 There have been changing rainfall patterns in the past 5 years

Figure 7.48 shows that 1.6% and 3.2% of the respondents strongly disagree and disagree respectively that rainfall patterns have been changing in the last 5 years. Only 8.6% of the respondents remained neutral on whether or not the rainfall patterns have been changing around the city. On the other hand, figure 7.48 shows that the majority (43.8%) of the respondents stated that they strongly agree that the rainfall patterns have been changing over the past 5 years. It is further indicated that 42.7% of the respondents agree that in the last past 5 years, there have been changing patterns of rainfall around the city. The majority (87.5%) of people believe that the rainfall patterns have been changing over the years. The finding is that the City of Polokwane has been experiencing changing rainfall patterns over the last 5 years. This demonstrates the awareness of the public about the effects that climate change continues to have on the city, and thus, resulting in the patterns of rainfall changing. This can be corroborated by literature that cities in developing countries are most vulnerable to the effects of climate change such as changing rainfall patterns.

However, it is worth noting that only a few respondents believe that the patterns of rainfall have not been changing over the past 5 years. This might suggest a lack of awareness of the climate change effects affecting the city.

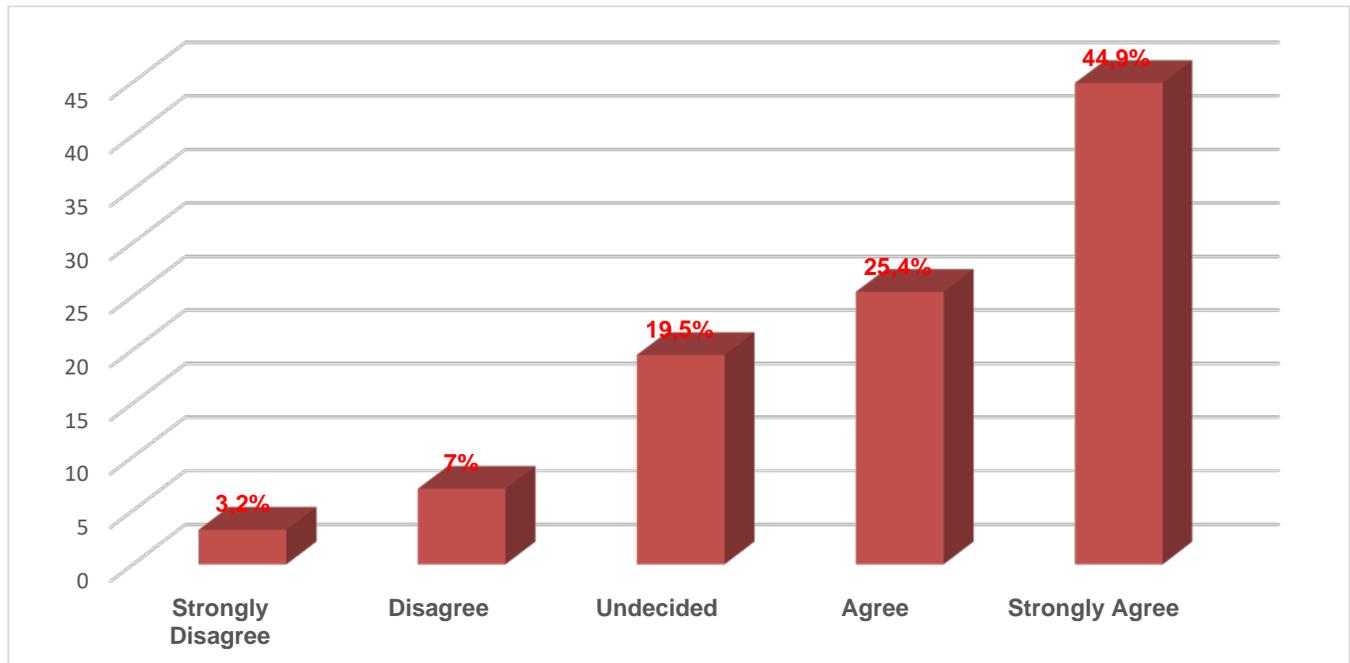
Figure 7.48: There have been changing rainfall patterns in the past 5 years



7.1.6.7 I feel good when using a solar geyser in my household for heating water.

Figure 7.49 shows that 3.2% and 7.0% of the respondents stated that they strongly disagree and disagree respectively that they feel good using solar geysers within the households. It is indicated in Figure 7.49 that 19.5% of the respondents remained neutral on the idea of using solar geysers. On the other hand, Figure 7.49 shows that 25.4% of the respondents stated that they agree that they prefer using solar geysers within the households for heating water. Furthermore, 44.9% of the respondents strongly agree that they prefer using solar geysers within households. It is clear that the majority (70.3%) of people prefer using solar geysers for heating water. The finding is that the majority of people prefer using solar geysers to reduce the consumption of electricity. The preference to use solar geysers is very important to introduce mixed methods of energy generation. Those who remained neutral stated that they do not have solar geysers in their households while others said they are expensive to procure.

Figure 7.49: Feeling good when using solar geyser in my household for heating water

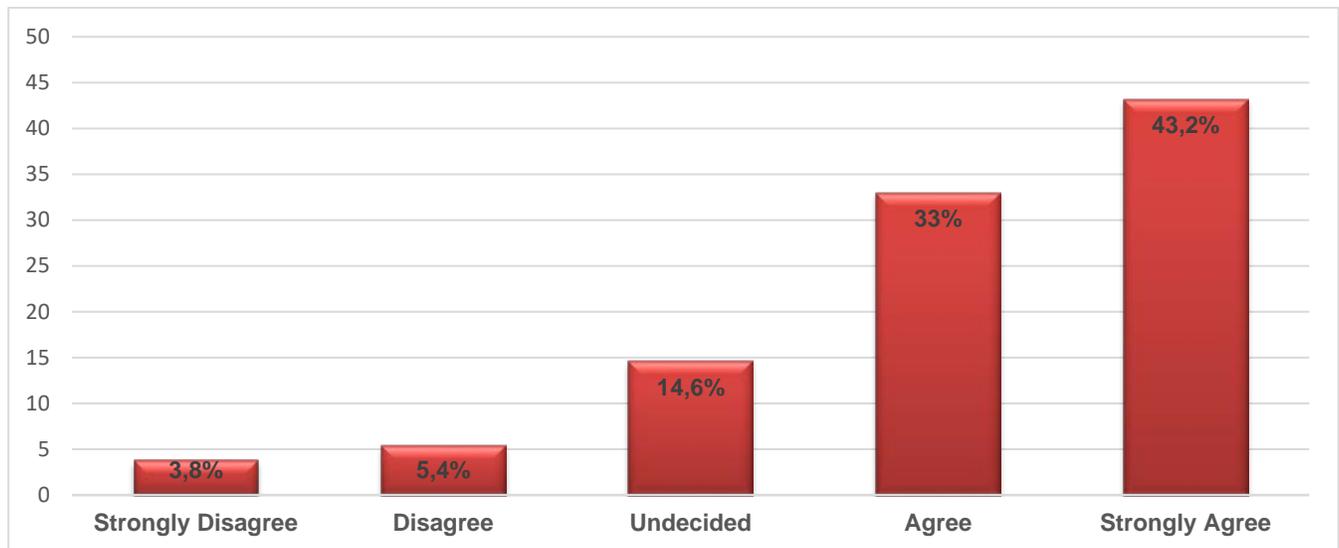


7.1.6.8 I feel responsible for reducing electricity consumption through the use of solar systems within my household.

Figure 7.50 presents data to assess the perceptions of the respondents about the reduction of electricity consumption through the use of a solar system, which includes solar geyser, solar panels and a battery (hybrid system) within the households. Figure 7.50 shows that 3.8% of the respondents strongly disagree that they are responsible to reduce electricity consumption by employing a solar system while only 5.4% disagree with this notion. Figure 7.50 shows that 14.6% of the respondents remained undecided on whether or not they have a responsibility to use the solar system within the households to reduce high electricity consumption. However, 33.0% of the respondents agree that they would prefer to reduce electricity consumption by using solar systems. It is indicated in Figure 7.50 that 43.2% of the respondents strongly agree that they would prefer to reduce the consumption of electricity through the use of a solar system. The majority (76.2%) of the respondents believe that the preference to use the solar system within their households has the potential to reduce the high consumption of electricity, which is generated by the combustion of coals. Therefore, the finding is that there is a preference to use solar systems (solar geysers,

solar panels and batteries) as clean energy sources to reduce electricity consumption generated from the combustion of fossil fuels, and thus has the potential to reduce GHG emissions. Consequently, the reduction of the high consumption of electricity has the potential to reduce the burning of fossil fuel (coal) and, thus contributes towards the reduction of GHGs emissions. Literature has demonstrated that a vast amount of GHGs emissions are produced during the burning of fossil fuels to generate electricity and emissions from traffic congestion. Therefore, households have the potential to play a critical role in the reduction of electricity consumption through the implementation of energy mix at a micro-level, and thus, contributing towards climate change mitigation. On the other hand, few people do not feel responsible for using solar systems to reduce the consumption of electricity. This is attributed to the high prices of procuring solar systems and solar geysers.

Figure 7.50: I feel responsible for reducing electricity consumption through the use of solar systems within my household

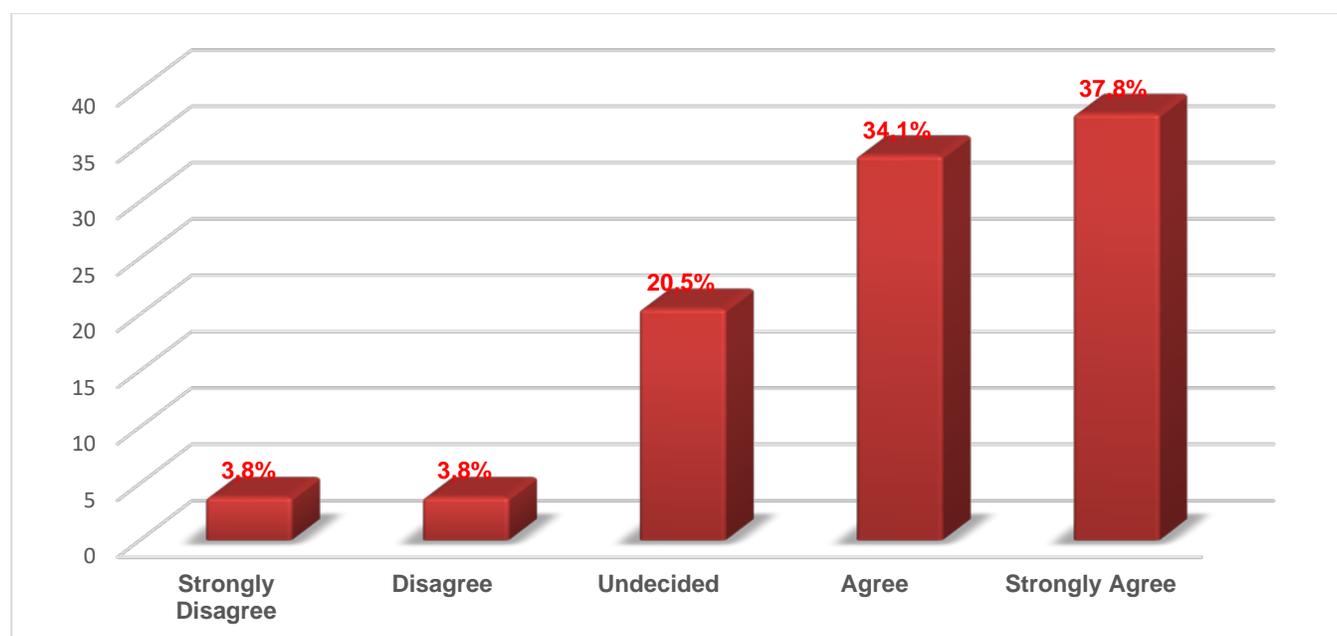


7.1.6.9 The implementation of nuclear power stations towards climate change mitigation

Figure 7.51 presents an analysis of data to explore the perceptions of the respondents about the implementation of nuclear power stations as a clean energy source to reduce GHG emissions in an attempt to mitigate climate change. Figure 7.51 shows that 3.8% of the respondents strongly disagree that there should be the implementation of nuclear power stations as a clean energy

source to generate electricity. Furthermore, 5.4% of the respondents disagree with the implementation of nuclear power stations in South Africa. A significant proportion (20.5%) of people remained undecided about the idea of implementing nuclear power stations. However, it is indicated in Figure 7.51 that 34.1% of respondents agree that nuclear power stations should be implemented as a clean energy source to reduce GHGs emissions. Figure 7.51 shows that 37.8% of the respondents strongly agree that there should be an implementation of nuclear power stations to reduce the emissions of GHGs in the country. It is clear that the majority of people are advocated for the implementation of the nuclear power station as a renewable energy source and, thus, reduce the burning of fossil fuel to generating electricity. The finding is that there is a requirement for the implementation of nuclear power stations to reduce GHG emissions in an attempt to mitigate climate change. The implementation of nuclear power stations is consistent with the Paris Agreement and National Development Plan that the country must shift from overreliance on coal to generate electricity towards clean energy sources such as solar, nuclear from uranium, wind and water (hydropower stations). However, a significant proportion of people remained neutral on the idea of implementing a nuclear power station. This can be attributed to the South African political landscape where the proposal to implement nuclear power was seen by the public as a way to influence a lot of corrupt activities.

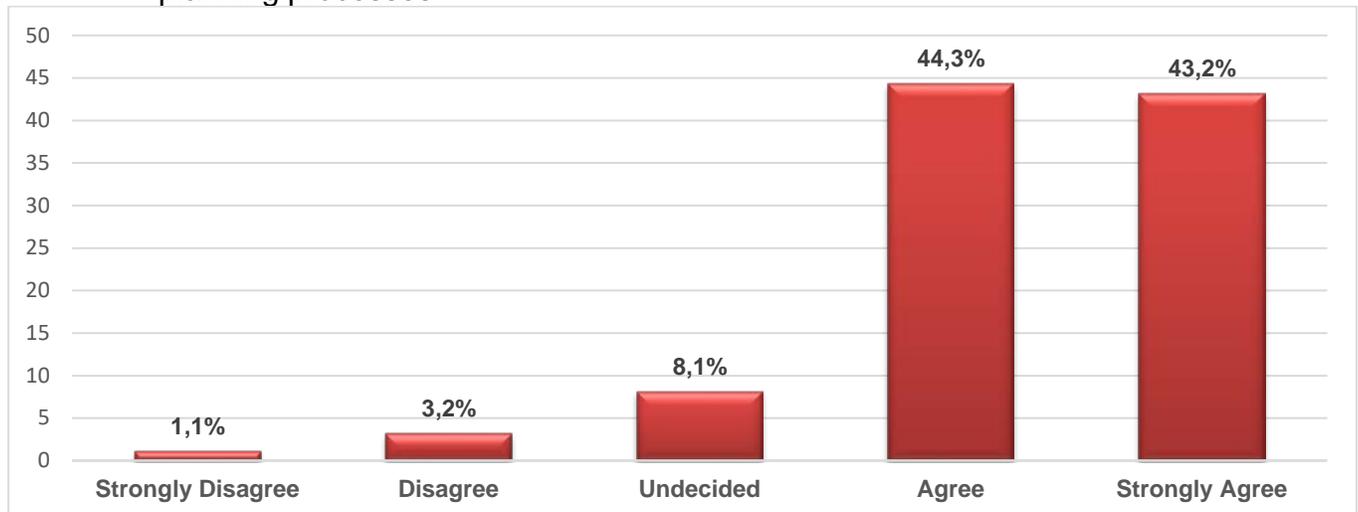
Figure 7.51: Implementation of nuclear power stations towards climate change mitigation



7.1.6.10 Local communities should be involved in climate change adaptation and mitigation planning processes

Figure 7.52 presents the perceptions of the respondents on the view that the local communities should be involved in climate change adaptation and mitigation processes. It is indicated in Figure 7.52 that 1.1% and 3.2% of the respondents strongly disagree and disagree respectively that local communities should be involved in climate change adaptation and mitigation processes while only 8.1% remained undecided. Figure 7.52 shows that 44.3% of the respondents agree that local communities must be part of climate change adaptation and mitigation processes. Furthermore, 43.2% of the respondents strongly agree that local communities around the municipality must be involved in climate change adaptation and mitigation processes. This demonstrates that the majority (87.5%) of people believe that the local communities must be part of the climate change adaptation and mitigation processes. The finding is that local people believe that they must be allowed to participate in climate change adaptation and mitigation processes. Only a small proportion of people stated that local communities should not be involved in climate change issues. This connotes that some of the respondents are not interested in taking part in the municipality and climate change issues.

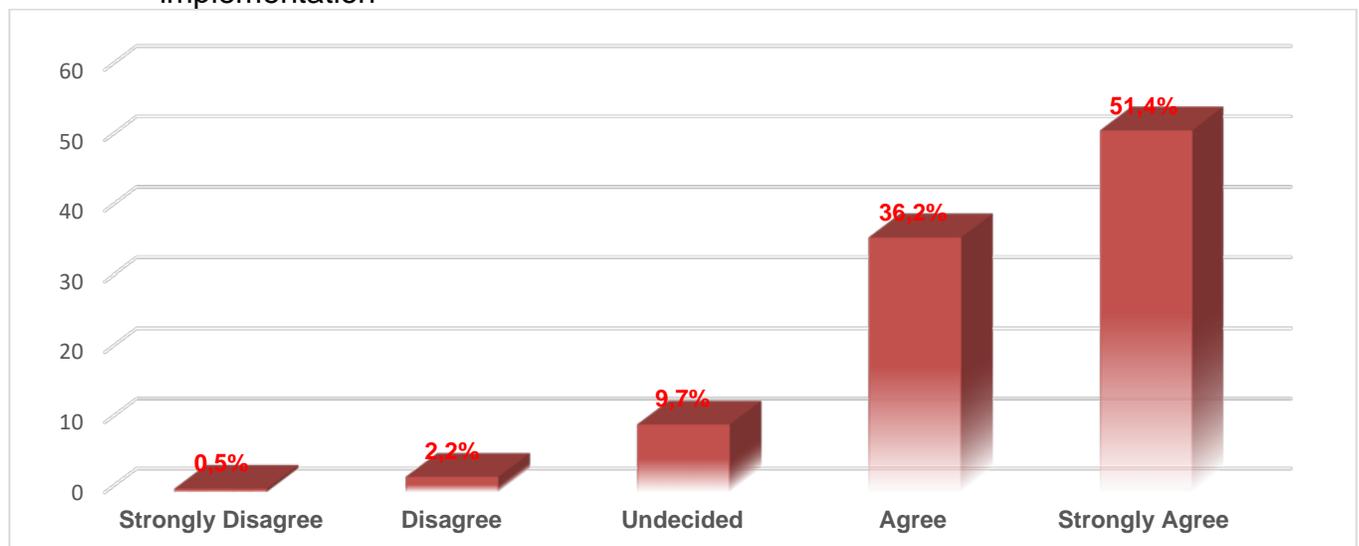
Figure 7.52: The involvement of local communities in climate change adaptation and mitigation planning processes



7.1.6.11 Multilevel governance needs to take a central role in climate change policy formulation and implementation

Figure 7.53 shows data results to assess the perceptions of the respondents about the collaboration of the national, provincial, local and other stakeholders (multilevel governance) to take a central role in climate change policy formulation and implementation. Figure 7.53 shows that 0.5% and 2.2% of the respondents strongly disagree and disagree respectively that national, provincial, local government and other stakeholders (multilevel governance) should take a central role in climate change policy formulation and implementation. Figure 7.53 shows that only 9.7% of the respondents have remained neutral on the notion of multilevel governance. On the other hand, 36.2% of the respondents agree that multilevel governance must be used during climate change policy formulation. It is indicated in Figure 7.53 that the majority (51.4%) of the respondents strongly agree that all spheres of government and other stakeholders must be involved in the formulation of climate change policy. This is based on the fact that policies have been recognised as important mechanisms to manage urbanisation. The finding is that there should be an implementation of multilevel governance in the formation and implementation of climate change policy. The integration of all affected stakeholders within the municipality has the potential to address the undying effects of climate change.

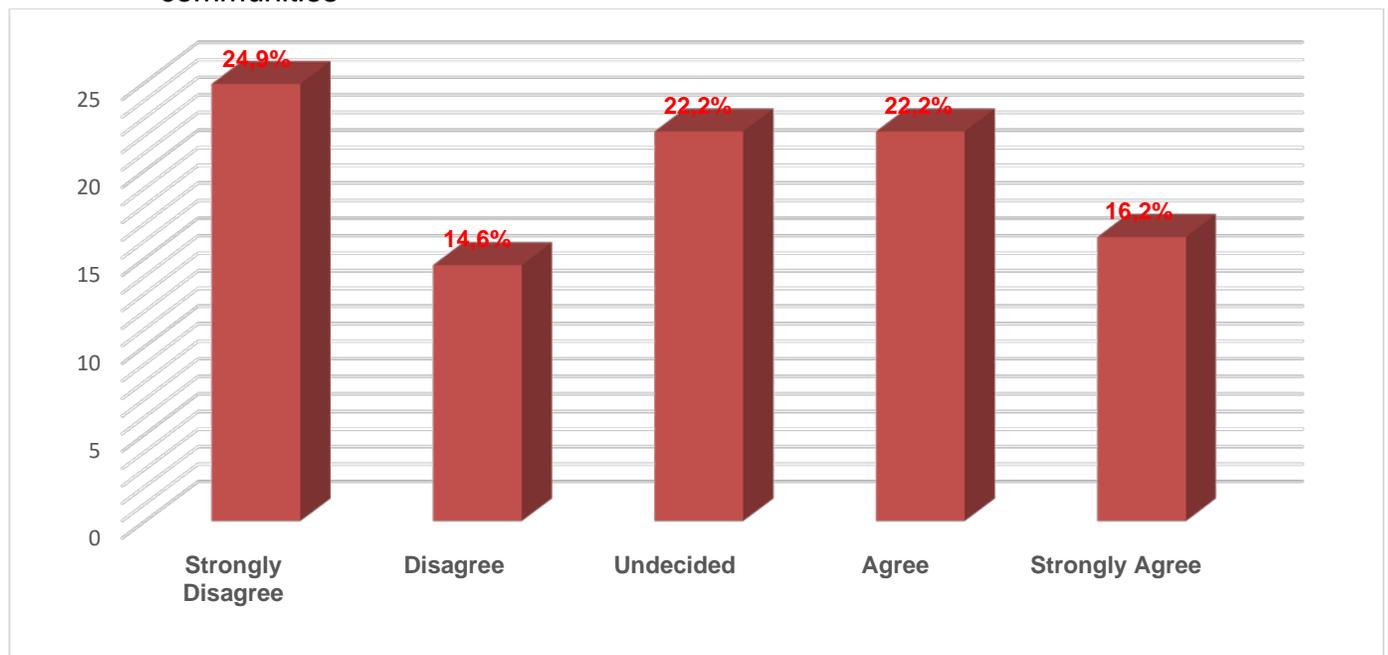
Figure 7.53: The importance of multilevel governance in climate change policy formulation and implementation



7.1.6.12 The municipality coordinates the formulation of climate change policy with the local communities

Figure 7.54 indicates that 24.9% of the respondents stated that they strongly disagree that the municipality coordinates the formulation of climate change policy with the local communities. Furthermore, 14.6% of the respondents disagree that the municipality coordinates climate change policies with the local community. Twenty-two point two per cent (22.2%) of the respondents remained neutral on this idea. On the other hand, Figure 7.54 shows that 22.2% of the respondents stated that they agree that the municipality does coordinate the climate change policies well with the local communities while 16.2% strongly agree with the notion. The finding is that there is a disconnection between the municipality and local communities in terms of policy formulation and implementation. On the other hand, many people believe that there is coordination between the municipality and local communities when it comes to climate change policy formulation. This suggests that the municipality has started including people when it comes to policy formulation about climate change. Furthermore, many people have demonstrated their lack of interest in engagement within municipal affairs.

Figure 7.54: The municipality coordinates the formulation of climate change policy with local communities



7.3 ANALYSIS OF QUALITATIVE DATA FROM INTERVIEWS

This section provides a presentation and analysis of qualitative data, which were collected through the interview. The interview schedule was constructed to solicit qualitative data from officials within the Polokwane Local Municipality and Capricorn District Municipality concerning the management of urbanisation in an attempt to mitigate climate. The interview schedule was used to collect qualitative data from the Director in Planning and Economic Development (Participant A, Manager in planning (Polokwane Local Municipality) (Participant B) and Air quality ambience Monitoring official (Capricorn District Municipality) (Participants C). Direct quotations of the text and ideas of the participants were used to ensure that the meaning and context are not misrepresented during qualitative data analysis. This ensures that the meaning of the participants is not lost in the interpretation but remained kept. This section will explore how the municipality plans and manages urbanisation within the City of Polokwane to mitigate climate change. It further explores some of the strategies that the local government (Polokwane local municipality and Capricorn District Municipality) employ in an attempt to mitigate climate change around the City of Polokwane. This sub-section will provide the findings from the interviewed participants about the planning and management of urbanisation in an attempt to mitigate climate change in the City of Polokwane.

7.3.1 The Management of urbanisation

Planning for and management of urbanisation within cities has demonstrated a multiplicity of complexities (as debated in chapter 2) to ensure that the city operates at the same time ameliorating various environmental challenges. This is because urbanisation is associated with industrialisation which has the potential to improve economic growth at the same time increasing electricity consumption, GHGs and traffic congestion. This notion is represented by participant A in this manner:

“The implications of urbanisation needs to be put in mind. This is because urbanisation has demonstrated to have both positive such as industrialisation, economic growth, and compact city and, negative consequences (GHGs emissions). Some of the strategies implemented are good but they impact negatively on the institution. The usage of solar,

groundwater and gas by households will render the municipality redundant and collapse it”.

Despite the willingness of people to use gas, groundwater, septic tanks and solar systems within their households it might negatively impact the municipality at the same time reducing electricity consumption. The reduction of electricity consumption through various other avenues such as the usage of solar systems and gas have serious consequences to the municipality due to the reduction in revenue collection. As discussed in chapter 2, the management of urbanisation in mitigating climate change demonstrates non-linear properties of the complexity theory. The non-linearity is based on the fact that the reduction of electricity through these solar systems has unintended consequences on the institution in terms of the reduction in revenue collection that can be used to service the community. However, the respondent advocates for the application of a compact city where people can work, play and have leisure time in the same space. This can be used as a way to manage urbanisation because it promotes an opportunity to walk and use a bicycle to work and the implementation of the Bus Rapid Transit (BRT). Furthermore, the management of urbanisation is based on the Spatial Planning and Land Use Management Act (SPLUMA) of the municipality. This is represented by respondent A as follows:

“Polokwane local municipality wants to roll out the Bus Rapid Transit (BRT) transportation which is guided by the Spatial Planning and Land-Use Management Act (SPLUMA). The spatial plan promotes a compact city in which concentration regards to transport”.

According to the respondents, the rollout of BRT buses will ensure that many people from Seshego, Legae la Batho, Madiba Park and around the city get access to a faster and cheaper transport system to reduce traffic congestion. This demonstrates that the municipality is making inroads concerning the management of traffic congestion around the city in the quest to reduce GHGs emissions produced by motor vehicles. BRT systems work well in a compact city. It is worth noting that the majority of people who undertook quantitative data believe that the improvement of transport systems will reduce the over-reliance on private cars. However, it is clear from the quantitative data that some people do not believe that the usage of public transport is the solution to traffic congestion within the city.

7.3.1.1 Green Spaces in the City of Polokwane

The respondents stated that there are insufficient plantations to attract rainfall around the City of Polokwane. Thus, the City of Polokwane is considered as a semi-arid place. Furthermore, the plantation is very important to ensure the resilience of the city post perturbation such as heavy rainfall and floods and the absorption of gases during photosynthesis.

Participant A stated that: "This is because of an insufficient plantation to attract rainfall during the process of photosynthesis. There is a need to plant more trees around the municipality".

The respondent feels that there is a need for the city to undertake a project to plant more green spaces (grass and trees) to help during infiltration and absorption of water after heavy rainfall and GHGs during the process of photosynthesis. The resilient theory postulates that the city as a system must have the ability to bounce back to its original state post any perturbation. Therefore, the increment in the level of the plantations, as opposed to the pavement, increases the potential for the City of Polokwane to be resilient.

7.3.1.2 Integrated Development Plan (IDP) as a planning document in the city

The participant indicated some of the challenges that local communities are facing. It was indicated that the implementation of IDP continues to fail the local communities in terms of service delivery and public participation. The participant indicated that the IDP is been used as a shopping list without any pragmatic evidence to support its impact on the ground. This means that the people around the City of Polokwane are not involved in planning for their own developmental needs. This is articulated by participant B as follows:

"IDP is failing the community in terms of addressing issues that the communities are facing. The IDP is addressing the shopping list. The municipality is not providing the community with feedback after undertaking the IDP processes".

According to the participant, the frustration of the community is based on the fact that as a strategic municipal planning document that should ensure public participation, the IDP guidelines continue

to be ignored by not involving the public in planning. Of paramount importance, Polokwane Local Municipality does not provide the communities with feedback on the IDP processes. This can be supported by what was indicated earlier in the quantitative data that the municipality does not involve the public in municipal affairs. This creates a serious problem regarding the management of urbanisation in an attempt to address some of the environmental problems such as climate change. In Chapter 2, it was stated that a complex system is made up of multiple elements that cannot be addressed using reductionism in which various entities are reduced to individual elements, but they are addressed as a whole system. Therefore, the city as a system must be managed more holistically.

On the other hand, participant C from Capricorn District Municipality stated that their IDP is based on the President's demand in terms of climate change objectives. The Capricorn District Municipality does make mention of climate change and ways of addressing it. Participant B stated this as follows:

“The IDP of the municipality (Capricorn District municipality) is based on the president's demand in order to respond to them. Climate change plans are mentioned within the Capricorn district municipality IDP”.

It is clear that the adoption of climate change projects from the President nullifies the ability of local communities to participate in the formulation of IDP. Although there is less involvement of local communities within the IDP, it is significant to note that the Capricorn District Municipality is committed to addressing climate change. Since the Capricorn District Municipality does not have land around their jurisdiction which falls under the local municipalities, this might create overlapping climate change projects between itself and Polokwane Local Municipality.

7.3.1.3 Stakeholder participation within the municipality

Engagement with various stakeholders is very important within the municipality to plan for and manage urbanisation. Participant B stated that the municipality does not consult the communities around the city regarding plans around the cities. This means that the communities are always kept in the dark about municipal affairs. This demonstrates the failure of the municipality to do its

constitutional obligation of ensuring that the public participates in municipal affairs. This is reflected by participant B as follows:

“There is a lack of consultation with the communities regarding the plans about the city. The municipality imposes the decisions on the communities”.

According to participant B, the communities are frustrated by the lack of consultation about the plans within the municipality. This potentially limits the contribution of the public within municipal affairs. It should be noted that public participation takes place through ward committees and councillors. The participant stated that the municipality imposes its decision on the communities. The participant supported this claim by stating that the municipality created RDP houses around urban areas and the enrolment of BRT systems without the community consent. The imposition of decisions on the communities has the potential to limit their interest to engage within municipal affairs. On the other hand, participant A stated that they engage communities thoroughly as their constitutional mandate. The engagement takes place to serve as an awareness to the communities about the municipal plans and developments. Participant A reflected this idea as follows:

“We engage thoroughly with the communities in order to ensure that there is public participation. Again, the municipality engages with the communities so that they can have a full understanding of the plans and development around the municipality”.

The idea suggests that the municipality engages the public on matters that concern them regarding their plans and developments. This is supported by the minority of people within households (quantitative data) who argued that the municipality engages the public in terms of the plans and other matters concerning them. This demonstrates that the municipality is beginning to ensure that the public participates in municipal affairs. However, many of the respondents around the City of Polokwane disagreed that they are involved in municipal plans and development.

7.3.2 Challenges facing the city

Cities are confronted with multiple challenges in the effective planning and management of urbanisation. Participant B stated that the city is confronted with the problem of the lack of capacity to plan and manage the city effectively. The lack of capacity within the municipality makes it difficult

to effectively plan and manage a complex process such as urbanisation. Furthermore, participant B believes that the lack of capacity by the ward committees and cadre deployment are serious challenges within the municipality. Within the current governance system in a municipality, ward committees are very instrumental to link the municipality with communities. Therefore, the deployment of people without proper skills and knowledge poses deleterious effects on the quality of planning in the municipality. Participant B reflected that:

“The municipality continues to be confronted with a lack of capacity to plan and manage the city. The issue of deployment and lack of capacity amongst the ward committees remain a serious problem around the municipality”.

The participant stated that the municipality is confronted with the challenges of lack of capacity. This is a serious challenge in the quest to plan and manage the process of urbanisation effectively. Therefore, it is clear that the lack of capacity from both municipal officials and ward committees pose serious effects on the quality of plans and management strategies within the city. Participant C stated that the roads that are constructed continue to demonstrate their inability to withstand harsh realities such as climate change. The occurrence of heavy rainfall washes away some of the roads which cause potholes. Furthermore, participants A and C stated that the City of Polokwane has experienced heavy rains, which resulted in the city been flooded. The ideas are expressed by participants A and C as follows:

“The road is been destroyed because of their inability to withstand climate change.”

“In Polokwane, if it can rain for 20 minutes, the town will be flooded. This is because of blocked drainage systems that are not cleaned or maintained regularly. This can also be attributed to poor planning”.

According to the participants, lack of capacity and poor planning within the Polokwane Local Municipality are responsible for the construction of poor roads and the inadequacy of the drainage system to drain the runoff around the city. The drainage systems around the city function without proper maintenance, which can be used as an adaptation strategy towards climate change. Poor planning to anticipate the future in terms of climate change within the City of Polokwane poses deleterious effects on the ability of the city to become resilient towards climate change. An inability of the city to effectively drain the water post heavy rainfall makes it not to be resilient. Furthermore,

participants stated that the diameter of the drainage is not big enough to adequately drain the water post heavy rainfall. The lack of maintenance of these drainage systems remains a serious problem during rainy seasons.

The City of Polokwane has been confronted with multiple effects of climate change. Participant A stated that the city is confronted with water shortages and successive heatwaves in summers. Participant A stated that heatwaves are currently not a problem in Polokwane city but in the future, it will be an issue. Although the participant stated that heatwaves are not a problem now, there is a requirement for the city to adapt and help address climate change. This is reflected by participant A as follows:

“The City of Polokwane is a water-scarce city”.

“The City of Polokwane is very hot, even though the heat is not attributed to heatwaves, but it can be an issue in the near future. The lack of rainfall and high temperature is because of an insufficient plantation to attract rain during the process of photosynthesis”.

Participant A articulated that although the city is not experiencing heatwaves, it continues to experience successive days of high temperatures. The successive occurrence of high temperature is one factor that characterises heatwaves. This demonstrates that the City of Polokwane is prone to drought and high temperatures (heatwaves). Participant A believes that there is insufficient plantation to attract rain, which exacerbates the intensifying levels of drought in the city.

Participant A stated that their inability to use solar systems to operate the traffic lights around the city is due to criminality. Polokwane Local Municipality does not want to install solar panels because they will be stolen. This is based on the fact that solar systems can be used to operate the traffic lights to assist in reducing the consumption of electricity generated from coal. This is articulated as follows:

“Due to criminality, it is difficult to install solar panels in order to operate traffic lights to reduce electricity usage”.

According to participant A, the reduction of electricity consumption through solar systems can be hampered by the criminality around the city. Thus, the municipality has not implemented any solar system to operate traffic lights to control traffic around the city. Participant A stated that there are multiple ways to effectively manage urbanisation towards the mitigation of climate change. The implementation of the solar system to operate streets lights, traffic lights and all municipal office lights are very instrumental in an attempt to reduce GHG emissions, which contribute towards climate change mitigation.

7.3.3 Promoting a compact city

A compact city has multiple benefits in managing urbanisation as it provides an opportunity for an integrated transport system and the reduction of electricity consumption. Participant A stated that it is believed that a compact city provides work, stay and leisure at the same time. Participant A stated this idea as follows:

“Compact city is promoted in order to ensure that the city provides work, stay and leisure”.

According to participant A, a compact city allows the municipality to construct walkways so that people can walk and use bicycles to work. The participant stated that Polokwane Local Municipality has constructed a walkway that stretches from Seshego Township to the City of Polokwane, which some people use to go to work. This has the potential to reduce traffic congestion around the city. The reduction in traffic congestion around the city has the potential to reduce the level of GHG emissions, which contributes immensely towards climate change. The compact city is very important in planning because the introduction of the Bus Rapid Transit has the potential to attract more passengers who did not use public transport before, due to its efficiency and comfort as opposed to the minibuses operating around the city.

7.3.3.1 New transportation system

Polokwane Local Municipality’s Integrated Development Plan articulates that the municipality plans to roll out the Bus Rapid Transit around the City of Polokwane. This is very important in the quest to reduce traffic congestion. Participant A stated that they are constructing roads around the city to

roll out the Bus Rapid Transit. This road is already underway starting from Seshego Township through the city and around Bendor. This will serve as the first phase of the project. The rollout of the Bus Rapid Transit is based on the City of Polokwane SPLUMA, which is aimed at promoting a compact city. This notion is reflected by participant A as follows:

“Polokwane Local Municipality wants to roll out the Bus Rapid transit (BRT) transportation which is guided by the spatial framework. The spatial plan promotes the compact city which ensures concentration regards to transport”.

Participant A stated that BRT is efficient, fast and cheaper to use. This allows the classes around the city to use the bus. Furthermore, it was stated that the introduction of a BRT is based on the idea of an integrated transport system around the City of Polokwane. Participant A also stated that the BRT will in the future reach places such as the Polokwane International Airport, Mall of the North, Savannah Mall and Peter Mokaba Stadium. It is very important to encourage the usage of public transport to reduce traffic congestion. Thus, the reduction of traffic congestion around the city is very instrumental in reducing the emissions of GHGs. The rollout of BRT transportation, compact city and the usage of the solar system holds the potential to effectively manage urbanisation in an attempt to mitigate climate change. It is worth noting that a concerted effort by all cities will have significant traction towards climate change mitigation.

7.3.4 Educating communities about climate change

One of the most important mechanisms of managing urbanisation towards mitigating climate change is educating the community about this environmental problem. A well-educated community about climate change and urbanisation will ensure that they move towards being green and reducing high electricity consumption, heavy reliance on private transportation and will have the ability to adapt to climate change by harvesting rainwater, use gas and solar systems in their households. Households have the potential to contribute significantly towards climate change mitigation through the use of solar geysers, solar systems, public transports and non-motorised transportation. Participant B articulated that there are not enough dialogues around the city about climate change and ways to adapt to it. This is further exacerbated by the lack of information about planning and plans within the municipality. This is reflected by participant B as follows:

“There are no enough dialogue, awareness and lesson sharing that are capable to empower the communities with information about planning and plans around the city”.

According to participant B, the municipality does not empower the communities with information about the effects of climate change, adaptation and mitigation strategies and the plans that are in place to address this undying environmental problem. The high electricity and water consumption can be attributed to the lack of knowledge by the community about climate change. On the contrary, the other participant C stated that the Capricorn District Municipality does not have a project that is aimed at promoting climate change adaptation. The district municipality only educates the communities on how they can adapt to climate change. This idea is reflected by participant C as follows:

“In term of adaptation to climate change, the municipality (Capricorn District Municipality) only serve to educate local communities about climate change adaptation”.

According to participant C, the local communities are educated concerning different ways to adapt to climate change. This demonstrates the significance of the community towards climate change and the management of urbanisation. This means that if communities are empowered with knowledge about climate change and ways to contribute towards adaptation and mitigation, it can help the municipality to comply with the national requirement in terms of emissions reduction. Participant C stated that the communities are encouraged to retrofitting their roofs to harvest rainwater and tap into groundwater as well. This is one of the ways communities can adapt to climate change during droughts.

7.3.5 The complexity of electricity consumption

The increment of electricity consumption connotes that there will be more burning of fossil fuel (coal) during the generation of electricity, which increases GHGs emissions. The increment in GHG emissions does not only affect climate change but also betrays the air quality standards and the Paris Agreement on climate change mitigation. However, participant A stated that they are not aiming at reducing the consumption of electricity around the municipality. Participant A reflected this notion as follows:

“The aim (of the municipality) is not to reduce the electricity consumption but ensure that consumption increases”.

According to the participant, the reduction in electricity consumption around the municipality connotes the reduction in the amount of revenue that they receive. Therefore, the municipality requires that the electricity consumption continue to rise which increases their revenues. Participant A stated that the decline in electricity of consumption has the potential to collapse the institutions, which are mandated to serve the community. This demonstrates the complexity of planning and managing the city. Furthermore, the reduction in electricity consumption has the potential to affect the municipality while its increment affects the environment. It is clear from the participant that they would rather keep the municipality afloat and serve the communities at the expense of the environment.

Participant A stated that many people are shifting from overreliance on unreliable and high electricity prices towards exploring other sources of energy such as gas and solar. It was stated that many people have installed solar geysers, gas stoves, solar systems and septic tanks for wastewater. The installation of these clean energy sources will make the municipality redundant. Participant A stated that Netcare Pholosho hospital used solar panels as roofs for the parking lot, which resulted in the reduction of the amount paid to the municipality by half. This was reflected by participant A as follows:

“The adoption of solar geysers, solar, gas stoves and septic tanks are good strategies to reduce electricity consumption and managing urbanisation. However, the installation of private solar reduces the amount of revenue that the municipality receives. Netcare Pholosho hospital has roofed its parking lot with solar panels which reduced the amount paid to the municipality by half”.

According to the participant, the shift by the communities to install their solar systems and septic tanks within the households has affected the municipality in terms of the revenue collected. This demonstrates the complexity of managing urbanisation in an attempt to mitigate climate change. The shift from heavy reliance on electricity generated from the combustion of fossil fuel towards using solar at a micro-level is good for the environment and arguably not good for the municipality.

Participant A asserted that the retrofitting of solar panels within households and other private institutions needs to be regulated to maximise the municipal revenue returns. However, it is clear that households are implementing the energy mix strategies, which the municipality and national government continue to struggle with its implementation. The implementation of solar systems is instrumental as an effective way of ensuring that the community play an active role in an attempt to mitigate climate change.

7.3.6 Climate change adaptation within the city

The effects of climate change such as heatwaves, drought, limited rainfall and high temperature that continue to affect the City of Polokwane compel the Polokwane Local Municipality to implement adaptation strategies. This is because the literature stated that any efforts to try to mitigate climate change without plans to adapt has the potential to derail the attainment of the intended purpose. Although the climate change adaptation projects have not started within Polokwane Local Municipality, participant C stated that they are planning to retrofit the school with gutters and water tanks to harvest rainwater. Water harvesting and retrofitting schools with cutters are national government initiatives that will be rolled out in school. Furthermore, participant C stated that the rainwater for farmers can be store in dams to irrigate the crops and serve as drinking water for the livestock. Participant C reflected this idea as follows:

“Capricorn District Municipality wants to provide schools with water tanks and gutters to ensure rainwater harvesting. This is a national government adaptation project and it will only be rollout in schools”.

“There was a project nationally that deals with communities for retrofitting roofs for rainwater harvesting. Again, they built dams to store water that can be used for irrigation”.
“We have implemented a climate change adaptation strategy by harvesting rainwater at few schools”.

According to the participant, harvesting rainwater has the potential to reduce the usage of the surface water because the dams are continuously drying up. Although this is an adaptation strategy, it is a short term method of adapting to the harsh realities of drought. Furthermore, participant C stated that the lack of adequate rainfall around the City of Polokwane is attributed to the lack of plantation. Therefore, participant A recommended the plantation of alien plants which

use more water but attracts more rain to circumvent the harsh realities of drought. It is clear that planning and management of urbanisation to mitigating climate change is not a linear process and it cannot be addressed using a reductionist ideology in planning. According to participant C, the building of dams to store harvested water from rain can be used for irrigation. Therefore, farmers will no longer excessively use surface water for irrigation, which is an important strategy for climate change adaptation.

Some of the participants stated that they are educating the communities about climate change. This is to ensure that the community knows the compliance with the climate change adaptation standards by the type of infrastructure provided to them. This should be understood in the context of the thickness of the tarred road to avoid been washed away by heavy rain. Participant C stated the idea as follows:

“Currently, we are educating the communities concerning climate change. The communities are educated about the type of infrastructure such as roads that should comply with climate change adaptation standards. This is concerning the thickness of the road to avoid been washed away when it rains”.

Even though communities are educated about the adaptation strategies, especially with regards to road constructions, most of them do not care about the standards until the roads are destroyed. On top of that, communities do not have the power to influence the construction of the road to meet the desired quality.

7.3.7 Climate change mitigation strategies

It is significant for individual municipalities to undertake strategies to plan for and manage urbanisation in an attempt to mitigate climate change. Participant C stated that their division is responsible to focus on climate change mitigation. Participant C stated that the Capricorn District Municipality is undertaking a pilot project to equip schools with solar systems and bio-digesters. The installation of these systems in the schools is aimed at ensuring that they are self-sufficient and green. Participant C stated that the bio-digesters will be used to produce gas from wastes that can be used for cooking at the schools. Participant C reflected this as follows:

“The responsibility of the division is predominantly for climate change mitigation as opposed to adaptation. The Capricorn District Municipality is implementing a pilot project which targets 2 or 3 schools depending on the budget around Polokwane. The schools will be equipped with solar geysers and bio-digesters. This is to ensure that schools use solar geysers to have access to hot water and bio-digesters to produce gas from wastes that can be used for cooking and thus, making them self-sufficient projects. This is still the first project this year (2019) and thus, the implementation is still underway”.

According to participant C, the installation of bio-digesters and solar systems will reduce electricity consumption and GHG emissions. This demonstrates the commitment of the Capricorn District Municipality towards addressing climate change. However, participant A believes that the implementation of private solar systems and bio-digesters have the potential to render the municipality redundant and thus, collapse the institution. This is because the installation of these systems will reduce the amount of revenue received by the municipality. It is important to note that all these projects are still in the planning stages.

Participant C in the Capricorn District Municipality stated that the approval of new houses in the City of Polokwane requires the installation of a solar geyser for it to be approved. On the other hand, Polokwane Local Municipality is planning on implementing a solar plant to supply the City of Polokwane with electricity generated from renewable energy sources. The aim is to implement the energy mix as stipulated in the Paris agreement, National Development Plan and the municipal IDP. These ideas are reflected by the participant C and A as follows:

“In the City of Polokwane, new houses are encouraged to use solar geysers for the reduction of electricity consumption”.

“The municipality (Polokwane Local Municipality) is working on having a rollout of a solar plant”.

It is clear that there is a unified commitment within the local government (district and local municipality) in an attempt to mitigate climate change. According to participant A from the local municipality, the construction of a solar plant around the city is to ensure that there is a continuous inflow of revenue while committed to climate change mitigation. The participant argued that the installation of solar into households needs to be regulated to ensure that the institution does not collapse or become redundant. This demonstrates the complexities that

the city portrays in an attempt to effectively manage urbanisation. The implementation of the solar plant might pose a financial problem to the municipality.

In addition to the implementation of a solar plant, the municipality aims to roll out biogas generated from cow dung. The generation of biogas can be used as an important source of energy that will be used for cooking within households. However, the idea is still at a planning stage. This is reflected by participant A as follows:

“The municipality wants to rollout biogas which will be generated from cow dung. And the implementation of an electric car”.

According to the participants, rolling out a bio-gas plant and the electric car can be the solution towards the reduction of GHGs emissions in South Africa. This is very important for the municipality to roll out the energy mix with the municipality. It is clear that the municipality is committed to the reduction of electricity consumption in the City of Polokwane. Since the country took a stand towards addressing climate change, all the projects are still at an embryonic stage.

7.3.8 Monitoring GHGs around the City of Polokwane

In an attempt to mitigate climate change, the continuous monitoring of GHGs emissions is very important for every city. Participant C stated that the Capricorn District Municipality is monitoring GHGs around the city continuously. This takes place through the collection of samples that are taken for assessment in the laboratory to check the level of contamination in the air. This is reflected in participant C's remarks as follows:

“The municipality is using the passive monitoring system to continuously monitor the greenhouse gases in the atmosphere. They use samplers that are exposed to the field and then taken to the laboratory to test the concentration of greenhouse gases”.

According to participant C, the City of Polokwane has pollution points such as industries, Smelter mines and the transport system. The usage of the passive monitoring system showed that the quality is still within the air quality standards. The district municipality discovered that, of the four local municipalities, Polokwane Local Municipality has shown to have a higher concentration of

greenhouse gases when compared to other local municipalities. This is attributed to the number of industries, mines and degree of traffic congestion. The participant C reflected on this notion as follows:

“We (Capricorn District Municipality) are responsible for monitoring air quality around the four municipalities. The air quality is monitored continuously. Currently, the municipalities are still complying with air quality standards. However, Polokwane has been seen to have higher GHGs emissions when is compared with the other three local municipalities”.

“Passive ambient air quality is conducted within the district to monitor the quality of the air that our communities are breathing. From the monitoring results thus far we can conclude that CDM has good air quality. Furthermore, awareness sessions are conducted to capacitate communities on air quality issues”.

According to the participant, the air quality around the City of Polokwane remains very good. Furthermore, it was discovered that the City of Polokwane continues to comply with air quality standards which is very important in an attempt to mitigate climate change. Although the City of Polokwane complies with the air quality standards, it was discovered that the other three local municipalities have better air quality than Polokwane local municipality. This can be attributed to the mine around Polokwane, traffic congestion and several manufacturing factories around the city. This demonstrates that urban areas harbour more air pollutants than desolated areas. Therefore, this presents an important notion that urban areas are important in an attempt to lower the emission of GHGs and the mitigation of climate change.

7.4 OTHER FINDINGS

It is clear from the analysis and findings that urban areas present the cities with both challenges and opportunities in managing urbanisation in mitigating climate change. However, it has been demonstrated that planning for and management of urbanisation is not a linear process but harbours multiple elements that cannot be addressed individually. For example, the reduction of high electricity usage in households is a good mechanism to reduce high GHG emissions and thus, has the potential to reduce the revenue of the municipality. Therefore, complexity theory serves as the basis for planning for and managing urbanisation focusing on the multiples elements that play a part around the City of Polokwane.

7.4.1 Effective planning and management of urbanisation

The management of urbanisation is not a linear process that is limited to the plans and policies that the municipality implements around the City of Polokwane. The implementation of IDP and SPLUMA are necessary for the management of urbanisation but they are not sufficient to ensure that this process is managed effectively. Public participation, the usage of public transport, solar systems, stakeholder engagement, promoting green spaces, and gas is important to ensure effective management and planning for urbanisation in an attempt to mitigate climate change. The decline in green spaces, lack of public participation, high consumption of electricity generated from the combustion of fossil fuels and relying on private cars are important determinants that demonstrate that urbanisation in the City of Polokwane is not effectively planned and managed. Furthermore, the usage of public transportation has the potential to reduce traffic congestion around the City of Polokwane. However, the increased usage of public transport requires community awareness to change the community's mind set about the current overreliance on private cars. The shift from over-reliance on private cars to public transport can be made possible through the implementation of a compact city. The implementation of a compact city in the City of Polokwane is to ensure that people can be able to use public transportation, walkway and bicycle. The rollout of the BRT (Leeto as it will be called in Polokwane) provides the potential to increase the usage of public transportation. However, this requires the reorientation of the public about the benefits of using public transportation. This connotes that for effective management of urbanisation, the public, industries, mines and municipalities need to work together to avoid the unintended consequences emanating from a management initiative.

Quantitative data from the communities provided evidence that the majority of people are not included in municipal planning. On contrary, the qualitative data stated that the municipality continues to ensure public participation in municipal planning. It is clear that there are diverging views regarding public participation within the municipality. Therefore, the triangulation between qualitative data, quantitative data and literature demonstrate that planning and management of urbanisation within the municipality takes place in the absence of the community. This has the potential to derail the implementation of any plans in an attempt to mitigate climate change such as promoting the use of public transport.

It is worth noting that the accumulation of municipal revenue has been elevated above environmental protection. This is indicated by the fact that Polokwane Local Municipality advocates for an increase in the consumption of electricity meanwhile discouraging the installation of solar systems within the households and other institutions. Consequently, there was a call for the regularisation of the procurement of systems that will limit the number of people using solar. The increasing consumption of electricity and the lack of clean energy sources such as solar has the potential to increase GHG emissions through the combustion of fossil fuels. This demonstrates the complexity of planning for and managing urbanisation in maintaining a balance between ensuring the financial sustainability of the municipality and the promotion of environmental protection. Furthermore, it is clear that there is a positive attitude from the communities in terms of their willingness to reduce electricity consumption, the usage of public transport, household solar systems, participating in municipal planning and plantation of green spaces which are significant in planning for and the management of urbanisation in an attempt to mitigate climate change. Therefore, the absence of these factors unravels a picture that a process of urbanisation in the City of Polokwane is not effectively planned and managed.

7.4.2 Misalignment between the district and local municipalities towards climate change mitigation

The CDM and Polokwane Local Municipality have demonstrated their commitment to climate change mitigation through their proposed plans such as the installation of the bio-digester, solar systems and BRT. The planned installation of the bio-digester, solar system and retrofitting the schools with gutters ensures that schools are self-sufficient in terms of clean resource use. Furthermore, Polokwane Local Municipality provided an initiative to construct a solar plant and generate gas from cow dung. These are clean energy sources that hold the potential to generate revenue for the municipality while contributing to the reduction of GHG emissions. Despite these clean energy plans around the City of Polokwane, there is no pragmatic that they will be implemented. Although plans and policies are important in the management of urbanisation, without their implementation on the ground, their contribution towards climate change mitigation will remain the largest part unknown.

Despite this commitment of the district and local municipalities, it was discovered in this study that there are some contradictions in terms of the measures that need to be undertaken to mitigate climate change. The study discovered that the Capricorn district municipality has planned to roll out a project to install solar systems, bio-digester and retrofitting the roofs with gutters to harvest rainwater which makes the schools self-sufficient from the services of the local municipality. Additionally, the district municipality encourages the installation of solar geysers in households around the city to reduce electricity consumption, which is very significant in an attempt for the municipality to contribute towards mitigating climate change. In contrast to this notion, Polokwane local municipality believes that the implementation of such measures (solar systems, bio-digester and retrofitting the roofs with gutters) have the potential towards collapsing the institution due to the reduction of revenue. This overlying of climate change mitigation responsibility or lack of clear role and jurisdiction of these institutions create serious problems in terms of the effective planning and management of urbanisation in an attempt to mitigate climate change. Therefore, for effective planning and management of urbanisation, both Capricorn district municipality and Polokwane local municipality need to align their climate change plans to intensify their commitment and effectiveness of addressing climate change. Other people and institutions deal with climate change through advocating for environmental protection while others focus on the generation of revenue. Literature has argued that the ideology of an institution informs an approach that will be followed to address climate change. Additionally, the conservatives advocate for the robust attempts to mitigate climate change while liberals focus on the improvement of municipal revenues. Therefore, this demonstrates the complexity of planning for and management of urbanisation in an attempt to mitigate climate change.

7.5 CONCLUSION

It is evident from the analysis that climate change mitigation requires collaboration among multiple actors such as the public sector, private sector, civil society, and local communities. The collaboration among these stakeholders provides the basis for multilevel governance which is a very important factor in climate change mitigation. Communities play a significant role in the municipal planning system. It was demonstrated from the findings that the communities in urban

areas have the potential to reduce electricity consumption through the installation of solar geysers, solar systems and gas appliances which contribute towards reducing GHG emissions. Therefore, to effectively plan and manage urbanisation, communities and municipalities should collaborate to reduce electricity consumption levels.

8 CHAPTER 8: SUMMARY, CONCLUSIONS AND RECOMMENDATIONS OF THE STUDY

8.1 INTRODUCTION

The main conclusions of the study are based on the findings which are drawn from the data collected within the City of Polokwane. The conclusion helps to provide a clear picture of the effectiveness of planning for and management of urbanisation in an attempt to mitigate climate change. This is based on the fact that urban areas harbour a complex system of economic, political and social systems that play out to increase the amount of GHG emissions. This is due to the notion that electricity is mainly generated from burning fossil fuel, and thus, produces a lot of GHGs. Furthermore, the recommendations of the study are drawn from the findings of the study. The next section presents the summary of the study, the main conclusions and recommendations of the study.

8.2 SUMMARY OF THE STUDY

Chapter 1 of the study has presented the introduction and background to the study which demonstrated that planning and management of urbanisation are important in mitigating climate change. The chapter presented the statement of the research problem and the gap of knowledge which is to examine the effective planning and management of urbanisation strategies in mitigating climate change. Furthermore, the chapter also presented the general question and specific questions, aim and objectives, definition of concepts, the methodology of the study, the significance of the study and ethical considerations.

Chapter 2 of the study presented the theoretical framework based on complexity and resilient theories. The chapter presented the etymology of the complexity theory which emanates from natural, social and economic studies. Complexity theory has made inroads into planning and urbanisation and posits that cities and urbanisation are complex systems that cannot be planned for and managed using reductionism, but it should embrace the notion of holism. Furthermore, the resilient theory provided an understanding that cities must have the potential to bounce back post any perturbation.

The literature review is covered in chapters 3, 4 and 5. Chapter 3 presented the complexities of planning and managing urbanisation effectively. The chapter presented the recent urbanisation trends which demonstrated that the world is becoming more urbanised than before. However, the chapter has demonstrated that rapid urbanisation in most countries took place without proper institutions and capacity to plan and manage this unprecedented process. Strategies that are used in an attempt to mitigate climate change are covered in chapter 4. The chapter demonstrated that there must be a shift in the generation of electricity from heavy reliance on coal towards clean energy sources such as wind, solar, hydro and nuclear generation. Chapter 5 presented the resilience and complexities of addressing climate change from a South Africa context.

Chapter 6 of the study presented the research design and methodologies that were adopted for the study. It outlines that the study was undertaken in the City of Polokwane which is under the Polokwane Local Municipality. The study used mixed-method (qualitative and quantitative) approaches. The data were collected from Legae la batho, Emdo, Serala View and Flora Park suburbs through a questionnaire. Municipal officials were selected to provide qualitative data through an interview schedule.

The data analysis, interpretation, and findings are covered in Chapter 7 which demonstrate that local citizens have the potential to play an important role in mitigating climate change. Furthermore, multilevel governance has the potential to shift energy sources from heavy reliance on electricity generated from the burning of fossil fuels towards clean energy sources such as solar and gas.

8.3 CONCLUSIONS

The study has demonstrated that an attempt to mitigate climate change cannot be attained without multiple stakeholder collaboration. The local citizens, local municipalities and private sector (multilevel governance) around the city will play a pivotal role to mitigate climate change. Multilevel governance has the potential to encourage the shift from electricity generated from fossil fuels to clean energy sources. The shift from fossil fuels towards clean energy sources reduces the amount of GHG emissions which is pivotal for climate change mitigation. It can be concluded that multilevel

governance in cities can be used to implement the construction of clean energy sources in an attempt to mitigate climate change. Furthermore, the local citizens around the city have the potential to help in the reduction of GHG gases. Communities can reduce the amount of electricity consumption through the implementation of solar geysers and solar systems in their households to reduce GHGs, with the potential to mitigate climate change in the distant future.

- **Indicators of effective management of urbanisation**

The analysis demonstrates that there is a perception that Polokwane Local Municipality continues to struggle to include the public in planning and managing urbanisation. It is clear from the analysis that the respondents perceive that the municipality is confronted with multiple problems such as lack of capacitated personnel, application of the top-down approach to planning, lack of public participation and inability to implement plans about urbanisation. Therefore, this multiplicity of challenges confronting the municipality derails the effective planning and management of urbanisation. Literature has demonstrated that effective planning and management is done through the implementation of plans and policies. It is clear from the analysis that many people perceive that the Polokwane Local Municipality cannot implement these plans and policies. It has been discovered that the level of green spaces is continuously reducing around the city. The perception that the municipality is discouraging the plantation of green spaces is corroborated by the literature. Green spaces have been recognised as a way of managing some of the urban environmental problems such as climate change, emissions and waterlogging around the city. Therefore, from the perception of the communities about urbanisation, the multiplicity of challenges within the Polokwane local municipality derails the potential to effectively plan and manage the urbanisation process.

- **The contemporary planning praxis for effective management of the urbanisation process**

Traffic congestion within the City of Polokwane has always accounted for the high amount of GHG emissions. The overreliance on private cars around the city has increased traffic congestion. It can be concluded that the implementation of the BRT system around the City of Polokwane is important

in reducing traffic congestion. Therefore, the proper management of urbanisation through the implementation of the BRT system is significant in reducing traffic congestion, which has the potential to reduce the amount of GHG emissions. It is the prerogative of the Polokwane Local Municipality to encourage the local citizens to use public transport. Therefore, the shift from over-reliance on private cars towards public transport can be used as a management strategy to reduce GHG emissions in an attempt to mitigate climate change.

Retrofitting the roof of the municipal buildings with solar panels will help ameliorate acts of criminality and thus, reduce the consumption of electricity. The solar systems can be used to operate all the traffic lights around the city, street lights and lighting within the municipal buildings. Consequently, this reduces the amount of money the municipality used to pay Eskom for electricity, and thus, potentially increase the municipal revenue while reducing the municipality's consumption of electricity. This is very important for the introduction of an energy mix in an attempt to mitigate climate change. Furthermore, the implementation of an energy mix, which is embodied in the National Development Plan and municipal Integrated Development Plan, connotes the shifting from overreliance on the burning of fossil fuel for the generation of electricity. Consequently, this shift in energy generation will result in the positive effects on the reduction of GHG emissions that takes place when generating electricity. This demonstrates that cities have the potential to contribute towards the reduction of GHGs emissions, thus, play a critical role in mitigating climate change.

It is clear from the analysis that the municipality is regularly collecting refuse wastes at communities around the City of Polokwane. This is important in the management of waste around the city to reduce the amount of emissions from the waste. The analysis demonstrates that there is still a lack of collaboration between the municipality and the communities around the city. This is fuelled by the lack of communication between the municipality and community and the lack of interest of people within municipal affairs in terms of planning and management of urbanisation within the City of Polokwane. In the quest for the municipality to reduce traffic congestion and overreliance over the usage of private cars, it is clear that the improvement of the current public transportation has the potential to increase the usage of public transport which has the potential to reduce the emissions of GHGs. Therefore, the shift from over-reliance on private cars to public transport usage

will reduce traffic congestion and GHGs emissions around the city, which is very significant in an attempt to mitigate climate change.

- **Characteristics of climate change**

The analysis shows that the City of Polokwane is vulnerable to various effects of climate change such as drought, heatwaves, high temperature, and declining rainfall. The areas around the City of Polokwane continue to experience the undying effects of climate change. However, it is also clear that the City of Polokwane is not vulnerable to floods and it has not experienced the effect in the past five years. Therefore, to avoid waterlogging, there is a need to improve the maintenance of the drainage systems as an adaptive strategy for heavy rainfall around the city. This provided the characterisation of climate change by focusing on the vulnerabilities that are facing the City of Polokwane.

- **The operative strategies to mitigate climate change in developing countries**

The majority of people strongly believe that they can contribute to municipal planning. People believe that a shift from over-reliance on private cars can reduce traffic congestion which is very important in reducing GHGs emissions. This is very significant because the reduction in traffic congestion can help in the abatement of the level of GHGs emissions. Therefore, the reduction in GHGs emissions will contribute significantly in an attempt to mitigate climate change. An attempt towards climate change mitigation is based on the fact that no individual city or nation can adequately address climate change. This requires collaboration between municipalities and communities to help manage the city more efficiently and effectively

- **Effective planning and management of urbanisation towards mitigating climate change**

On the other hand, an attempt to mitigate climate change must be coupled with an attempt to adapt to this environmental problem. The Polokwane Local Municipality in collaboration with the local communities should play an important role in planning and managing urbanisation to adapt to

climate change. The findings of the study suggest that the City of Polokwane has reduced the amount of green places around the city. It can be concluded that there must be planting of green spaces such as green parks and trees around the city as a management strategy to increase the infiltration of rainwater and reduce soil erosion. However, local communities have always been encouraged to use pavements as opposed to lawns within the households and this has increased runoffs. The implementation of pavements was used as an adaptation strategy towards climate change. On the other hand, the plantation of lawn and green spaces within households can be nurtured through re-used water. Furthermore, retrofitting households with gutters will increase the amount of water harvesting. The water can be used for watering the gardens or lawns within their yards. Therefore, it can then be concluded that green spaces can serve as both an adaptation and mitigation strategy against climate change. This is important because plants use carbon dioxide during photosynthesis which reduces the amount of GHG emissions in the atmosphere.

Drawing from the findings of the study, it can be concluded that in the Polokwane Local Municipality, urbanisation is not effectively planned and managed in such a way that it presents the potential to mitigate climate change. This is based on the fact that the City of Polokwane continues to experience traffic congestion during pick hours, depend on electricity generated from fossil fuels, lack public participation and has growing industries. Furthermore, the majority of citizens around the City of Polokwane are without solar geysers and gas stoves for cooking, which increases their dependency on electricity generated from the burning of fossil fuels. Hence, this multiplicity of factors interplaying within the City of Polokwane demonstrates ineffective planning for and management of urbanisation in an attempt to mitigate climate change.

8.4 RECOMMENDATIONS OF THE STUDY

The findings of the study demonstrate that climate change mitigation is not supposed to be the sole responsibility of the government, but ordinary citizens can also play a significant role in addressing this environmental problem. South African citizens around the city continue to consume a lot of electricity which directly increases the proportion of GHG emissions in the country. The increasing GHG emissions will directly contribute to the changing climatic conditions in the distant future.

8.4.1 Collaborative planning and governance

Collaborative planning around the city among the local citizens, local municipality, private sector, and manufacturing companies will enhance the potential to reduce high electricity consumption and carbon emissions from electricity generation and cars. The reduction of GHG emissions from all the stakeholders around the city can be done through the installation of solar systems in their households, hospitals, manufacturing companies, retail shops, mines and municipal buildings, thus reducing the amount of electricity that is consumed. Shifting the type of generation of electricity from heavily relying on coal towards clean energy sources such as solar will reduce the amount of GHG emissions in South Africa. Furthermore, the collaboration between the local municipality and the local citizens will reduce the heavy reliance on private transport.

Planning and management of urbanisation are very important in climate change mitigation. It can be recommended that the local municipality should construct a solar plant to generate electricity which can be sold to citizens at a cheaper price. The construction of clean energy sources such as the solar system will help in the generation of electricity that can be sold to improve the municipal revenue. Collaboration between the local municipality and the private sector will enable the implementation of the solar plant. This will reduce the amount of GHG emissions and, thus, contribute to climate change mitigation. Shifting from the heavy reliance on coal or fossil fuels towards the usage of solar systems and gas appliances by households in urban areas will significantly contribute to climate change mitigation. However, this does not mean the abandonment of the usage of electricity within the households. This connotes the implementation of hybrid systems that use electricity, solar systems, batteries, and gas appliances.

8.4.2 Generation of Bio-gas from waste

Generally, cities produce a lot of waste from the municipal sewage system coming from households. Literature has demonstrated that waste can be used as a great source of biogas that can be used for cooking within households. The densification of people and industries around the cities due to urbanisation has increased the amount of waste in the municipal sewage system in Polokwane, which presents an opportunity for the municipality to produce biogas that can be sold

to households. The National Development Plan states that there should be a shift from fossil fuels towards clean energy. Therefore, the production of biogas is an important development towards reducing electricity for cooking and thus, reduce the amount of GHG emissions. It can be recommended that the municipality should construct biogas generation plants at all their sewage plants. The construction of biogas plants will demonstrate commitment towards the implementation of green renewable resources in an attempt to mitigate climate change.

8.4.3 Maintenance of the drainage system

In recent years in the City of Polokwane, heavy rainfall has resulted in overflowing roads and at times the water encroaches into the shops. The findings of the study show that these negative events were due to the blockage of the drainage system or the inability of the system to drain all the runoff. Therefore, it can be recommended that there should be routine maintenance of the drainage system to avoid blockages so that the city can operate optimally even after heavy rainfall. Resilience theory asserted that the city should have the ability to bounce back post any perturbation such as heavy rainfall. A well operational and improved drainage system around the city of Polokwane will enable it to be resilient post heavy rainfall. Therefore, the maintenance of the drainage system can be seen as an adaptation strategy towards the effects of climate change. Proper implementation of adaptation strategies around the municipality is very important for climate change mitigation.

8.4.4 Increasing plantations around the City of Polokwane

Another climate change adaptation strategy involves increasing plantations around the city. Therefore, the reduction in the level of plantations around the city increases the amount of GHG emissions. The plantation of green spaces can be used as both climate change mitigation and an adaptation strategy.

8.5 LIMITATIONS OF THE STUDY AND FURTHER RESEARCH

During the process of data collection around the City of Polokwane, the researcher was confronted with various limitations. This section will unpack some of the limitations of the study:

- Firstly, some of the people in the communities around the City of Polokwane were not willing to participate in the study. Some of the people attributed their unwillingness to participate in the study to a lack of communication between community members and community leaders. The lack of communication between the community members and the community leaders resulted in the citizens being unwilling to allow the researcher into their households even though the researcher had the approval to conduct the study. This hindered the administering of the questionnaires in Legae la Batho, Emdo Park, Serala View and Flora Park suburbs. Some of the questionnaires were not returned after they were distributed to the community members.
- Secondly, due to the criminal factor around the City of Polokwane, some of the citizens did not allow the researcher into their houses to administer the questionnaire. Therefore, criminality around the city became a hindrance during data collection preventing citizens from participating in the study.
- Thirdly, some of the key informants who were solicited to participate in the study were absent during the process of data collection. It was discovered that some of the key informants were out of the country on duty regarding municipal affairs. Furthermore, some of the ward committees were unavailable for interviews.
- The fourth limitation of the study is that the financial constraints to undertake data collection could not enable the researcher to solicit data from all the towns in the Limpopo Province. It is significant to extend the study throughout the Limpopo Province.

Various issues could not be covered in the study. It is therefore important for further research to cover the following issues to adequately address climate change.

- During the investigation, it was found that there is a misalignment between the Polokwane local municipality and Capricorn district municipality in terms of ways to address climate change. This is based on their ideology of viable strategies that are employed to mitigate climate change. The misalignment and difference in political ideology between the local

municipality and district municipality have the potential to deter the commitment of municipalities as detailed in the National Development Plan to address climate change. Therefore, further research should explore the alignment of the local municipality towards climate change mitigation. This is based on the notion that collaboration between all stakeholders can help circumvent some of the challenges such as funding to address climate change mitigation. Furthermore, further research should be aligned to all the municipal departments in terms of their ideology towards climate change.

- Due to the challenges that the country is facing, further research needs to assess some of the institutional barriers that hinder the municipalities from implementation strategies that attempt to mitigate climate change.
- Urbanisation has been recognised as one factor that can result in increased GHG emissions and thus, contributing to climate change mitigation. Thus, further research needs to assess the feasibility of rolling out integrated transport planning in an attempt to mitigate climate change. This is based on the notion that vehicles emit high amounts of greenhouse gases into the atmosphere.
- Lastly, further research should investigate the effectiveness of planning for and management of urbanisation to mitigate climate change focusing on the big cities around South Africa. This should consider some of the challenges that municipalities face in implementing climate change initiatives.

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APPENDIX A: QUESTIONNAIRE SCHEDULE

The questionnaire is part of my research project for the Doctor of Administration in Development. The research project is titled 'Towards an effective planning and management for urbanization process in mitigating climate variability in Polokwane Local Municipality, Limpopo Province, South Africa'.

The research project hopes to help improve the planning and management of urbanisation towards climate change mitigation within Polokwane local municipality, Limpopo province, South Africa. Every information will be treated with a high level of confidentiality. Further, the research project guarantees all respondents anonymity.

It will be much appreciated to provide your most honest response to the questions. Therefore, your participation in this research, especially in the completion of this questionnaire will be highly appreciated, as the information will have profound significance in completing this research project.

Researcher:
Signature: _____

Respondent:
Signature: _____

Date: _____

Date: _____

Date of the Interview: _____

Section A: Bibliographical information of the respondents

Instruction: Please mark the applicable block with an 'X'

1. Gender

1. Male	<input type="checkbox"/>	2. Female	<input type="checkbox"/>
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2. Age group (in years)

19 or less	20 – 29	30 – 39	40 – 49	50 and above
<input type="checkbox"/>				

3. Educational level

Grade 7 or less	Grade 8 - 9	Grade 10 – 11	Grade 12	Diploma	Degree	Post graduate
<input type="checkbox"/>						

4. Occupation	
5. Years of experience	

Section B: The Indicators of Effective Management of Urbanisation

Listed below are aspects assessing effective management of urbanisation within local government. Please mark an appropriate response with an 'X' in the box below.

<p>Legends</p> <p>1 = Strongly Disagree; 2 = Disagree; 3 = Undecided; 4 = Agree; 5 = Strongly Agree</p>

B1. The municipality involves the community during planning and budgeting.	1	2	3	4	5
B2. The municipality does not provide the community with information about the plans regarding the problems associated with urbanisation.	1	2	3	4	5
B3. There are non-functional ward committees in addressing urban problems.	1	2	3	4	5
B4. The community is consulted in the formulation of a plan to manage the city.	1	2	3	4	5
B5. There is the capacity to plan and implement urban policies by the municipality.	1	2	3	4	5
B6. Limited capacity is affecting the municipality in addressing urbanisation in the city.	1	2	3	4	5
B7. The municipality is still using the top-down approach to urban planning.	1	2	3	4	5
B8. The infrastructure around the city is adequate in controlling traffic congestion.	1	2	3	4	5
B9. We are encouraged to have green spaces and avoid pavement which helps prevent soil erosion.	1	2	3	4	5

B10. The municipality has implemented technological infrastructure to improve communications with the communities in order to manage urbanisation effectively.	1	2	3	4	5
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Section C: The Contemporary Planning Praxis for Effective Management of Urbanisation

Listed below are aspects assessing the current planning praxis effective management of urbanisation within local government. Please mark an appropriate response with an 'X' in the box below.

Legends

1 = Strongly Disagree; 2 = Disagree; 3 = Undecided; 4 = Agree; 5 = Strongly Agree

C1. The city has several parks to manage urban environmental problems.	1	2	3	4	5
C2. The municipality is collecting refuse waste regularly.	1	2	3	4	5
C2. The rate of urbanisation is reducing the amount of green spaces around the city.	1	2	3	4	5
C3. Various stakeholders are involved in the planning and management of the city.	1	2	3	4	5
C4. The improvement in transportation systems can help increase the number of people using public transport.	1	2	3	4	5
C5. The planning systems at a local government are not communicated well with the community.	1	2	3	4	5

Attitude to participate in municipal playing systems.

Ap1. Participating in the municipal planning system makes me feel good.	1	2	3	4	5
Ap2. Participating in the municipal planning system makes less comfortable.	1	2	3	4	5
Ap3. The quality of planning will be improved if I participate in the municipality.	1	2	3	4	5

Ap4. Participating in the municipal planning system is a waste of my time.	1	2	3	4	5
Ap5. Participating in the municipal planning system is not enjoyable.					

Section D: The Characterisation of Climate Change

Listed below are aspects that evaluate contemporary strategies in an attempt to mitigate climate change. Please mark an appropriate response with an 'X' in the box below

Legends:					
1 = Strongly Disagree; 2 = Disagree; 3 = Undecided; 4 = Agree; 5 = Strongly Agree					
D1. There has been a decline in the levels of rainfall in the past 5 years.	1	2	3	4	5
D2. In the past 5 years, we have experienced floods in our area.					
D3. The area has been experiencing increasing intensity in temperature over the past 5 years.	1	2	3	4	5
D4. We have witnessed heatwaves which resulted in extreme temperature in the past 5 years.					
D5. Due to the increasing temperature and declining rainfall in these areas, we have witnessed an intensifying drought.	1	2	3	4	5

D6. Which one of these effects do you think your areas are vulnerable to the most?

Change in precipitation patterns,	Soil acidification	Extreme temperatures	Warming of oceanic water	Heat islands	Rising sea levels
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Section E: The Operative Strategies Employed in the Attempt to Mitigate Climate Change

Listed below are aspects that evaluate contemporary strategies in an attempt to mitigate climate change. Please mark an appropriate response with an 'X' in the box below.

Legends:	
1 = Strongly Disagree; 2 = Disagree; 3 = Undecided; 4 = Agree; 5 = Strongly Agree	

E1. The municipality provides the local community with information about the effects of climate change.	1	2	3	4	5
E2. Reducing the use of private car around the city increase traffic congestion.	1	2	3	4	5
E3. I have adequate knowledge about the effects of urban environmental problems.	1	2	3	4	5
E4. With my knowledge of urbanisation, I can add a valuable contribution to the municipal planning system.	1	2	3	4	5

E5. How often do you use public transport in order to reduce traffic congestion?

Once a week	Once a month	Twice a month	Once a month	Never used it
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E6. Rate the problem of traffic congestion around the city with 1 being the most serious and 5 been the least serious. _____

Attitude about electric conservation

Att1. Reducing my electricity usage is too much of a nuisance.	1	2	3	4	5
Att2. Saving electricity makes me live less comfortable.	1	2	3	4	5
Att3. My quality of life will decrease when I reduce electricity.	1	2	3	4	5
Att4. Saving electricity will restrict my freedom.	1	2	3	4	5
Att5. Saving electricity in my household is not very enjoyable.	1	2	3	4	5

Feeling guilty about the high consumption of electricity

Fg1. I feel bad about using more electricity than necessary in my house.	1	2	3	4	5
Fg2. I feel bad about not following the measures to save electricity in my house.	1	2	3	4	5
Fg3. It makes me feel like a better person to save electricity in my house.	1	2	3	4	5
Fg4. The electricity shortages caused by high electricity use, do not make me feel guilty.	1	2	3	4	5

Section F: Planning for and Management of Urbanisation can be employed for Effective Attempt to Mitigate Climate Change

Listed below are aspects assessing the planning and management of urbanisation to mitigate climate change. Please mark an appropriate response with an 'X' in the box below.

Legends: 1 = Strongly Disagree; 2 = Disagree; 3 = Undecided; 4 = Agree; 5 = Strongly Agree

Awareness of the problem of climate change in the city

F1. High electricity consumption and traffic congestion increase the burning of fossil fuel (coal) which contribute to climate change.	1	2	3	4	5
F2. Climate change is affecting the lives of people around the city.	1	2	3	4	5
F3. There have been increasing levels of temperature in the past 5 years.	1	2	3	4	5
F4. The city has experienced serious water (draught) shortage in the past 5 years.	1	2	3	4	5
F5. The city has experienced floods that resulted in damage to infrastructure in the past 5 years.	1	2	3	4	5
F6. There have been changing rainfall patterns in the past 5 years.	1	2	3	4	5

Climate change mitigation and adaption

F7. I feel good when using solar geyser in my household for heating water.	1	2	3	4	5
F8. I feel responsible for reducing electric consumption through the use of solar in my household.	1	2	3	4	5
F9. I Feel responsible for ensuring that the carbon emission to address climate change.	1	2	3	4	5
F10. There should be an implementation of a nuclear power station to reduce Greenhouse Gases to address climate change.	1	2	3	4	5
F11. Local communities should be involved in the climate change adaptation and mitigation process.	1	2	3	4	5

F12. The national, provincial, local and other stakeholders need to take a central role in climate change policy formulation.	1	2	3	4	5
F13. The municipality coordinates the formulation of climate change policy well with the local communities.	1	2	3	4	5

THANK YOU FOR TAKING YOUR TIME TO COMPLETE THIS QUESTIONNAIRE

APPENDIX B: INTERVIEW SCHEDULE

Date of the interview _____

The research project is titled **towards effective planning and management of urbanisation towards mitigating climate change within Polokwane local municipality, Limpopo Province, South Africa**. The purpose of the research projects is to investigate the effective planning of and management of urbanisation towards climate change mitigation. The information will be used strictly for academic purposes and it will be kept confidential.

1. Gender

1 Male	2 Female

2. Highest level of education _____

3. Position _____

4. Please explain the challenges that you are facing in managing urbanisation within the city.

5. What are the strategies the municipality is putting in place to manage urbanisation?

6. In your view, to what extent is the municipality effective in integrating various stakeholders in planning?

7. How has the municipality involved the local communities within the governance in mitigating the harsh realities of climate change?

8. What are the strategies that you use to monitor the emission levels around the city?

9. What is the role that the municipality play in mitigating climate change and ensuring that city is adaptable?

10. In your view, to what extent does the municipality implement plans to address climate change?

11. How do you monitor the implementation of municipal plans to mitigate climate change?

12. What are the climate adaptation strategies that have been implemented to ensure that the city is adaptable to climate change?

13. What are some of the effects of climate change that the city continuously faces?

14. To what extent is climate change affecting the city?

15. Explain what needs to be done better in managing urbanisation to address climate change?

16. What are other comments or recommendation that you have about climate change mitigation strategies?

APPENDIX C: LETTER OF CONSENT

To: Municipal Manager
Polokwane Local Municipality

From: Mr NJ Mokoete,
Department Development Planning and Management

Date: September, 05, 2016

Subject: REQUEST FOR PERMISSION TO CONDUCT RESEARCH POLOKWANE
LOCAL MUNICIPALITY

Dear Municipal Manager

This letter serves to request permission to conduct research at Polokwane local municipality. The data is part of my research project for the Doctor of Administration in Development. The research topic is on: **Towards effective planning and management of the urbanisation process in mitigating climate variability in Polokwane City, Limpopo Province, South Africa.** The research is undertaken solely for academic purposes. The study aims to evaluate the effectiveness of planning for and management of urbanisation in an attempt to mitigate climate change in Polokwane city. Furthermore, the study aims to answer the following research questions:

- What are the typologies of urbanisation?
- What are the indicators for effective management of urbanisation;
- What is the contemporary planning praxis for effective management of the urbanisation process?
- What are the characteristics of climate change?
- What are the operative strategies employed in an attempt to mitigate climate change in developing countries?
- How can the contemporary planning for and management of the urbanisation process be effectively employed in mitigating climate change?

Hoping that my requesting will be accepted.

Thank you very much

Signed: _____

Mr NJ Mokoete

Department of Development Planning and Management

APPENDIX D: APPROVAL FROM FACULTY OF MANAGEMENT AND LAW



University of Limpopo
Faculty of Management and Law
OFFICE OF THE EXECUTIVE DEAN
Private Bag X1106, Sovenga, 0727, South Africa
Tel: (015) 268 2558, Fax: (015) 268 2873, Email: frikkie.ponelis@ul.ac.za

25 June 2018

N.J Mokoele (200517999)
SCHOOL OF ECONOMICS AND MANAGEMENT
Doctor of Administration (Development Planning and Management)

Dear Mr N.J Mokoele,

FACULTY APPROVAL OF PROPOSAL

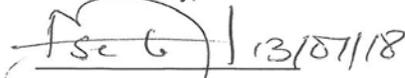
I have pleasure in informing you that your Doctoral proposal served at the Faculty Higher Degrees Committee meeting on **20 June 2018** and your title was approved as follows:

"Towards an Effective Planning for and Management of Urbanisation Process in Mitigating Climate Variability in Polokwane City, Limpopo Province, South Africa".

Note the following: The study

Ethical Clearance	Tick One
Requires no ethical clearance Proceed with the study	
Requires ethical clearance (Human) (TREC) (apply online) Proceed with the study only after receipt of ethical clearance certificate	✓
Requires ethical clearance (Animal) (AREC) Proceed with the study only after receipt of ethical clearance certificate	

Yours faithfully,


Prof MP Sebola

Chairperson: Faculty Higher Degrees Committee

CC: Prof MP Sebola, Supervisor, and Acting Director of School of Economics and Management, Mrs MD Mathebula, HoD, Development Planning and Management.

Finding solutions for Africa

APPENDIX E: APPROVAL FOR ETHICAL CLEARANCE



University of Limpopo
Department of Research Administration and Development
Private Bag X1106, Sovenga, 0727, South Africa
Tel: (015) 268 3935, Fax: (015) 268 2306, Email: anastasia.ngobe@ul.ac.za

**TURFLOOP RESEARCH ETHICS
COMMITTEE CLEARANCE CERTIFICATE**

MEETING: 27 November 2018

PROJECT NUMBER: TREC/226/2018: PG

PROJECT:

Title: Towards an Effective Planning for and Management of Urbanisation Process in Mitigating Climate Variability in Polokwane city, Limpopo Province, South Africa.

Researcher: NJ Mokoale
Supervisor: MP Sebola
Co-Supervisor/s: N/A
School: Economics and Management
Degree: PhD (Development Planning and Management)



PROF. TAB MASHEGO

CHAIRPERSON: TURFLOOP RESEARCH ETHICS COMMITTEE

The Turfloop Research Ethics Committee (TREC) is registered with the National Health Research Ethics Council, Registration Number: **REC-0310111-031**

Note:

- i) Should any departure be contemplated from the research procedure as approved, the researcher(s) must re-submit the protocol to the committee.
- ii) The budget for the research will be considered separately from the protocol.
PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES.

Finding solutions for Africa

APPENDIX F: APPROVAL FROM POLOKWANE LOCAL MUNICIPALITY

REPORT CONTROL SHEET

SUBJECT: Request to Conduct Research (Mr. M. J. Mphahlele)
 DOCS NUMBER: _____

POLOKWANE MUNICIPALITY
 OFFICE OF THE MUNICIPAL
 MANAGER
 2019-07-18
 P.O. BOX 111, POLOKWANE 0700
 LIMPOPO PROVINCE

SECTION A: SUBMISSION BY SBU MANAGER
 SBU: Human Resource NAME [AUTHOR]: Kgaso
 SIGNATURE / SBU MANAGER: _____ DATE: 2019/07/10

SECTION B: AUTHORISATION / SUBMISSION BY
 DIRECTORATE: Corporate & Shared Services
 SIGNATURE / DIRECTOR: _____ DATE: 11/07/2019

SECTION C: COMMENTS REQUIRED FROM: [TICK IN APPLICABLE BLOCK]

DIRECTOR: ENGINEERING SERVICES	<input type="checkbox"/>	SIGNATURE: _____	DATE: _____
DIRECTOR: DEVELOPMENT & ECON. PLAN	<input type="checkbox"/>	SIGNATURE: _____	DATE: _____
DIRECTOR: COMMUNITY SERVICES	<input type="checkbox"/>	SIGNATURE: _____	DATE: _____
DIRECTOR: CORP. AND SHARED SERV.	<input type="checkbox"/>	SIGNATURE: _____	DATE: _____
CHIEF FINANCIAL OFFICER	<input type="checkbox"/>	SIGNATURE: _____	DATE: _____
DIRECTOR: COMMUNITY DEVELOPMENT	<input type="checkbox"/>	SIGNATURE: _____	DATE: _____
DIRECTOR: STRAT PLAN. MONITOR. & EVAL	<input type="checkbox"/>	SIGNATURE: _____	DATE: _____
MAN: COMMUNICATION AND PUBLIC PART.	<input type="checkbox"/>	SIGNATURE: _____	DATE: _____

SECTION D: SECRETARIAT & ADMINISTRATION
 REG. NO: _____ REG. DATE: _____ COMMITTEE CLERK: _____

SECTION E: MUNICIPAL MANAGER
 APPROVED FOR SUBMISSION: [Signature] DATE: 23/07/2019
 REMARKS: _____
ALLOCATION TO COMMITTEES

FINANCE & LED	ENERGY	HOUSING	CULTURE, SPORTS, REC & SPEC. FOCUS	ADMIN & GOV.
WATER & SANITATION	COMMUNITY SAFETY	ROADS, S/WATER & TRANSPORT	WASTE & ENVIRON.	SPATIAL PLAN & DEV
LAND USE MAN.	LOCAL LABOUR FORUM	COUNCIL	MAYORAL COMMITTEE	

APPROVED ITO DELEGATED POWERS _____ DATE _____
 MM/ NUMBER ALLOCATED BY CAO – SECRETARIAT _____ MM/ _____

APPROVAL OF EXECUTIVE MAYOR IN TERMS OF DELEGATED POWERS

APPROVED ITO DELEGATED POWERS _____ DATE: _____
 EM/ NUMBER ALLOCATED BY CAO – SECRETARIAT _____ EM/ _____

(10/07/2019)

DIRECTORATE: CORPORATE AND SHARED SERVICES

ITEM:

FILE REF: 5/16/2

REQUEST TO GRANT MR. NGOAKO JOHANNES MOKOELE PERMISSION TO CONDUCT HIS RESEARCH WITHIN POLOKWANE MUNICIPALITY

Report of the Director: Corporate and Shared Services

Purpose of the Report

To request approval from Municipal Manager to grant permission to Mr. Ngoako Johannes Mokoete to conduct his research within Polokwane Municipality.

Background and Discussion

Mr. N.J Mokoete is Doctoral student at University of Limpopo under Development Planning and Management and the title of his Thesis is "*Towards an effective planning and Management of Urbanisation in an attempt to mitigate climate change in Polokwane City Limpopo Province, South Africa.*"

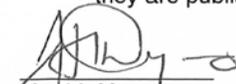
The information collected during the survey shall be kept confidential and the University shall promise to observe all relevant research ethics in line with University of Limpopo's standards and requirements.

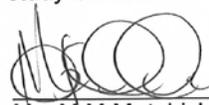
FINANCIAL IMPLICATION

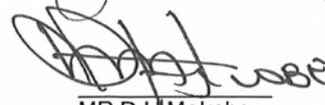
There is no financial implication on this project

RECOMMEND

1. That approval be granted for Mr. N.J Mokoete to conduct his research within Polokwane Municipality.
2. That the findings from the research study be shared with the municipality before they are published.


Mr. J.L Manyama
Human Resource Manager


Ms. M.M Matshivha
Director: Corporate Shared & Services


MR D.H Makobe
Municipal Manager

APPENDIX G: APPROVAL LETTER FOR DATA COLLECTION AT CAPRICORN DISTRICT MUNICIPALITY



**CAPRICORN
DISTRICT MUNICIPALITY**

41 Biccard Street
P.O. Box 4100
POLOKWANE
0700

Tel: (015) 294-1000 x 1211
Fax: 086 506 2104
Web: www.cdm.gov.za
E-mail: vanrooyent@cdm.org.za

Reference: 16/2/2/4

Enquiries: Ms Molatelo Mashego

13 February 2019

The Director: School of Economics and Management
University of Limpopo
Private Bag X1106
SOVENGA
0727

Attention: Professor MP Sebola

Dear Professor Sebola

REQUEST TO CONDUCT RESEARCH WITHIN THE CAPRICORN DISTRICT

Your letter dated 10 December 2019 as well as recent email correspondence with our officials regarding the above, refer.

We have no objection to your Doctoral student, Mr NJ Mokoale, conducting research within the Capricorn district and will support and assist him in his endeavor where we can.

Yours faithfully



NOKUTHULA MAZIBUKO
MUNICIPAL MANAGER

15/02/2019
DATE

Re Soma le Setšaba



Anti-Fraudline 0800 20 50 53

APPENDIX H: REQUEST TO COLLECT DATA

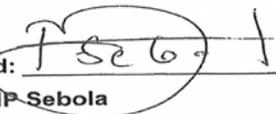


University of Limpopo
School of Economics & Management
Department of Public Administration
Tel: +27 (15) 268 3157/3994; Fax: 015 268 3522 E-mail: mokoko.sebola@ul.ac.za

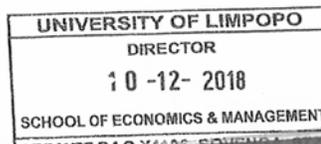
To: Whom it may concern
From: Prof MP Sebola
Director: School of Economics and Management
Date: 10 December 2018
Subject: Request Letter to Conduct Research: Mr NJ Mokoale (200517999)

1. This serves to confirm that the above-mentioned candidate is a registered Doctoral student in our Department of Development Planning and Management in the University of Limpopo.
2. The student is conducting a study on *"Towards an Effective Planning and Management of Urbanisation in an Attempt to Mitigate Climate Change in Polokwane City, Limpopo Province, South Africa"*.
3. The study is solely meant for academic research purpose only and to obtain his Doctoral Degree of Administration in Development Planning and Management.
4. I therefore as a study leader of this project, request your office to approve his request to conduct research in your area of demarcation.

Yours Sincerely

Signed: 
Prof MP Sebola
Director: School of Economics and Management

Date: 10/12/18



Finding solutions for Africa

APPENDIX I: APPROVAL TO COLLECT DATA AT EMDO PARK



University of Limpopo
School Economics and Management
Department of Development Planning and Management
Tell: +27 (15) 268 3158; Ngoako.mokoеле@ul.ac.za

POLOKWANE MUNICIPALITY
CLLR S.M. MASHABELA
DATE: 03/02/2019
SIGNATURE:

APPROVED FOR
DATA COLLECTION

To: Emdo Residents
From: Mr Ngoako Johannes Mokoеле (Research Student)
Department of Development Planning and Management
Date: January, 18, 2019
Subject: Request Letter to Conduct Research: Mr NJ Mokoеле (200517999)

1. This letter serves to confirm that Mr. NJ Mokoеле is a registered Doctoral student in the Department of Development Planning and Management, School of Economics and Management, University of Limpopo.
2. The title of the study is: ***"Towards an Effective Planning and Management of Urbanisation in an Attempt to Mitigate Climate Change in Polokwane City, Limpopo Province, South Africa"***.
3. The data will be used solely for academic research purposes and to obtain his Doctor of Administration in Development Planning and Management.
4. The main research question of the study is: *"how can municipalities effectively plan and manage urbanisation in an attempt to mitigate climate change in Polokwane city?"*.
5. I therefore, request for the approval of this request to conduct the study in your area of demarcation (Emdo). A questionnaire schedule will be used collect data from households in Emdo by going from one house to another.

Hoping a positive responds and thank you in advance.

Yours Sincerely,

Signed:

Mr NJ Mokoеле

Department of Development Planning and Management

Email: Ngoako.mokoеле@ul.ac.za

Cell Number: 079 786 4699

Office Tell: 015 268 3158

Finding solutions for Africa



APPENDIX J: APPROVAL TO COLLECT DATA AT SERALA VIEW

SERALA VIEW HOMEOWNERS ASSOCIATION

Wendy House
Mamba Street
Serala View – POLOKWANE
0699

P O Box 3677 SOVENGA 0727 / 072 433 3771 – 083 597 1609
Emails: monandimolem@gmail.com - gatelapele@hotmail.com

Directors: Mamabolo MN, Mathenda CPM and Mowasa KI

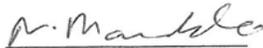
The Director
University of Limpopo School of Economics and Administration
Department of Public Administration
SOVENGA
0727

Dear Sir

Re: REQUEST LETTER TO CONDUCT RESEARCH: MR NJ MOKOELE – 200517999

1. Matter above refers
2. We acknowledges receipt of your letter dated 10th December 2018 and content thereof;
3. Kindly be informed that the Directors Serala View Homeowners has no objection for your accademic research within Serala View township dermarcation. Therefore your request is approved and residents will be informed about your present in the area. Over and above that it is a plea to your good-self to share the finding with directors on your completion of the project.
4. Hope that this will meet your requirements and we wish you good luck on your endovour.

Kind regards



CHAIRPERSON

28/04-2019

DATE

The Muniapi Manager
Polokwane Local Municipality