# ASSESSING THE LEVEL OF DISASTER PREPAREDNESS OF THE CITY OF EKURHULENI USING THE CLIMATE RELATED INCIDENT OF 2015

By

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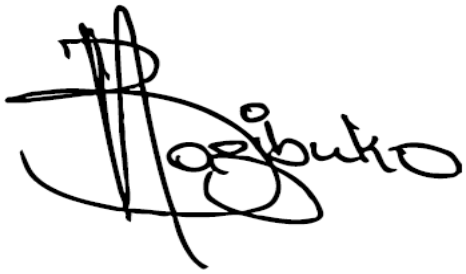
## DECLARATION

This mini-dissertation research project is my original work and has not been submitted for any degree in any University in the country or outside of the country. References have been acknowledged without prejudicing the sources used or quoted.



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Bafana Alfred Mazibuko

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## DEDICATION

***This dissertation is dedicated to my late brother, Thabo Mazibuko, and my father, Mr Isaac Simani Mazibuko, who planted the seed of education in me from a young age and for believing in me throughout his life until his death in July 2019. Mwelase, Nzima, Kondlo, Mazezulu, Phuthini awuqedwa lala ngoxholo no khokho uyishiyile induku ebandla.***

## ABSTRACT

**Problem statement**: The City of Ekurhuleni is known for its extreme precipitation events which, sometimes, lead to late afternoon thunderstorms and frequent nature related disasters. From 2010 to 2016, the city declared four states of disasters because of climate hazards such as floods, tornado or hailstorm. Although the city had a number of extreme weather events and disaster declarations, the literature review revealed insufficient research regarding the level of the city's disaster preparedness to respond to major emergency incidents and /or disasters related to climate change. The insufficient information on the city's disaster preparedness meant that the city could not determine its level of preparedness for disasters, hence the intention of this study.

**Purpose**: The primary aim of this study was to examine the City of Ekurhuleni disaster preparedness, using the 16 November 2015 climate related hailstorm disaster in the city, from the views of the ward committee members and the municipal government officials. The four objectives that were evaluated to determine the primary objective were the disaster planning regime, the early warning systems, municipal response mechanism and public education and training programme.

**Methods**: The methodology that was employed in the study was a mixed research method. The sample of the study consisted of 78 ward committee members from eight (8) customer care centre affected by the 2015 hailstorm disaster and 68 City of Ekurhuleni's local government officials that might have responded to the same disaster. Questionnaires were administered to 97 participants and 49 participants were earmarked for interviews to collect data. The data was analysed using the Statistical Package for the Social Sciences (SPSS) with the assistance of an experienced researcher.

**Findings**: The study findings after triangulation were as follows:

- The community vulnerability assessment tool was not being used to plan for disaster preparedness.
- Few households in the communities' have households' disaster preparedness plans; the majority does not have any plans in place.
- The study showed that to some extent the city institutes disaster preparedness planning for their area of responsibility.
- The early warning system in the city to a greater degree was confirmed to be in existence for the communities.
- The implementation of the response mechanisms of disaster and emergency response in city is balanced.

- The city's disaster and emergency public education and training programmes in the communities had a limited impact for disaster preparedness.

**Recommendations**: The main recommendations of the study based on the four objectives were as follows:

(i) Disaster Planning Regime

- The city should involve the internal departments and other stakeholders through the Municipal Advisory Forum and the communities through the process of the Integrated Development Plans to improve on the usage of the disaster community vulnerability assessment to prepare for disasters.
- The Disaster Management Service in the city should raise the awareness on this critical aspect of disaster preparedness through communicating community risk and possible mitigation strategies to protect themselves.
- The city has to broaden their municipal planning for disaster preparedness similar to the use of the community vulnerability assessment which was stated as the involvement of the internal departments and other stakeholders' through the Municipal Advisory Forum and the communities through the process of the Integrated Development Plans.

(ii) Early Warning System

- The city can upgrade and maintain the elements of the early warning strategy to increase the spread of coverage for this system to strengthen disasters preparedness.

(iii) Municipal Response Mechanism

- The response mechanisms of the city should be improved through media communication that includes the communication of community's risks and available resources and mechanisms in the city to respond to dominant disaster hazards.

(iv) Public Education and Training Programme

- Refining programmes by including ward committees and non-governmental organisations as partners in the planning and implementation.

**Conclusion**: The implication of the study's' findings was that it confirmed the conclusion that the City of Ekurhuleni had some components of disaster preparedness that existed though not at the required level to enable it to respond effectively to major emergency incidents and /or disasters. Therefore, it might be required for the city to have a deliberate strategy to develop a disaster preparedness plan to be able to response to their challenges of extreme weather incidents and disasters.

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## ACRONYMS

| | |
|---|---|
| ARC | African Risk Capacity |
| AU | African Union |
| CCC | Customer Care Centre |
| COE | City of Ekurhuleni |
| DEMS | Disaster and Emergency Management Service Department |
| DMA | Disaster Management Act |
| DMC | Disaster Management Centre |
| DRR | Disaster Risk Reduction |
| EAC | East African Community |
| Ecowas | Economic Community of West African States |
| EMM | Ekurhuleni Metropolitan Municipality |
| HODs | Head of Departments |
| IDP | Integrated development Plan |
| IRFRC | International Federations of Red Cross and Red Crescent Societies |
| SADC | Southern African Development Community |
| Stats SA | Statistic South Africa |
| UN | United Nations |
| UNISDR | United Nations International Strategy for Disaster Reduction International |

## DEFINITIONS OF TERMS

### Disaster management and climate change terms

**Adaptation**: For the purpose of this study, the adopted definition is the one attributed to UNFCCC by the UNISDR Terminology (2009: 4), which views adaptation as an "… *adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities.*" The Organisation for Economic Co-operation and Development and International Energy Agency (OECD/IEA) in the '*Adaptation to Climate Change: Key Terms'* guide (2006) acknowledged that there are four different ways to explain the term adaptation though these four different explanations of the terms adaptation are fundamentally similar.

Various authors, according to Serrao-Neumann; Crick; Harman; Schuch & Choy (2015), acknowledge the relationship between adaptation and disaster preparedness in the context of disaster risk reduction. UNISDR Terminology (2017) views disaster risk reduction as any measures that contribute to resilience at community or government level. It aims to prevent any emerging or occurring disaster risk and deals with residual risk to attain sustainable development goals. Resilience is understood as the capacity of any community or system that is faced with disaster hazard to adapt, resist or change its capacity for continued survival. Serrao-Neumann et al (2015) conclude by saying that to increase the integration of adaptation and risk reduction (i.e. prevention, mitigation and preparedness), there should be common implementation of programmes, change in intra and inter-organisational operation procedures and the modification of the training for both climate change adaptation and disaster management practitioners. It is also suggested that integration should start at the theoretic and research level because it is where new ideas are generated for programme implementation, new procedures and the training of new breed of practitioners that will integrate adaptation and disaster risk reduction into a single field.

**The definition for climate change** adopted in the study is directly quoted from IPCC Glossary (2018). It refers to climate change as "…*a change in the state of the climate that can be identified (e.g., by using statistical tests) by changes in the mean and/or the variability of its properties and that persists for an extended period, typically decades or longer. Climate change may be due to natural internal processes or external force such as modulations of the solar cycles, volcanic eruptions and persistent anthropogenic changes in the composition of the atmosphere or in land use*." The IPCC report by Cubasch, Wuebbles, Chen, Facchini, Frame, Mahowald, and Winther

(2013) states that averaging of climate change variables should be at least 30 years as per the world meteorological organisation guidelines.

**Disaster**: there are multitudes of definitions for the concept of disaster. Most of these definitions have some minor differences. For example, Quarantelli (1986) defines a disaster as a sudden crisis event or occurrence that cannot be dealt with using routine measures but requires extra-ordinary measures. Enshassi, Shakalaih & AlKilani (2019: 108) quoting Baas et al (2008) contends that a disaster is a "*a serious breach of the daily life of people in a community, causing serious losses, as human life, flora and fauna, trade and industrial activities resulting in failure of a community to handle the situation as resources could be reduced."* The UNISDR Terminology (2017: 13) explains the concept of disaster as a serious community or societal disruption at any magnitude by a hazardous occurrence increased by "…*conditions of exposure, vulnerability and capacity leading to one or more losses and impacts in human, material, economic and environmental losses".* The South African Disaster Management Act, Act 52 of 2002 states that disaster means a progressive or sudden, widespread or localised, natural or human-caused occurrence which—

*(a) causes or threatens to cause—*
  *(i) death, injury or disease;*
  *(ii) damage to property, infrastructure or the environment; or*
  *(iii) significant disruption of the life of a community; and*
*(b) is of a magnitude that exceeds the ability of those affected by the disaster to cope with its effects using only their own resources.*

Whilst Quarantelli (1986) emphases the non-routine response measures to disasters, other literature such as South African Disaster Management Act (2002) argue that a disaster is both natural and man-made but also progressive or sudden with the potential to disrupt the community's life to the degree that the community cannot afford its recovery using its own capacity. More importantly, the impact of a disaster can be affect human life, environment and/ or economy of the community.

According to the UNISDR Terminology (2017), an emergency is an everyday incident that is dealt with using routine response measures and does not necessarily disrupt the functioning of a community. This is unlike a disaster which Quarantelli (1986: 1) defines as "…*those relatively sudden crisis events which cannot be dealt with by ordinary measures or routines*."

**Disaster management** is an act of "…*organisation, planning and application of measures preparing for, responding to and recovering from disasters*" (UNISDR Terminology, 2017: 14). The South African Disaster Management Act (2002: 6) elaborates on the same UNISDR definition by stating that disaster management is "…*a continuous and integrated multi-sectoral, multi-disciplinary process of planning and implementation of measures aimed at preventing or reducing the risk of disasters; mitigating the severity or consequences of disasters; emergency preparedness, rapid and effective response to disasters; and post-disaster recovery and rehabilitation*."

Albtoush, Dobrescu & Ionescou (2011) define term disaster management as a discipline with four phases, which are mitigation, preparedness, response, and recovery, that seek to increase disaster risk avoidance. In other words, as stated in National Disaster Management Framework (2005), disaster management is a management function that seeks to coordinate the multiple sectors and multiple disciplines in terms of implementing their plans and strategies either to reduce or to respond to disaster risk that is beyond the capacity of the community.

Similar to disaster and emergency, disaster management is confused or used interchangeably with emergency management (UNISDR Terminology, 2017), which is incorrect. Drawing from the definition of disaster and emergency above and from the South African National Disaster Management Framework (2005), emergency management is not disaster management or vice versa, because it is a line function but not a management function like disaster management. In other words, emergency management is a repetitive and predictable everyday function. Again, according Albtoush et al (2011: 54), emergency management is a generic term used to define the "…*process used to protect critical assets of an organisation from hazard risks that can cause disasters or catastrophes, and to ensure their continuance within their planned lifetime."*

Kent (1994:12), in the Disaster Preparedness Module for the United Nations Development Programme (UNDP), originally defined the concept of **Disaster preparedness** as an effort to minimise "…*the adverse effects of a hazard through effective precautionary actions, rehabilitation and recovery to ensure timely, appropriate and effective organisation and delivery of relief and assistance following a disaster*." The same definition was then refined in the UNISDR Terminology (2017: 21) with emphasis on the aspects of knowledge and capability of the responding agencies. Preparedness is expressed as the ability of different agencies such as organs of state, the humanitarian organisations in response and recovery, communities and individuals to "…*effectively anticipate, respond to and recover from the impacts of likely, imminent or current disasters*…" using their knowledge of hazards and the environment as well as capacities.

Enshassi et al (2018) confirmed that disaster preparedness stresses the advance measures and actions taken to assure an effective response to disasters impact. Therefore, disaster preparedness is an interconnection of disaster response and recovery within the context of contingency planning to deal with immediate and pending adverse effects of disaster hazards. Twigg (2004) summed the terms as having three basic elements, which are to forecast events to issue early warnings; take precautionary measures based on the warnings and to improve response trough enhanced capacity to achieve a timely and effective disaster response and recovery.

**Risk perception** is a term not normally used in disaster management. Therefore, in the context of this study, the term has to be first broken down to define what is referred to as risk. The UNISDR Terminology (2009: 25) sees risk as "*the combination of the probability of an event and its negative consequences.*'' However, risk, as a term, is contested. According to Weber & Milliman (1997), such definitions, as contained in the Oxford Dictionary (2015) and UNISDR (2009), leave out an important aspect of the magnitude of potential losses. Weber & Milliman (1997), argue that both the 'chances of occurring' (i.e. possibility) and magnitude of potential losses are important in influencing people's choices or judgement of risk. Skjong & Wentworth (2001: 538) who studied the concept of risk as outlined by Sjrberg (1980) point out that to mention only the characteristics of possibility and consequence might be interpreted as not including the perceived risk because it is not well represented.

Same as risk, risk perception is also a contested term. On one hand, authors such as Oltedal, Moen, Klempe & Rundmo (2004: 11) argue *"…it is impossible to perceive risk since there is nothing "out there" which can be called "risk" and which can be sensed. Hence, there is no risk perception (Brehmer, 1987). Risk is all about thoughts, beliefs and constructs (Sjöberg, 1979). A person's own estimate of risk may be very different from the "objective" estimate (Boholm, 1996). "Objective" risk is the risk that exists independent of an individual's knowledge and worries of the source of the risk (Ulleberg & Rundmo, 1996). To some extent, perceived risk is clearly a reflection of real risk, especially when risks are well-known (Sjöberg, 1995)."*

*Risk perception* according to Alshehri, Rezgui & Li, 2012: 1815 and ;Pidgeon et al., 1992 is defined as ''*people's beliefs, attitudes, judgments, and feelings, as well as the wider social or cultural values and dispositions that people adopt, towards hazards and their benefits*.'' Raaijmakers, Krywkow & van der Veen (2008: 308) stressed that risk perception is not just any judgment but an intuitive judgement from individuals and/ or group of people about risks in their context characterised by limited and uncertain information. They also specify that it is important

to view risk perception according to intuitive judgement. With regard to underlying perceived risks, there are three fundamental and related characteristics that inform individuals or a specific group to apparent risks, which are: awareness, worry and preparedness. Raaijmakers et al. (2008) argument, which is supported by Dicks, Davids & Button (2009: 508) states that individuals or communities as social beings will always learn something about their environment and their prevalent risks. Individual or community learned lessons (i.e. awareness) will increase or decrease certainty on the action required in the face of a prevalent risk. Bradford, O'sullivan, Van Der Craats, Krywkow, Rotko, Aaltonen, Bonaiuto, De Dominicis, Waylen & Schelfaut (2012: 2300), argue that in the event that awareness, worry and preparedness is increased in "…*any or a combination of these it raises the perception of risk and in so doing contribute to enhanced resilience.*"

# CHAPTER ONE: INTRODUCTION AND BACKGROUND OF THE STUDY

## 1.1 Introduction

Humankind, for centuries have been attracted, and sometimes trapped in cities. The cities have urbanized humankind to a point that they became the origin of the modern municipal administrations with dynamic responsibilities. According to Van Der Waldt et al. (2014), anthropologists have traced the origins of cities to Mesopotamia (about 3500 BC), Egypt (3000BC), China and India (about 3000 – 2500 BC). They indicate that cities were religious, administrative and political centre's, their residents were mostly landowners whose physical presence was not necessary in their productive rural land. These property owners had established a social system that was connected to rural production and communities. Cities as we know them today have their origin in the 19$^{th}$ century industrialisation. In other words, the phenomenon of urbanisation has been part of humankind for many years and is likely to lead to the extinction of rural settlements, as we know them today.

The report by Engelke (2013) captures this phenomenon vividly, when it declares that for most part of human history, cities have positioned themselves as a default condition for human settlement that will configure and drive local, regional and international social, political, economic and environmental conditions at all scales. Engelke (2013) further states that urbanisation has already attracted half of humankind to the cities with Asia, Africa and the Middle East reaching the same numbers as Latin America, Europe, North America and Australia. Engelke (2013) predicts that from 2010 to 2050, the number of people living in the cities will reach three (3) billion. The numbers, as suggested above mean that cities are becoming critical human centers for settlement in the 21$^{st}$ century and beyond.

While cities may appear to be an attractive settlement destination, they are the source of some of the current world problems. It is maintained that cities are the biggest polluters in the world in terms of water and air pollution as 60 to 80 percent consumption of energy and emission of carbon dioxide happens in the cities. This increases the impact of climate change on the poor and marginalised communities through extreme weather disaster events like floods, thunderstorms, etc. (Engelke, 2013). Engelke (2013), further states that cities create an environment for increased urbanisation and the extreme exposure of poor and marginalised communities to the impacts of disasters because of climate change.

In South Africa, the democratic government in 2002 introduced the legal frameworks to prepare the country to respond to disaster challenges in the country including in the cities by promulgating

the Disaster Management Act (57 of 2002). In 2005, it further published the National Disaster Management Framework as a policy framework to outline the implementation of the Disaster Management Act. Both these pieces of legislations were a paradigm shift from the previous legislation, which focused on disaster response and preparedness. Despite the fact that the South African national government passed the legal framework for disaster management, cities such as Ekurhuleni still experience major emergency incidents and disaster challenges as stated in the City of Ekurhuleni's Comprehensive Disaster Risk and Vulnerability Assessment (2016). The city's Comprehensive Disaster Risk and Vulnerability Assessment (2016) also states that between 2011 and 2015 the city experienced five climate related emergency incidents which were either declared as a local state of disaster or handled as major emergency incidents.

In view of the context above, it will be interesting to determine the level of disaster preparedness in the City of Ekurhuleni. The importance of knowing the level of disaster preparedness for the city will highlight any strengths and weaknesses in the municipal framework for disaster preparedness with the hope that recommendations on identified gaps would strengthen the city's state of readiness and that other municipalities will learn and improve on their preparedness practices.

## 1.2 Study area

### 1.2.1 Location

The study area is the Ekurhuleni Metropolitan Municipality (EMM) otherwise known as the City of Ekurhuleni. It lies in the South African Highveld region nearly 2000 meters above sea level on a flat plateau of the Gauteng Province with a multitude of lakes (Bonner et al, 2012). According to the South African Government website (2019), the City of Ekurhuleni is part of the 278 municipalities in the country but one of the three metropolitan municipalities in Gauteng Province and part of the eight metropolitans in the country. The website also states that the City is bordered by Midvaal Local Municipality in the south, the City of Tshwane in the northeast and the City of Johannesburg in the west as well as the Mpumalanga Province in the east.

Figure 1.1 below illustrates the geographic location of the City of Ekurhuleni on the South African map and in Gauteng and Figure 1.2 gives the names of the service deliver areas called customer care centres in the city that respond to disasters.


Figure 1.1: City of Ekurhuleni geographical position in South Africa
Source: On The World Map website, n.d.

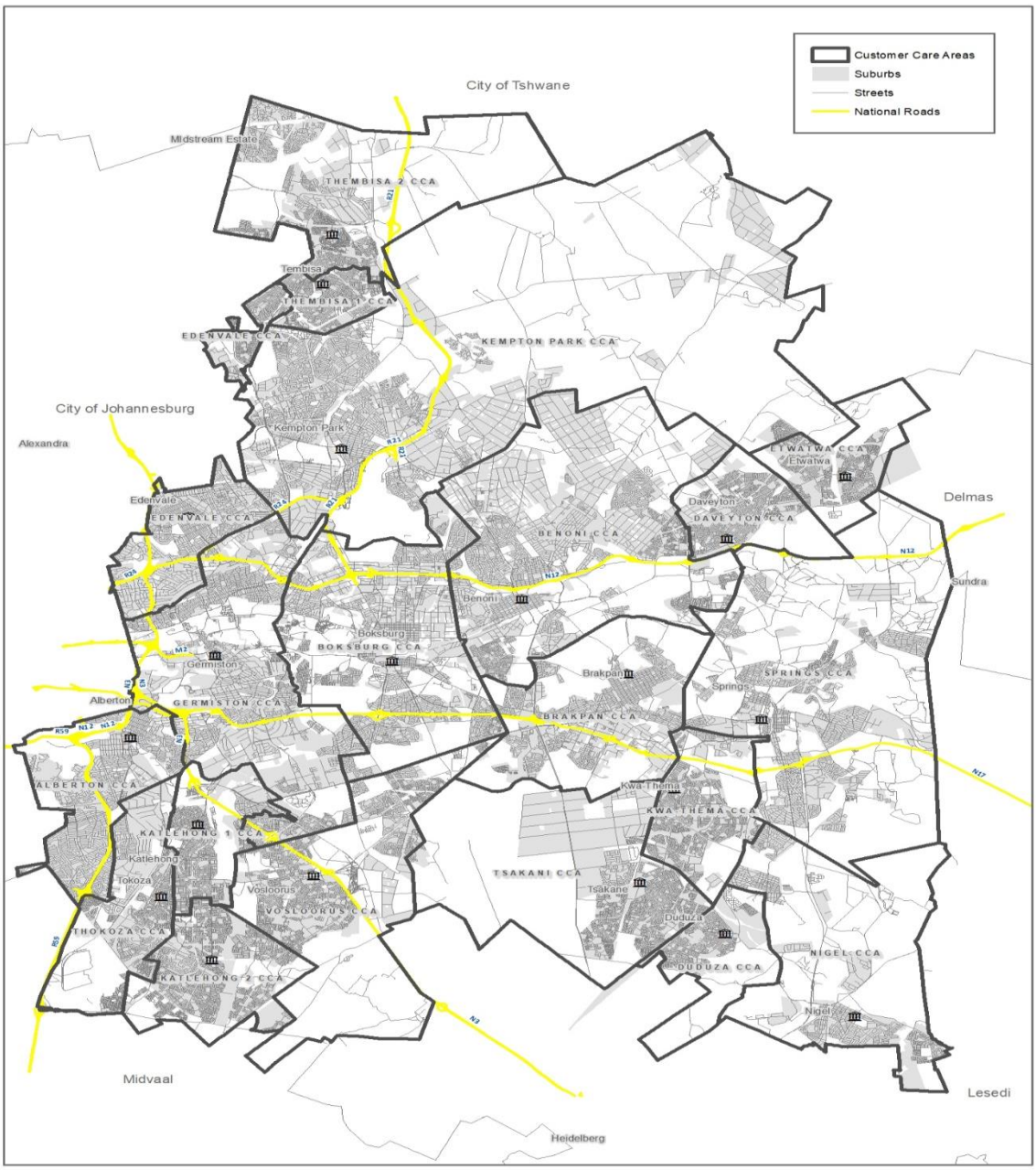


Figure 1.2: City of Ekurhuleni customer care areas
Source: Ekurhuleni: Disaster Risk & Vulnerability Assessment Report: 2016

The City of Ekurhuleni is a recent municipality in terms of its existence in the country. However, the earlier historical records of the towns that today constitutes the city can be traced to 1840 and the acceleration of the towns' development in 1886 with the discovery of gold in most of the East Rand towns such as Germiston, Boksburg, Benoni, Springs, and Brakpan as part of Witwatersrand (Bonner et al, 2012). The 2015-16 Ekurhuleni Integrated Development Plan (IDP)

(2016) indicates that the city was established in the year 2000 and extends from Germiston from the west to Springs and Nigel to the east. The document also mentions that based on the 2011 National census, the total surface area of the city is 1975km². The city is described as spreading over 15.6% of Gauteng's land mass with 112 wards, which are located within the 20 Customer

### 1.2.2 Socio-economic status

The 2015-16 Ekurhuleni Integrated Development Plan (IDP) (2016) states that since the National census in 2011, the city has grown from a population of 3 178 470 million to 3.5 million people in 112 wards, located within the 20 Customer Care Centers. The 2015 -16 IDP document mentions that the city accommodates 25.5% of Gauteng's population and 5.4% of the country's population which projects the city's socio-economic outlook as similar to other metropolitan cities in South Africa

Migration into the municipality is one of the main challenges highlighted by the number of informal settlements and informal trading activity (EMM IDP, 2016). The city has 119 informal settlements of which only 20% are upgradable and accommodate more than 400 000 residents. As part of the challenges of the municipality, the EMM IDP (2016) identifies five critical handicaps of the city as human settlements planning, infrastructure, inefficient natural resource use, skewed urban form and disorganised densities with urban informality.

The economically active people in the city constitute 41.5% of the population and contribute approximately 6.1% of the national production. From 1996 to 2011, the city's economy grew at an average rate of 3.2% per annum (EMM IDP, 2016).

In the same vein as the City of Johannesburg in Gauteng central region and West Rand Municipality, the city is part of the Main Reef mining belt (i.e. a series of the gold conglomerate ore region), which is also the main reason for its existence and its riches (Bonner et al, 2012). Bonner et al (2012) also state that the city's economy is larger and more diverse than that of many small Africa countries and accounts for a quarter of the Gauteng economy and over a third of the South African Gross Domestic Product. The city's status is because of its production of structural steel and fabricated metal products serving as inputs into other areas of the national economy (EMM IDP, 2016).

According to the IDP (2016), the city's infrastructure can compete with most cities in Europe and Africa. The network of roads, airports, rail lines, telephones, electricity grids and telecommunications are at first world infrastructure level and are able to support a well-

established industrial and commercial business. Its infrastructure and centrality in the country makes the city the transportation hub of the country as it is also home to the O.R. Tambo International Airport, the largest and busiest airport in Africa. To support the argument that the city is the transport hub of the country, it has South Africa's largest railway hub in Germiston that links it to all the major population centre's and ports in the Southern African region (IDP, 2016). The modern freeways and expressways connect the city to other cities and provinces in the country. Table 1.1 below gives a clear picture of the socio-economic status of the city as captured in the 2011 National Census.

Table 1.1: Ekurhuleni socio-economic statistics

| FACTOR | STATISTIC |
|---|---|
| Total population | 3,178,470 |
| Young (0-14) | 24,3% |
| Working Age (15-64) | 71,7% |
| Elderly (65+) | 4% |
| Dependency ratio | 39,4 |
| Sex ratio | 105 |
| Growth rate | 2,47% (2001-2011) |
| Population density | 1609 persons/km2 |
| Unemployment rate | 28,8% |
| Youth unemployment rate | 36,9% |
| No schooling aged 20+ | 3,6% |
| Higher education aged 20+ | 14,6% |
| Matric aged 20+ | 35,4% |
| Number of households | 1,015,465 |
| Number of Agricultural households | 69,013 |
| Average household size | 2,9 |
| Female headed households | 31,3% |
| Formal dwellings | 77,4% |
| Housing owned/paying off | 44% |
| Flush toilet connected to sewerage | 85% |
| Weekly refuse removal | 88,4% |
| Piped water inside dwelling | 57,2% |
| Electricity for lighting | 82,2% |

Source: South African 2011 National Census

### 1.3 Research problem

According to Davis-Reddy & Vincent (2017), during the past four decades (i.e. 1980 to 2015), South Africa, like the rest of the Southern African Development Community (SADC), experienced a surge in climate related natural disasters such as floods, droughts, wildfires and storms. They point out that during this period, the recorded climate related disasters were 491 in the SADC with 110 978 deaths or 67% of deaths connected to natural disasters'. In the same period, an estimated 140 million persons were affected with 2.47 million of them left destitute by climate change-related disasters. The majority of people, approximately 1.7 million, were left homeless by storms with the remainder caused by floods. The disasters not only damage infrastructure but also lead to loss of livelihood for communities.

In the period between 2008 and 2017, the City of Ekurhuleni experienced eight major emergency incidents and / or disasters with different degrees of impact to the municipal communities (Ekurhuleni DEMS Risk Committee Report, 2017). These major emergency incidents and / or disasters with their impact are captured in Table 1.2 below:

Table 1.2: City of Ekurhuleni major emergency incidents and/ or disasters – 2008 to 2017

| YEAR | TYPES OF INCIDENT/ DISASTER | STATUS OF DISASTER DECLARATION & THE AUTHORITY | COMMUNITY IMPACT |
|---|---|---|---|
| 2008 | Xenophobic Attacks | Provincially & Nationally Declared Disaster | 15 205 people affected and no confirmed death |
| 2010 | Bapsfontein sinkhole | Municipally Declared Disaster | 3394 people affected no deaths |
| 2010 | Floods | Nationally Declared Disaster | 319 structures including municipal infrastructure were affected |
| 2011 | Duduza Tornado | Municipally Declared Disaster | 2790 people, 863 houses and 1 death were reported |
| 2015 | Xenophobic Attacks | Not declared as a disaster but as a major emergency | 1050 people affected no confirmed death |
| 2015 | Hailstorm Disaster | Municipally Declared Disaster | 3381 households spread in all municipal areas were affected |
| 2016 | Tornado Incident: (Tembisa/ Bapsfontein/ Combiza) | Not declared as a disaster but as a major emergency | 138 households with 5 minor injuries and a shopping centre were affected |

| | | | |
|---|---|---|---|
| 2016 | Flood Disaster | Municipally Declared Disaster | 1091 households and 2160 individuals affected |
| 2017 | Thunderstorm (Etwatwa) | Not declared as a disaster but as a major emergency | 500 households were affected, and 400 people displaced |

Source: Ekurhuleni DEMS Risk Committee Report: 2017

From the table above, the City of Ekurhuleni, in the space of 6 years from 2010 to 2016, declared four states of disasters because of climate hazards such as floods, tornado or hailstorm. The city's frequency of local disaster declarations in the same period was very high with a probability of 0.6 chance for a similar declaration per year in that period.

To capture the potential climate disaster problem in the city, Ekurhuleni Metropolitan Municipality Climate Change Response Strategy (2017) acknowledged that in the past few decades there had been a number of studies that addressed Gauteng's provincial climate variability in terms of temperature and rainfall because of climate change. Most importantly, the strategy recognised that the city was inclined to extreme precipitation events sometimes leading to late afternoon thunderstorms. The strategy also indicated that storms in the city resulted in heavy rains and major flood occurrences that affected and damaged infrastructure and livelihoods.

As highlighted in the table above, scholars already know about potential occurrence of climate related hazards such as floods, storms, and tornados in the city. The literature review revealed that there is no research regarding the level of the city's disaster preparedness to respond to major emergency incidents and /or disasters related to climate change. Therefore, the intention of this study was to determine the level of disaster preparedness in the City of Ekurhuleni in the face of climate related disasters such as flood, hailstorms and tornados. The study objectives intended to measure the City of Ekurhuleni's level of disaster preparedness for major emergency incidents and /or disasters based on the climate related incident in 2015, which had the largest area spread and impact. From 2010 to 2017, there were four climate related disaster and two major emergency incidents of the same nature that affected the city. However, the climate related disaster in 2015, as shown in Table 1.3, had the largest spread in the city and severe impact to the community.

## 1.4 Objectives

### 1.4.1 Aim

The aim of the research was to assess the City of Ekurhuleni's level of disaster preparedness to respond to major emergency incidents and /or disasters using the climate related incident in 2015.

### 1.4.2 Objectives

The following objectives will assist to achieve the above stated aim:

- To evaluate the development and implementation of a disaster planning regime for the city. The disaster planning regime means to identify the potential risk of the community, to develop emergency response plans, to develop and implement mitigation, and to communicate the risk, the planning process and preparedness measures to community;
- To examine the early warning systems by the City of Ekurhuleni's;
- To evaluate the response mechanisms used by the City of Ekurhuleni's;
- To assess the disaster and emergency public education and training programme in the communities; and
- To identify any gaps and make recommendations to the city disaster management team.

## 1.5 Research questions

The research questions will naturally emanate from the objectives of the research proposal as stated above. Thus, the research questions are as follows:

- How is the disaster-planning regime handled and implemented for disaster preparedness in the city?
- Are the early warning systems in the city adequate to assist in averting the impacts of imminent disasters?
- How are the response mechanisms engineered in the city in the context of disaster preparedness?
- Are there any public education and training programmes in place to support disaster preparedness?

It was expected that by answering the above-mentioned research questions, the study would be to be able to address the fundamental research problem of this project.

## 1.6 Significance of the study

Despite numerous responses to major emergency incidents and / or disasters occurring in the city from 2008 to 2017, the City of Ekurhuleni's level of disaster preparedness had never been measured which pointed to the need to research the topic. Thus, the municipal senior managers, disaster management officials, ward committee members and the previously affected communities would value any evaluation of the level of disaster preparedness in the city. Therefore, the first significance of the study was to fill the gap that existed as result of no scientific

research regarding the preparedness level of the City of Ekurhuleni. The research gab existed despite the city having experienced six major emergency incidents and/ or disaster (i.e. two major emergency incidents and four declared disasters) in a space of nine years, which translates into a frequency of at least one major emergency incident and/ or disaster a year. Secondly, the study provided a benchmark for the City of Ekurhuleni to work on consolidating or improving some of its disaster preparedness measures and mechanisms that were identified as strong or weak by the research participants for the purpose of either maintaining or improving on them. Lastly, the study was to set precedence in the city to evaluate its level of disaster preparedness before or after every major emergency incidents and/ or disasters.

## 1.7 Methodology

### 1.7.1 Research design

The research project employed a mixed research method to investigate the research problem. Scholars of mixed research methods, such as Creswell (2009), Halcomb and Hickman (2015) and Almalki (2016), agree that mixed research methods can be defined as the integration of qualitative and quantitative research approaches into a single study. The data collection methods comprised of both qualitative and quantitative techniques (Babbie & Mouton, 2001) (Leedy & Ormrod, 2001). Qualitative techniques were used to unpack data that represented in-depth insights and perceptions of social actors in their real social environment. Quantitative techniques were used to collect measurable data in the field (Almalki, 2016). Both qualitative and quantitative data was collected simultaneously but analysed separately before being compared and integrated. The comparison and integration of data took place at the data interpretation stage. According to Creswell (2009), this data treatment as proposed determines data convergence, differences, or some combination.

Almalki (2016) outlines some benefits of adopting a mixed method approach. The first reason was that the project focused on the benefits of both research approaches i.e. the qualitative and quantitative methods and minimized the limitations of both approaches. Secondly, mixed method waws used to manipulate time, resources, and access issues as well as increasing the research participation. Lastly, the mixed method approach was suitable for the applied study.

### 1.7.2 Population and sampling

#### 1.7.2.1 Population

Alvi (2016), points out two important considerations with regard to framing the study population. The first one is that the target population refers to all members of a particular group that meet a specific criterion for the research study. Secondly, Alvi (2016) explains that the group can be homogenous or heterogeneous which means that the target population can be the same or different in other respects. In line with Alvi (2016) framing of the study population, the target population comprised all the people in the areas that were affected by the City of Ekurhuleni's climate related disaster in 2015 including all government officials and non-governmental organisations that were part of the response task teams.

Because of the extensive nature of the target population, the research had to exclude certain elements of this population to concentrate on the population of interest in the study. Therefore, the study demarcated the target population as all the five hundred and twenty ward committee members in the affected areas and eighty-one City of Ekurhuleni employed local government officials that might have responded to 2015 climate related disaster.

The first sub-group of the population of interest which was the five hundred and twenty ward committee members was from the eight customer care centres affected in the 2015 disaster. In the eight customer care centres, there were fifty-two wards and each ward was comprised of ten ward committee members which translated into 520 members. The reason that the population of ward committee members was of interest was that it was composed of both the ward councilors and the elected committee members. Moreover, the ward committee members could have a recollection of the previous disasters in their areas. The other reason was that the sub-group occupied a legitimate municipal structure elected by the community. This meant that the ward committee members existed to fulfill a democratic requirement as per Section 157 of the Constitution of the Republic South Africa and the Section 72 & 73 of the Local Government: Municipal Structural Act, Act No. 117 of 1998.

The study also had eighty-one City's employed local government officials as a population of interest because of their role in the 2015 disaster which came from the total of Ekurhuleni employees. The city's local government officials were from the thirty internal departments. The population of interest had 66 local government officials from all the thirty city's internal departments and 15 disaster management officials directly employed in the Disaster Management Centre in the city. The fifteen disaster management officials did not include this researcher. The

inclusion of all the fifteen disaster management officials, as part of the local government officials' population of interest, was because they were directly responsible for drafting and implementing the disaster management plans which included the city's disaster preparedness plans. Therefore, the population of interest for the study was 601 persons comprising of 520 ward committee members and 81 local government officials from thirty City of Ekurhuleni's internal departments. The thirty internal departments of the City of Ekurhuleni are list below.

Table 1.3: City of Ekurhuleni internal department

| No. | POSITION/DEPARTMENT |
|---|---|
| 1. | City Manager |
| 2. | Chief Operating Officer (COO) |
| 3. | Chief Financial Officer |
| 4. | Chief Risk Officer |
| 5. | Chief Audit Executive |
| 6. | Executive Support |
| 7. | Head of Department: City Planning |
| 8. | City Secretariat/Council Secretariat |
| 9. | Head of Department: Communications and Brand Management |
| 10. | Head of Department: Corporate Legal Services |
| 11. | Head of Department: Customer Relations Management |
| 12. | Head of Department: Disaster and Emergency Management Services |
| 13. | Head of Department: Economic Development |
| 14. | Head of Department/Chief of Police: Ekurhuleni Metropolitan Police Department (EMPD)/ |
| 15. | Head of Department: Energy |
| 16. | Head of Department: Enterprise Project Management Office (EPMO) |
| 17. | Head of Department: Environmental Resource Management |
| 18. | Head of Department: Fleet Management |
| 19. | Health and Social Development |
| 20. | Head of Department: Human Resources Management and Development |
| 21. | Head of Department: Human Settlements |
| 22. | Head of Department: Information Communication Technology |
| 23. | Head of Department: Real Estate |
| 24. | Head of Department: Roads and Storm water |
| 25. | Head of Department: Sports, Recreation, Arts and Culture |
| 26. | Head of Department: Strategy and Corporate Planning |
| 27. | Head of Department: Transport, Planning and Provision |

| | |
|---|---|
| 28. | Head of Department: Waste Management Services |
| 29. | Head of Department: Water and Sanitation |
| 30. | Secretary of Council |

Source: Annual Report 2015/ 2016

### 1.7.2.2 Sample design

The study made use of both probability and non-probability (i.e. purposive) sampling techniques. Stratified random sampling was the probability sampling method used and purposive (i.e. convenient or deliberate) sampling was selected from the non-probability sampling techniques. The choice of sample design, as advised by Kothari (2004), was made to protect the reliability and the appropriateness of the research study. Moreover, Kothari (2004) advises that the sample design choice should consider the following seven important elements:

- **Type of universe**: i.e. the set object of interest, which could be finite or infinite. In case of the project, the object of interest or the universe was the ward committee members and the local government officials in the city.
- **Sample unit:** i.e. the physical setting of the interest in the study. The project used the ward committee members (i.e. both the ward councillors and the elected committee members) and the city's local government officials in thirty internal departments and in the city's Disaster Management Centre.
- **Source list**: i.e. the list from which the sample is picked is called the 'sampling frame'. The study drew the sample for the list of the local government officials from the randomly selected attendance registers of the 2015 Hailstorm Declared Disaster Joint Operation Centre meetings from 17 November 2015 to the end of September 2016 and the employment records. The attendance registers were relevant for selecting the sample for the questionnaire and the employment record was used for the fifteen disaster management officials and the participants in the interviews. The ward committees were verified using the registration list from the Municipal (City) Legislature department.
- **Sample size**: The size of the sample was determined by considering the scientific requirements, manageability, representativeness, flexibility, efficiency, and reliability. **Parameters of interest**: refers to the interest of the project. The interest of the study was to gauge the perception of ward committee members, as external from the administration of city, and the local government officials, as internal administrators, on the level of the city's disaster preparedness.

- **Budgetary constraint**: i.e. the cost implication to conduct the research. The cost for the project was from the personal budget of the researcher. Due to the lack of external funding, the project was expensive to carry out.
- **Sampling procedure**: i.e. the choice of the sample technique employed in the study was informed by the sample size, cost, best techniques to avoid sampling error and sampling bias. The sample procedure is detailed below.

The respondents for the research questionnaire were selected using first the stratified random sampling method. The stratified random sampling permitted for the proportional allocation of the sample and random sampling in the identified two sub-groups i.e. the ward committee members and the local government officials (Alvi, 2016) allowed for each element of the population to have an equal chance to participate in the study (Visser et al., 2000) (Ritchie & Lewis, 2003). In the random sampling for the 520 ward committee members, an arbitrary twenty percent was used to limit the envisaged participants in the group. The twenty percent for the ward community members' sub-group translated into one hundred and four participants. The selection of the ward community members' sub-group participants was based on the lottery technique. The same stratified random sampling method was also applied to select thirty out of eight-one local government participants. In this regard, out of thirty internal departments an arbitrary one representative per department was adopted and the selection of meetings' attendance registers for Joint Operation Centre of 2015 was done randomly using a lottery technique. For the total sample size of the local government officials which was forty-five, the fifteen disaster management officials were added to the thirty internal departments' local government officials using the second sampling technique called purposive sample. According to Kothari (2004), in the non-probability technique, which is sometimes called convenience sampling or deliberate sampling, respondents are deliberately selected because they reflect a particular paradigm of interest and ease of access. The fifteen disaster management officials employed in the Disaster Management Centre of the City of Ekurhuleni as local government officials were purposively selected for the study to bring the disaster management dimension into the study. Ritchie et al (2003) endorse that purposive sampling is exactly what the name suggests. The members of the purposive sample are chosen deliberately with the aim of representing a particular key criterion viewed as seen important by the researcher and any diversity that might be existing in the research population but with a fairly commonality to enable the subgroups to be compared. The actual selection process is captured in Table 1. 4. The proportional allocation, as designed for the questionnaire

respondents, was expected to make sure that each sub-group is equally represented in the study without necessarily being biased to the other subgroup (Welman & Kruger, 1994).

Table 1. 4: Questionnaire research sample

| Research Questionnaire | | | |
|---|---|---|---|
| 1. **Group One** | **Target population – sub-group** | **Sampling process** | **Sample size** |
| **520** ward committee members represents all the community members including the 3381 affected households. Each ward of the eight wards affected has ten members of the ward committees which translates into 520 ward committee members. | **520** ward committee members | - Stratified random sampling;<br>- An arbitrary twenty percent 20% of participants was selected from the total number of from 520 ward committee members.<br>- Selection will be based on the lottery technique using the ward councilors, and<br>- Confirmation of the participants using the Municipal (City) Legislature ward committee registration list. | **104** ward committee members as research participants. |
| 2. **Group Two** | **Target population – sub-group** | **Sampling process** | **Sample size** |
| **81** government or city officials | 66 government or city departmental officials | - *Stratified random sampling*;<br>- Arbitrary one (1) representative per | 30 government or city officials as research participants. |

| | | | |
|---|---|---|---|
| | | department which translated into 30 participants;<br>- Selection will be based on the lottery technique using the researcher; and<br>- The lottery is based on the 2015 climate related disaster randomly selected meetings' attendance registers for JOC. | |
| | 15 government or city officials | - *Purposive sample*<br>- All the 15 disaster management officials included in the study. | 15 government or city officials as disaster management officials |
| **TOTAL** | **81** government or city officials | - 30 internal departments local government officials plus 15 disaster management officials which is **45** city officials. | **45** government or city officials. |

Source: Researcher's Design. 2019

The second part of the study was to select the sample for the interviews. Purposive sampling technique was used to select both the sample for the ward committee members and government officials' sub-groups. As part of the ward committee members' sub-group, the ward councillors were included in the study based on convenience or availability for the interviews. The selection process of the 26 participants in the ward committee members sub-group was done through the application of arbitrary five percent on the total population of 520. On the other hand, the same technique was applied in the selection of the managers and senior managers as part of the local government officials. The selection of the 23 participants in the local government officials sub-

group was done through the application of arbitrary twenty-eight percent on the total population of eighty-one. The actual selection process is captured in Table 1. 5.

Table 1.5: Interviews research sample

| Qualitative Research | | | |
|---|---|---|---|
| **1. Group One** | **Target population – sub-group** | **Sampling process** | **Sample size** |
| **520** ward committee members representing 3381 affected households i.e. the elected members of a community political structure. | **520** ward committee members | - *Purposive sample*;<br>- Arbitrary five percent (5%), and<br>- Convenience or availability for the interviews | **26** ward committee members as research participants. |
| **2. Group Two** | **Target population – sub-group** | **Sampling process** | **Sample size** |
| **81** government or city employed officials i.e. thirty (66) internal government departments' representatives plus fifteen (15) Disaster Management Centre officials. | **81** government or city officials | - *Purposive sample*;<br>- Arbitrary twenty-eight percent (28%); and<br>- Convenience or availability for the interviews | **23** government or city officials. |

Source: Researcher's Design. 2019

### 1.7.3 Data collection tools

For data collection, the nature of the research question of the study dictated that the study could not use naturally occurring data but generated data. Ritchie and Lewis (2003) advice that the choice of generating data for the project should also be informed by the research context, the sufficiency of the data, the interpretation of the phenomenon that is regarded as key in the research and the issue of access to the participants. Ritchie and Lewis (2003) argue that data

that is collected from the participants' natural setting and existence (i.e. naturally occurring data) and the data that is collected in a research setting (i.e. generated data) have distinct intention and data collection methods. A research that uses generated data intends to produce new ideas that contribute to the development of social theory or improves the policy solutions from the perspective and insight of the participants, which was the ultimate intention of the study. Naturally occurring data is used for exploratory reasons of the unspoken and/ or demonstrated variable of the participants in the research. Mason (2002) views the approach of generated data as the process of knowledge construction rather than knowledge mining.

The study collected data using two data collection methods and tools. The first data collection method and tool was a structured questionnaire administered to the sample population of 104 ward committee members in the communities and forty-five government officials. The questionnaire collected both quantitative and qualitative data from the participants for analysis. The questionnaire designed for the data collection followed the structure identified in the research literature. For example, Welman and Kruger (1994) state that the semantic differential method can be used in this regard to design the questionnaire with pre-defined adjective pairs of opposite meaning. The seven-point scale with the two endpoints describe the opposite attributes e.g. good and bad with each bipolar adjective representing a scale on its own with fifty adjectives already available and room to add more. Welman and Kruger (1994) advise that the semantic differential method in terms of the level of measurement applies the ordinal measurement, that is the measurement that assumes that the highest scorer portrays more of the attribute measured than those with less scores. They also point out that the scale has a built-in internal consistency. In the case of this study, these pre-defined adjective pairs of opposite meaning were used to increase the reliability of the study and adequately describe the various aspects around the level of disaster preparedness in the City of Ekurhuleni. The questionnaire also had open-ended questions, covering the quantitative and qualitative aspects of the mix method research.

Interviews were the second data collection method and tool used in the study. The interviews were conducted with the sub-group of 26 ward committee councillors from the ward committees and 23 government officials from the thirty internal departments. The interviews were based on the interview guide with open-ended and closed-ended questions in line with the designed questionnaire. The interviews were semi-structured. The researcher relied on personal experience related to the research topic to clarify some of the questions in the interview schedule. Welman and Kruger (1994) state that the use of semi-structured interviews by the interviewer requires flexibility about the depth of the interview, the participants' level of education and the

appropriate language to use with different participants but not losing the critical themes of the interview. The mix method approach was used for triangulation to validate the collected data.

### 1.7.4 Data analysis

The study employed the mixed research methodology qualitative and quantitative data analysis approaches. Both the qualitative and quantitative data analyses were conducted separately before they were presented in graphs, tables and narratives from the respondents to determine the triangulation.

Scholars agree that there are many different processes to follow when analysing qualitative data. The process to undertake the data analysis must be informed by a clear strategy (Mason, 2002; Ritchie et al., 2003; Creswell, 2009). Mason (2002) dedicates a whole chapter outlining the critical questions and consideration that the qualitative researcher must ask and be aware of during the process of analyzing qualitative data. Ritchie et al (2003), argues that the process requires the performance of three forms of activity: data management, descriptive accounts and explanatory accounts. Ritchie et al (2003) and Mason (2002) both give a good account of what should be part of the process of qualitative data analysis. However, the most detailed process, and the one that was adopted for this project, was by Creswell (2009). Creswell (2009) identifies six steps for the process of qualitative data analysis, and advises that in step three, the eight steps proposed by Tesch (1990), should be included to have a complete framework for analysis. The main six steps, including Tesch (1990) inserted eight steps, in brief, are as follows:

- Step 1. Organising and preparing data for analysis. Here the intention is to transcribe, visually scan, rework and sort the interview notes.
- Step 2. Read for the first time all the data. Here the aim is to get the appreciation of the overall data but also to formulate the first thought on its quality.
- Step 3. Detailed analysis and begin the coding process. The purpose in this step is to read the data again with the intention to fit it into specific frames such as themes, categories and labels. At this point Creswell (2009) suggests that one should implement the steps outlined by Tesch (1990) because it the climax of data analysis. Tesch (1990) eight step process are mentioned below:
    - ✓ Carefully read all the transcriptions and thoughts as they come.
    - ✓ Randomly pick the shortest and interesting interview and write the underlying tones and meanings.

- ✓ Make a list of similar topic and cluster them together before arranging them into specific major topics. In the process, the leftovers must be identified.
- ✓ Abbreviate the topics into codes and read the scripts again to identify the codes. Herein pre-existing codes, the new ones and interesting ones can be identified.
- ✓ Find the most descriptive wording for each topics and codes.
- ✓ Make a final decision to reduce the abbreviation for each code.
- ✓ Organise similar material and perform preliminary analysis.
- ✓ If necessary, recode the data.

- Step 4. Generate a description of the setting or people as well as categories or themes for analysis using the coding process.
- Step 5. Justify how the description and themes will be represented in the qualitative narrative.
- Step 6. The final step is to make an interpretation or meaning of the data in data analysis.

To implement the last step, the project used the Statistical Package for Social Sciences (SPSS) software program to do the thematic analysis for qualitative data analysis after its conversion into values.

Again, for the quantitative data analysis, the project used the Statistical Package for Social Sciences (SPSS) software program to apply the inferential statistical method. However, Howell (1995) advices that irrespective of the decision to apply the inferential statistical method, the descriptive technique still has to be used for statistical analysis. The application of the descriptive technique gives meaning to the raw data before inference. The decision to use inferential statistical method was based on the aim of the study, which was to understand the relationship between two events i.e. people's perceptions and the level of disaster preparedness of the City of Ekurhuleni.

The two data collection procedures i.e. the administered questionnaire and interviews were used for the purpose of triangulation. Thurmond (2001) defines triangulation as the process undertaken in the research to blend two or more data sources, investigators, methodology approaches, theoretical viewpoints, or analytical methods within one study which could be regarded as data triangulation, investigator triangulation, methodological triangulation, theoretical triangulation, or analytical triangulation. In other words, for a study to claim that triangulation took place there must be a combination of any of the two or more aspects as identified by Thurmond (2001).

The triangulation technique that was adopted is called methodological triangulation (also been called multi-method, mixed-method, or methods triangulation) (Thurmond; 2001). The specific methodological triangulation that was used in the project is referred to as between or across-method triangulation. Thurmond (2001) explains between or across-method triangulation as a process employing two or more data collection methods for the purpose of comparing them with the example being the application of both the participant questionnaire and the interviews in the same study. The between or across-method triangulation is said to be different from the second type of methodological triangulation which is within-method triangulation and is explained as triangulation that uses either qualitative or quantitative data collection with the purpose of comparing the data with the second data set. The example used to describe within-method triangulation in the qualitative approaches is the observation of non-participants in the study and compare the data with the focus group interviews. The ultimate objective of triangulation, as advised by Creswell (2009), is to determine data convergence, differences, or some combination.

### 1.8 Data validity and reliability

According to Leedy and Ormrod (2010), validity, in this context, refers to the extent to which the used measurement instrument measures what it intended to measure. On the other hand, the reliability relates to the measurement consistency in the measurement of the intended aspect. Two approaches were used to increase the validity and reliability of the study.

The first approach was on the data gathering instruments that were used in the study. The questionnaire design was based on the semantic differential method and the in-depth interview guide was used to increase the construct validity because more than one measure was used to measure the same construct and they were expected to overcome the participants' subjective issues of distortion, social desirability and acquiescence. According to Welman and Kruger (1994), the pre-existing measurement instruments besides overcoming participants' subjective issues, increases reliability, specifically the internal consistency which leads to the ability to generalise the outcome of the research to the entire population. In other words, the study intended to manipulate the development of the questionnaire in such a way that it accounted for both validity and reliability. The quantitative questionnaire and interview schedule were constructed to measure what was intended to be measured and to produce similar results if they were applied to measure the same aspects at a different time or repetitively.

The second strategy to improve the study's validity and reliability was on measurement instruments application. A defined and documented procedure for the application of both

instruments with qualitative and quantitative measurement were made available for external evaluation before being deployed to dispel any uncertainties on the study. The study leader who is an expert in research before application evaluated the data collection instruments with both quantitative and qualitative research questions. Creswell (2009) argues that applied procedures regarding measurement instruments must be stated prior to the study and documented to give assurance that the conclusion drawn from the instruments are consistent and open for scrutiny. The researcher strived for trustworthiness, authenticity, and credibility in the application and interpretation of the research instruments.

## 1.9 Limitations and delimitations

### 1.9.1 Limitations

This study, like any similar study, had embedded delimitations and limitations, which must be disclosed. Pyrczak and Bruce (2005) define a limitation as a weakness that might potentially limit the validity of the study from applying the principle of generalisation beyond the observed sample group. Price and Murnan (2004) contend that, sometimes, the researchers deliberately omit to state their study's limitations to increase the publication chances of their work. However, on the contrary, this study outlined its limitations and delimitations to increase the acceptance of the study as a contribution to academic material and discourse.

This section outlines the limitations according to the researcher. This meant that any omitted limitation could be an oversight from the study. Theofanidis and Fountouki (2019) argue that limitations for the research studies may arise from the researcher's chosen research design, statistical model constraints, funding constraints, or any other factors associated with the project and may affect the study design, results and ultimately the conclusions.

The researcher devised strategies to deal with the following limitations:

The first limitation was the constructed samples for the study, which might be inadequate to draw enough, and convincing conclusion to the general population beyond the sampled population (Price & Murnan. 2004). However, the sample was confined by the number of the total population of interest, which the researcher could not manipulate beyond the stated point. The second expected limitation was the inadequate return rate especially from the internal municipal staff who received the questionnaire through email. To mitigate the expected limitation, the researcher planned to make follow-up with emails, phone calls, WhatsApp messages and accidental personal visits. The third limitation was the probability of respondents that do not respond truthfully to items on the instruments. The researcher addressed the limitation by personally conducting the

interviews and availing himself to the participants taking part in the study. This was to increase the participants' access to the researcher to assist in bridging any language gabs (Bruce; 2005).

The fourth limitation was the absence of one or more measurement instruments with psychometric properties. The researcher developed the questionnaire and the interview guide for the study with the guidance of the study supervisor as an experienced researcher to limit the weakness. The involvement of research experts helped to reduce systematic errors in the project. The last three limitations relevant to this study were stated by Theofanidis and Fountouki (2019) and Pyrczak and Bruce (2005), which were identified as the fifth and sixth weaknesses. The fifth limitation was the limit of access to all the participants because of the geographical spread of areas or non-availability of respondents. The researcher asked for permission to access the participants from both the City of Ekurhuleni legislature department and the Office of the City Manager and used the assistance of ward councillors to access some of participants especially ward committee members. Time was the sixth limitation, which had the potential to distort study results. The time limitation might be from the participants or the researcher. The researcher allocated enough time for the purpose of the research, and identified potential assistants as a backup, so that even when second visits were necessary the research could continue. The last weakness was the different treatment of participants. The researcher applied the principles of fairness and openness in the treatment of all the respondents.

### 1.9.2 Delimitations

This researcher had built in some of the delimitations to direct the study to a particular end, which was the success of the project. The first delineation was on the problem statement, specifically the research population. The researcher confined the research to the ward committee members of the affected communities by the 2015 climate related disaster in the City of Ekurhuleni, specifically those that experienced damages and losses caused by thunderstorms with the exclusion of the general community or the affected three thousand three hundred and eighty-one households. The reason for the delimitation was to control the size of the research population and its sample.

The second delineation was around the specific areas included in the study. Only the areas under the eight (8)-customer care centres that registered any damage during the thunderstorms were included. This selection was based on the interest of the study as the areas had been affected during the disaster. The third delineation was based on the sampling of the population. Two subgroups were created based on the parameters of the study. The first sub-group was the ward

committees who represented the communities and local government officials. The government officials excluded the government officials from both the provincial and national departments that responded to the 2015 climate related disaster as well as non-governmental organisations. The exclusion of these elements of the target population was informed by two critical factors. The first, factor was the research purpose of the project which was to measure the level of disaster preparedness in the City of Ekurhuleni. Alvi (2016) states that some elements of the target population can be excluded depending on the purpose of the research. The second factor was related to the resources planned for the project. Kothari (2004) argues that the choice of the target population can be informed by available resources in terms of time, money and energy.

### 1.10 Ethical considerations

The fact that human beings were engaged for the purpose of the study fundamental ethical issues arose that were confronted and addressed in the study. These ethical considerations, are highlighted below:

- Offensive and personal questions that might unsettle the participants and intrude in their privacy.
- The acknowledgement of the authority that the participants fall under. Permission was sought prior to the engagement of any participants and no underage participants were engaged in the study.
- The falsification of data and the study's conclusion. The honest character of the researcher guarded against such instances.
- Manipulation and coercing of participants to take part in the study. The researcher sort written and verbal consent from the participants before any data collection. The consent forms were kept as proof.
- Anonymity of participants was respected and respondents were not forced to identify themselves during the data collection process.

Huysamen (1996) and Creswell (2009) state that the researcher should always be aware of the above ethical considerations. Participants need to be treated with courtesy and respect at all times. Hence, the researcher while administering the questionnaire and the interviews was mindful of the impact of the fact that some of the municipal officials might feel compelled to participate in the study or not give honest responses as they worked under the researcher. The consent form clearly stated that it was not compulsory for them to take part in the study with no effect to their appointment as the employees of the city.

### 1.11 Chapter outline

Chapter 1 introduced the reader to the overall intention of the study, the study area, the problem statement and the approach to explore the problem. Chapter 2 dealt with international, African, and South African legislative frameworks. It outlined theoretical frameworks relevant to disasters, disaster preparedness and climate change. Chapter 3 dealt with the literature review on the relevant concepts, climate change causes and effects locally and globally. Chapter 4 discussed the applied methodology in detail to answer the problem statement. Chapter 5 presented the results of the data analysis in the form of graphs, tables, charts etc. for interpretation. Chapter 6 drew conclusions and recommendations based on the objectives of the study.

### 1.12 Conclusion

Chapter 1 of this study introduced the study area of the City of Ekurhuleni. The reader was presented with the research problem, research questions, the objective and the significance of the study. The chapter also outlined the methodology of the study in terms of research design, population and sampling design, data collection tools, data analysis and its validity and reliability. Lastly, and, before embarking on chapter two, this chapter delineated the study limitations and delimitations and the ethical consideration.

# CHAPTER TWO: LEGISLATIVE AND THEORETICAL FRAMEWORK

## 2.1 Introduction

Disasters are taking place more frequently across the globe (Batool, Ahsen, Saif & Sajid, 2016). People and communities are affected the most when disasters occur. According to the UNISDR document called Disaster Preparedness for Effective Response (2008), the past two decades have experienced increased frequencies and impacts with disasters multiplying from approximately 200 to over 400 per year. The report on Disaster Preparedness for Effective Response (2008) states that climate related disasters accounted for nine out of ten disasters and the same trend is expected to continue in the future. On the other hand, the report also mentions that with an increase in climate related disasters there is also a rise in community vulnerability which leads to an escalation of disaster impacts. The increasing vulnerability is caused by an acceleration in urbanisation, which pushes people to disaster-prone locations, poverty, HIV prevalence, and not recognising the changing patterns of disaster risks.

Following the increase of disasters, disaster management as a knowledge area has also evolved overtime. The field of climate change mainstreaming has also grown as a knowledge area. This chapter demonstrates the progress made in the disaster management and climate change field to date. The chapter explores disaster management legislative framework starting from the United Nations (UN) Resolutions and Frameworks. Under the UN frameworks, the Hygo Framework of Action 2005 – 2015 and Sendai Framework for Disaster Risk Reduction – 2015 – 2030. The African initiatives in the different economic regions such as African Union (AU), Economic Community of West African States (Ecowas), East African Community (EAC) and Southern African Development Community (SADC) are briefly explored. The chapter also outlines the South African disaster management legislative context and explores the different models of disaster management with specific emphasis on the disaster preparedness framework and the risk perception model that is relevant to this project. Lastly, a framework was identified that properly mainstreamed disaster preparedness within the context of disaster risk reduction (DRR) and climate change adaptation (CCA) into policy.

## 2.2 Legislative frameworks

The legislative frameworks will be explored starting from international legislation, moving to African and then South African legislative frameworks.

### 2.2.1 International legislation

#### 2.2.1.1 United Nations resolutions

The year 1971 marked a turning point worldwide in terms of disaster management and disaster preparedness in particular. The United Nations, for the first time, through the resolution 2816 (XXVI) of 14 December 1971, assigned the Office of the United Nations Disaster Relief Coordinator the responsibilities and functions of disaster prevention and disaster preparedness (U.N. General Assembly (A/42/49), 1987). The resolution meant that disaster prevention and disaster preparedness were put at the center stage of the world agenda for the first time.

It was only until the 1980's that the world was called upon to clearly define new approaches and programmes for dealing with national and international disasters. The forty-second session of the UN General Assembly recognised the impact of disasters around the world and took the now famous resolution called UN resolution 42/ 169, which focused on three particular areas, which were:

- That the UN systems should be used for promoting the international cooperation and research in the area of natural disasters and the development of the methods for disaster mitigation, relief, preparedness and prevention as well as early warning,
- That the UN designates the 1990s as a decade for disaster reduction internationally, and
- That the UN should develop a framework for disaster reduction in the 1990's (UN General Assembly (A/42/49), 1987).

The implication of the UN 42/ 169 resolution was that there would be other two more resolutions to amplify the actual international efforts on disaster mitigation, prevention and preparedness, that is, disaster risk reduction.

The UN resolution 43/ 202 confirmed the undertakings in the UN resolution 42/ 169. The resolution noted the progress made in the establishment of national committees on natural disaster reduction by some countries and the efforts made by some to establish similar structures. It also noted the progress made by the ad hoc panel of experts on the preparations for the Decade for Natural Disaster Reduction from 1990 (UN General Assembly (A/43/49), 1988).

However, the Ninth Conference of Heads of State or Government of Non-Aligned Countries held in Belgrade from 4 to 7 September 1989 prior to the UN resolution 43/ 202 in December 1989 was the practical turning point. The Conference resolved that the 1990 decade be declared an International Decade for Natural Disaster Reduction; that the second Wednesday of October each year be designated as an International Day for Natural Disaster Reduction to be observed

annually; and that the UN adopts the International Framework of Action for the International Decade for Natural Disaster Reduction. The Belgrade conference resolutions were captured in detail under the UN resolution 44/ 236 (U.N. General Assembly (A/44/49), 1989).

The International Framework of Action for the International Decade for Natural Disaster Reduction was a foundational agenda that influenced the forthcoming international frameworks and legislations. Two goals of the framework alludes to disaster preparedness. It states that its intention is to improve the capacity of member states to mitigate the effects of disasters by up scaling their technical skills on assessing disaster damage potential and establishment of early-warning systems as well as disaster resistant structures when and where needed. The framework also seeks to develop measures for the assessment, prediction, prevention and mitigation of natural disasters. From the two goals, one of the practical measures expected from each country is to take steps to enhance public awareness, education and training and disaster preparedness, prevention, relief and short-term recovery activities for disasters (U.N. General Assembly (A/44/49), 1989).

The first resolution that called for changes and results driven agenda was the UN resolution 58/214 on the International Strategy for Disaster Reduction. This resolution called for the convening of the World Conference on Disaster Reduction in 2005 to deliberate on the five specific objectives that are directly linked to the new framework to address disaster management and community vulnerabilities. The first objective was to conclude the Yokohama Strategy and its Plan of Action review focusing on the guiding framework for natural disaster prevention, preparedness and mitigation (i.e. disaster risk reduction) as well as the action plan for the twenty-first century. The second objective was to identify and link specific activities of the new framework to assist in the implementation of relevant provisions of the Plan of Implementation of the World Summit on Sustainable Development specifically on issues of vulnerability, risk assessment and disaster management. The third objective was to share disaster reduction's best practices and lessons learned to improve the attainment of sustainable development. The fourth objective was to improve governments' awareness and implementation of disaster reduction policies. Lastly, the fifth objective focused on improving the trustworthiness and availability of relevant information about disasters and disaster management to the public and all relevant agencies in the world (U.N. General Assembly (A/58/484/Add.5), 2004).

### 2.2.2 International frameworks

#### 2.2.2.1 Hyogo and Sendai frameworks

As directed by the International Strategy for Disaster Reduction objectives, the World Conference on Disaster Reduction was held in Kobe, Hyogo, Japan from 18-22 January 2005 (U.N. General Assembly (A/RES/58/214), 2004). The Hyogo conference adopted a new framework called the Hyogo Framework for Action 2005 – 2015: Building the Resilience of Nations and Communities to Disasters. The framework's expected outcome was the reduction of losses in lives, social, economic and environmental assets because of disasters. Hence, one of the priorities for action was to fortify disaster preparedness for effective response at all levels (UN/ISDR, 2008).

Subsequent to the Hyogo Framework for Action, the second framework was adopted at the Third UN World Conference in Sendai, Japan, on March 18, 2015. The framework was then called the Sendai Framework for Disaster Risk Reduction 2015-2030 (UNISDR/GE, 2015). Again, the Sendai Framework emphasized the importance of disaster preparedness in priority four. It intended to improve the *"…disaster preparedness for effective response and to "Build Back Better" in recovery, rehabilitation and reconstruction"* (UNISDR/GE, 2015:10).

### 2.2.3 African initiatives

#### 2.2.3.1 African union

Although, the Africa Union built on its governance systems mechanisms to implement the UN adopted disaster reduction agendas, there are two outstanding initiatives, which focused on addressing disasters in the African context. The first of such initiative is the Africa Regional Strategy for Disaster Risk Reduction (ARSDRR). The strategy was deliberated at the 10th Meeting of the African Ministerial Conference on the Environment (AMCEN) from 26-30 June 2004. Subsequently, the strategy was endorsed by the Heads of State at the 3rd Ordinary Session of the Assembly in Addis Ababa, Ethiopia, from 6-8 July 2004. The strategy called for the development of a programme of action for its implementation (ARSDRR, 2004).

There are two reasons that make the strategy important in the African context in terms of influencing the legislation on the continent. The first one is that it was the first strategy that had baseline findings on the status of disaster risk reduction in Africa. The strategy set out clearly the impediments of implementing disaster risk reduction in African. Secondly, the strategy as one of its objectives advocates for the integration of disaster risk reduction into emergency response management. The inclusion of disaster risk reduction in the emergency response is important in the African context because disaster and emergency responses tend to focus less on *"…bridging*

*the relief-rehabilitation gap or investing in developing people's capacities to cope with future disasters*" (ARSDRR, 2004: 8). Part of this objective is to put in place the contingency planning and preparedness measures in emergency management. This approach is different from the focus on food aid during emergencies because of chronic food insecurity and vulnerability in Africa (ARSDRR, 2004). The two reasons stated above clarify African problems in disaster risk reduction and what needs to be done beyond disaster relief in food aid for emergencies.

The second major African initiative was the establishment of African Risk Capacity (ARC) in 2012 by the African Union (Scott, Simon, McConnell & Villanueva, 2017: 12). According to Scott et al (2017), in the Independent Evaluation of African Risk Capacity (ARC) Final Inception Report, the ARC has two institutions. The first one is the African Risk Capacity Agency that is established to improve the African states disaster risk management, which assists countries in their disaster *"…weather risk models, pooled risk insurance, and a capacity building programme in disaster risk and its management through risk financing, early warning and contingency planning."* (Scott et al, 2017: 12). The second agency is ARC Insurance Company Limited for funding purpose.

The ARC was the first such initiative by the African Union in the context of many challenges in the continent. According to the African Risk Capacity Strategic Framework 2016-2020 (2016), the ARC was a welcome initiative as many African countries are vulnerable to even small climate or market disruptions, which normally require major international humanitarian intervention and emergency response. In Africa, sometimes, these interruptions have a 'multiplier effect', which trigger other sociopolitical challenges to these states. Thus, African states disaster vulnerabilities are an extreme risk to the already weak states.

Beside the two initiatives, African has been following, sometimes leading, the implementation of United Nations disaster risk reduction legislative frameworks. According to the Common African Position to the 2017 Global Platform for Disaster Risk Reduction (2017), the continent adopted the Africa Regional Strategy for Disaster Risk Reduction and related Programme of Action in line with the Hyogo Framework for Action. Due to the successes recorded by the continent under its strategy and actions from 2005 to 2015, the African Union Heads of State and Government in January 2015 before the Sendai Framework approved a decision for the new Programme of Action associated with the period after the Hyogo Framework for Action. The AU Executive Council Decision 943(XXX) (25 - 27 January 2017) was a formal decision to implement the Sendai Framework for Disaster Risk Reduction in African taken at the 30th Ordinary Session of the Executive Council in Addis Ababa. The meeting also instructed the Commission on Disaster Risk Reduction to develop an Africa Position for the Global Platform for Disaster Risk Reduction

(A.U.EX.CL/Dec.943 (XXX), 2017). On top of the common approach at AU level, each African sub-region dealt with disaster risk reduction matters in a regionalised manner such as West, East and Southern African countries.

#### 2.2.3.2 West African disaster preparedness

West Africa countries are organised as Economic Community of West African States (ECOWAS). According to the report drafted by United Nations Conference on Trade and Development (UNCTAD) called Regional Integration and Non-Tariff Measures in the Economic Community of West African States (ECOWAS), the association was formed in 1975 by fifteen (15) member states. The states are Benin, Burkina Faso, Cape Verde, Cote d' Ivoire, Gambia, Ghana, Guinea, Guinea Bissau, Liberia, Mali, Niger, Nigeria, Sierra Leone, Senegal and Togo with the goal to integrate the regional economic activities (UNCTAD/DITC/TAB/2018/1).

In terms of disaster risk reduction including disaster preparedness, the region has been working towards aligning itself with the UN and African initiatives. The Ecowas Policy for Disaster Risk Reduction (EPDRR, 2006), which is the central documents for reference in the region, acknowledges the region's participation and efforts to align with the United Nations and African Union frameworks such as Hyogo Framework for Action 2005-2015 and African Regional Strategy for Disaster Risk Reduction. The policy priorities were based on the five (5) region's disaster reduction statuses and challenges, which include the need to consolidate disaster preparedness and response mechanisms. In the same policy correlating disaster preparedness is the fifth focus area seeking to improve response and disaster preparedness mechanisms. The policy also sought to integrate disaster risk reduction into the sub-regional issues of poverty reduction, security, and sustainable development agendas and legislations (EPDRR, 2006).

#### 2.2.3.3 East Africa disaster risk reduction

East Africa has a regional structure that coordinates the intergovernmental relations and is called East African Community (EAC). It is composed of six (6) countries, which are Burundi, Kenya, Rwanda, South Sudan, Tanzania and Uganda and was founded in 1967 (Wama, 2014). The region had equal participation in all the international and continental structures on disaster risk reduction. For example, during the 6th Africa Regional Platform (AfRP) on Disaster Risk Reduction (DRR) in Mauritius Mr. Jean Baptiste Havugimana represented the East African agenda. Mr. Jean Baptiste Havugimana also presented the EAC Position Paper and Commitment in the implementation of the Sendai Framework in the Ministerial Session (EAC Press Release, 2016).

EAC's greatest achievement on the continent in disaster risk reduction came in October 2012. The EAC Secretariat published the East African Community Disaster Risk Reduction and Management Strategy (EACDRRM: 2012 – 2016). The strategy anticipated that the region will have an increase in the numbers and victims of natural disasters because of climate change and disaster risk impact on lives and economy (EACDRRM Strategy, 2012). The strategy looked at the intervention on disaster risk reduction in the context of Hyogo Framework of Action (HFA). The five key priority areas are government policy and strategies, risk identification and early warning systems, knowledge innovation and education, reducing underlying risk factors, and strengthened disaster preparedness for effective response (EACDRRM Strategy, 2012). Moreover, the strategy in conducting the SWOT analysis and outlining the strategic goals and actions follows the same structure of HFA that makes it easy for implementation (EACDRRM Strategy, 2012).

The second achievement of the region was the enactment of the East African Community Disaster Risk Reduction and Management Act (EACDRRMA) of 2013. According to one of the EAC Press Release (11 March 2016), the Act was passed on the 11 March 2016 without any obstacles or objection from the members states. The intention of the Bill was to provide a regional legal framework for assisting member states after the impact of disasters and to establish a common approach to issues of disaster risk reduction and practice. According to the accompanying memorandum of the Act, the legislation aim is stated as follows:

"*The Bill is an attempt to operationalise Article ll2 (l) (d) of the Treaty for the Establishment of the East African Community, in which the Partner States undertook to cooperate in the management of the environment and agreed to take necessary disaster preparedness, management, protection and mitigation measures especially for the control of natural and man-made disasters*" (EACDRRMA, 2013).

The statement in the memorandum reinforces the enforceable nature of the East African Community Disaster Risk Reduction and Management Act, 2013 to member states.

#### 2.2.3.4 SADC declaration for disaster risk reduction

The South African Development Community (SADC), previously known as the Southern African Development Co-ordination Conference (SADCC), was formed in 1980 and includes all the fifteen (15) countries of the region, that is, South Africa, Botswana, Angola, Lesotho, Democratic Republic of Congo, Madagascar, Mauritius, Malawi, Namibia, Malawi, Mozambique, Seychelles, Zimbabwe, Zambia, Tanzania and Kingdom of Eswatini (Hwang, 2007).

In terms of disaster management, and specifically disaster risk reduction, the region has done a lot like other regions in the continent. However, a proper foundation for disaster risk reduction in the region was set by the 2008 Report on the Status of Disaster Risk Reduction in the Sub-Saharan Africa Region. The 2008 report was commissioned by World Bank, the UNISDR, and Sub-Saharan Africa countries to evaluate the status and progress of the continent in the implementation of the Hyogo Framework for Action 2005 – 2015. The findings of report projected a picture of the continent in terms of both the general achievements and the shortcomings in the implementation of disaster risk reduction in the continent. For example, the report (2008) mentions that the continent has instituted policies, institutions, and organisations for disaster risk reduction but fall short on the following:

- institutionalisation of disaster risk reduction;
- information management and communication;
- involvement of citizens;
- risk identification and assessment across the region; and
- integration of disaster risk reduction in development plans.

In brief, the report acknowledges the existence of policies and legislations on the continent on disaster risk reduction but pointed out it lacks mainstreaming.

Subsequent to the 2008 Report on the Status of Disaster Risk Reduction in the Sub-Saharan Africa Region, the SADC Secretariat, Economic Commission for Africa (ECA) and United Nations Office for Disaster Risk Reduction under UNISDR instituted an evaluation report called Assessment Report on Mainstreaming and Implementing Disaster Risk Reduction Measures in Southern Africa in 2015. The assessment report (2015) outlines six (6) findings and eleven (11) recommendations. However, key in these findings is the confirmation of the 2008 Report on the Status of Disaster Risk Reduction in the Sub-Saharan Africa Region that shows a marked improvement in legislative mechanisms and the mainstreaming of disaster risk reduction albeit the lack of resources for implementation. The assessment report advised that the region to facilitate disaster risk reduction mainstreaming should review the Regional Indicative Strategic Development Plan, which is the chief strategic document in the region for the implementation of key priority actions (Assessment Report on Mainstreaming and Implementing Disaster Risk Reduction Measures in Southern Africa, 2015). In November 12, 2017, the SADC Secretariat approved the Restructuring Paper on a Proposed Project Restructuring of Strengthening Disaster Risk Coordination, Planning and Policy Advisory Capacity of SADC. The project had five deliverables, which were related to the 2015 assessment report. However, it is the first deliverable

that is directly linked to disaster preparedness, which was to enhance the regional institutional coordination mechanisms for disaster preparedness and response. The project was funded by the World Bank, US$2.5 million was made available for the region to incorporate disaster risk reduction in SADC strategic priorities and actions (REPORT NO, RES32825).

### 2.2.4 South African context

#### 2.2.4.1 National legislative frameworks

South Africa sets an example of how far Africa has come in the implementation of the legislative framework for disaster risk reduction. According to Handbook 1 of the South African Disaster Risk Management Handbook Series (2008), after the advent of the democratic state in 1994, the South African approach to disaster management and disaster risk reduction became more contemporary. The new democratic government began a systematic process of mainstreaming disaster risk reduction into the developmental plans at the national, provincial and municipal levels as per the anticipation of many international initiatives. The process of mainstreaming disaster risk reduction into developmental plans through legislative frameworks can be traced back to the country's constitution. The Constitution of the Republic of South Africa (Act 108 of 1996) in Section 41(1) (b) directs that the government has a responsibility *to "ensure the well-being of the people of the Republic"* and in Section 152(1)(d) it also requires the government to *"ensure a safe and healthy environment "* for its citizens.

To support the Constitution of the Republic of South Africa (Act 108 of 1996), the country enacted the South African National Disaster Management Act, Act 57 of 2002. The first preamble of the Act clearly articulates the position of the new government to implement a pro-active approach to disaster management with consideration for disaster preparedness. It states that the Act provide for:

*"an integrated and co-ordinated disaster management policy that focuses on preventing or reducing the risk of disasters, mitigating the severity of disasters, emergency preparedness, rapid and effective response to disasters and post-disaster recovery and rehabilitation;"*

Besides the National Constitution and Disaster Management Act, the country also drew up the National Disaster Management Framework (NDMF) of 2005. In line with the spirit of the Constitution and Disaster Management Act, the framework in one of the four key performance areas, that is, disaster risk reduction clearly supports disaster preparedness as one of the key principles (NDMF, 2005). The framework which is linked to the Disaster Management Act section 7(2)(b), section s 39(2)(1) and section 53(2)(i), expects all government spheres' to focus on efforts

to reduce disaster risks. This is done by developing strategies and measures that mitigate the impact of hazards or vulnerability whilst increasing the *"…capacity to prepare for and enable timely response and recovery"* (NDMF, 2005: 45). The legislative framework in South African from the Constitution, the Disaster Management Act and the National Disaster Management Framework advocates for the mainstreaming of disaster risk reduction which includes disaster preparedness.

## 2.3 Theoretical frameworks

### 2.3.1 Disaster management models

Since the recognition of the importance of disaster management, many models have been developed starting with the traditional models up to more recent ones. However, the ones that are central to the advancement of disaster preparedness are the ones discussed hereunder.

The **Disaster Management Continuum** model, sometimes called circular or traditional model is one of the most popular first models. Twigg (2004) states that the impression of a disaster being a cycle is found in various documents and training courses. The idea of a disaster as a cycle explains disaster management as a circular process that combines the relief and recovery process with development. According to this thinking the occurrence of a disaster is a disruption in the development process, which is temporary repaired by humanitarian aid. Furthermore, rehabilitation, which leads to reengineered development, amends the process going forward. According to Albtoush et al (2011), the classic model comprises of two phases, which is pre-disaster risk reduction phase (i.e. preparation, mitigation, and prevention) and post-disaster phase (i.e. response, recovery, and development), which is similar to Kelly's circular model except that the latter has eight stages instead of four stages. Figure 2.1 below shows the traditional model.

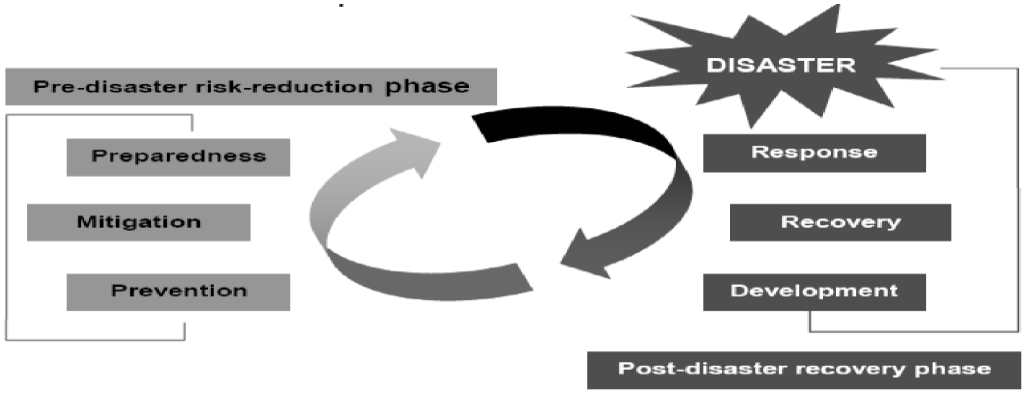


Figure 2.1. Two-phase traditional model
Source: Albtoush et al (2011)

One of the authors that captured the essence of traditional model in general is Kelly (1999). Kelly (1999) argued that the circular model development was based on, "…*identifying stages, events actions and time frames which make up the course of a disaster*." Kelly (1999) further mentioned that the linkage of the three elements might be either tight or loose. Kelly (1999) however, criticised the implied order in the disaster stages as not being true because the disorder defines the disastrous conditions. Kelly (1999), Twigg (2004) and Albtoush et al (2011) concurred that the circular model was too simplistic and trivial because its components in the phases did not fit into a neat sequence as shown on most diagrams. Moreover, they mention that the circular model does not deliberate on the disaster occurrence.

The **Pressure and Release (PAR) Model** is the next popular disaster management model. Whilst the disaster cycle models are concerned with articulating the disaster process in terms of its stages, events, actions and timeframe that make up a disaster, the Pressure and Release Model according to Kelly (1999) focuses on the social production of vulnerability that leads to disasters if collided with natural hazards (Wisner, Blaikie, Cannon & Davis, 2004). Awal (2015: 16) explained the essence of the PAR model emphatically, when he stated that the "… *basis of the PAR model is recognition that a disaster is the intersection of two opposing forces: the processes generating vulnerability on one side, and the physical exposure to hazard on the other. Increasing pressure can come from either side, but to relieve the pressure, vulnerability has to be reduced*."

According to the PAR model, the assumption is that natural hazards will always be present as a slow set or sudden occurrence. However, the progression of vulnerability is dependent on three factors for the disaster to manifest, which are the roots causes, the dynamic pressures and unsafe conditions. All these factors have to connect with present natural hazards to generate a disaster. (Wisner et al, 2004). The PAR model is applied not only to understanding what causes a disaster but also for disaster risk reduction (i.e. prevention, mitigation and preparedness) by "…*addressing the underlying causes, and analysing the nature of hazards. This leads to safer conditions, which help to prepare the community to deal with disasters*" (Asghar, Alahakoon & Churilov, 2006). Elaborating on the three components of PAR model, Batool et al (2016) stated that root causes include inadequate resources, poverty and urbanisation. The dynamic pressure comprises of lack of institutions, education, training, overpopulation and environmental degradation. Unsafe conditions deal with population exposure to risk such as unsafe locations and unsafe buildings.

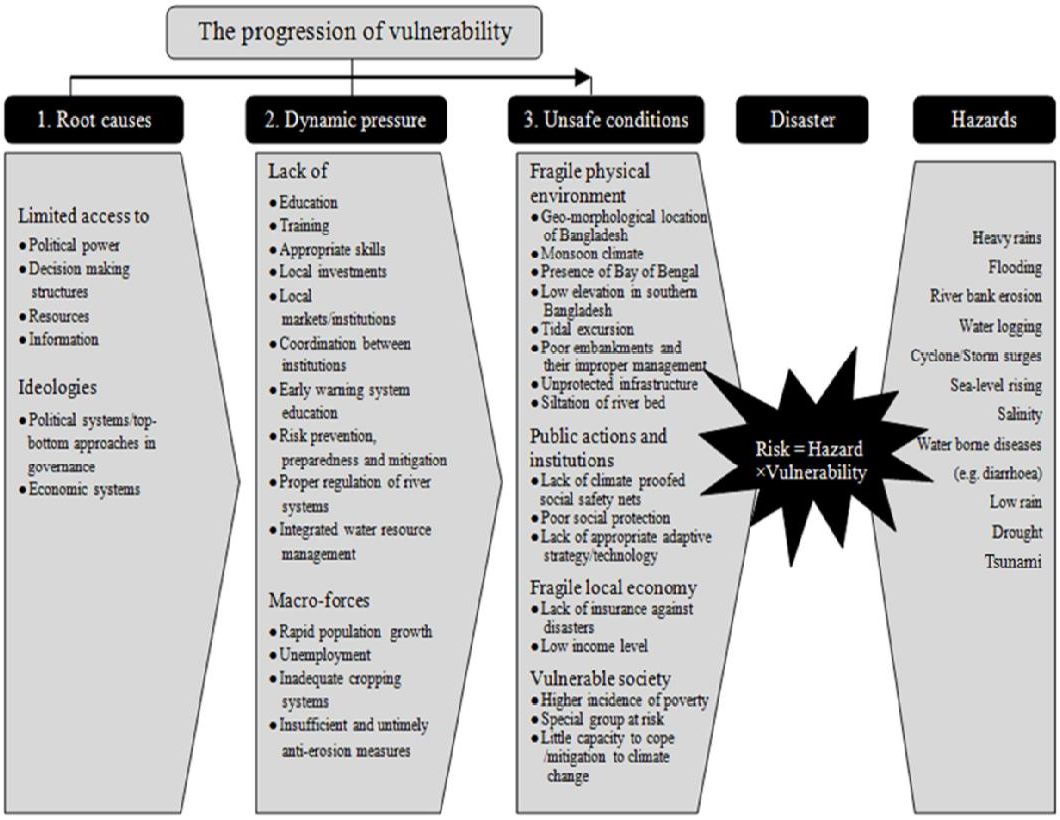


Figure 2.2: Pressure and Release (PAR) Model
Source: Wisner et al: 2004

As stated earlier, the two disaster management models above are the most popular ones, which anticipate that disaster preparedness will form part of disaster management. However, Asghar et al (2006) have proposed what they call **A Comprehensive Conceptual Model for Disaster Management** as an elaborate model for disaster management. The model covers six fundamental components, which are strategic planning, hazard assessment, risk management, disaster management actions (i.e. mitigation, preparedness, response and recovery), monitoring & evaluation and environmental effects. Within each component, there are different activities, which facilitate disaster management operations. Figure 2.3 below shows the Comprehensive Conceptual Model for Disaster Management.

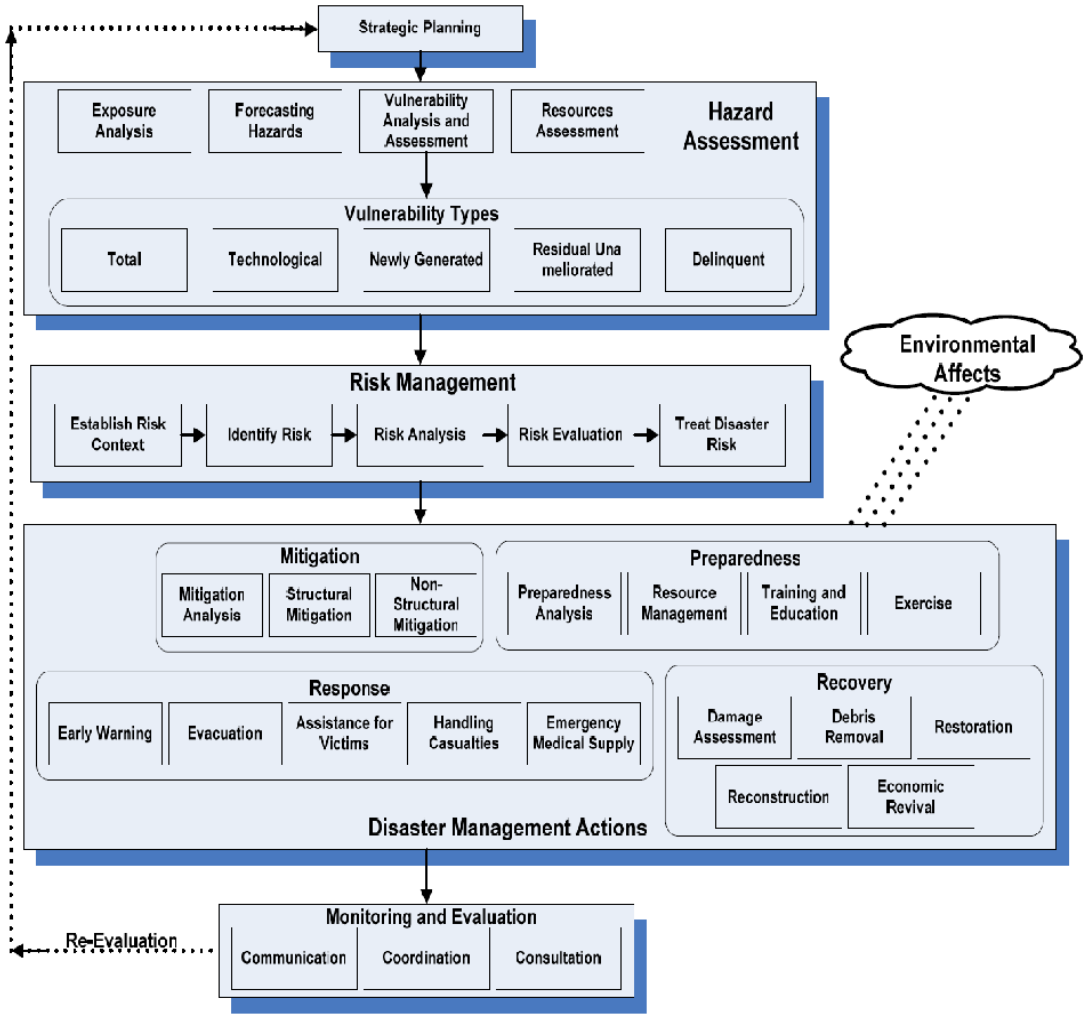


Figure 2.3: A Comprehensive Conceptual Model for Disaster Management
Source: Asghar et al: 2006

This model was proposed after studying different disaster management models. To simplify their study, they grouped the disaster management models into three major categories and studied their weakness (Asghar et al, 2006: 4 -5). They concluded that all the disaster management models do not systematically cover all the aspects of disaster management. For example, all the disaster management models focus on the four major phases of disaster management, which is prevention, mitigation, response and recovery. Specifically, in Category 1: Logical Models (i.e. Traditional, Expand & Contract, Kimberly and Tuscaloosa Models), they observed that the models confirm either the basic four stages disaster management or the causes of disaster but lack hazard assessment and risk management activities. Category 2: Integrated Models (i.e. Manitoba and Weichselgartner Models) lack the activities of response and recovery. Lastly, while Category 3: Cause Models (i.e. Crush and Release Models) explore vulnerable conditions of the

communities they ignore environmental factors that might influence the severity of a disaster. Even though Asghar et al (2006) did a commendable job in analysing and proposing a new way of framing disaster management activities in their comprehensive disaster management model, they did not include the Cartesian Plane Model by Kelly (1999) and Metamodel based Decision (Othman & Beydoun, 2010).

From the literature above, it is apparent that disaster preparedness is either explicitly covered in some models like the disaster management continuum and the comprehensive model or implicitly referred to in models such as the PAR model. In the comprehensive model, it is clear that disaster preparedness is part of the general disaster management operations but it is also an embedded activity. To unpack the embedded disaster preparedness activities, the study outlined the disaster preparedness model below.

### 2.3.2 Applied Disaster Preparedness Model

This section explores the incorporation of disaster preparedness in the actual model that is used as the foundation of this project. Asghar et al. (2006), using Kelly (1999), identified four major reasons to use the models in understanding complex concepts. The first advantage of using the models is to simplify complex events. Secondly, the models assist in comparing the actual conditions or events with the theoretical framework. Thirdly, the models help in computing the events in the research. Lastly, the models help to establish a common foundation of unfolding events. It is based on these reasons that this study identified the Disaster Preparedness Framework as created by Kent (1994) for the UNDP as the foundation to understand the essential activities of disaster preparedness.

The Disaster Preparedness Framework is comprised of nine essential activities of disaster preparedness. These activities are vulnerability assessment, planning, institutional framework, information system, resource base, warning systems, response mechanisms, public education and training, and rehearsal. Some authors, such as Sutton and Tierney (2006: 7), configured the disaster preparedness activities differently. They identified "…*eight dimensions or desired end-states for preparedness activities: (1) hazard knowledge; (2) management, direction, and co-ordination of emergency operations; (3) formal and informal response agreements; (4) resource acquisition aimed at ensuring that emergency functions can be carried out smoothly; (5) life safety protection; (6) property protection; (7) emergency coping and restoration of key functions; and (8) initiation of recovery activities*." The two disaster preparedness frameworks at a glance are different because Kent (1994) framework has nine dimensions and Sutton and Tierney's (2006)

one has eight critical activities. They are also different because they use different descriptions for each activity. However, the actual difference that can be discerned from the two frameworks is that Kent's (1994) model refers to information system, warning systems, response mechanisms, public education and training, and rehearsal. On the other hand, Sutton & Tierney (2006) talked about safety protection, property protection, emergency coping and restoration, and early recovery activities. Overall, the two frameworks, though termed differently, are similar in the analysis of disaster risk, planning, and institutional arrangements.

To appreciate the critical dimensions entailed in Kent's (1994) Disaster Preparedness Framework see Figure 2.4 below.

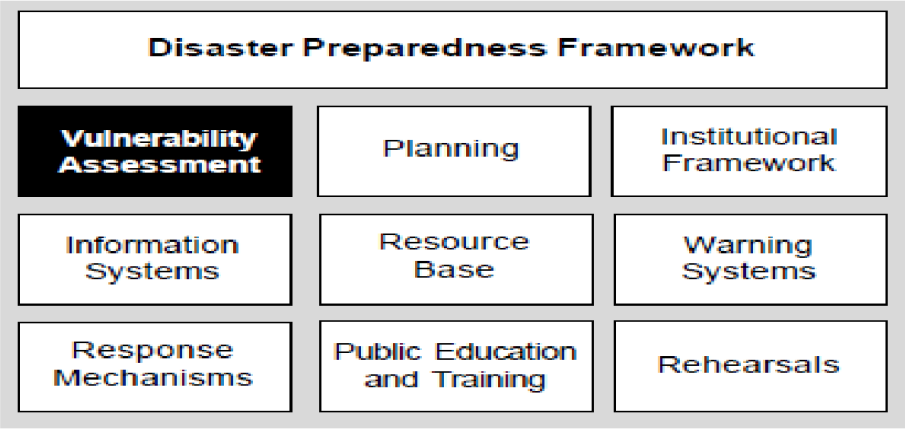


Figure 2.4: Disaster Preparedness Framework
Source: Kent. 1994 in UNDP

The first area of Kent's (1994) Disaster Preparedness Framework is vulnerability assessment. UNISDR Terminology (2009: 30) defined vulnerability as the "…*characteristics and circumstances of a community, system or asset that makes it susceptible to the damaging effects of a hazard*." Similarly, Wisner et al (2004: 11) elaborate on the meaning of vulnerability by framing it as "…*the characteristics of a person, group, and their situation that influence their capacity to anticipate, cope with, resist and recover from the impact of a natural hazard*." In other words, vulnerability is driven by the elements of socio-economic and environmental aspects of a community in the face of hazard. The assessment of vulnerability should then be a process that seeks to understand the likely impact of disaster risk in a particular community setting given the underlying characteristics of the community to cope, anticipate and react to danger with available resources. The reason why vulnerability assessment is important is that disaster preparedness must be based on the

knowledge about community susceptibilities to known hazards and their likely impact within their given environment (Sutton & Tierney, 2006).

The second dimension is planning. This is no disaster planning for preparedness. Disaster Planning is, central to the whole process of disaster preparedness because it overlaps to all the other eight dimension of the framework. Hence, Kent (1994: 18) sees planning as a "…*theme for the whole disaster preparedness exercise*". If disaster planning is fundamental in disaster preparedness, this study will try to elaborate on this point and compare it to other dimensions of the framework.

According to Kent (1994) and Sutton & Tierney's, (2006) disaster preparedness planning is a process to develop clear goals and objectives that are underpinned by specific tasks and responsibilities for people and agencies in disaster response. Mutual aid agreements that are formal or informal to ensure an effective, coordinated response are advocated for in the planning phase (Kent, 1994; McEntire & Myers, 2004; Sutton & Tierney's, 2006). Tierney (1993), and Basolo, Steinburg, Burby, Levine, Cruz, & Huang (2008) outline the disaster planning process as a four step approach. The first step is to identify the potential risk of the community. The second step is to develop emergency response plans. The third step is to develop and implement mitigation. Lastly, the fourth step is to communicate risk, planning process and preparedness measures to the community.

In the planning phase, there are also specific themes that must run across the actual process to guide the planner. Quarantelli (1986) states that planning for a disaster is unlike planning for routine emergencies. Disaster preparedness planning involves planning in four critical phases or areas. The first phase is to plan for the eliminating or reducing the probability of the occurrence of a disastrous event, which is mitigation. The second phase is to plan for proactive measures such as early warning system and evacuation, which is preparedness. The third phase is to plan for response, which includes planning for emergency response at all levels. The fourth phase is to plan for recovery in the event of a devastating disastrous event. It can be argued that although the planning process can still employ the four-step approach as contended by Basolo et al (2008) it is necessary to focus on the four areas or 'phases' that Quarantelli (1986) has identified for disaster planning to be complete.

The third dimension to be explored is the institutional framework. Institutional arrangements have no prescribed shape or form. There is no set standard for institutional arrangements for coordination except that it should be both horizontal and vertical within the already existing

structures and systems (Kent, 1994). However, the institutional framework should at least include policy, operational guidelines, structures, and systems. In the South African context, some of the structures and policies are legislated in the Disaster Management Act, Act 57 of 2002. The examples of the institutional arrangement include ordinances (McEntire & Myers, 2004), government departments and entities, community structures, non-governmental organisations, volunteer organisations, private sector, and civic organisations (Sutton & Tierney, 2006).

The fourth dimension in the Disaster Preparedness Framework is information systems. Alter (2008:6) defines an information system as "…*a system in which human participants and/or machines perform work (processes and activities) using information, technology, and other resources to produce informational products and/or services for internal or external customers*." In the context of disaster preparedness, Kent's (1994) primarily associates the explanation of the information system with early warning system wherein vulnerability assessments are monitored and disseminated to communities. However, Krumay and Brandtweiner (2015) view information as the all-embracing enabler to support the four phases of disaster management i.e. mitigation, preparedness, response and recovery. For disaster preparedness, they argue that the information system is used during emergencies and to store the information before communicating it to the communities.

The fifth dimension in the Disaster Preparedness Framework is the resource base. The resource dimension is primary related to resource management. While the information system stores all the information Krumay and Brandtweiner (2015), resource management, on the other hand, is linked to disaster preparedness planning. Sutton & Tierney (2006) mention that resource management issues (i.e. identifying resource needs, acquiring resources, and storing and distributing or using resources) are linked to the planning dimension on mutual aid agreements, resource sharing and the type of disasters that are anticipated in the preparedness plan. In other words, resource management starts from pre-disaster, during the disaster and after the disaster phase to be fully disaster prepared.

Early warning systems are the sixth dimension in the Disaster Preparedness Framework. Early warning systems according to the UNISDR Terminology (2017: 12) are defined as a "...*set of capacities needed to generate and disseminate timely and meaningful warning information to enable individuals, communities and organisations threatened by a hazard to prepare and to act appropriately and in sufficient time to reduce the possibility of harm or loss*." Kapucu (2008), quoting another author, contends that early warning systems are designed by a combination of scientific and social factors for monitoring and detection with the purpose of notifying the

communities at risk. Kapucu (2008) states that early warning systems use integrated communication processes to the communities at risk based on scientific, managerial, technological, and social components as capabilities.

However, the availability of early warning systems capabilities does not guarantee effectiveness. Kent (1994: 30) recognises that community perceptions play a role in early warning systems effectiveness. Kent (1994: 30) states that early warning systems can be hindered by lack of trust towards these systems. Sometimes, the ineffectiveness of the early warning systems can be because of general misunderstanding of the message or previous history of false alarm associated with the same warning. Lastly, the lack of prior training or exposure to similar conditions of the early warning system might mean that the warning is ignored based on the local community's conditions, attitudes and experiences.

Kent's (1994) framework identifies response mechanisms as the seventh dimension in the model. The response mechanisms are sometimes called disaster response. UNISDR Terminology (2017: 24) explains response as the "…*provision of emergency services and public assistance during or immediately after a disaster to save lives, reduce health impacts, ensure public safety and meet the basic subsistence needs of the people affected*." Tierney (1993) and (Kent, 1994) concur that there are many disaster response mechanisms. The mechanisms include all the activities taken to deal with the actual or threat of the hazards impact. These activities might involve routine acts of saving lives and property to complex activities of provisions of humanitarian relief, evacuation, providing emergency reception centre's and shelters, damage assessment, debris removal, search and rescue, medical care and mass care during the post-impact emergency period. The primary purpose of the disaster response activities is to predict and monitor the possible disasters and to respond effectively when the disaster occurs.

According to Kent's (1994), the eight dimension of the Disaster Preparedness Framework is public education and training. Hoffmann & Muttarak (2017) noted that there are stakeholders that provide disaster educational programmes and emergency training to raise the awareness, increase resilience and preparedness. These providers can be non-governmental organisations or governmental institutions and more. In general, disaster educational programmes and emergency training can be either formal or informal. According to Hoffmann and Muttarak (2017:34) formal programmes "…*refers to classroom-based education normally delivered in a systematic way by trained teachers in a structured environment such as a school, college, or university. In this context, formal education is measured as years of schooling assuming that the*

*higher the number of years an individual spent in a formal education setting, the more educated she/ he is.*"

Informal programmes are unstructured or semi-structured with less emphasis on progression but still with the aim of imparting some sort of knowledge. Informal programmes can be referred to as public awareness. According to UNISDR Terminology (2009: 22), public awareness is a type of "*common knowledge*" about the disaster risk and measures to avoid or reduce it but also increasing community or individual resilience. The same knowledge is developed and disseminated via media, educational channels, information centres such as libraries, community network structures, and public participation platforms. Kent (1994) categorizes disaster educational programmes and emergency training, both formal and informal, into four types, which are:

- Public education in schools (i.e. school curriculum based learn)
- Special training courses (i.e. workshop etc.)
- Extension programmes (i.e. community based outreach workers such as community emergency response teams – CERT)
- Public information (i.e. print media, television, radio, advertising etc.)

Paton and Johnston (2001: 270) warn that sometimes disaster educational programmes and emergency training may not be effective to change community's behaviour. They say that these programmes are referred to as "*information- action link*" because of the expected automatic knowledge adaptation, understanding and utilization. Paton and Johnston (2001: 270) argue that the assumption that public education and training will be successful is in most instances unjustified. One reason is that little reaction should be expected from the public education and training recipients as ordinary people expect local government to protect them. Moreover, it is because people compare themselves to others in the community and look at themselves as safer than others.

Rehearsal is the ninth, and the last, dimension for Disaster Preparedness Framework. The dimension of rehearsal is one that carries many names compared to any other dimension in the framework. Some of the names attributed to this dimension is testing, drills, exercises or simulations (Kent, 1994; McEntire & Myers, 2004; Sutton & Tierney, 2006). The above stated authors also agree that, except for training purpose, the central reason to conduct a rehearsal is to comprehensively test and evaluate all the components of disaster response to confirm the

disaster preparedness of the systems. The intention of the rehearsal is to test the response systems and ultimately identify gaps and implement corrective measures.

McEntire & Myers (2004) note that there are three ways to carried out rehearsals i.e. table-top, functional, and full-scale exercises. The first one is table-top exercise, which is said to be easily implemented in a meeting environment with a given scenario. The second one is the functional exercise that test one function or the component of the disaster response system. Lastly, the full-scale exercise evaluates the full extent of the preparedness in the disaster response system. In drill planning, a multi-stakeholders committee and not an individual must plan the rehearsals (McEntire & Myers, 2004). In addition, the planned rehearsals must not be kept as a secret to the role-players to increase participation and avoid the element of surprise. Kent (1994) notes that although rehearsals might be well planned, they a bound to be infested by negative views. Kent (1994) contends that rehearsal is the only way to refresh the disaster plans and the only scenario you can implement simulating the actual disaster.

### 2.3.3 Applied Perception Model

This section evaluates the model to determine the level of disaster preparedness in the City of Ekurhuleni. In other words, what are the appropriate scientific lenses to apply in measuring the level of disaster preparedness in city or a given social context? For this study purpose, risk perception is used as a microscope to evaluate the level of disaster preparedness in the city.

There are two dominant perspectives of risk perception in the risk studies. For example, Rippl (2002) views risk perception as part of the psychometric models which are entrenched in psychology. On the other hand, Douglas and Wildavsky (1982) explain risk perception as part of cultural theory. However, the cultural theory by Douglas and Wildavsky (1982) cannot adequately determine the level of disaster preparedness based on risk perception as expected in this study. The appropriate theoretical paradigm to address the objective of the study is the psychometric models as advocated by Rippl (2002).

However, there are many approaches to the concept of risk perception in the field of psychometric paradigm such as Hommel, Müsseler, Aschersleben, and Prinz (2001), Schubo, Aschersleben and Prinz (2001) and others. The one psychometric paradigm that perfectly fits the objective of this study is the psychological model by Raaijmakers, Krywkow and van der Veen (2008) called Relationship between Risk Characteristics. The model is different from the cultural theory because the focus is on "…individual's interpretation or impression based on an understanding of a particular threat that may potentially cause loss of life or property (Bradford et al., 2012: 2300).

This is unlike, the cultural theory which states that social aspects and cultural adherence of individuals determines the people's perceptions and actions around themselves (Oltedal et. al, 2004). In general, the psychometric model contends that individual compression, thoughts and experiences shape their reaction under all circumstances. This is different from the cultural theory wherein individual compression, thoughts and experiences are a construct of a social group and their relation to each other in a specific context.

According to Raaijmakers et al (2008) model, risk perception is defined as a relationship between three risk characteristics i.e. awareness, worry and preparedness. In this case, hazard knowledge is captured as awareness, hazard fear as worry, and hazard reduction actions as preparedness.

The sequence of the three risk characteristics i.e. awareness, worry and preparedness is shown in Figure 2.5. Awareness is understood to increase when there is the availability of information and knowledge about the hazard. Conversely, in an event there is no proper information and knowledge or memories, the awareness diminishes overtime (Raaijmakers et al, 2008; Bradford et al; 2012). Raaijmakers et al. 2008 argue that from the awareness perspective, one needs an element of worry to take preparedness actions. However, in circumstances where one is not worried about the hazard no preparedness actions will be taken. Hence, individuals that are worried about a hazard will take preparedness action.

Raaijmakers et al (2008: 308) realize that in the psychometric paradigm such as the one mentioned above, the fundamental characteristic is voluntariness, which is explained as "…*the freedom of choice a person has to expose him or herself to a particular risk.*" They further state that freedom of choice is high if it is under the following condition:

- There is a large number of available alternatives with similar perceived benefits;
- An individual is not significantly influenced by a social environment in his or her choice;
- A person has significant influence on the currently selected behaviour;
- The importance of the foreseen benefits for fulfilling major individual or societal values or essential human needs is small.

Any choice a person makes in relation to a particular risk is motivated by corresponding benefits or lack of benefits. Hence, Raaijmakers et al (2008) contend that with regard to freedom of choice there are three options available to individuals, which are, to accept the level of risk; to reduce the risk or to avoid it altogether. Therefore, freedom of choice and voluntariness is a trade-off between acceptable risk exposure and the perceived benefit, if the benefits are non-existent the choice will be to avoid the risk.

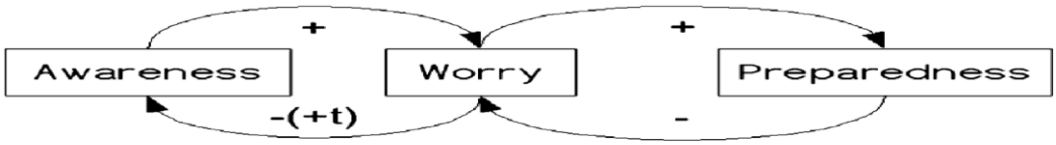


Figure 2.5: Relationship between risk characteristics
Source: Raaijmakers et al (2008)

Based on the three risk characteristics i.e. awareness, worry and preparedness as well as the principle of voluntariness, Raaijmakers et al (2008) developed individual typologies or classification. The taxonomy is arranged into four individual categories, which are ignorance, safety, risk reduction and control. The four individual typologies are explained in Figure 2.6 below:

- **Ignorance**: An ignorant individual will not worry about, and will not be prepared for the risk because he or she is not aware of it;
- **Safety**: An individual who imagines him or herself to be safe, will not worry, and is thus not prepared for a risk, because the risk is acceptably small (or believed to be small) or the individual may be prepared to take risks;
- **Risk reduction**: An individual who is highly aware, worried and badly prepared will demand risk reduction. When an individual considers exposure to a hazard as involuntary, he or she will assume the responsibility for preparing the population for a hazard and lays the responsibility in the hands of authorities, instead of taking individual action;
- **Control**: When an individual feels prepared, then he or she has a sense of control over the risk, and is, as a consequence, less worried."

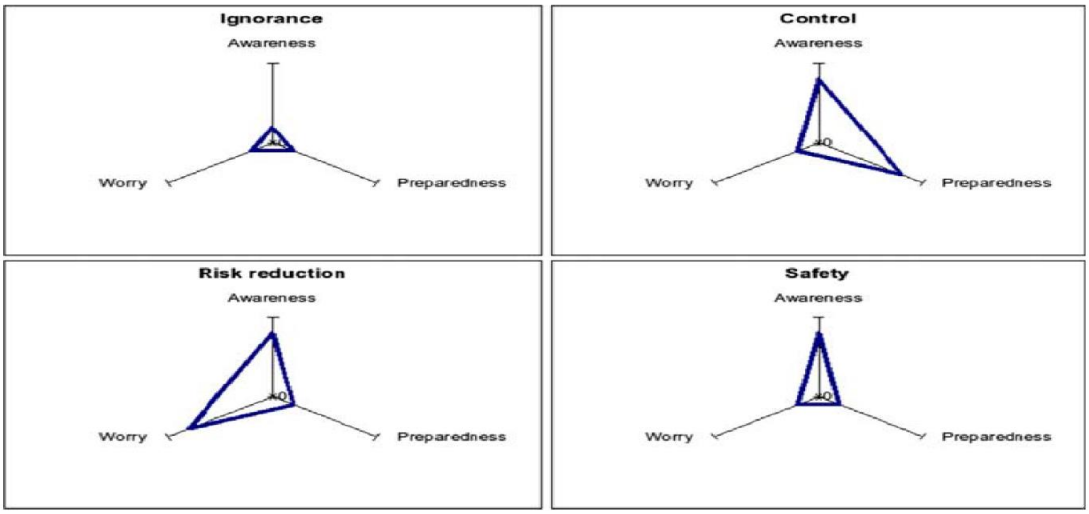


Figure 2.6: Typologies of risk characteristics
Source: Raaijmakers et al (2008)

The categorization of individuals based on the three risk characteristics might be useful in classifying individual risk perceptions relating to the disaster preparedness framework.

## 2.4 Framework to mainstream disaster preparedness within disaster risk reduction and climate change into policy

Countries around the world and South Africa have either attempted to or implemented some mainstreaming measures for disaster risk reduction (i.e. prevention, mitigation and preparedness) and climate change adaptation (Stott, 2014; Averchenkova, Gannon, & Curran, 2019). The terms mainstreaming in this context is referred to the incorporation and integration of practices, policies and measures aimed at both disaster risk reduction and climate change into resilience and developmental "sectoral planning and management" (Hay, 2010). The process should not only include developmental goals but also governance arrangements, policies and practices (Moreno, Ponte, Emperador & Noriega, 2017). There are many ways to integrate the aspects of disaster risk reduction such as disaster preparedness with climate change measures like adaptation. For example, one such approach is suggested by Serrao-Neumann et al (2015) in which mainstreaming of disaster risk reduction (DRR) and climate change adaptation (CCA) is sector based and implemented on spatial planning processes.

However, for the purpose of this study a more comprehensive approach is adopted as recommended by Begum, Sarkar, Jaafar and Pereira (2014). Before the actual framework is outlined, it is necessary to justify the choice of the approach. The first advantage of the framework is that it can be used with any of the three aspects of disaster risk reduction (i.e. prevention,

mitigation and preparedness). It is compatible with the disaster preparedness model by Kent (1994) adopted in this study. Secondly, the approach is flexible and can be applied from any sphere of government from national, provincial and local level where policy development is necessary. Thirdly, the framework in some instances mirrors some of the nine (9) focus areas of the disaster preparedness model. Lastly, the framework is more practical than theoretical which means that the application will not be complex.

Begum et al (2014), in an effort to link DRR and CCA, proposed a conceptual framework that has nine (9) components for mainstreaming the two fields into one developmental agenda, resilience measures and policies. The nine components of the framework are vulnerable sectors, stakeholders' involvement, integrated approach and integrated policy, institutional capacity building, education and awareness, effective fund allocation and disbursement, coordination and collaboration, and political and institutional will. All the stated components must work in unison to achieve the DRR and CCA link. Figure 2.7 depicts the components of the framework linking DRR and CCA.

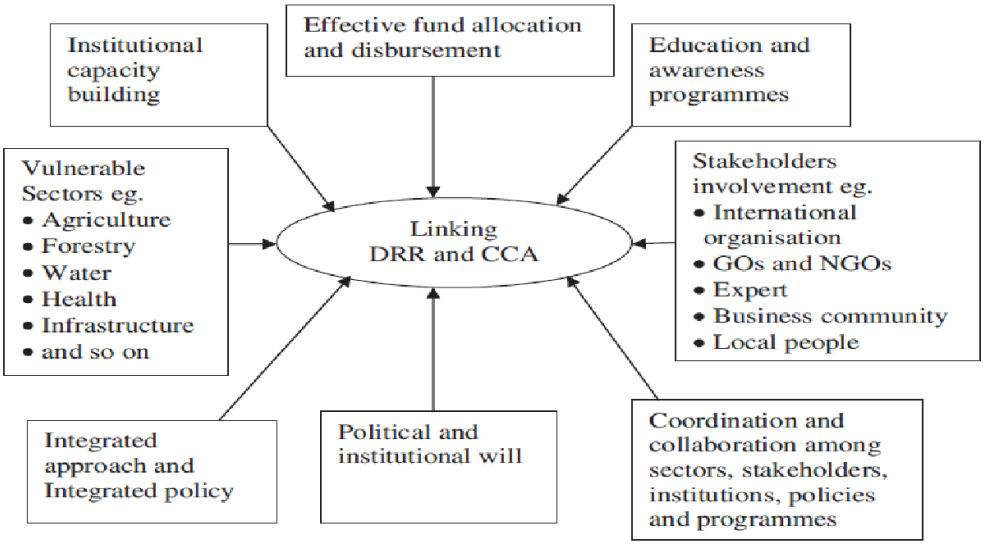


Figure 2.7: Framework linking DRR and CCA
Source: Begum et al (2014: 367)

The components in the framework are explicit and self-explanatory, only a brief elucidation will be given for each element as stated by Begum et al (2014).

- Vulnerable sectors

Multiple vulnerable sectors depend on the risk assessment outcomes of a specific area. This means that different areas will have different risks, thus different vulnerable groups per area.

However, most notable sectors for vulnerability in the climate change impact could be generalised as vulnerable communities, agriculture, forestry, water, health and infrastructure.

- Stakeholders' involvement

In every sphere of government from national to local sphere, there are multiple stakeholders from the government itself, non-government organisations, business community, local people, experts, international organisation and any other identifiable interest groups.

- Integrated approach and integrated policy

The institutional integrated approach and policy formulation in any sphere of government is central in the coordination and integrating the DRR and CCA. A fragmented policy approach normally leads to silo mentality, which is a barrier in integrating different government strategies. Thus, a silo approach extends bureaucracy in government and blocks the implementation of many policy decisions.

- Institutional capacity building,

The implementation of any policy decision requires the correct institutional capacity. An institutional arrangement that emphasizes both the capacity of government and the communities is important to facilitate the implementation of decisions relating to DRR and CCA. Therefore, institutional capacity building in government and communities is a necessary enabler for policy implementation for DRR and CCA.

- Education and awareness

Education and awareness for DRR and CCA integration stakeholders is important to facilitate coordination. Both education and awareness plays a critical role in the mind shift from a silo mentality to an integrated approach.

- Effective fund allocation and disbursement

Effective budgeting and expenditure when supported by correct institutional capacity enables any institution to realise its policy objectives. Begum et al (2014: 368) state that "*Effective fund allocation and disbursement can enhance integration through capacity building for planning, preventive measures, preparedness and management of disasters related to climate change for instance, contingency planning, in particular, for droughts and floods in areas prone to extreme weather events*". In other words, for any elements of DRR and CCA to be implemented it requires the institution to budget correctly and be able to effectively use the available resource to the prevailing climate related disaster risks.

- Coordination and collaboration

The successful integration of DRR and CCA relies on proper coordination and collaboration of different stakeholders in both fields. In both fields, there are multi-sectoral and multi-disciplinary stakeholders with different programme outcome interests. Therefore, to institute the required coordination and collaboration, correct mechanisms and programmes should be established in the institution.

- Political and institutional will

Political and institutional will drives the successful implementation for any policy position. If there is no political or institutional will for a policy to succeed the chances for implementation are non-existent. Therefore, the integration of DRR and CCA hinges on the political and institutional will that exist for such programmes to succeed in the implementation.

### 2.5 Summary

This Chapter firstly dealt with the evolution of disaster management which was traced from the legislative frameworks within the context of United Nations, Africa and South Africa as a country. In the context of Africa, it explored the AU in general and the three (3) sub-regions in the continent from the West, East and Southern Africa before unpacking the South African legislative framework from its Constitution, the Disaster Management Act and its National Disaster Management Framework. From there, the chapter dealt with the main disaster management models before introducing the disaster preparedness and risk perception models that are the focus of this project. Lastly, the chapter introduced climate change as a filed on interest. Specifically, the chapter identified the most appropriate framework to link disaster risk reduction and climate change adaptation. The next chapter will deal with a scholarly review of climate change in the context of disasters.

# CHAPTER THREE: LITERATURE REVIEW

## 3.1 Introduction

In most instance, climate change impacts have become synonymous with disasters globally. According to Schipper and Pelling (2006), the world climate change activities and impacts are interrelated in one way or another. They also point out that climate related disasters in many poor countries have caused many people to lose their lives and to suffer economic losses. In the process, the most vulnerable and marginalised people are the hardest hit group.

Schipper and Pelling (2006) acknowledge that since the start of the current millennium climate change has changed the frequency and the magnitude of natural hazards. Equally, world vulnerability has increased because of the increase in underdevelopment. Kent (1994) identifies the roots causes of underdevelopment as poverty, population growth, armed conflict, urbanisation, change in cultural practices, degradation of environment, and lack of information. The severity of natural hazards and increased vulnerability worldwide amplifies the world's disaster risks. Schipper and Pelling (2006) contend that climate driven disasters have also overturned many years of development in the world. For the next century, it is also expected that climate change caused by greenhouse gas emissions will further increase temperatures and change the patterns of rain with adverse consequences to human livelihoods. It is under these disaster risk conditions that measures to reduce disasters in the context of development are important. This, according to UNISDR report called Disaster Preparedness for Effective Response (2008), has led to the growing policy agenda of the world to implement both climate change adaptation and disaster preparedness in the context of development.

It is within the background of disaster preparedness and climate change driven disasters that this Chapter will focus on the following. The first, part of the chapter will outline the causes of climate change globally and its effects before exploring the results of climate change in some of the least developed countries as per the Intergovernmental Panel on Climate Change Fifth Assessment Report Work Group II (IPCC AR5 WGII, 2014). South African climate change status will be dealt with as the second part of the chapter. The third part will deal with the trends in global disasters and their impact. The fourth part explores South African disasters and their likelihood in future, especially in the City of Ekurhuleni. Lastly, the chapter outlines a good disaster preparedness programme to attend to the likelihood of disasters in the future.

### 3.2 General causes and effects of climate change

#### 3.2.1 General causes of climate change

Many studies describe how climate change occurs but the IPCC report by Cubasch et al. (2013) is more informative as it explores the topic on climate change by discussing the concept of a climate system. According to Le Treut, Somerville, Cubasch, Ding, Mauritzen, Mokssit, Peterson & Prather (2007:96), climate system should be conceived as a compound that is comprised of "…*atmosphere, land surface, snow and ice, oceans and other bodies of water, and living things.*" The IPCC report by Cubasch et al. (2013) regards these elements with their related changes in the form of surface temperature, atmospheric water vapour, precipitation, severe events, glaciers, ocean and land ice, and sea level due to physical response as indicators of climate change. From all the stated elements and its reaction, climate or its system is different from weather. Weather is a state of the atmosphere at a specific place in a specific time due to "…*temperature, pressure, humidity, wind, and other key parameters (meteorological elements); the presence of clouds, precipitation; and the occurrence of special phenomena, such as thunderstorms, dust storms, tornados and others"* (Cubasch et al, 2013).

Climate change is caused by both internal and external factors such as a dynamic nature of climate system and human actions. Le Treut et al (2007) state that one of the factors which lead to climate change starts from the climate system because of its own make-up which constantly undergoes the process of 'forcing'. 'Forcing' is a process of change in climate because of external factors. The external factors that induce climate change are different natural phenomena. The three notable natural phenomena; that is, volcanic eruptions, solar variations (i.e. deviations), and anthropogenic activities, influence changes in an atmospheric make-up as part of 'forcing'. The solar radiation, which might have variations, from the three notable natural phenomena, drives the climate system. The solar variations, which is solar imbalance, affects solar radiation in three ways. The first one is the change of solar radiation into the climate system. The solar imbalance might be caused by changes in the sun's radiation or earth's orbit. The second one is the change in the size of reproduced fractions of solar radiation in the climate system. The second change is normally called *'albedo'.* It might be caused by the changes in atmospheric particles (i.e. vegetation) or cloud cover. The third change in solar radiation might be because of the change in the radiation from the earth back to space which is called long wave radiation. This solar radiation change might be because of the changes in the greenhouse gas concentration on earth. Naturally, climate either directly or indirectly responds to these changes by producing its own feedback

mechanisms. It is mostly the third type of solar radiation, long wave radiation (i.e. the reflection of the incoming solar radiation (energy) back to space and some energy absorbed by atmospheric gases), occurs that, causes the temperature to be warmer than the moon (Sivaramanan, 2015)

One of the main external factors that lead to change in the atmospheric make-up is the anthropogenic activities caused by humans. Sivaramanan (2015) mentions that since the industrial revolution the emission of greenhouse gases (GHG) increased exponentially in the atmosphere from an average of 33 degrees Celsius prior to industrialisation. Sivaramanan (2015) states that the three most decisive human activities that increased the greenhouse gas were industrial chemicals, deforestation and oceanic pollution that led to global warming. He explained global warming as the earth surface warming and change in energy between atmosphere, space, land and the oceans. He further confirmes that the burning of fossil fuel alone has driven the process to increase the greenhouse gases by 30% and temperature by 0.18 degrees Celsius in the 20th century. Hence, in the 21$^{st}$ century, it is expected that greenhouse gases and temperature will further increase by 1.1 and 6.4 degrees Celsius, respectively. This is against the background of 251 years of industrialisation (i.e.1750 to 2001) carbon dioxide increased by 31%, methane by 150% and nitrous oxide by 16% in the atmosphere. In essence, Sivaramanan: (2015) agrees with Le Treut et al (2007) that greenhouse gas increase global warming which leads to climate change. Figure 3.1 below depicts the climate system and its process as present above.

In line with the 2013 IPCC report on Climate Change, Sivaramanan (2015) uses the National Oceanic and Atmospheric Administration (NOAA) indicators to simplify the factors that increase and decrease with global warming in the world. Sivaramanan (2015) identifies the following seven factors that increase with global warming and three factors that decrease with global warming in the world as:

**Factors that increase with global warming**

- Temperature of land
- Sea surface temperature
- Troposphere temperature
- Temperature over oceans
- Ocean heat content
- Sea level
- Humidity

**Factors that decrease with global warming**

- Glaciers
- Snow cover
- Sea ice

Le Treut et al (2007:96) contends that because of the changes in greenhouse gases and temperature that influence solar energy, changes the humidity, wind, ocean currents, cloud patterns affecting world climate. The new global climate leads to an increase in the number and impacts of natural disasters *"…such as storms, flooding rain, landslides, drought, land degradation and agricultural loss, species loss and epidemics.*" Figure 3.1 below presents a diagram of the elements of climate system, their process and interactions for change.

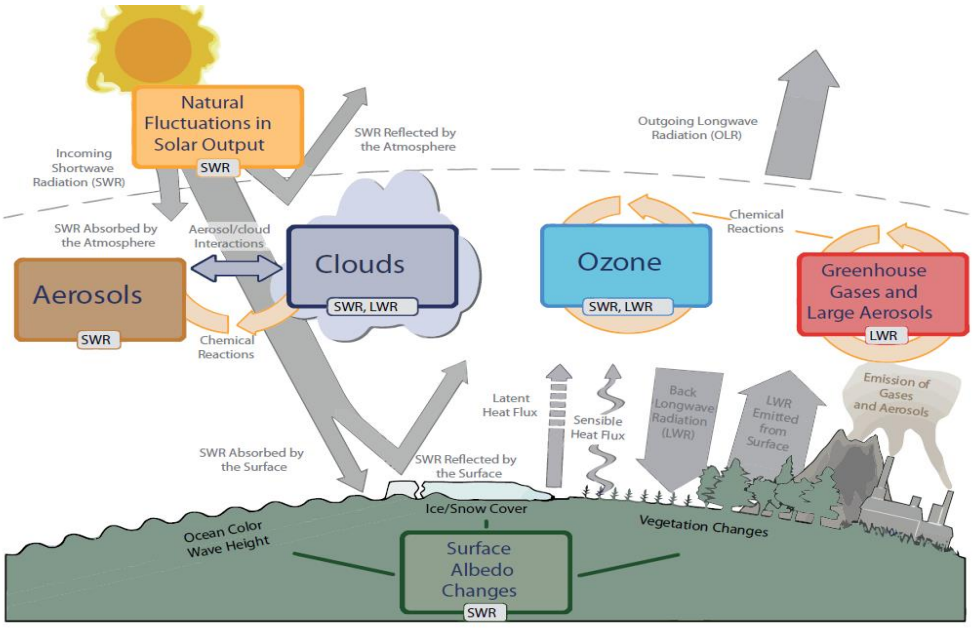


Figure 3.1: Schematic view of the elements of climate system, their process and interactions
Source: IPCC Report on Climate Change (2013)

### 3.2.2 Effects of climate change

The IPCC Report on Climate Change (2013), Hunt and Watkiss (2011), Sivaramanan (2015), and Le Treut et al (2007) agree that generally climate change and global warming has resulted into five most noticeable changes, which are as follows:

- Sea level rise (this impact of the coastal settlements);

- Increase in extreme events such as wind storms and storm surges, heavy flooding from rains, heat extremes or cold, long sometimes unusual droughts (this impact on built infrastructure and agriculture);
- Increase in health complications associated with heat or cold that leads to illnesses or death, vector-borne disease, food & water borne disease from extreme temperatures and weather events;
- Impact on the use of energy for heating and cooling; and
- Impact on available water sources.

When these effects of climate change, as mentioned above, are realised in a particular area with underlying vulnerabilities, they increase the risk of disasters, which requires disaster preparedness measures. The next section, explores the results of climate change in some of the least developed countries and South Africa. However, it should be mentioned that when dealing with least developed countries not all the countries in the Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report Work Group II (IPCC AR5 WGII, 2014) will be dealt with but only those countries that have attracted a lot of interest even in other studies. However, the selected countries will give a balanced understanding of the status of these countries that can be generalised.

### 3.3 Least developed countries and climate change

According to Stott (2014) the United Nations and Intergovernmental Panel on Climate Change are the two agencies that categorise countries. Stott (2014) also identifies criteria that qualify a country to be considered a 'least developed country'. The criterion includes the countries' gross national income (GNI) which is between low to middle income, human assets, and economic vulnerability and under-development.

According to Stott (2014), the Least Developed Countries constitute the majority of persons living in rural areas in the world. He states that the Least Developed Countries accounts for 92 percent population that live in rural areas which is part of the 42 percent of the world rural population. When the Least Developed Countries rural population is compared with the world, it has 72% rural population and the less developed countries have 50 percent in this category. Lastly, in the Least Developed Countries, there is rapid urbanisation or migration. Stott (2014) states that It is predicated that by 2030 urbanisation or migration in the Least Developed Countries will constitute over one third of the world population that will be a tenth of world urban population. In 2050, the numbers are projected to rise to half of the world population.

From the criteria for Least Developed Countries outlined above, it can be discerned that the measure to classify the countries as 'least developed countries' was informed by one or more of the causal factors of disaster vulnerability. The initial module on disaster management called "An Overview of Disaster Management", by the United Nations Development Programme in Disaster Management Training Programme (UNDP-DMTP) (1992), identifies seven underlying causes of disaster vulnerability as poverty, population growth, rapid urbanisation, change in cultural practices, environmental degradation, lack of awareness and information, and civil wars. Therefore, the exclusion of countries in some continents that cannot be classified as least developed countries with underlying disaster vulnerabilities, such as those in Europe, Americas except Haiti and other continents, is most justifiable. The justification is because countries and continents that have less underlying causes of disaster vulnerability are less exposed to climate risks and disasters because of their socio-economic resilience.

The Least Developed Countries (LDC) endure the most brunt of the natural hazards from climate change than any other countries (Stott; 2014). He also contends that, though the least developed countries lose more people during climate related disasters, the developed countries suffer more economic losses because of their huge infrastructural investments which have a high replacement cost in terms of the gross national income (GNI). To substantiate (Stott; 2014), O'Brien et al. (2006) state that, from the data collected from the Centre for Research on the Epidemiology of Disaster (CRED) in Belgium and world insurance companies, it is the LDC that suffers most in terms of loss of lives and livelihoods. Economic losses have risen sevenfold from 1960s and in 1990s it stood at USD 659.9 billion. The 'most developed countries' (MDC) registered two third of this economic loss than deaths that was 27,464 and 594,899 fatalities between 1992 and 2001 for the MDCs and LDCs respectively. These figures in ratio terms translated into 1,052 deaths per disaster in the LDC compared to 23 deaths for MDC with high human development index (HDI).

Now a brief summary of a background on LDCs has been dealt with above, the section below will at a small scale demonstrate the impact of climate change in different regions of the world. Stott (2014) indicates that Africa accounts for 34 countries, Asia 9 countries, Small Islands 4 countries and Americas 1 country. Therefore, due to the vast number of the countries regarded as LDC and the size of this study only a few regions will be included. The Americas and the Small Island region will not be considered. The only regions that were considered will be Asia focusing on Nepal and Africa by summarising the regions.

### 3.3.1 Asian region

The three countries in the Asian region that are regarded as the LDC in the IPCC AR5 WGII (2014) is Nepal, Bangladesh and Afghanistan. However, the most interesting country in terms of climate change in the region is Nepal. The country is regarded as a country with so much potential for future hydropower generation because of the glaciers and the fact that it is currently only using 0.75% of this potential (Shrestha & Aryal; 2010).

According to Giri (2016), Nepal is a geographically landlocked country with an area of approximately 147,181 km2 situated between two Southern Asian superpowers i.e. India and China with an average width of 150 km. The country has an altitude of 60 to 8,848 metres above sea level depicting the uneven nature of the country with the southern region consisting of 23% of the country's land with only 40% of the land being useable for agriculture. The central part of the country is 42% of the entire land but with 10% of the land being suitable for cultivation. The northern part of the country consists of the remaining 35% of the country's land with only 2% of the land being useable for agriculture. In essence, this means that the cultivatable land in the country is 14.1% of the entire area of 20, 605 km2. Shrestha and Aryal (2010) and Giri (2016) show that 80% of the population of the country relies on agriculture which is dependent on rainfall for livelihood. However, Giri (2016) acknowledges that because of climate variability the country is susceptible to floods, landslides and drought as natural disasters, which affects most to the poor communities due to poverty as a causal factor of vulnerability.

Nepal climate is said to be subtropical with most of the monsoon rainfalls in summer from June to September being used for water resource in agriculture. The average precipitation of 70% to 85 % in the country is generally around 1,768 millimetres per year. The maximum temperatures average between 45 and 46. 4 degrees Celsius around May and June and then decreases in December and January. The variability of the climate is also associated spatial differences, which were recorded in June 1995 (Shrestha & Aryal, 2010). Stott (2014) confirms that climate change started to melt the Himalayan glaciers beyond the usual supply of freshwater and increasing the incidents of floods that results in community mortalities six fold and damaged the infrastructure like the bank of Kosi River in 2008. The floods have also increased the incidents health incidents of malaria and tuberculosis.

### 3.3.2 African continent

#### 3.3.2.1 Western region of Africa

According to the Food and Agriculture Organisation (FAO) (2011), the Western African region is not a homogenous area with a single climate change impact to all the countries of the region. However, there are shared impacts that can be attributed to most of the countries, if not all of them. The changes in the intensity and frequency of temperature and rainfall are some of the shared effects of climate change in the region, which have increased the occurrence of drought and floods with their accompanied transition in vegetation, water availability, and health challenges in the form of increased malaria infections. All these climate changes with new natural disaster hazards happen in the context of heightened vulnerability coupled with less capacity of the states. Consequently, the countries in the Western African region experience frequent disasters caused by natural hazards. For example, Niger is one of the Western African countries that vividly demonstrate the impacts of climate change because of natural hazards that are compounded by community vulnerability and the lack of capacity. Normally, the region is known for low rainfall and high temperature with a single rainy season in June to September. However, climate change in the thirty-year period from 1980s to 2000 brought about a shift in these patterns with a frequency of drought and more wet conditions resulting in floods. For instance, according to Bacci and Mouhaimouni (2017), the 1980s period was dry followed by a shift during the next 10 years in the climate toward more wet conditions. The last ten years until around 2000 was the first stage of a persistent wet period. These three decades demonstrated uneven distribution in their weather occurrence (Bacci & Mouhaimouni, 2017). Stott (2014) concurs that Niger is faced with changes in temperature and rainfall patterns. Further, Stott (2014) states that the effects of climate hazards are mostly felt on vegetation through environmental degradation and malaria infection rates. Besides the climate hazard that has brought new changes in the country, the situation is amplified because the majority of people live in poverty and have economic dependency on agriculture. The migration of males to urban areas leaves women to work the land with less labour in rural areas. Bacci (2016) admits that the lack of state capacity to implement disaster measures because of poor economy with limited resources results in the country depending on international donors and non-governmental organisation for its disaster risk reduction policy implementation.

#### 3.3.2.2 Eastern region of Africa

The eastern region of Africa is not different to the western region in terms of the impact of climate change. The variability of temperature and precipitation with changes in the intensity and

frequency of these two climate elements has led to more floods and drought in that region. Both floods and droughts, given the characteristics of the countries in the region have increased the likelihood of disasters (Stott (2014).

The country of interest in the region is Tanzania, as the biggest country in Eastern Africa, that extends from the north-east to the south-east encircled by seven countries (i.e. Uganda, Rwanda, Burundi, Malawi, Zambia, Mozambique, Kenya) and Indian Ocean. Like most of the countries in Africa and specifically in the eastern region, Tanzania has been badly affected by climate change both in its variability to temperature and rainfall with dire consequences to all socio-economic aspects of life. Stott (2014) confirmed that in Tanzania, climate change involves the change in temperature and precipitation patterns that affects vegetation cover and results in degradation of the coastal areas because of water inundation. Heavy rains also affect urban areas whilst in the rural areas climate unpredictability erodes the existing livelihoods which are aggravated by environmental degradation, population's health deterioration (i.e. because of HIV/AIDS, malaria rates, cholera incidences, mortality rate, etc.), country's economic policy, and globalisation. Stott (2014) predicts that for future food security, women will be affected the most as agriculture drives food production and employment. Shemsanga, Omambia and Gu (2010) confirm the socio-economic impact of climate unpredictability in Tanzania when they highlighted that climate change had the worst impact on food security. Due to climate change impact, Tanzania today has a serious loss of value in the food chain, which affects more than 90 % of the country's population as their livelihood depends on agriculture or agricultural related activities. The socio-economic impact of climate change for Tanzanian' communities of Masaai, Barabaig and Nyaturu are worse because they have already lost their livelihood in the form of livestock husbandry because of constant droughts. This has affected the working population mostly women and has increased malnutrition, prices of food and the outbreak of diseases. The consequence of climate change on agriculture is not the only outcome but also salt water incursion and sea level rise has disrupted water supplies especially in the urban areas.

Faldi and Macchi (2017) agree that in Dar es Salaam, which is the city in Tanzania, the effects of climate change have caused aquifer salinization because of anthropogenic pollution and seawater intrusion. However, due to the growing urban population and the inadequate municipal water system that service only 25% to 30% of the total urban water demand, the 4.36 million Dar es Salaam population with a growth rate 5.6% is mostly dependent on groundwater to support human activities in the urban periphery.

#### 3.3.2.3 Central region of Africa

The literature review of climate change impact in the central region of Africa is divided into two parts. The first part is on the central western part and will be represented by Angola. The second part is the eastern central part region, which will be represented by the Democratic Republic of Congo (DRC). The reason for exploring the central African region in this manner is the fact that climate change impact in this region is varied and cannot be easily generalised like in other regions. The diversity is not only according to country by country but also within the same country, sometimes because of lack of accurate available information on climate change research. In Angola, for example, Lotz-Sisitka and Urquhart (2014) acknowledge that because of the lack of accurate information of precipitation in the country scientists differ regarding projected rainfall prediction. However, the current observation confirms that there is a well-established climate change trend in Angola already. It is confirmed that the surface temperature between 1970 and 2004 has already increased by 0.2 to 1.0 degrees Celsius in the coastal area and northern region of the country. In the central and eastern regions, the increase is the highest at between 1.0 to 2.0 degrees Celsius. In terms of precipitation, though there are no reliable data sources except the data from Luanda, it is noted that there is already a fluctuation of rainfall in the country with an increase between 1941 and 1964, a drop between 1964 and 1978 and a second rise after 1978. The predictions of future temperature also show an increase of 3.0 to 4.0 degree Celsius in the east, north and the coastal regions in the next 100 years. The rainfall patterns are predicted to continue fluctuating with more extreme weather events such as localised floods, more wildfires, increased sea levels and changes in the flow of seas and lakes.

The Democratic Republic of Congo (DRC), as a country in an inter-tropical convergence zone of the continent, has demonstrated unique climate variability. According to the Ministry of Foreign Affairs of the Netherlands report on Climate Change Profile on Democratic Republic of the Congo East (2018), though there is a lack of reliable meteorological data, the annual average rainfall in the country is estimated at 1,070 mm per year. However, the highest rainfalls are observed in the east with an average of 1,570 mm per year. Regular rainfall is experienced around the equator throughout the whole year. The areas in the south of the equator, the rain is from October to May whilst those that are in the north the rain is from April to November. However, in both cases there are also dry seasons. On the other hand, the average temperature in the country is around 25 degrees Celsius with the eastern areas averaging below 15 degrees Celsius.

The report also confirms that there is a shift in climate observation in DRC. It mentions that between 1901 and 2013 there is evidence that temperatures are increasing with 0.05 degrees

Celsius per decade with the last 30 year seeing a surge of 0.17 degrees Celsius per decade. The interesting part of DRC climate is the fact that there has been a slight observation of rainfall variation between 1901 and 2013 with a strong reflection of the overall stability in the precipitation patterns at the same time.

On climate change projection, the Research Report on the Democratic Republic of Congo by Burton, Leroux-Rutledge and Godfrey (2010) mentions that temperatures will keep on increasing in future years. At the same time, rainfall is predicted to become more extreme with destructive effects such as floods, mudslides and soil erosion in the central country. Rain duration will become shorter in the south by two months in 2020 with drought effects affecting the rural population. Some of the climate impacts predicted in the country is reduced agricultural land because of desertification, coastal erosion, rising sea levels, drought, increased malaria infections and limited resources.

### 3.3.3 South Africa and Ekurhuleni climate change

Quoting the IPCC report of 2001, Kandji, Verchot, and Mackensen (2006) mention that change in the climate observed in Southern Africa is not different from the global observations in the last decades. They confirm that the Southern region temperature rise that was observed between 1970s and 1990s are consistent with the global warming global trend of 0.5 degree Celsius in the last 100 years. Kandji et al (2006) state that Namibia, between 1950 and 200, experienced a temperature rise of 0.023 degree Celsius per year and the Indian Ocean temperature increased by 1 degree Celsius since 1950 with decreased rainfall in the same period. Moreover, between 1988 and 1992, there were more than 15 drought events in the different parts of the southern region due to the rise in the frequency and severity of the El Nino occurrences. They argue that this is different from the norm of El Nino episodes in every 10 to 20 years on average before the 1980s.

In South Africa, the report by the Department of Environmental Affairs called the Long-Term Adaptation Scenarios Flagship Research Programme (LTAS) (2013) made two critical observations in relation to temperature and rainfall patterns in the country. The first observation is that the rate of temperature has varied in the last five decades from 1970s to mid-2000. In 1970s to early 1980s as well as late 1990s to mid-2000, there was high increase in general temperatures in South Africa than in any other period. The second observation is that precipitation, on the other hand, has also shown inter-annual fluctuations sometimes reaching double the national average of 300 mm per year. The above average rainfall was registered in

1970s and late in both 1980s and 1990s. The below average precipitations was experienced in 1960s and early 2000 with normal average registered in 2010. However, according to LTAS (2013), the overall projections for annual precipitation are expected to have a weak variability in future with estimates pointing to a decrease in rainfall days. Van der Bank and Karsten (2020) confirm that in the past five decades, the annual temperature variability has already shown that the temperature has increased with approximately 1.5 times from the normal global average of 0.65 degree Celsius which will negatively affect sectors such as biodiversity, ecosystems, water resources, food security, health, infrastructure and environment. Van der Bank and Karsten (2020) also struggled to show any future changes in the rainfall patterns in their study.

The City of Ekurhuleni, though unique in its geographic location, shows a similar climate pattern as the broader SADC region and the country. It also shows the same increase in natural incidents because of climate change. The Ekurhuleni Metropolitan Municipality Climate Change Response Strategy (2017) acknowledges that in the past few decades there have been a number of studies that studied the Gauteng Province climate variability in terms of temperature and rainfall because of climate change. The city is reported to have an average temperature of 24 degree Celsius and it seldom reaches 30 degree Celsius. The city is in the South African region within which 80% of precipitation is in summer between October and April with an average of 715 mm to 735 mm per year. The cool dry winter is between May to August. The city is inclined to extreme precipitation events sometimes leading to late afternoon thunderstorms. The storms in the city results in heavy rains and major floods occurrences that affect and damage infrastructure and livelihoods. Therefore based on these acknowledgements, it makes sense that a study to assess the disaster preparedness level of the city is undertaken to measure the disaster pro-activeness in this jurisdiction.

### 3.4 Climate related disasters

#### 3.4.1 Global disasters

Globally, climate related disasters (i.e. natural disasters) have been causing havoc in different parts of the world at different intervals. The Centre for Research on the Epidemiology of Disasters (CRED) EM-DAT (2016), in 2015 recorded 346 disasters with 22 773 fatalities which affected 98.6 million people with economic damage of US$ 66.5 billion. Asia topped the continent as the worse affected with 152 disasters, Americas came second with 93 events with Africa taking the third spot with 56 disasters followed, by Europe with 23 events and Oceania at number five with 22 disasters. In the same period, EM-DAT (2016) noted that the distribution of natural disasters in

terms of disaster type indicates that the top four deadliest disasters are floods with 152 reported incidents, followed by storms with 90 events, drought with 32 disasters and landslides with 20 incidents.

The 2019 climate related disasters followed the same pattern with noticeable increase. CRED (EM-DAT) (2020) summarises the occurrences and the impact as follows: there were 396 reported natural disasters with 11,755 deaths out of 95 million people affected across the world. The economic loss was estimated at US$ 103 billion. Again, the top five continents that recorded the most climate related disasters are Asia with 160 events, Africa with 89 events and Americas with 80 disasters, Europe with 57 incidents and Oceania with 10 events. In 2019, the same pattern of the distribution of climate related disasters in terms of disaster type confirmed the top two deadliest disasters as floods with 194 disasters and storms with 90 events.

An interesting observation in the comparison of the two periods of 2015 and 2019 is that there is an increase in the number of people affected by storms and deaths in Africa. CRED (EM-DAT) (2016) states that in 2015 the number of people affected by storms was 10 592 279 with 996 deaths. In terms of deaths Asia took the majority at 71.8%, Europe at 16.4%, Americas at 6.5%, Africa at 5% and Oceania at 0.3%. In 2019, the statistics show that the deaths in Africa are increasing at an alarming rate. CRED (EM-DAT) (2020) mentions that the global distribution of death in 2019 was 45%. There was a sharp decrease in Asia. However, all the other continents showed an increase with Europe seating at 23.4%, Africa at 23.0%, Americas at 8.0% and Oceania at 0.6%. The death toll and the number of people affected by storms doubled recording 2525 deaths and 32.2 million people affected.

When comparing the global climate related disasters for 2015 and 2019, the results confirm that Africa, same as the whole world, is experiencing a sharp increase in the incidents of deaths.

### 3.4.2 South African disasters

According to Davis-Reddy & Vincent (2017), the Southern African Development Community (SADC) during the past four decades (i.e 1980 to 2015), experienced a surge in climate related natural disasters such as floods, droughts, wildfires and storms. During this period, the recorded climate related disasters were 491 in the region with 110 978 deaths or 67% of natural disasters' deaths. In the same period because of climate related disasters an estimated 140 million people were affected with 2.47 million of them left destitute. The majority of people approximately 1.7 million were left homeless by storms with the remainder caused by floods. Moreover, infrastructure was damaged and communities lost their livelihoods. The South African insurance

industry in the 2013 and 2014 financial year paid over R1 billion in claims. The overall economic damage in terms of recovery and rehabilitation to the region is estimated at 10 million US dollars.

The year 2015 was significant for South Africa in terms of climate related disasters. The country, according to CRED) EM-DAT (2016), featured in the top ten countries that had the most affected persons because of natural disasters. The country had 2.7 million people that were affected by these disasters and had economic damage of US$ 2.2 billion. These economic costs and human distress justifies the need for proactive disaster management measures such as disaster preparedness.

The November 2015 climate related hailstorm disaster in the City of Ekurhuleni was by no means a coincident but a possible disaster risk due to prevailing conditions. During spring and specifically in November the city has a greater chance of experiencing some kind of hailstorm. The difference from year to year might be the magnitude and the direct consequences of that occurrence. Simpson and Dyson (2017) confirm that severe weather in the form of heavy rainfall and hail are common in the Highveld area of Gauteng during the month of November. Historically the indications can be traced from 1 November 1985, Pretoria experienced one of the worst hailstorm disasters and the four most recent ones took place across the Highveld between 2007 and 2013.

South African weather service climate records confirmed severe weather in the form of heavy rainfall and hail in the months of November from 2011 to 2015 in Gauteng. This was despite the below normal rainfall over the Highveld in the same period. The key observations made by Simpson and Dyson (2017) from South African weather service weather stations is that between 1977 and 2013 there was 135 days in November with rainfall surpassing 50 mm in a 24 hour period at a Gauteng weather station. In November 200, weather stations in the province recorded the highest number of days with rainfall exceeding 50 mm in a 24-hour period. November had the highest daily rainfall of 200 mm that fell on the far southern parts of Gauteng on 26 November. The months of November generally record a monthly average of between 80 and 100 mm, which sometimes increases to 150mm rainfall over Gauteng eastern escarpment. The eastern escarpment is where the City of Ekurhuleni is located. This justifies the need for the city to have a solid disaster preparedness programme in place.

### 3.5 Disaster preparedness programme

Generally, Sutton and Tierney's (2006) and Kent (1994) disaster preparedness frameworks have some seminaries but they are using different labels to refer to their framework components. What came out of the two frameworks were the four critical themes of good disaster planning regime;

effective early warning systems; proper and adequate response mechanisms; and effective public education and training programmes. A good disaster programme should strongly exhibit the four critical elements without necessarily undermining the other five elements of the disaster preparedness framework as captured by Kent's (1994) disaster preparedness framework. These four critical elements were captured in the following sub-objectives of this study:

- Good disaster planning regime;
- Effective early warning systems;
- Proper and adequate response mechanisms; and
- Effective public education and training programme.

A good disaster-planning regime cannot be over-emphasized for a successful disaster preparedness programme. Kent (1994) states that disaster planning is the most important element in the disaster preparedness framework that runs through all the other eight elements of the model as a binding strip. Sutton and Tierney (2006) confirm that disaster planning is about setting clear goals and objectives as well as clarification of roles and responsibilities for internal and external stakeholders for future disaster response. Besides, the consideration of internal policies, relevant legislation and structures for disaster management, good disaster planning naturally involves mutual aid agreements that are formal or informal to ensure an effective, coordinated response (McEntire & Myers, 2004). Most importantly, a good disaster planning regime for disaster preparedness considers community vulnerability assessment which informs the whole planning process and governance.

The second crucial element in a good disaster preparedness programme is an effective early warning system not just any warning system. Kent (1994) recognises that there is trust deficit between the community and the authorities, which could render the early warning system ineffective. However, when the early warning is trusted and proven effective, it has the potential to save lives; hence it is also central in disaster preparedness. Kapucu (2008) acknowledges that for the early warning to be effective it has to have a combination of scientific and social factors for monitoring and detection with the purpose of notifying the communities at risk. Furthermore, it has to integrate communication processes to the communities at risk based on scientific, managerial, technological and social components as capabilities. Most importantly, the early warning has to be for prevailing and relevant disaster risks in the areas to be effective.

By its nature, disaster preparedness acknowledges that a disaster will occur at an unspecified time. However, it does also advocate for proper and adequate disaster response mechanisms. Tierney (1993) and Kent (1994) concur that disaster response mechanisms are vast and can include all the activities taken to deal with the actual or threat of the hazard impact. While there are many disaster response mechanisms, disaster response includes multiple agencies, resources and information sharing. Janssen, Lee, Bharosa and Cresswell (2009) admit that when disaster strikes many organisations with different capabilities immediately respond to the disaster. Disasters by their nature generate huge amount of information. Therefore, the most important thing under such conditions is the ability to collect and disseminate the correct information to the relevant stakeholders and role-players. The ability to coordinate a multi-agency and to share correct information is crucial. That ability requires planning prior to any disaster and testing measures to ensure adequacy to save lives and property. Tierney (1993) and Kent (1994) agree that disaster response mechanisms should include routine acts of saving life and property to the complex activity of providing humanitarian relief, evacuation, providing emergency reception centres and shelters, damage assessment, debris removal, search and rescue, medical care and mass care during the post-impact emergency period.

The last crucial element of a good disaster preparedness programme is an effective public education and training programme. According to Ritchie (2012: 109), the value of effective public education and training programme is in the fact that people are playing a "…*crucial role in disaster reduction as government or non-governmental organisations, private business sectors or the community. Therefore, it is important that they are aware of, and are trained and helped in their efforts to fulfill their responsibilities*." Hoffmann and Muttarak (2017) point out that there are many providers of disaster educational programmes and emergency training to raise awareness, increase resilience and preparedness. These providers can provide either formal or informal programmes as non-governmental organisations or governmental institutions.

### 3.6 Summary

The chapter sketched the causes of climate change globally and its effects in the context of LDCs as per the Intergovernmental Panel on Climate Change Fifth Assessment Report Work Group II (IPCC AR5 WGII: 2014). The chapter explored South African climate change status as part of the study area. Global disasters and their impact were discussed before looking into South African disasters, especially in the City of Ekurhuleni. Lastly, the chapter dealt with the four critical elements of a good disaster preparedness programme to attend to the likelihood of future disasters

# CHAPTER FOUR: RESEARCH METHODOLOGY

## 4.1 Introduction

If a research problem inspires research work, the research methodology should be the systematic way to resolve that problem. Kothari (2004) confirmed that research methodology is a scientific way of resolving a research problem using specific procedures or techniques to identify, select, process and analyze the problem utilising special research methods. In this chapter, the proposed research methodology in Chapter 1 is expanded. The chapter outlines the research design, population and sampling, data collection tools and procedures and data analysis undertaken to facilitate the data interpretation in the next chapter. Moreover, the chapter also reports on data validity and reliability, the study limitations and delimitations and the ethical considerations encountered in the study.

## 4.2 Research design

The mixed method research was the research design used to research the problem of the study. The mixed method research design is a combination of both qualitative and quantitative research approaches into a single study (Creswell, 2009; Halcomb & Hickman, 2015; Almalki, 2016). The mix method approach in practice means that both qualitative and quantitative techniques are used to collect data (Babbie & Mouton, 2001; Leedy & Ormrod, 2001).

Qualitative and quantitative data was simultaneously collected and analyzed separately before the process of assimilation and comparison across the two data collection methods took place. This was a process of data treatment at the data analysis stage and convergence, differences, or some combination was determined (Creswell, 2009).

The three reasons for the adoption of the mixed method research were as identified by Almalki (2016) which the first one was to leverage on the benefits of both the qualitative and quantitative approach but again regulate the limitations of both approaches. The second reason was to use the time, the resources and participants' access economically with the aim of increasing the participation response rate in the study. The mixed method research was suitable for the objective of this study, which was to be an applied study and sought to increase the validity and reliability of the research. This was important for the acceptance of this study during academic evaluation. Lastly, it increased the chance of the study's results to be used in policy improvement.

### 4.3 Population and sampling selection

#### 4.3.1 Population

The total population of the study comprised everyone in the areas that were affected by the City of Ekurhuleni's 2015 climate related disaster including the government officials that were involved in the areas to respond to the said disaster. As stated in Chapter 1, a research decision was made to divide the target population into two parts. The first part was to consider only the five hundred and twenty (520) ward committees' members from the eight (8) customer care centre that were affected by the 2015 hailstorm disaster as the total population of the study. In the eight customer care centre, there were fifty-two wards and each ward was comprised of ten ward committee members which translated into 520 members.

Creswell (2009) states that the study may always excludes certain elements of the population that are not of interest to the study. This study excluded the general population and households that resides in the eight (8) affected customer care centres comprised of fifty-two (52) affected wards. The study also excluded three thousand and three hundred and eighty-one (3381) households that were affected by the 2015 climate related disaster. The reason for the exclusion of general population, households and the 3381 directly affected households was twofold as advised by Creswell (2009): The first part was that the researcher was managing the issue of accessibility to the research population. The second part of the reason was that the researcher had to consider the cost that would be required to conduct the research. The extensive nature of possible target population such as the inclusion of the general population, all the households and the 3381 directly affected households required more research resources to access the research population. On the other hand, the choice of including only the 520 ward committees' members from the eight (8) customer care centre affected by the 2015 disaster required less research resources and the access was manageable. Moreover, the choice of the 520 ward committees' members, as a population of interest, was made because of three reasons. The first reason was that the population of ward committee members was composed of both the ward councilors and the elected committee members. The second reason was that the ward committee members could have a recollection of the previous disasters in their areas. The third, and the last, reason was that the sub-group occupied a legitimate municipal structure elected by the community. This meant that the ward committee members existed to fulfill a democratic requirement as per Section 157 of the Constitution of the Republic South Africa and the Section 72 & 73 of the Local Government: Municipal Structural Act, Act No. 117 of 1998.

The second part of the target population was the total number of the all the government officials and non-governmental officials that responded to the 2015 disaster in the city. However, Creswell (2009) advises that the population of interest in the study can exclude some elements of the population. In this regard, the study demarcated only eighty-one City's employed local government officials as a population of interest because of their role in the 2015 disaster. The population of interest had 66 local government officials from all the thirty city's internal departments and 15 disaster management officials directly employed in the Disaster Management Centre in the city. The fifteen disaster management officials did not include this researcher as an employee of city in disaster management. In other words, the study excluded the non-governmental organisations and the government officials from both the provincial and national departments that responded to the 2015 climate related disaster. Alvi (2016) and Kothari (2004), agree that for the purpose of the research and the available resources to the researcher some elements of the total target population can be excluded in the study. The reasons to limit the choice of population of interest to 81 City's employed local government officials was similar to those mentioned under the choice of 520 ward committee members except that in this group employment instead of election was used as a part of the criteria. Moreover, the city's local government officials' involvement with matters of the 2015 disasters not necessary response was also used to identify the population of interest. On the other hand, the inclusion of all the fifteen disaster management officials, as part of the local government officials' population of interest, was informed by their direct responsibility to draft and implement the disaster management plans which included the city's disaster preparedness plans.

Therefore, the population of interest for the study was 601 persons comprising of 520 ward committee members and 81 local government officials from thirty City of Ekurhuleni's internal departments.

### 4.3.2 Sample selection

The study applied a sample design that included both probability and non-probability (i.e. purposive) sampling techniques. Stratified random sampling is the probability sampling technique that was used and purposive (i.e. convenient or deliberate) sampling was the type of non-probability sampling utilised in the study.

The stratified random sampling method was used to select both the hundred and four (104) ward committee members and the thirty (30) government officials who filled in the questionnaire. The stratified random sampling technique was adopted with a complete understanding of its

disadvantages, which is that it needed more effort, time consuming and demanding in terms of resources if the sample size is too large (Welman & Kruger, 1994). To satisfy the research principle of proportional representative or the allocation of comparative samples within each strata during the random sampling, the following technique was applied.

From the population of 520 ward committee members, one hundred and four sample was selected using the random technique. However, firstly a decision was made to allocate an arbitrary twenty percent to limit the envisaged participants in the sub-group. The twenty percent if applied in the eight customer care centres with fifty-two wards of 10 ward committee members each translated into two participants per ward. The reason to apply arbitrary 20% to randomly select the 104 population sample was based on the fact that not everyone was expected to participate in the study. Moreover, a reasonable decision to limit the number of participants had to be made by the researcher considering the researcher's available resources and access to participants (Kothari; 2004). The second decision was to adopt the lottery technique to randomly select the 104 participants from the ward committee members' sub-group.

In apply the lottery technique, the first step was to receive the latest list of all City of Ekurhuleni ward committee members allocated per ward from the City of Ekurhuleni legislature to verify the authenticity of the participants. The second step was to use the fifty-two (52) ward councillors in the 52 affected wards to select any two (2) ward committee members as participants as long as they are recognised by the City of Ekurhuleni legislature. This means that for each of the fifty-two (52) affected wards two (2) participants were selected using each ward councillors as the conductors of the raffle in their wards to arrive at one hundred and four (104) participants.

From the 81 local government officials, the sampling of 45 local government officials was based on the number of departments in the city which was 30 internal departments and included the fifteen (15) disaster management officials in the city. In the sub-group, the stratified random sampling technique was used to select 30 local government officials from the identified total of 66 internal department local government officials whilst the fifteen (15) disaster management officials in the city were automatically selected using purposive sampling to make the total number of forty-five local government officials. The following procedure was used in the random selection of the thirty City of Ekurhuleni's internal department's participants:

- The first step was that each City's internal department was allocated one chance of selection in the study. This meant that only one representative was selected to represent one department which translated into 30 local government officials;

- The second step was to select the attendance registers of the 2015 Hailstorm Declared Disaster Joint Operation Centre meetings from 17 November 2015 until the end of September 2016 to select the sample. The attendance registers were sourced from the City of Ekurhuleni Disaster Management Centre in the department called Disaster and Emergency Management Service (DEMS);
- The third step was for the researcher to identify a representative of the internal departments using the randomly selected attendance registers of the 2015 Hailstorm Declared Disaster Joint Operation Centre meetings from 17 November 2015 until the end of September 2016 to group the officials in terms of their respective thirty (30) departments. From all the attendance registers, 66 internal department officials were identified;
- The fourth step was for the researcher to conduct the lottery using the attendance registers. The principle of the lottery was to select all officials per their departments in terms of their attendance of meetings. The second principle was that in the case of a specific department having a single participant in the meetings that government official was automatically selected. The third principle was that in the case of a specific department having two or more participant in the meetings with equal participation a draw would be conducted. The fourth principle was that in the case of a participant no longer being employed in the municipality that participant would be excluded from the sample and the next one would be chosen. Lastly, for the departments that never attended the 2015 Hailstorm Declared Disaster Joint Operation Centre meetings or did not have a representative in the meetings, the employment records would be used for the selection of the participant using a ruffle.

As stated, the fifteen (15) disaster management officials in the city were selected using purposive sampling technique to bring the number of local government officials to forty-five (45). The intention was to include in the study a particular paradigm of interest i.e. the fifteen (15) disaster management officials and their ease of access (Kothari, 2004). The City of Ekurhuleni's practitioners in the Disaster Management Centre excluding the researcher comprised fifteen (15) disaster management officials. The proportional allocation of ward committee members and government officials' participants was important to make sure that every element of the population had an equal chance to participate in the study without any bias to one group (Welman & Kruger, 1994; Visser et al, 2000; Ritchie & Lewis, 2003).

Purposive sampling technique was used to sample groups in the interviews. In literature, the non-probability sampling technique compared with probability sampling is explained as a technique that does not use randomly selected elements of the study to create a representative population sample. It lessens the probability of certain elements in the study's population from being selected. Furthermore, selection probability in non-probability is zero, while in probability sampling the chances of selection from the research population is known (Visser et al, 2000; Ritchie & Lewis, 2003). Ritchie and Lewis (2003: 78) explain the non-probability sampling by stating that… "*Qualitative research uses non-probability samples for selecting the population for study. In a non-probability sample, units are deliberately selected to reflect particular features of or groups within the sampled population*." Therefore, the second groups of ward committee members and government officials' sub-groups were selected using purposive sampling technique. As part of the ward committee members' sub-group, the ward councillors were purposively included in the study using their convenience or availability for the interviews. The same tactic of convenience or availability was implemented to include the managers and senior managers, as part of the local government officials, in the City of Ekurhuleni's internal departments but with the exclusion of employees directly employed as disaster management officials. In essence, a deliberate strategy to include the identifiable subgroups within the two participants' groups i.e. ward committees and government officials was implemented. Ritchie et al (2003) endorsed purposive sampling when they confirmed that the members of the stratified purposive sample are chosen deliberately with the aim to represent a particular key criterion viewed as important by the researcher and any diversity that might exist in the research population but with a fair commonality to enable comparing of subgroups. Therefore, the reason interviews sub-groups were included was to select people that knew and or had personal experience of municipal systems and disaster management in the City of Ekurhuleni.

The sample size in the purposively sampled sub-groups for interviews was kept at forty-nine (49) participants for both the ward committee members (i.e. ward councillors) and government officials (i.e. managers and senior managers). The selection was done using the same source list from the Municipal (City) Legislature Department for the ward councillors as part of the ward committee members. Employment records were used for the managers and senior managers as part of the local government officials. According to Welman & Kruger (1994) it is necessary for proportional representation in the sub-groups to balance the outcomes. In this regard, the study selected a sample of ward councillors in the population of five hundred and twenty ward committee members applying an arbitrary 5% principle which translated into twenty-six ward councillors (i.e. 26 participants). In the government officials' sub-group, an arbitrary 28% was applied to the initial

population of 81 which translated into twenty-two point six (22.6) and was rounded off to the nearest denominator i.e. twenty-three (i.e. 23 participants) managers and senior managers. The number was kept just below fifty (50) participants as recommended by Ritchie et al (2003) who advocates for the cut-off point to be 50 participants and Hancock et al (2009) who advises on a range of twenty (20) to sixty (60) participants for good comparison of different results. Importantly, the 49 participants from both the ward committee members and the government officials' sub-groups were first identified through the researcher's deliberate selection based on the participants' knowledge of disaster management in the city. Secondly, the researcher used convenience sampling to select the participants.

As alluded in Chapter 1, the combined figures of participants for both the administered questionnaire and interviews in the mixed research method that were approached in the study was one hundred and ninety-eight (198) participants. Table 4.1 and 4.2 below simplified the research sampling above in terms of the research groups, target population, sampling process and the sample size for both the questionnaire and interviews.

Table 4.1: Questionnaire research sampling

| Research Questionnaire | | | |
|---|---|---|---|
| **Group One** | **Target population – sub-group** | **Sampling process** | **Sample size** |
| **520** ward committee members represents all the community members including the 3381 affected households. Each ward of the eight wards affected has ten members of the ward committees which translates into 520 ward | **520** ward committee members | - Stratified random sampling;<br>- An arbitrary twenty percent 20% of participants was selected from the total number of from 520 ward committee members.<br>- Selection will be based on the lottery technique | **104** ward committee members as research participants. |

| | | | |
|---|---|---|---|
| committee members. | | using the ward councilors, and<br>- Confirmation of the participants using the Municipal (City) Legislature ward committee registration list. | |
| **Group Two** | **Target population – sub-group** | **Sampling process** | **Sample size** |
| **81** government or city officials | 66 government or city departmental officials | - *Stratified random sampling*;<br>- Arbitrary one (1) representative per department which translated into 30 participants;<br>- Selection will be based on the lottery technique using the researcher; and<br>- The lottery is based on the 2015 climate related disaster randomly selected meetings' attendance registers for JOC. | 30 government or city officials as research participants. |

| | | | |
|---|---|---|---|
| | 15 government or city officials | - *Purposive sample*<br>- All the 15 disaster management officials included in the study. | 15 government or city officials as disaster management officials |

Source: Researcher's Design. 2019

Table 4.2: Interviews research sampling

| Qualitative Research | | | |
|---|---|---|---|
| **Group One** | **Target population – sub-group** | **Sampling process** | **Sample size** |
| **520** ward committee members representing 3381 affected households i.e. the elected members of a community political structure. | **520** ward committee members | - *Purposive sample*;<br>- Arbitrary five percent (5%), and<br>- Convenience or availability for the interviews | **26** ward committee members as research participants. |
| **Group Two** | **Target population – sub-group** | **Sampling process** | **Sample size** |
| **81** government or city employed officials i.e. thirty (66) internal government departments' representatives plus fifteen (15) Disaster Management Centre officials. | **81** government or city officials | - *Purposive sample*;<br>- Arbitrary twenty-eight percent (28%); and<br>- Convenience or availability for the interviews | **23** government or city officials. |

Source: Researcher's Design. 2019

### 4.4 Data collection tools

The study, generated the data by using two data collection tools. The first data collection method was used to collect data through administered structured questionnaires to the identified sample of hundred and four (104) ward committee members in the communities and (45) forty-five government officials. The second data collection tool that was employed in the study was to conduct physical or virtual interviews based on the interview guide designed along the same structure of the administered research questionnaire. The interviews were conducted with forty-nine (49) participants from both ward committee members (i.e. ward councillors) and government officials (i.e. managers and senior managers). The reason for the similarities in the administered questionnaire and the interview guide is discussed in the data analysis section. However, the physical interviews were conducted at the participants' place of work or at a location that was convenient for them. The researcher made sure that each physical interview adhered to COVID-19 protocols of hand sanitization, wearing of masks and social distancing. Virtual interviews were conducted using the Microsoft Team program. During the interview, the researcher transcribed the participants' responses on the interview guide.

### 4.5 Data collection procedure

The data collection procedure on the questionnaire was administered to the two subgroups in the study differently. For the (45) forty-five city's officials, questionnaires were emailed to all the identified participants. Four procedures were used to increase the response rate regarding the return of the questionnaire. These were follow-up electronic emails, telephone calls, WhatsApp messages and the accidental physical encounter as and when the participants were met to encourage them to submit their completed response. For the hundred and four (104) ward committee members in the communities, the ward councilors were either called, sent a message via WhatsApp or visited personally by the researcher in their respective offices in the different customer care centre's. In both cases, the responses were received either physically or through email from the participants or the ward councilors.

The forty-nine (49) participants who included ward committee members (i.e. ward councillors) and government officials (i.e. managers and senior managers), virtual and physical interview meetings were used. Most of the government officials were interviewed using the Microsoft Team meetings while for some participants' physical meetings were engaged in their offices. The ward councillors were engaged physically for interviews because it was difficult for them to honor virtual appointments. Appointments for interviews were done telephonically before confirmation on the Microsoft Team meetings invite or physically visiting them.

However, in some instances because of the difficultly in have scheduled interviews the researcher resorted to the option of unannounced visits at government officials' offices, ward councilors' customer care centre's offices or at the legislature. For most of the accidental interviews that were secured it was difficult to record the proceedings. This approach was used to increase the respond rate while minimizing the researcher's frustration with the sub-groups. In all the physical encounters, minimum compliance with the COVID-19 regulations of wearing of masks and social distancing were exercised. It must be noted that because of social distancing while recording proceedings, the quality of the recordings was sometimes not good but the transcription was a good fallback later on in the data analysis.

### 4.6 Data analysis

The data analysis was done using the computer software called Statistical Package for the Social Sciences (SPSS) with the assistance of an experienced researcher. Welman and Kruger (1994), Howell (1995), Huysamen (1996), and Johnson and Wichern (2007) confirm that computer software such as SPSS with the help of research experts can be used to assist with data analysis. Research data analysis is not easy, especially the research novice, therefore the need for expert assistance. However, even when computer software is used for data analysis the right information has to be collected for correct data interpretation.

Before the data was loaded into the SPSS, there were some data treatment that had to be done. The first data treatment that was done related to the qualitative data i.e. the open-ended questions that were included in both the questionnaire and the interview guide. The data treatment for qualitative data analysis followed the six (6) specific data processing steps that were advised by Creswell (2009). In summary, the researcher first, read and transcribed notes from both the questionnaire and interview guide notes to determine the quality of the information received from the respondents. The researcher then read and determined how the data would be organized and prepared for data analysis. In reading the the questionnaire and interview guide notes, themes were generated using key words. All frequent appearing words were noted and transformed into specific themes, categories and labels. The researcher then grouped multiple themes, categories, and labels into manageable groups. The standard to represent the themes, categories, and labels was presented as numbering values appearing in a scale format such as one (1), two (2), three (3), etc. in the excel spreadsheet. The excel spreadsheet carried the standard description and the numeric values.

The second data treatment that was done related to quantitative data i.e. the close-ended questions that were included in both the questionnaire and the interview guide. This part of the data treatment was easier because the questionnaire and the interview guide had a third section that had a five (5) point rating scale to choose from by the participants. It should be noted that the same numeric values were used in the excel spreadsheet to capture the response from ward committee members. However, for the local government officials, the numeric values in their responses were converted into a higher number on the excel spreadsheet. For example, the local government response of one (1) in the five (5) point rating scale was regarded as six (6) in the excel spreadsheet but still carried the same meaning with one (1) in the scale. This was important to differentiate the responders' (i.e. the ward committee members to the local government officials) feedback in the five (5) point rating scale. At this point, the quantitative data and the qualitative data were ready to be captured in the excel spreadsheet for loading the data into the SPSS computer software to generate data analysis for interpretation.

First, the study carried out data analysis to describe the perceptions of the two sub-groups i.e. ward committee members and government officials based on the questionnaire and repeated the same for the interviews. In the same data analysis, the two sub-groups were also compared in terms of their perceptions on the level of disaster preparedness in the City of Ekurhuleni. The second part, carried out data analysis called inferential technique to explain the descriptive data. Howell (1995: 9) confirms that both the descriptive and inferential statistical technique are required for data analysis to make sense. The last part compared the data collection methods i.e. the administered questionnaire and interviews to establish convergence point or triangulation. In this study, methodological triangulation was employed (also known as multi-method, mixed-method, or methods triangulation), specifically the between or across-method triangulation as explained by Thurmond (2001).

### 4.7 Data validity and reliability

Data validity refers to the extent to which the measurement instrument measures what it intended to measure and data reliability refers to measurement consistency in measuring what is intended (Leedy & Ormrod, 2010).

There were certain processes that were followed to increase the validity and reliability of data in the study. The processes had two strategies. The first strategy contained three approaches that were related to the construction of the data collection tools. The first approach was in the design and structuring of the data gathering instruments (i.e. the questionnaire and the interview guide)

used in the study. The second approach was to use pre-existing data collection instruments to guide the process of developing the questionnaire and interview guide. Welman and Kruger (1994) point out that pre-existing measurement instruments besides suppressing the participants' subjective issues will increase reliability, specifically internal consistency that is the ability to generalise the outcome of the research to the entire population. The third approach used is called peer-to-peer review. Here, the researcher gave the designed questionnaire and interview schedule to another master's student in the same University of Free State programme to review. The second strategy concerned the procedure used to apply the data collection tools. Creswell (2009: 155) points out that the applied procedures together with measurement instruments must be stated prior to the study and documented to give assurance that the conclusions drawn from the instruments are consistent and open for scrutiny. The researcher should strive for trustworthiness, authenticity and credibility in the application and interpretation of the research instruments.

### 4.8 Limitations and delimitations

Academic studies usually have limitations and delimitations. This study had its own limitations and delimitations. Pyrczak and Bruce (2005) described delimitations as thoughtful shortcomings that are built into the study for a particular purpose, while the limitations are the weaknesses that are unforeseen which might affect the validity of the study. If the delimitations and limitations affect the validity of the study this may affect the generalisation of the outcome of the study beyond the studied sample groups. Ethically the researcher has to disclose the embedded limitations and delimitations in the study.

Theofanidis and Fountouki (2019) point out that the delimitations and limitations may arise from the researcher's chosen research design, statistical model constraints, funding constraints, or any other factors associated with the study which may affect the study design, results and ultimately the conclusions. In this study, there were limitations that were noted by the researcher. However, the strategies to rectify the limitations were implemented. Highlighted below are the limitations and their corresponding redress:

- The sampling for the local government officials might be inadequate to draw enough and convincing conclusions for the general population beyond the sampled population (Price & Murnan, 2004). The correct spread of this population sample was supposed to be equal to the number of ward committee members. The equal number of local government officials to ward committee members was impossible since not all the City

of Ekurhuleni internal department officials were directly involved in the 2015 climate related hailstorm disaster. Hence, the researcher included all the disaster management officials in the study as a way to redress the shortcoming. The total number of possible participants who had relevant information was limiting to the researcher and could not be manipulated beyond the stated point.

- The limitation of response rate and access to all the participants was addressed by doubling efforts to receive feedback from the respondents. To improve access, the researcher had to ask for permission to access the participants from both the City of Ekurhuleni Legislature Department and the Office of the City Manager and to use the assistance of ward councillors to access some of the participants especially ward committee members.
- The other limitation was either untruthful responses or lack of understanding of the subject matter. The researcher built a contingency in the design by having both questionnaires and interviews in the same study. Moreover, the researcher conducted the interviews, which was beneficial for clarifying and correcting any misunderstanding of the subject matter.
- The study did not have a readily available measurement instrument. The researcher had to develop a tailor-made questionnaire and an interview guide with the help of a research expert, who was the study supervisor to improve the quality of the measurement.
- The other limitation was the availability of time and resources, which had the potential to distort the study results. The researcher had to go work extra hours and weekends to have enough time to carry out the research. To reach the participants, the researcher had to use unorthodox methods such as accidental meetings and WhatsApp messages to encourage participants to make time for the study.

Authors such as Pyrczak and Bruce (2005) and Theofanidis and Fountouki (2019) also identified the limitations highlighted above. Most importantly, the identified limitations were those that the researcher was aware of and any omission is regarded as an oversight.

The study also had the delimitations deliberately constructed by the researcher to direct the study to its successful conclusion. The delimitations in the study were as follows:

- The first delimitation was the exclusion of all the other climate related disasters and only concentrate on the 2015 disaster. The City of Ekurhuleni had about eight major emergency incidents in the last eleven (11) years with different degree of damages to the areas.

However, researcher chose the 2015 climate related disaster which was the biggest experienced by the city.

- The second delimitation was related to the research population. The study was confined to the ward committee members of the affected communities and the local government officials that might have responded to the 2015 climate related disaster in the City of Ekurhuleni. The demarcation excluded potential participants such as the whole community of the affected areas, the affected households, the non-governmental organisations, the provincial and national government officials that responded to the same disaster. The reason for the delimitation was to control the size of the research population and its sample based on the time and resources available to the researcher.
- The third demarcation was around the intended areas of the study. The study only focused on the areas that were affected by the disaster. The reason was that the researcher expected these areas to be more relevant to the study than areas that were never affected by the same disaster in the city.
- The last delineation was regarding the sample. From the two subgroups that were created based on the parameters of the study i.e. the ward committee members and local government officials, the researcher included all the 15 disaster management officials into the study. The reason was that they would add value in terms of the subject matter because they are directly involved in developing the disaster management plan for the city.

### 4.9 Ethical considerations

Many ethical considerations were taken note of in the study. The ethical considerations that were dealt with in the study are as follows:

- The study avoided any sensitive, offensive and personal questions that had the potential to unsettle the participants or invade their privacy. The questionnaire and the interview guide were strictly directed to the subject of the research, which was disaster preparedness.
- The authority that the participants belonged to, in the community or institution was acknowledged. The researcher before embarking on the study requested and received approval to engage the ward committee members and the City of Ekurhuleni government officials. Permission to conduct the study was received from the City of Ekurhuleni's, to engage city's officials, and the City's legislature department gave approval to approach ward committee members and the councillors. The researcher was also given permission

to use municipal resources and to receive assistance relevant to the fulfilment of the study. Hence, the usage of the ward councillors to select ward committee members as participants and the utilisation of municipal time and resources such as Microsoft Teams for the purpose of this study could not be construed as an ethics bridge.

- As the researcher is a senior manager in disaster management in the city, efforts were made to avoid the manipulation and coercing of participants to take part in the study, especially the staff junior to the researcher. The researcher requested the consent of the participants in writing and verbally where possible before any data was collection. The consent forms were also clear that the study should not be construed as related to the responsibilities of the researcher in the city.
- The participants were also allowed to participate in the study even in instances where they required to remain anonymous. The researcher respected the rights of the participants to remain anonymous at all times. The participants, therefore, had a choice not to identify themselves when they were completing the questionnaires or in the records of the interviews. In the same vein, the researcher guaranteed the participants' confidentiality of the information and the same was clearly stated in the consent form.
- The researcher avoided any actions that may be construed as the falsification of data collected which could have influenced the study's conclusion. The honest character of the researcher guarded against such instances.

Huysamen (1996) and Creswell (2009), advice researchers to be aware of ethical considerations and to treat participants with courtesy and respect at all times. Therefore, the researcher in administering the questionnaires and the interviews was mindful of all the above-mentioned ethical consideration.

### 4.10 Summary

The chapter dealt with the research design, population and sampling, data collection tools and procedures, data analysis that were applied as envisaged in Chapter 1 of this study. Data validity and reliability, limitations and delimitations and ethical considerations encountered in the study were also discussed. The chapter outlined the research strategy that was adopted to arrive at interpretation of data, discussion and conclusion.

# CHAPTER FIVE: RESEARCH DATA ANALYSIS AND RESULTS PRESENTATION

## 5.1 Introduction

This chapter aims to analyse the patterns in the data and to give a logical interpretation of the data. However, it is stated that the purpose of the data presentation should always demonstrate how it links with the research question or the problem statement in the study (Huysamen, 1996). Such presentation could be organized in tables, graphs, charts etc. The presentation below will first give the anticipated figures of the overall participants in both the administered questionnaire and the interviews to indicate planned and the actual response rate. The chapter will outline the results of the administered questionnaire followed by the interview's outcomes. The last part will give a summary of the combined research findings for both data collection methods, which attempt to triangulate the results of the interviews with the outcomes of the questionnaire. The ultimate objective of triangulation, as advised by Creswell (2009), is to determine data convergence, differences, or some combination.

## 5.2. Data presentation on both data collection methods

### 5.2.1 Socio-demographic and economic factors

1. The actual response rate of Ward Committee Members and Government Officials in the study: Table 5.1 below presents the data set or sample consisting of 90 participants that responded to the administered questionnaire belonging from both the ward committee members and government officials. From the participants in the data set, 64% of them were ward committee members and 36% were government officials. Hence, as depicted by the table, 58 participants were ward committee members and 32 were government officials. The same table also presents the data set of interviews consisting of 31 respondents belonging to the ward councillor group as well as government officials. From the interviewed participants in the data set, 55% of them were ward councillors and 45% were government officials. Table 5.1 also shows that 17 participants were ward councillors and 14 were government officials.

In the same table, regarding the administered questionnaire, the planned sampling statistics were 104 ward committee members and 45 government officials which when compared with the actual response rate. The results indicated that 55.76% of ward committee members and 71.11% of government officials responded to the study which was a good response rate. In the same table, on the interviews conducted, 17 ward committee members were equal to 65.38% from the planned sample of 26 participants. On the other hand, 14 government officials were equivalent to

60.86% from the planned sample of 23 participants. Therefore, the results of the interviews conducted also indicated a good response rate.

Table 5.1: The actual response rate – Questionnaire & Interviews

| **Questionnaire** | | | | | **Interviews** | | | |
|---|---|---|---|---|---|---|---|---|
| **Respondents** | **Plan** | **Resp. freq.** | **Resp. %** | **% from Planned** | **Plan** | **Resp. freq.** | **Resp. %** | **% from Planned** |
| **Ward Committee members** | **104** | 58 | 64% | **55,76%** | **26** | 17 | 55% | **65,38%** |
| **Government Officials** | **45** | 32 | 36% | **71.11%** | **23** | 14 | 45% | **60,86%** |
| **Total** | **145** | 90 | 100% | | **49** | 31 | 100% | |

Source: Researcher's Design. 2019

2. The distribution of Customer Care areas from where the ward committees' respondents were recruited:

Table 5.2 below shows the name of the Customer Care Areas that the ward committee members who participated in the both the questionnaire and interviews study were recruited from. Of the 58 (100%) respondents that participated in the questionnaire survey, the majority of them, which is about 24.1% came from Thembisa 1 and Katlehong 1 had 20.7% participants while the lowest number of respondents (3.4%) came from Katlehong 2. The table below also shows that 19% of the participants came from Daveyton, 12.1% from Germiston, 8.6% from Etwatwa and 6.9% from Thokoza, whereas the remaining 5.2% come from Vosloorus. In the interviews, Table 5.2 confirms that the ward councillors' respondents also came from the same areas. Of the 17 (100%) respondents that participated in the interview, the majority of them, which is about 29% came from Etwatwa while the lowest number of respondents (6%) came from Thembisa 1 and Germiston, Daveyton did not have any participants. The Table also shows that 18% of the respondents are from Katlegong 2 and Thokoza, whereas the remaining 12% is from Katlegong 1 and Vosloorus.

From Table 5.2, it is clear that the questionnaire study generated more interest from the Thembisa 1 and Katlehong 1 Customer Care Centres followed by Daveyton. However, in Katlehong 2 there was less interest even when the area is compared to other participants' areas. In the interviews, Etwatwa, Katlehong 1 and Thokoza which had less participants in the questionnaire showed an improved interests from respondents. In conclusion, one can say that at least every areas of the research interest was covered in terms of the participants at different degrees of response from

participants. The significance of the results confirmed that the study did manage to cover all the areas affected by the 2015 disaster at a different degree.

Table 5.2: The areas of respondents – Questionnaire & Interviews

| **RESPONDENTS AREAS** | | | | | |
|---|---|---|---|---|---|
| **Questionnaire** | | | | **Interviews** | |
| **Areas** | **Frequency** | **Percent** | **Cumulative Percent** | **Freq.** | **%** |
| Etwatwa | 5 | 8.6 | 8.6 | 5 | 29% |
| Daveyton | 11 | 19.0 | 27.6 | 0 | 0% |
| Katlehong 1 | 12 | 20.7 | 48.3 | 2 | 12% |
| Katlehong 2 | 2 | 3.4 | 51.7 | 3 | 18% |
| Thokoza | 4 | 6.9 | 58.6 | 3 | 18% |
| Thembisa 1 | 14 | 24.1 | 82.8 | 1 | 6% |
| Germiston | 7 | 12.1 | 94.8 | 1 | 6% |
| Vosloorus | 3 | 5.2 | 100.0 | 2 | 12% |
| **Total** | **58** | **100.0** | | **17** | **100%** |

Source: Researcher's Design. 2019

3. The gender of the Ward Committee sub-group that participated in the study:

Table 5.3 below represents the gender group of ward committee members who participated in the study. Fifty-eight (58) ward committee members participated in the questionnaire study, 36 (62.1%) of the ward committee members were male while 22 (37.9%) were female. In the interviews seventeen (17) ward councillors participated and 14 (82%) were males while 3 (18%) were females. From the presented statistics, it is obvious that men dominated the participation in the study as compared to females.

Table 5.3: The gender of respondents – Questionnaire & Interviews

| **Questionnaire** | | | | Interviews | |
|---|---|---|---|---|---|
| **Gender** | Freq. | % | Cumulative Percent | Total Number | % |
| **Male** | 36 | 62.1 | 62.1 | 14 | 82% |
| **Female** | 22 | 37.9 | 100.0 | 3 | 18% |
| **Total** | **58** | **100.0** | | **17** | **100%** |

Source: Researcher's Design. 2019

4. The age group of the ward committee member's sub-group that participated in the study:

The table below shows the age groups of the ward committee members and councillors in the questionnaire and the interviews. From the 58 ward committee members who participated and completed the questionnaire, the majority of them, which is 74.1%, were in the 36 to 65 years category. Furthermore, 20.7% belonged to the age group of 16 to 35 years and just 5.2% were above 65 years old. Table 5.4 also shows the age groups of the ward committee councillors. From the seventeen (17) ward councillors who participated in the interviews, all of them were between 36 to 65 years. Given that the South African labour law does not allow for children less than 16 years to work, the age considerations started at 16 years going upwards. In the data set, the results show that most of the ward committee members who participated in the study were between the ages of 36 to 65 years category, which is above the youthful age but below the early old age. Few ward committee members were above the age of 65 years.

Table 5.4: The age of respondents – Questionnaire & Interviews

| **Questionnaire** | | | | Interviews | |
|---|---|---|---|---|---|
| **Age** | Freq. | % | Cumulative Percent | Total Number | % |
| **16 to 35 Years** | 12 | 20.7 | 20.7 | 0 | 0 |
| **36 to 65 Years** | 43 | 74.1 | 94.8 | 17 | 100% |
| **Above 65 Years** | 3 | 5.2 | 100.0 | 0 | 0 |
| **Total** | **58** | **100.0** | | **17** | **100%** |

Source: Researcher's Design. 2019

5. The level of experience of ward committee members and government officials in the service of local government:

The bar graph below represents the level of experience for ward committee members and government officials in the questionnaire represented by years of service or level of experience. The majority (77.6%) of ward committee members had 1 to 5 years of experience whilst the minority of the ward committee members (6.9%) had above 10 of experience. The rest of them (15.5%) had 5 to 10 years of experience. The bar graph also shows the level of experience for government officials represented by years of service and experience in the department. The minority (18.8%) of the government officials that were interviewed had 1 to 5 years of experience, whilst the majority (40.6%) of the officials had 5 to 10 and above years of experience. From the

bar graph, one can conclude that most of the government officials had more experience than ward committee members.

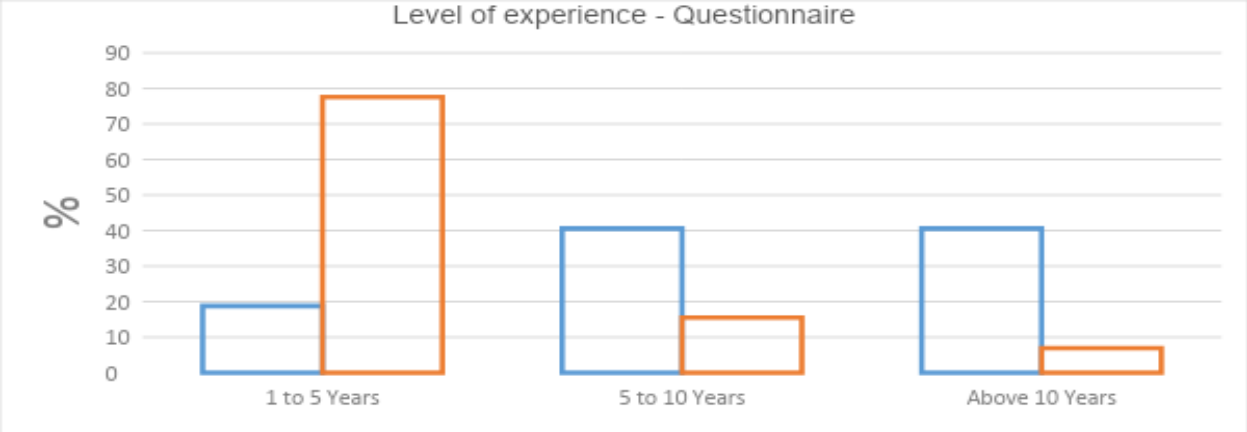


Figure 5.1: Level of Experience – Questionnaire
Source: Researcher's Design. 2019

Table 5.5 below represents the level of experience for government officials and ward committee councillors in the interviews represented by years of service. Of the 14 officials that were interviewed, the majority (86%) of the officials had 5 to 10 years of experience while the minority (14%) of the officials had 1 to 5 years of experience. On the other hand, the nine (9) respondents which is 53% of ward councillors out of 17 (100%) had 1 to 5 years of experience. The minority of the ward councillors, which is 2 (i.e. 12%) had above 10 of experience, while the rest of them (35%) had 5 to 10 years of experience. From the table, one can determine that most of the government officials had more experience than ward committees. In essence, for both the questionnaire and the interviews, the government officials had more experience than the ward committees. The assumption, therefore, is that government officials have more awareness and experience on the local government systems and services compared to ward committees. Again, the level of experience of more than 5 years was important to indicate the possible awareness of the sub-groups of the November 2015 climate related disaster in the city.

Table 5.5: Level of Experience – Interviews

| Years | Government Officials | Perc. | Ward Committee Councillors | Perc. |
|---|---|---|---|---|
| **1 to 5 years** | 2 | 14% | 9 | 53% |
| **5 to 10 years** | 12 | 86% | 6 | 35% |
| **Above 10 years** | 0 | 0 | 2 | 12% |
| **Grand Total** | **14** | **100%** | **17** | **100%** |

Source: Researcher's Design. 2019

6. The level of property ownership represented by house ownership by ward committee members: The table 5.6 represents the ownership of a house in the area of residence by ward committee members. Of the total ward committee members that took part in the study, majority of them (50%) stay in their parents' house and the minority (8.6%) were renting a house. The rest of the ward committee members either owned a house or did not want to specify. From the data analysis, it is clear that the majority of ward committee members in the study lack home ownership. They mostly reside in their parents' house or rented properties, which can be interpreted as a sign of poor background and lack of access to economic resources. Socially, the fact that the majority of ward committee members stay in their parents' houses can be seen as a sign of being born and breed in the areas as well as being the next generation of their areas

Table 5.6: The respondents' property ownership - Questionnaire

| **Property Ownership** | **Frequency** | **Percent** | **Cumulative Percent** |
|---|---|---|---|
| Other or unspecified | 3 | 5.2 | 5.2 |
| Owning the house | 21 | 36.2 | 41.4 |
| Parents' house | 29 | 50.0 | 91.4 |
| Renting the house | 5 | 8.6 | 100.0 |
| Total | 58 | 100.0 | |

Source: Researcher's Design. 2019

7. The assets ownership of the ward committee members

The table below represents the ownership of assets by ward committee members. Of the ward committee members that took part in the study, the majority of them (60.3%) did not want to specify their assets ownership and the minority (3.4%) had extra property. The rest of the ward committee members owned a car. The fact that the majority of ward committee members did not specify their assets, while a good percentage owned cars might suggest that the participants were not comfortable to disclose their assets rather than a lack of assets ownership.

Table 5.7: The respondents' assets ownership - Questionnaire

| **Assets ownership** | **Frequency** | **Percent** | **Cumulative Percent** |
|---|---|---|---|
| Other (None or Unspecified) | 35 | 60.3 | 60.3 |
| Owning a car | 21 | 36.2 | 96.6 |

| | | | |
|---|---|---|---|
| Extra property | 2 | 3.4 | 100.0 |
| Total | 58 | 100.0 | |

Source: Researcher's Design. 2019

8. Household size of ward committee members:

The table below represents the size of ward committee members' households that responded to the questionnaire. Of the total ward committee members that took part in the study, the majority of them (67.2%) had members above 3 but less than 7 and the minority (5.2%) had 12 and above members. From the response, it is clear that most of the respondents came from average families which were not small or large in size.

Table 5.8: The respondents' households' size - Questionnaire

| **Number of Members** | **Frequency** | **Percent** | **Cumulative Percent** |
|---|---|---|---|
| Less than 3 | 11 | 19.0 | 19.0 |
| Above 3 but less than 7 | 39 | 67.2 | 86.2 |
| Above 7 but less than 12 | 5 | 8.6 | 94.8 |
| 12 and above | 3 | 5.2 | 100.0 |
| Total | 58 | 100.0 | |

Source: Researcher's Design. 2019

9. The size of the house owned by the ward committee members in the area:

The table 5.9 below represents the size of the house owned by ward committee members in the area. Of the ward committee members that took part in study, the majority of them (53%) had houses with 3 or more rooms but not above 6 rooms. The minority (9%) did not want to specify the size of their houses. From the response, it is evident that the majority of the respondents owned decent houses, which were not too small or too large compared to the size of the members of their families as expressed in number 8 above.

Table 5.9: The respondents' house sizes - Questionnaire

| **Size of the house** | | |
|---|---|---|
| None or unspecified | 5 | 8.6 |
| Less than 3 rooms | 8 | 13.8 |
| Above 3 but less than 6 | 31 | 53.4 |
| Above 6 but less than 10 | 14 | 24.1 |
| Total | 58 | 100.0 |

Source: Researcher's Design. 2019

10. The ward committee members' main source of household income:

The figure 5.2 below represents the source of income in the household of the ward committee members in the study. Of the ward committee members that took part in the study questionnaire, the majority of them (29%) said their income was from employment and the minority (12%) said they had no source of income. The rest of the ward committee members said their income was from either the government grant (28%) or unspecified (19%). The employment and government social grants are the two major sources of income for ward committee members.

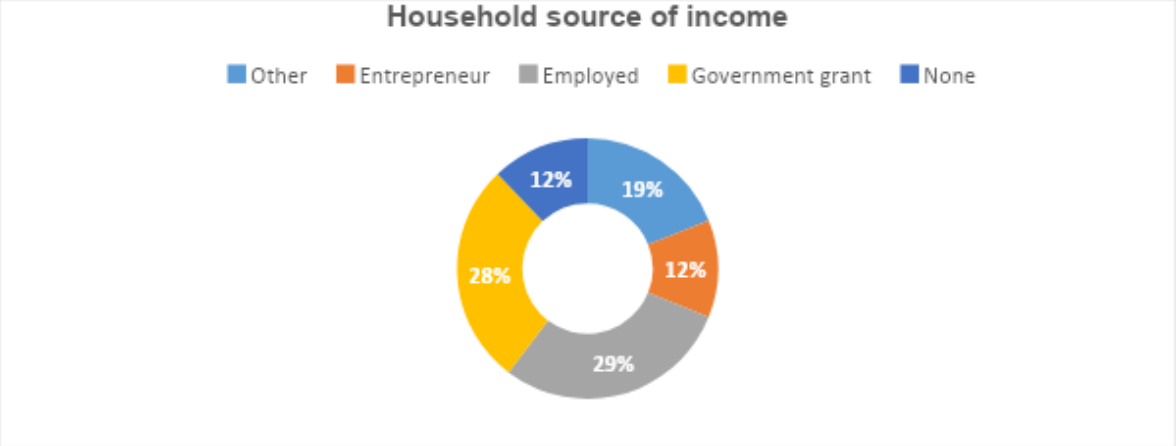


Figure 5.2: The respondents' household source of income – Questionnaire
Source: Researcher's Design. 2019

11. The individual government services that the ward committee members have access to:

The pie chart below represents the individual government services that the ward committee members have access to in the area. Of the ward committee members that took part in the study, the majority of them (43%) had no access to a specific service or did not specify and the minority (10%) had access to sewer. The rest of the ward committee members had access to either electricity (16%) or water (31%). The views of the ward committee members on their access to individual local government services such as water, energy and sewer indicated that they believed that they had no access to a specific service in their areas. This might suggest that the participants had limited access to municipal services. The results indicate that the ward committee members come from the underdeveloped areas of the city.

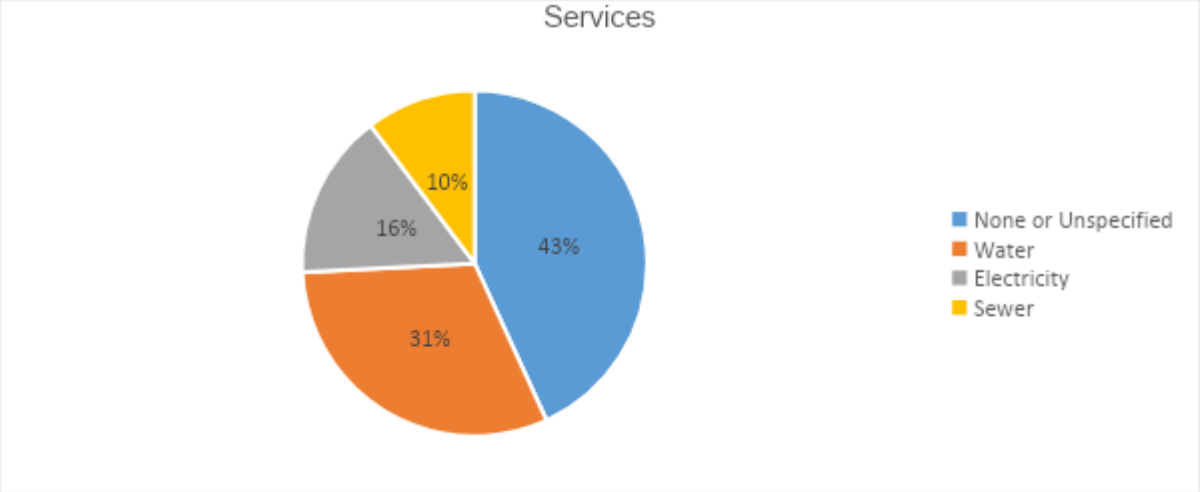


Figure 5.3: Services - Questionnaire
Source: Researcher's Design. 2019 researcher

12. Community access to government services in the area:

Table 5.10 below represents ward committee members and government officials' impression of community's access to government services in the area. Of the ward committee members that took part in the questionnaire survey, the majority of them (51.7%) said they had access to all the services. The minority of ward committee members (1.7%) said they had no access to services at all or they were not sure. The majority of government officials (53%), on the other hand, believed that the community had access to all the services. The minority of government officials (47%) had confidence that the community does have some access to services. The general impression from the majority of ward committee members and government officials was that there were municipal services for communities in their areas.

Table 5.10: The respondents' impression on community's access to services – Questionnaire

| **Ward Committee Members** | | | **Government Officials** | |
|---|---|---|---|---|
| **Service Level** | **Frequency** | **Percent** | **Frequency** | **Percent** |
| Not sure | 1 | 1.7 | 0 | 0 |
| All the service | 30 | 51.7 | 17 | 53% |
| Some of the services | 26 | 44.8 | 15 | 47 |
| None | 1 | 1.7 | 0 | 0 |
| **Total** | **58** | **100.0** | **32** | **100.0** |

Source: Researcher's Design. 2019

13. The knowledge on the existence of disaster management services in government by the respondents:

The table below represents the knowledge of the existence of disaster management services in government by ward committee members in the area. Of the ward committee members that took part in the study, the majority of them (79.3%) had knowledge's about the existence of disaster management services and the minority (20.7%) said there is no disaster management services. Knowledge of the existence of disaster management as part of the local government services is very high from ward committee member respondents in the study.

Table 5.11: The respondents' knowledge of disaster management - Questionnaire

| | **Frequency** | **Percent** | **Valid Percent** | **Cumulative Percent** |
|---|---|---|---|---|
| Yes | 46 | 79.3 | 79.3 | 79.3 |
| No | 12 | 20.7 | 20.7 | 100.0 |
| Total | 58 | 100.0 | 100.0 | |

Source: Researcher's Design. 2019

14. The involvement of ward committee members in disaster management services in the area:

The bar graph 5.4 below represents ward committee respondent's role or involvement in disaster management services in the municipality. The graph demonstrated that most of the ward committee members (58.6%) in the study regarded themselves as supporting role of disaster management in their areas. In addition, few ward committee members (10.3%) in the study were not sure if they were involved in disaster management services in the municipality and the remaining 31% ward committee members believed that they were not involved in disaster management services. The majority of the ward committee members, therefore, believe that they were providing a supporting role to disaster management in their areas, which is a good sign of the acceptability of their role in the implementation of disaster management programmes in the communities.

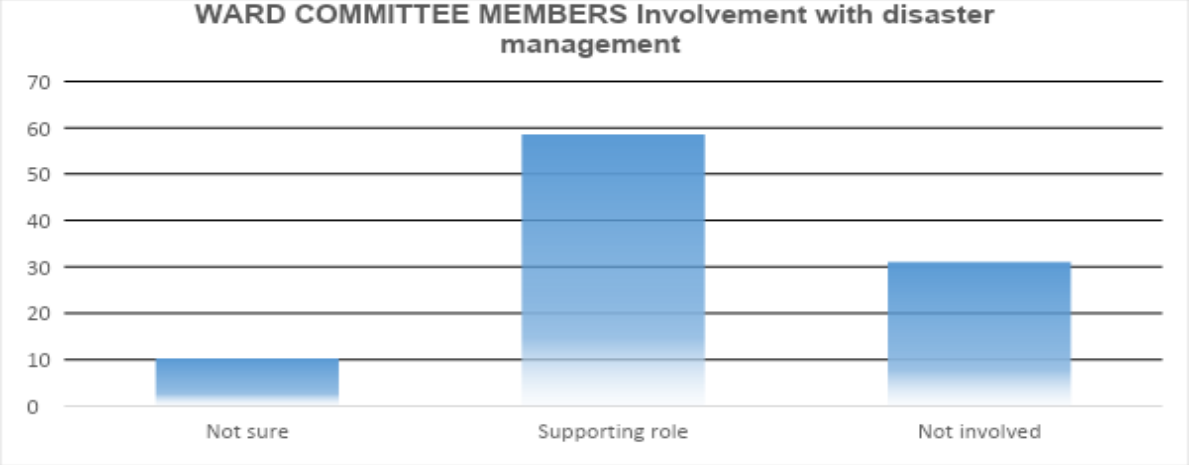


Figure 5.4: Ward Committee Members' involvement with disaster management - Questionnaire
Source: Researcher's Design. 2019

15. The government officials' departmental function having a responsibility in disaster management:

Table 5.12 below represents both the questionnaire and interview study's results in which the government officials' departments have a direct responsibility in disaster management function. Of the government officials that took part in questionnaire study, the majority of them (71.9%) were not directly involved in disaster management function. The minority of government officials (28.1%) were directly involved in disaster management. The table below also indicates that regarding government officials i.e. all 14 (100%) in the interviews were all not in disaster management but worked in other departments in the city. In conclusion, the majority of the government officials that took part in the study were not directly involved in disaster management, which gave assurance that the disaster management officials' bias could not influence the direction of the responses in the study. Depending on the understanding of the subject matter by other government officials from other departments, it could also mean that the quality of the responses may not address what is being investigated in the study.

Table 5.12: The respondents' departmental function relates to disaster management – Questionnaire & Interviews

| **Questionnaire** | | | | **Interviews** | |
|---|---|---|---|---|---|
| **Relate To Disaster Management** | **Freq.** | **%** | **Cumulative Percent** | **Freq.** | **%** |
| Disaster Management | 9 | 28.1 | 28.1 | 0 | 0% |
| Other | 23 | 71.9 | 100.0 | 14 | 100% |
| Total | 32 | 100.0 | | 14 | 100% |

Source: Researcher's Design. 2019

16. The government official respondents' department directly involved with communities:

The table below represents the distribution of government official respondents that are directly involved or not with communities. Table 5.13 depicts the distribution within the sample of government official in the study for both data collection methods. Among the government officials in the questionnaire study sample, 66% believed that their departments were directly involved with communities and the rest 34% said their departments were not directly involved with the communities. In the interviews, of the 14 government officials questioned, nine (64%) officials said their departments were directly involved with communities and the other five (36%) said their departments were not directly involved with the communities. The results show that most government officials believed that their departments were directly involved with the communities. Therefore, the majority of the government officials that took part in study were from the departments that were directly involved with the communities though some minorities were not.

Table 5.13: Officials directly involved with communities – Questionnaire & Interviews

| **Questionnaire** | | | **Interviews** | |
|---|---|---|---|---|
| **Directly Involved with Communities** | **Freq.** | **%** | **Freq.** | **%** |
| Directly - Yes | 11 | 34% | 9 | 64% |
| Not directly – No | 21 | 66% | 5 | 36% |
| **Grand Total** | **32** | **100%** | **14** | **100%** |

Source: Researcher's Design. 2019

17. The government official respondents' seniority in the department and the municipality:

The table below represents government official respondents' seniority in the department and the municipality in both data collection methods. In total, 32 government officials participated in the questionnaire study, the majority 40.6% were low officials while the minority 21.9% were senior managers and 34.4% were managers. Hence, the sample consisted of more officials and few senior managers. In the interviews, from the 14 government officials that were interviewed, 8 (57%) were senior managers, five (36%) were managers, and only one (7%) was an official. In essence, the interviews were able to target the majority of the decision makers in the city in the form of senior manager and managers with the exception of one (i.e. 7%) participant compared to lower officials in the questionnaire study. Overall, the study managed to spread the response fairly to all the possible senior levels of the municipality including lower officials. Therefore, the response was inclusive of both the officials in general and the senior managers, which is also important for the study to get the perceptions of the decision makers on the issues, covered in the study.

Table 5.14: The respondents' seniority in the department – Questionnaire & Interviews

| | | | | |
|---|---|---|---|---|
| **Seniority level** | **Frequency** | **Percent** | **Frequency** | **Percent** |
| **Other** | 1 | 3.1 | 0 | 0% |
| **Senior Manager** | 7 | 21.9 | 8 | 57% |
| **Manager** | 11 | 34.4 | 5 | 36% |
| **Official** | 13 | 40.6 | 1 | 7% |
| **Total** | **32** | **100.0** | **14** | **100%** |

Source: Researcher's Design. 2019

18. The government officials that are directly working in disaster management services:

The table 5.15 below represents government officials that directly work in disaster management services in the municipality. Table 5.15 shows that most of the government officials, 46.9% from those who participated in the questionnaire study, were in a supporting role. In addition, (21.9%) government officials were not involved in disaster management in the municipality, whereas the remaining 31.3% officials were directly working in disaster management services. In the interviews, no disaster management officials were recorded. However, the table displays that two (14%) government officials from the 14 that were interviewed, were not involved with disaster management services in the municipality, whereas the remaining 12 (86%) officials were in a supporting role of disaster management services. Hence, our study sample consists of the majority of government officials who were in a supporting role in disaster management in their respective municipal departments. The majority of the government officials confirmed that they had some responsibility in disaster management services.

Table 5.15: Officials directly involved in disaster management – Questionnaire & Interviews

| **Questionnaire** | | | **Interviews** | |
|---|---|---|---|---|
| **Function Relate To Disaster** | **Frequency** | **Percent** | **Frequency** | **Percent** |
| Directly involved | 10 | 31,3 % | 0 | 0% |
| Supporting role | 15 | 46,9% | 12 | 86% |
| Not involved | 7 | 21,9% | 2 | 14% |
| **Grand Total** | **32** | **100%** | **14** | **100%** |

Source: Researcher's Design. 2019

### 5.2.2 Disaster impact and community reaction

The data collected and analysed from the questionnaire and interviews in this part relates to the description of the prevalent disaster hazards, their severity, impact on people and the

infrastructure. The section also looked at the communities' willingness to relocate from the potential disaster prone areas, their coping capacity and their disaster preparedness measures.

19. The prevalent hazard in the study area according to the respondent's i.e. ward committee members, councillors and government officials:

Table 5.16 below represents the responses by the participants of the questionnaire study when asked which hazard is prevalent in the study area whilst the bar chart 5.5 below represents the respondents in the interviews on the same question. In the Table 5.16 below on the questionnaire, the majority of government officials (40.60%) believed that hazards such storms, fires, floods, extreme weather conditions are more prevalent while the majority of ward committee members (83%) had the impression that storms were more prevalent. In the bar chart 5.5 on the interviews, the majority of government officials (42.9%) believed that fires were more prevalent while the majority of ward committee councillors (35.3%) had the impression that storms were more prevalent. The results demonstrated that government officials had a shifting choice in both the data collection methods, which was between all the hazards including others' not mentioned and fires whilst the ward committees were adamant that the predominant hazard faced by the communities were storms. Interestingly, in the questionnaire and the interviews, the government officials' second prominent choice of prevalent hazards was storms. Besides fires, storms were prevalent in the study area which confirmed the conclusions of the Ekurhuleni Metropolitan Municipality Climate Change Response Strategy (2017) when it recognized that the study area is inclined to extreme precipitation events which leads to late afternoon thunderstorms which resulted in damage to infrastructure and livelihoods.

Table 5.16: The prevalent hazard(s) - Questionnaire

| **Prevalent hazard in the study area - Questionnaire** | **Government officials** | | **Ward committees** | |
|---|---|---|---|---|
| | Frequency | Percent | Frequency | Percent |
| Storms | 7 | 21,90% | 48 | 83% |
| Fires | 5 | 15,60% | 1 | 2% |
| Floods | 5 | 15,60% | 3 | 5% |
| Extreme weathers (cold & hot) | 2 | 6,30% | 1 | 2% |
| Other hazards | 13 | 40,60% | 5 | 9% |

| | | | | |
|---|---|---|---|---|
| Total | 32 | 100% | 58 | 100% |

Source: Researcher's Design. 2019

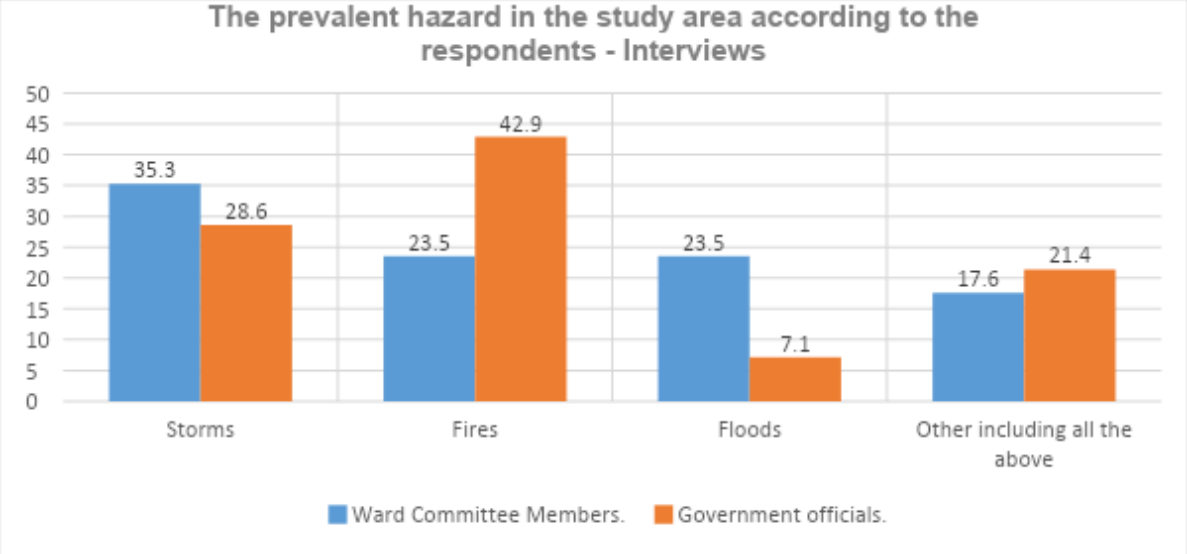


Figure 5.5: The prevalent hazard(s) - Interviews
Source: Researcher's Design. 2019

19.1 The reasons for the prevalence of a specific hazard in the study area according to the respondents i.e. ward committee members, councillors and government officials:

Table 5.17 below presents the reasons for the prevalence of a specific hazard in the study area according to the respondents in both the data collection methods. In the questionnaire, the majority of both ward committee members (51.7%) and government officials (53.1%) could not specify the reasons for the prevalent hazards in the study area. However, the second highest scores for both the ward committee members (29.3%) and the government officials (25%) showed that both sub-groups believe that the reason for the prevalence of the hazards in the study area is seasonal. In the interviews, the table depicted that the majority of government officials (50%) believed that the prevalence of a hazard was because of the extent of damage, while the majority of ward committee councillors were divided equally into three parts at 29.4% with the beliefs to be either seasonal, bad infrastructure and no service, or all seasons and severity.

The results show that the views of the participants on the reasons for a prevalent hazard(s) were divergent in both data collection methods. They ranged from no reason, extensive damages, seasonal, bad infrastructure or all seasons. Despite the fact that most of the participants were not in agreement on the reasons for the prevent hazard, the choice of all seasons might be related to fire hazard, as identified by government officials. Whilst, the reason that hazard(s) are seasonal with extensive damages confirm the contention by Simpson and Dyson (2017) who stated that

some hazards such as heavy rainfall and hailstorms were seasonal and common in late spring causing a high degree of damage. They also state that such seasonal hazards with related damages are most frequent during the months of November, in the Highveld area of Gauteng which covers the study area.

Table 5.17: The reasons for the prevalent of hazard(s) – Questionnaire & Interviews

| | **Questionnaire** | | | | **Interviews** | | | |
|---|---|---|---|---|---|---|---|---|
| **Reasons** | **Ward committees** | | **Government officials** | | **Ward committees** | | **Government officials** | |
| | Freq. | % | Frequency | % | Freq. | % | Frequency | % |
| Seasonal | 17 | 29.3 | 8 | 25 | 5 | 29.4 | 4 | 28.6 |
| All seasons and severity | 1 | 1.7 | 0 | 0 | 5 | 29.4 | 1 | 7.1 |
| The extent of damage | 3 | 5.2 | 2 | 6.3 | 2 | 11.8 | 7 | 50 |
| Poor victims | 1 | 1.7 | 1 | 3.1 | 0 | 0 | 1 | 7.1 |
| Bad infrastructure and no service | 6 | 10.3 | 4 | 12.5 | 5 | 29.4 | 1 | 7.1 |
| No reasons | 30 | 51.7 | 17 | 53.1 | 0 | 0 | 0 | 0 |
| **Total** | **58** | **100.0** | **32** | **100.0** | **17** | **100.0** | **14** | **100.0** |

Source: Researcher's Design. 2019

20. The severity of the hazard in the study area according to the respondents:

Table 5.18 below represents the severity of the hazard in the study area according to the respondents in both data collection methods. In the questionnaire, of the government officials and ward committee members that participated in the study, majority of them, i.e. 62.5% and 67.2% respectively, said the severity of the hazards were moderate. Table 5.18 also showed that in the interviews from the government officials and ward committee that participated in the study, the majority of them, i.e. 85.7% and 58.8% respectively, said the severity of the hazards in the study area were extreme. In general, the majority of the participants agreed that the study area was exposed from moderate to extreme hazards, which were both high. The difference in the perception of the exposure might be related to the observation of CRED (EM-DAT) (2016) which declared that there is an increase in the number of people affected by climate related disasters, deaths, infrastructural damages and economic losses. The variant view might also be based on the respondents' personal perception and encounter with disaster hazards.

Table 5.18: The severity of the hazard – Questionnaire & Interviews

| | **Questionnaire** | | | | **Interviews** | | | |
|---|---|---|---|---|---|---|---|---|
| **Severity** | **Ward committees** | | **Government officials** | | **Ward committees** | | **Government officials** | |
| | Freq. | % | Frequency | % | Freq. | % | Frequency | % |
| Extreme | 12 | 22.4 | 9 | 28.1 | 10 | 58.8 | 12 | 85.7 |
| Moderate | 40 | 67.2 | 20 | 62.5 | 6 | 35.3 | 2 | 14.3 |
| Less exposed | 4 | 6.9 | 3 | 9.4 | 1 | 5.9 | 0 | 0 |
| Not Exposed | 2 | 3.4 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Total** | **58** | **100.0** | **32** | **100.0** | **17** | **100.0** | **14** | **100.0** |

Source: Researcher's Design. 2019

20.1 The reasons for the severity of the hazard in the study area according to the respondents:

Figure 5.6 and 5.7 below represents the reasons given by the respondents for the severity of the hazard in the study area. In figure 5.6 on the questionnaire, of the total respondents, the majority of the government officials (40.6%) believed the reason to be that some areas are vulnerable due to their location while the majority of ward committee member (46.6%) believed the reason to be other than the ones mentioned. In figure 5.7 on the interviews, the majority of government officials and of ward committee councillors, 50% and 29.4% respectively, had the impression that the reason could be that some areas are vulnerable due to the location.

In both data collection methods, there was consensus that the reasons for the severity of the hazard(s) impact were that some areas were located in vulnerable areas. In addition, there was some deviation from the ward committee members in the questionnaire study who mentioned that other reasons could be attributed to severity of the hazard impact in the study area. In this response, there were few interesting reasons given by the respondents. For example, in the questionnaires, the first interesting response from the ward committee members was that *"The municipal disaster management is well equipped to deal with any disaster"*. The second interesting response was *"Disaster hazards at the most are caused by householders stealing electricity such as illegal connections. Floods caused by poor storm water drain."* Thirdly, the interesting by divergent response was *"Enforce by-laws and avail policing on the ground because we are experiencing criminality".* To support the view that the severity of hazard(s) was because some areas were located in vulnerable areas, one of the government officials from Human Settlement in the interviews lamented the number of informal settlements in the city without proper layout plans and lack of resources to address the backlog of houses. In paraphrasing, he said,

*"The city has 119 informal settlements spread across all the regions which are informally built on unsafe lands such over the mineshafts, mine dumps, etc. without proper environmental impact assessment studies or approved township layout plans. Mostly, when there are shack fires or any disaster in these areas the city does not have enough resources and budget to rebuild or relocate the communities to the already constrained number of RDP houses".*


Figure 5.6: The reasons for severity of the hazard – Questionnaire
Source: Researcher's Design. 2019

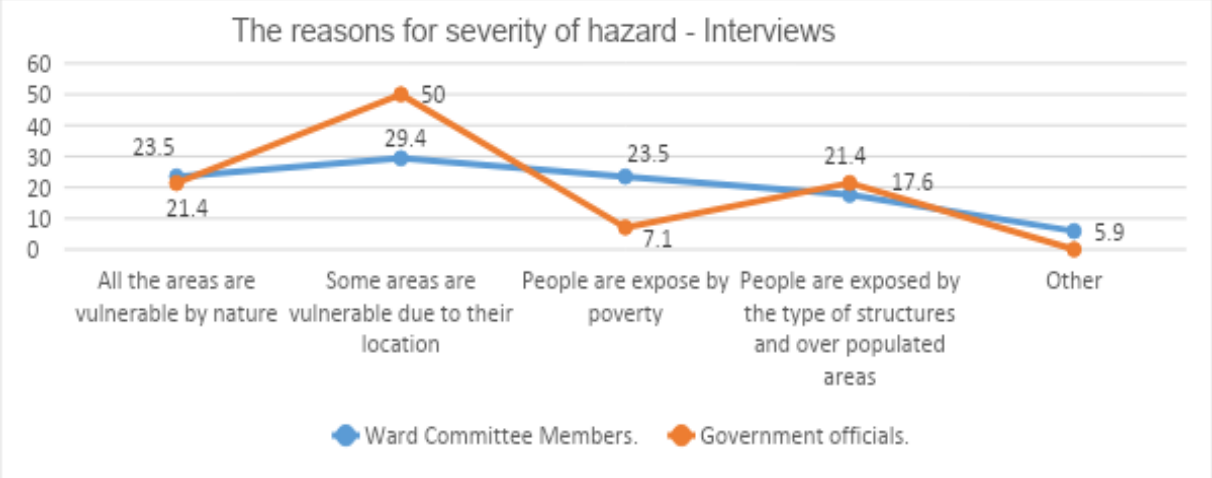


Figure 5.7: The reasons for severity of the hazard – Interviews
Source: Researcher's Design. 2019

21.The impact of the hazard in the study area according to the respondents:

Table 5.19 below highlighted the existence of the impact of the hazard in the study area from both data collection methods. In the questionnaire, the majority of ward committee members (91.4%) that participated said the impact of the hazard exists and the minority of 8.6% said the impact does not exist. The majority of the government officials (93%) said the impart of the hazard exists while the remaining 6.3% said that the impact does not exist. In the interviews, from all the ward committee councillors that participated, 94.1% of them said the hazard impact does exist and 5.9% said the impact does not exist. On the other hand, all government officials (100%) who participated in the study's interview believed that the impact of the hazard exists.

In both the data collection tools there was a strong convergence from the majority of participants that confirmed that there was a disaster hazard impact in the study area. The majority views also collaborated Bank & Karsten (2020) who stated that in the past five decades' weather related disasters have negatively affected sectors such as biodiversity, ecosystems, water resources, food security, health, infrastructure and environment.

Table 5.19: The impact of the hazard – Questionnaire & Interviews

| | **Questionnaire** | | | | **Interviews** | | | |
|---|---|---|---|---|---|---|---|---|
| **Impact** | **Ward committees** | | **Government officials** | | **Ward committees** | | **Government officials** | |
| | Freq. | % | Frequency | % | Freq. | % | Frequency | % |
| Does the impact exist - Yes | 53 | 91.4 | 30 | 93.8 | 16 | 94.1 | 14 | 100 |
| Does the impact exist - No | 5 | 8.6 | 2 | 6.3 | 1 | 5.9 | 0 | 0 |
| **Total** | **58** | **100.0** | **32** | **100.0** | **17** | **100.0** | **14** | **100.0** |

Source: Researcher's Design. 2019

21.1 The reasons for the impact of the hazard in the study area according to the respondents:
The table below presents the reasons for the impact hazards in the study area. In the questionnaire, of the total respondents, the majority of the government officials (31.3%) believed the reason to be that some areas are impacted and vulnerable due to their location while the majority of ward committee member (29.3%) believed the reason to be other than the ones mentioned. In the interviews, the majority of the government officials (35.7%) believed the reason to be that some areas are impacted and vulnerable due to the structures and over populated areas while the majority of ward committee councillors (35.3%%) believed the reason to be the same.

During data analysis, the convergence of the reasons was established in the interviews in which both the ward committee councillors and government officials agreed that the hazard(s) impact was because people were vulnerable due to their structures and overpopulation. However, the questionnaire response indicted divided opinions from the ward committee councillors and government officials. In summary, there were some generic reasons that were given by the participants. It might be because the respondents were somehow area specific in their response hence, some diversity in the questionnaire. For example, one of the ward committee members said *"The area is affected because of lack of trees"* and one government official said, *"The area is normally affected because roads get damaged and people lose their homes".* In support of this view that communities were vulnerable and exposed by the type of their house structure and overpopulation, one ward committee councillor said that "*Although there is congestion in the informal settlements, our people are not allowed to create space in between of the shacks because the municipality wants to re-block the areas on its own".*

Table 5.20: The reasons for the impact of the hazard – Questionnaire & Interviews

| **Reasons** | **Questionnaire** | | **Interviews** | |
|---|---|---|---|---|
| | **Ward committees** | **Government officials** | **Ward committees** | **Government officials** |
| | **%** | **%** | **%** | **%** |
| Other | 29.3 | 28.1 | 5.9 | 7.1 |
| People are impacted & vulnerable because. of structures & overpopulation | 22.4 | 12.5 | 35.3 | 35.7 |

| | | | | |
|---|---|---|---|---|
| People are impacted & vulnerable because of poverty & unemployment | 5.2 | 9.4 | 5.9 | 14.3 |
| Some areas are impacted & vulnerable due to location | 23.9 | 31.3 | 23.5 | 21.4 |
| All areas are impacted & vulnerable by nature | 17.2 | 18.8 | 29.4 | 21.4 |
| **Total** | **100** | **100** | **100** | **100** |

Source: Researcher's Design. 2019

22. The impact of the hazard on the infrastructure and people's shelter in the study area according to the respondents:

The table below represents the impact of the hazard to the infrastructure and people's shelters in the study area in both the data collection tools. In the questionnaire, of the government officials and ward committee members that took part in the study, the majority of them (84.4%) and (84.5%), respectively, confirmed that the impact affects the infrastructure and people. In the interviews, the government officials and ward committee councillors, the majority of them (93%) and (82%), respectively, confirmed the impression that the impact affects the infrastructure and people. The data analysis in both the data collection tools indicated that unanimously the majority of both government officials and ward committees believed that the impact of disaster hazard was felt on the infrastructure and people. The views of the participants confirm the observation that SADC during the past four decades (i.e.1980 to 2015) has experienced an increase in climate related natural disaster such as floods, droughts, wildfires and storms. It also, recorded the highest impact with regard to damage to infrastructure and peoples' shelters, sometimes leading to peoples' deaths, destituteness, loss of livelihood and economic damage (Davis-Reddy & Vincent, 2017).

Table 5.21: The impact of the hazard on infrastructure and people's shelter – Questionnaire & Interviews

| **Impact affects infrastructure & people's shelter** | **Questionnaire** | | | | **Interviews** | | | |
|---|---|---|---|---|---|---|---|---|
| | **Ward committees** | | **Government officials** | | **Ward committees** | | **Government officials** | |
| | Freq. | % | Frequency | % | Freq. | % | Frequency | % |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Yes | 49 | 84.4 | 27 | 84.5 | 14 | 82 | 13 | 93 |
| No | 9 | 15.6 | 5 | 15.5 | 3 | 18 | 1 | 7 |
| **Total** | **58** | **100.0** | **32** | **100.0** | **17** | **100.0** | **14** | **100.0** |

Source: Researcher's Design. 2019

22.1 The reasons for the impact of the hazard on infrastructure and people's shelter in the study area according to the respondents:

Table 5.22 below represents the community infrastructure and people's shelters that are normally affected by the hazard impact in both data collection methods. In the questionnaire, the majority of the government officials (65.6%) believed that both people's shelters and service infrastructure were affected while the majority 31% of the ward committee members, equally divided, believed that both people's shelters and others were impacted. In the interviews, the majority of both the government officials (57.10%) and ward committee councillors (52.90%) said both people's shelters and service infrastructure are affected by the impact of hazard(s).

The overall majority for both data collection tools agreed that both people's shelters and service infrastructure were affected by hazard(s) with only the ward committee members dividing their opinion between people's shelters and others were impacted. From the questionnaire, specifically for the categories of others and infrastructure, some of the typical responses from both the ward committee members and government officials were very telling. For example, one ward committee member lamented the effects the hazard has on their crops. He stated, *"Crops usually die as a result of drowning and also erosion"*. However, the most interesting and typical response received in the questionnaire from one of government official stated that *"Municipal and community facilities, peoples' homes, businesses, government buildings – schools, clinics, hospitals, fire stations etc are normally affected."*. The other government official in the interviews loosely indicated that *"Illegal electric connections in the informal settlements leads to shack fires which in turn affects the electrical supply in the formal areas and other critical services such as water provision from reservoirs because of electrical pump failures."*

Table 5.22: The reasons for the impact of the hazard on the infrastructure and people's shelter – Questionnaire & Interviews

| **Reasons** | **Questionnaire** | | **Interviews** | |
|---|---|---|---|---|
| | **Ward committees** | **Government officials** | **Ward committees** | **Government officials** |
| | **%** | **%** | **%** | **%** |
| Other | 31 | 15.6 | 0 | 7.1 |

| | | | | |
|---|---|---|---|---|
| Proper settlements with spatial planning | 1.7 | 0 | 0 | 0 |
| Unplanned or poor settlements with no spatial planning | 5.2 | 6.3 | 29.4 | 0 |
| Both people's shelters & service infrastructure | 13.8 | 65.6 | 52.9 | 57.1 |
| Government infrastructure | 17.2 | 3.1 | 0 | 0 |
| People's shelters | 31 | 9.4 | 17.6 | 35.7 |
| **Total** | **100** | **100** | **100** | **100** |

Source: Researcher's Design. 2019

23. The sub-groups mostly impacted by the hazards in the study area according to the respondents.

Table 5.23 below presents the sub-groups that were impacted by the hazards in the study area according to the respondents in both data collection tools. In the questionnaire, the government officials that participated in the study, the majority 81.3% believed that everyone is impacted by the hazard, and the majority of 67.2% of ward committee members also expressed the same sentiments. In the interviews, the same was believed by the majority of both ward committee councillors (52.90%) and government officials (71.40%). The majority of both the data collection methods believed that everyone was impacted by the hazards in the study area. One government official in the interviews captured the common theme that "*During disasters, school going children lose their stationary and uniforms, the elderly loses their clinic and pension appointment cards and people in general lose their shelters and belongings which are sometimes difficult to replace."*

Table 5.23: The sub-groups mostly impacted by hazard(s) – Questionnaire & Interviews

| **Sub-groups** | **Questionnaire** | | **Interviews** | |
|---|---|---|---|---|
| | **Government officials** | **Ward Committee Members** | **Government officials** | **Ward Committee** |
| | **%** | **%** | **%** | **%** |
| Everyone | 81,3 | 67,2 | 71.4 | 52.9 |
| Most children, elderly, disabled persons | 15,6 | 27,6 | 14.3 | 11.8 |
| Other | 3,1 | 5,2 | 14.3 | 35.3 |
| **Total** | **100** | **100** | **100** | **100** |

Source: Researcher's Design. 2019

23.1 The reason for the choice of the sub-groups that are mostly impacted by the hazards in the study area according to the respondents.

Table 5.24 below presents the reasons for the choice of the sub-groups mostly impacted by the hazards in the study area according to the respondents in both data collection methods. In the questionnaire, the majority, 62.5% of government officials that participated in the study believed, that the reason for the choice of the sub-groups to be mostly impacted by the disaster hazards in the study areas was that everyone was equally exposed and vulnerable to suffer losses. The government officials were supported by the ward committee members with a majority of 51.7%. In the interviews, the ward councillors shared the same view according to 66% respondents and government officials with 78.5%.

All respondents in all the data collection tools agreed that the choice of the sub-groups to be mostly impacted by the disaster hazards in the study areas was everyone, since everyone was equally exposed and vulnerable to suffer losses. In essence, they agreed that the reasons for disasters impact were that it has no artificial boundaries of age, sex, religions, creed or region. Most importantly, they agree on this perception because disaster related deaths are on the rise in the world except in Asia. CRED (EM-DAT) (2020) noted that the global distribution of death in 2019 was 45% in Asia, which was a sharp decrease from previous statistics. However, all the other continents have shown an increase with Europe at 23.4%, Africa at 23.0%, Americas at 8.0% and Oceania at 0.6%.

Table 5.24: The reasons for the sub-groups selection on who was mostly impacted by hazard(s) - Questionnaire & Interviews

| **Reasons for the choice of the Sub-groups** | **Questionnaire** | | **Interviews** | |
|---|---|---|---|---|
| | **Government officials** | **Ward Committee Members** | **Government officials** | **Ward Committee** |
| | **%** | **%** | **%** | **%** |
| *Everyone is equally exposed and vulnerable to suffer losses* | 62.5 | 51.7 | 78.5 | 66 |
| *The most suffered are children, elderly and disable as they are most re-disposed materially* | 18.8 | 19.0 | 14.3 | 18 |

| | | | | |
|---|---|---|---|---|
| *Other reasons* | 18.8 | 29.3 | 7.2 | 18 |
| **Total** | **100** | **100** | **100** | **100** |

Source: Researcher's Design. 2019

24. The reasons why people stay in their current hazardous areas

Figure 5.8 and 5.9 below presents the reason that keeps people in their current areas with the potential for or exposure to disaster hazards. In figure 5.8 that represents the questionnaire, the majority of government officials (62.5%) and ward committee members (48.3%) shared the perception that the major reason that keep people in their current areas was economic. In figure 5.9 for the interviews, both the study sub-groups' i.e. ward committee councillors and government officials' had majorities of 52.9% and 71.4%, respectively, believed that socio-economic factors and other forces keep people in their current areas. In the results, there was an equal split in the position of the two data collection methods. The data analysis in the questionnaire showed there was consensus that economic forces were responsible for keeping people in their current areas. Similarly, the interviews registered similar reasons but this time socio-economic factors and other factors as the reasons for attracting people to their areas. The typical response from the interviews involved the mentioning of the social networks, employment opportunities, the securing of livelihoods and access to better government services compared to other areas out of Gauteng province.

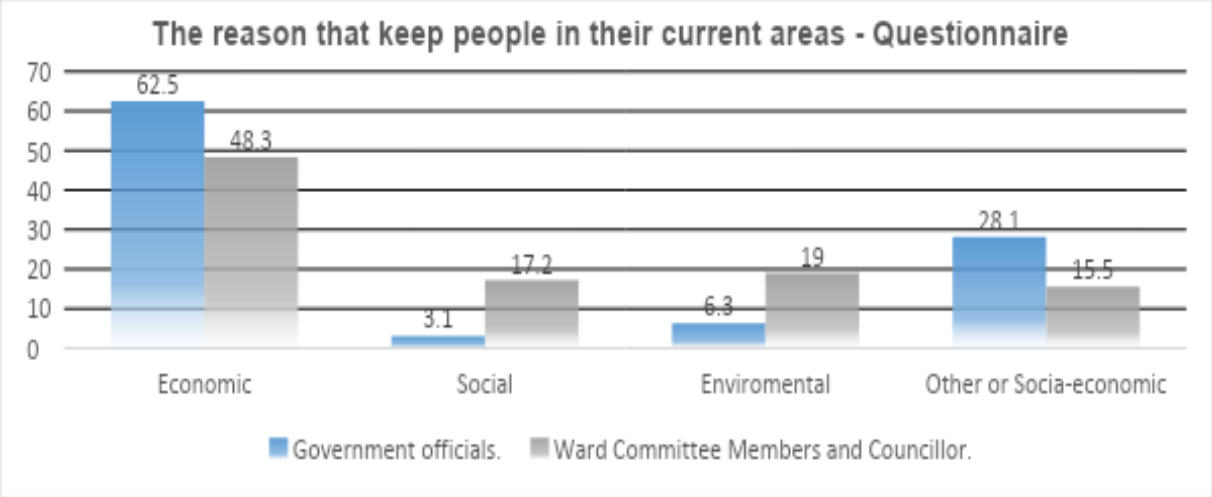


Figure 5.8: The reasons keeping people in the current areas – Questionnaire
Source: Researcher's Design. 2019

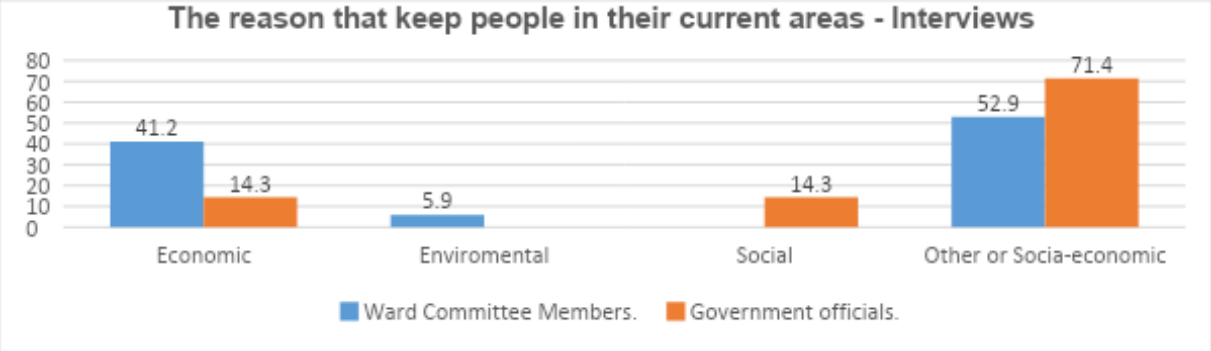


Figure 5.9: The reasons keeping people in the current areas – Interviews
Source: Researcher's Design. 2019

24.1 The explanation for the reason that keeps people in affected areas with the potential for or exposure to disaster hazards.

The table below represents the explanation for reason that keeps people in their current areas according to the respondents. In the questionnaire, of the government officials and ward committee members that took part in the study, the majority of 40.6% and 63.8% respectively, agreed that socio-economic and other unmentioned factors explained the reasons for people occupying their current areas. In the interviews, the reasons by both the majorities of ward councillors (47.1%) and government officials (64.3%) was identified as access to work opportunities and livelihoods either formal or informal. The results showed that there was an equal split of the perception between the socio-economic and other factors and the access to work opportunities and livelihoods either formal or informal on both data collection tools. However, a typical response from the questionnaire coming from one government official was, that *"Most people relocate for work purposes or to seek work. Some for relationships – to be with partners and parents."*

Table 5.25: The explanation for occupying unsafe areas – Questionnaire & Interviews

| **Explanation of the reason** | **Questionnaire** | | **Interviews** | |
|---|---|---|---|---|
| | **Government officials:** | **Ward Committee Members** | **Government officials:** | **Ward Committee Councillors** |
| | **%** | **%** | **%** | **%** |
| Access to work opportunities & livelihoods either formal or informal | 37,5 | 24,1 | 64,3 | 47,1 |

| | | | | |
|---|---|---|---|---|
| Government services | 9,4 | 5,2 | 7,1 | 5,9 |
| Proper environment | 12,5 | 6,9 | 7,1 | 5,9 |
| Other including socio-economic factors | 40,6 | 63,8 | 21,4 | 41,2 |
| **Total** | **100** | **100** | **100** | **100** |

Source: Researcher's Design. 2019

25. The communities' tolerance of their areas according to the respondents:

Table 5.26 below presents the results of communities' tolerance of their areas according to the respondents in the two data collection tools. In the questionnaire, the majority of 51.7% ward committee members believed that communities do tolerate their areas whilst the majority of and remaining government officials (46.9%) had the perception that somehow the communities do tolerate their areas. In the interviews, the ward committee members together with the majorities of both the ward councillors (47.1%) and government officials (57.1%) stated that people tolerate their areas. The data analysis in the study confirms that the participants agreed that communities tolerate their areas with a divergent view from the government officials in the questionnaire who doubted communities' tolerance of their areas.

Table 5.26: The communities' tolerance of their areas – Questionnaire & Interviews

| **Communities tolerance of their areas** | **Questionnaire** | | **Interviews** | |
|---|---|---|---|---|
| | **Ward committees** | **Government officials** | **Ward committees** | **Government officials** |
| | % | % | % | % |
| Yes | 51.7 | 40.6 | 47.1 | 57.1 |
| No | 6.9 | 9.4 | 23.5 | 21.4 |
| Somehow | 36.2 | 46.9 | 17.6 | 21.4 |
| Not at all | 5.2 | 3.1 | 11.8 | 0 |
| **Total** | **100.0** | **100.0** | **100.0** | **100.0** |

Source: Researcher's Design. 2019

25.1 The reason the communities tolerate their residence in their areas according to the respondents i.e. ward committees and government officials:

Table 5.27 below shows the reasons for the communities to tolerance their areas according to the respondents in both the data collection methods. The majority of government officials (59.4%) and ward committee members (72.4%) that took part in the questionnaire study agreed with the majority of government officials (64.3%) in the interviews that the reason communities tolerate

their areas is because of socio-economic factors and other reasons. Ward committee councillors, in the interviews, with an equally divided majority of 35.3% believed that both the government services and access to work opportunities and livelihoods either formal or informal attracts people into their areas. The findings indicated that in both the data collection methods government officials and the ward committee members largely agreed in general on the main reason for socio-economic and other factors that attracts communities to their areas. A notable response was from a ward committee participant in the questionnaire who stated that people *"found understanding in background culture. At some point they see potential in the surrounding place for employment."*

Table 5.27: The reasons for communities' tolerance of their areas – Questionnaire & Interviews

| **Reasons for communities' tolerance of the areas** | **Questionnaire** | | **Interviews** | |
|---|---|---|---|---|
| | **Government officials** | **Ward Committee Members** | **Government officials:** | **Ward Committee Councillors** |
| | **%** | **%** | **%** | **%** |
| Access to work opportunities and livelihoods either formal or informal | 31,3 | 6,9 | 28.6 | 35.3 |
| Government services | 9,4 | 15,5 | 7.1 | 35.3 |
| Environment | 0 | 5,2 | 0 | 0 |
| Socio-economic & Other reasons | 59.4 | 72.4 | 64.3 | 29.4 |
| **Total** | 100 | 100 | **100** | **100** |

Source: Researcher's Design. 2019

26. The communities' benefit(s) of staying in the area:

Table 5.28 below depicts the communities' benefit in staying in the area according to the respondents in both the data collection tools. The results showed that in the questionnaire, the widely held view by both government officials (53.1%) and ward committee members (39.7%), was that economic factors kept the communities in their areas. In the interviews, the results were mixed with the majority of government officials (64.3%) supporting the view that the communities were staying in their areas because of socio-economic and other factors whilst ward councillors majority was split into 35.3% of two positions that it was because of both the economic and social

factors individually. The predominant perceptions that run across both data collection tools were economic factors with some deviations from the interviewed government officials and partly the ward committee councillors who are split in between.

Table 5.28: The communities' benefit in staying in the area – Questionnaire & Interviews

| **Communities' benefit(s) in the area** | **Questionnaire** | | **Interviews** | |
|---|---|---|---|---|
| | **Government officials** | **Ward Committee Members** | **Government officials:** | **Ward Committee Councillors** |
| | **%** | **%** | **%** | **%** |
| Economic | 53.1 | 39.7 | 28.6 | 35.3 |
| Social | 9.4 | 19 | 7.1 | 35.3 |
| Environmental | 6.3 | 8.6 | 0 | 0 |
| Socio-economic & Other reasons | 31.3 | 32.8 | 64.3 | 29.4 |
| **Total** | 100 | 100 | **100** | **100** |

Source: Researcher's Design. 2019

26.1 The reasons for the communities' benefit in exposing themselves to disaster hazards in their areas:

Table 5.29 below depicts the reasons for the communities' benefit in staying in their areas. In the questionnaire study, the majority of government officials (50%) believed that access to work opportunities and livelihoods either formal or informal was the reason communities stay in their areas whilst ward committee councillors (51.7%) supported the view that it was because of the socio-economic and other factors. In the interview study, the majority of government officials (50%) and ward committee councillors (58.8%) also believed that people stay in their areas because of access to work opportunities and livelihoods either formal or informal. The overall perceptions of both participants' sub-groups in the data collection methods was that access to work opportunities and livelihoods either formal or informal was the main reason for community benefits in staying in their area with a slight deviation from ward committee members in the questionnaire study who believed that socio-economic and other factors were more important.

For example, a typical response from the ward committee members that viewed socio-economic and other factors as more important was from one of the ward committee members who states that the benefit of staying in the areas is that "*There is no high rentals and there is humanity*

*amongst the communities."* One government official stressed that there is *"access to work opportunities, being close to friends and family as well as increased living standards and amenities*". However, the prominence of the choice of access to work opportunities and livelihoods either formal or informal was somehow captured by the views of one-ward committee councillor' participant who said that *"By nature, staying in any Gauteng areas comes with advantage of being closer to job opportunities and people can also buy or sell stuff to anyone."*

Table 5.29: The reasons for the communities' benefit in staying in the area – Questionnaire & Interviews

| **Reasons for communities' benefit in the area** | **Questionnaire** | | **Interviews** | |
|---|---|---|---|---|
| | **Government officials** | **Ward Committee Members** | **Government officials:** | **Ward Committee Councillors** |
| | **%** | **%** | **%** | **%** |
| Access to work opportunities & livelihoods (formal & informal) | 50 | 27.6 | 50 | 58.8 |
| Government services | 15.6 | 13.8 | 28.5 | 17.6 |
| Proper environment | 6.3 | 6.9 | 0 | 0 |
| Socio-economic & Other reasons | 28.1 | 51.7 | 21.5 | 23.6 |
| **Total** | 100 | 100 | **100** | **100** |

Source: Researcher's Design. 2019

27. The communities' willingness to relocate to an alternative area:

Table 5.30 below presents the communities' willingness to relocate to an alternative area away from their current location. In the questionnaire, half of the ward committee members (50%) said that there was no willingness to relocate to an alternative area while the other half (50%) said there was willingness to relocate. The majority of the government officials (53.1%), on the other hand, believed that there was willingness to relocate to an alternative area. In the interviews, both the ward committee councillors (52.9%) and government officials (57.1%) majorities agreed that the communities were not willing to relocate to other areas. The overall perceptions of the participants in terms of the two data collection methods was slightly leaning towards the view that communities were unwilling to relocate to an alternative area with an almost equal majority that believed that people were willing to relocate to other areas.

Table 5.30: The communities' willingness to relocate from the area- Questionnaire & Interviews

| **Communities' willingness to relocate** | **Questionnaire** | | **Interviews** | |
|---|---|---|---|---|
| | **Ward committees** | **Government officials** | **Ward committees** | **Government officials** |
| | % | % | % | % |
| Yes | 50 | 53.1 | 47.1 | 42.9 |
| No | 50 | 46.9 | 52.9 | 57.1 |
| **Total** | **100.0** | **100.0** | **100.0** | **100.0** |

Source: Researcher's Design. 2019

27.1 The reasons for communities' willingness or not to relocate to an alternative area:

The table below shows the reasons for communities' willingness or predisposition to relocate or not to relocate to alternative areas. In the questionnaire study, the majority of the ward committee members, 55.2% believed that the socio-economic and other factors were the main reason and government officials, 31.3% believed that communities' willingness or not to relocate was determined by access to work opportunities and livelihoods either formal or informal. In the interviews, there was a unanimous perception by both sub-groups' majority of government officials with 41.2% and ward committee councillors with 42.9% that access to work opportunities and livelihoods either formal or informal determined the communities' willingness or not to relocate to an alternative area. Therefore, there was a greater convergence of the views regarding the reasons for the communities' willingness or not to relocate to an alternative area, which was stated as access to work opportunities and livelihoods either formal or informal by all the respondents in both the data collection tools except the government officials in the questionnaire study. One respondent however, had a unique reason for people's willingness or not to relocate who said that it is *"Because we love the area we are in"* whilst a government official said people were willing to relocate, *"Because currently people are busy risking their life for the sake of making a living."*

Table 5.31: The reasons for the communities' willingness to relocate – Questionnaire & Interviews

| **Reasons for communities' willingness to relocate in the area** | **Questionnaire** | | **Interviews** | |
|---|---|---|---|---|
| | **Government officials** | **Ward Committee Members** | **Government officials:** | **Ward Committee Councillors** |
| | **%** | **%** | **%** | **%** |
| Access to work opportunities & livelihoods (formal & informal) | 12.1 | 31.3 | 41.2 | 42.9 |
| Government services | 12.1 | 28.1 | 28.6 | 35.3 |
| Proper environment | 18.8 | 20.7 | 7.1 | 11.8 |
| Socio-economic & Other reasons | 55.2 | 21.9 | 21.4 | 11.8 |
| **Total** | 100 | 100 | **100** | **100** |

Source: Researcher's Design. 2019

28. Communities' coping capacity to hazards and their impact in their area:

Table 5.32 below presents the coping capacity of the communities to deal with the impact of hazard(s). In the questionnaire study, the majority was divided into two, half of the government officials (50%) believed people have coping capacity while the other half (50%) believe that people do not have coping capacity. The ward committee members' majority, on the other hand, 55.2% of them said that people have coping capacity. In the interviews study, the majority views were mutual with 64.7% of ward committee councillors and 57.1% of government officials agreeing that people have no coping capacity. In both the data collection methods, the overwhelming majority of the participants except the ward committee members in the questionnaire study believed that the people have no coping capacity to deal with the impact of their disaster hazard(s) in their area.

Table 5.32: The communities' coping capacity – Questionnaire & Interviews

| **The communities' coping capacity** | **QUESTIONNAIRE** | | **INTERVIEWS** | |
|---|---|---|---|---|
| | **Ward Committee Members** | **Government officials** | **Ward Committee Councillors** | **Government officials** |
| | Percent | Percent | Percent | Percent |
| People have coping capacity - Yes | 55.2 | 50 | 35.3 | 42.9 |
| People have no coping capacity - No | 44.8 | 50 | 64.7 | 57.1 |
| Total | 100.00 | 100.0 | 100.0 | 100.0 |

Source: Researcher's Design. 2019

28.1 The reasons for the communities' hazard coping capacity and their impact in their area:

Figure 5.10 and 5.11 below presents the reasons for the communities' coping capacity against hazards and their impact in their area. Figure 5.10 on the questionnaire indicated that of the total respondents, the majority of the government officials (37.5%) believed the reason for coping or not was because of government services including rebuilding of their shelters while the majority of ward committee member (39.7%) believed the reason to be socio-economic and other factors not mentioned.

Figure 5.11 concerning the interviews demonstrated that 42.9% majority of government officials concurred with their counterparts in the questionnaire survey that the government services including rebuilding of communities' shelters was responsible for people's coping or not coping capacity. The majority of ward committee member (i.e. 29.4%), with equal split, believed the reason to be both the same with government officials as well as socio-economic and other factors. Therefore, the findings were that, from both data collection tools, the majority believed that government services including rebuilding of communities' shelters was responsible for people's coping or not coping with less participants' saying that there were socio-economic and other factors as the reason. From the two reasons one can deduce that ward committee councillors believed that people ability to cope was either strengthened or weakened by socio-economic factors to cope, hence one of them, said that "*The coping mechanisms comes from people having favourable circumstances such as access to employment, schools, municipal services,*

*transportation, roads etc*." Government officials believe that the services provided by their government increased the communities coping capacity.

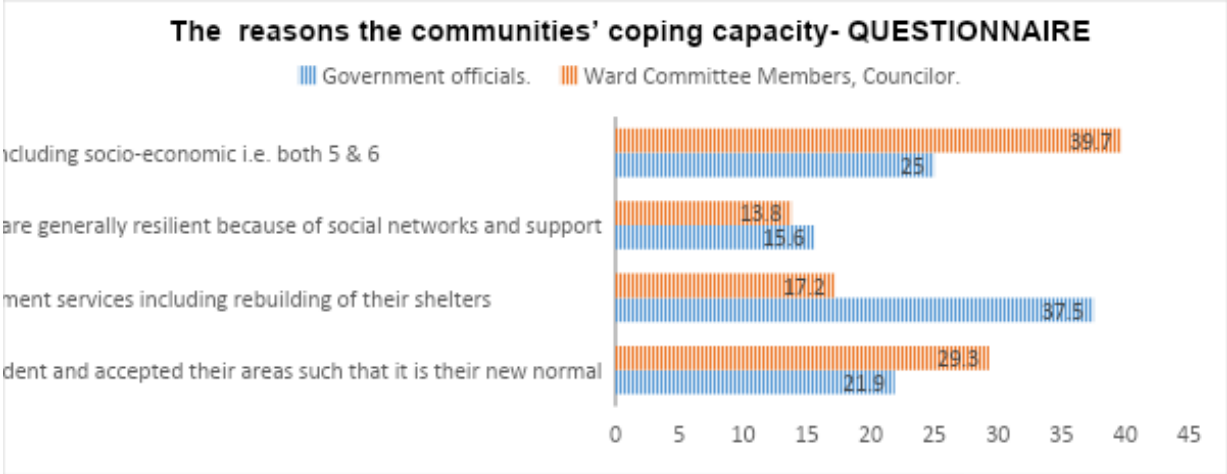


Figure 5.10: The reasons for the communities' coping capacity – Questionnaire
Source: Researcher's Design. 2019

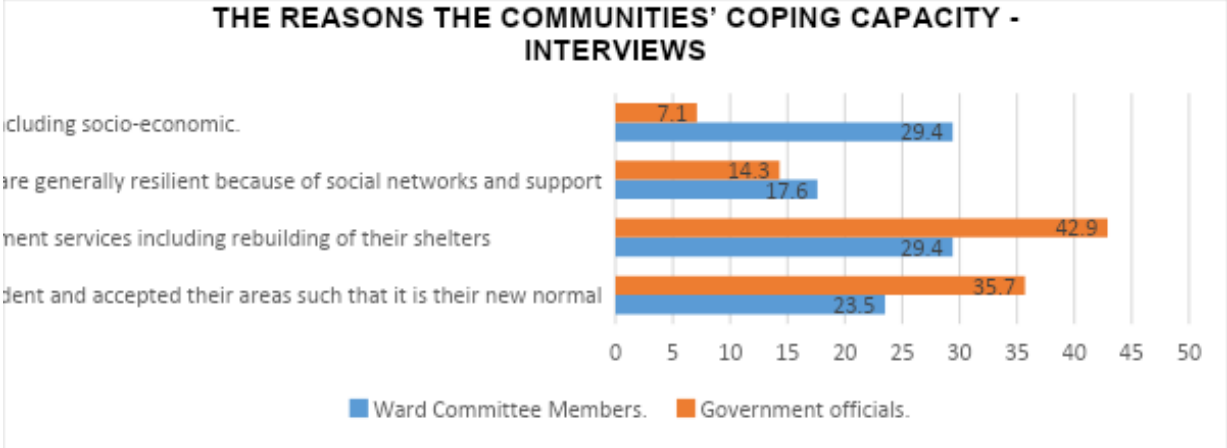


Figure 5.11: The reasons for the communities' coping capacity – Interviews
Source: Researcher's Design. 2019

29. The communities' preparedness for hazards and their impact in their area:

Table 5.33 below depicts the communities' preparedness for hazards and their impact in their area. The majority of government officials and ward committee members that participated in the questionnaire survey, i.e. 68.8% and 60.3% respectively, believed that people were not prepared for disasters. The same view was shared by both the majority of 76.5% of ward committee councillors and 85.7% of government officials in the interview study. The results in the data analysis showed that all participants in the study for all data collection methods agreed that people were not prepared for hazards and their impact in their area. The fact that both sub-groups in the

both data collection methods were consistent with their response to the same question, confirms their observation as a true perception.

Table 5.33: The communities' preparedness – Questionnaire & Interviews

| **People's preparedness for disasters** | **Questionnaire** | | **Interviews** | |
|---|---|---|---|---|
| | **Government officials** | **Ward committees** | **Ward committees** | **Government officials** |
| | % | % | % | % |
| Yes | 31.3 | 39.7 | 23.5 | 14.3 |
| No | 68.8 | 60.3 | 76.5 | 85.7 |
| **Total** | **100.0** | **100.0** | **100.0** | **100.0** |

Source: Researcher's Design. 2019

29.1 The reasons for the communities' preparedness for disaster hazards and impact that exists in their area according to the respondents:

Figure 5.12 and 5.13 below presents the reasons for communities' preparedness or not for the hazards and their impact in their area. Figure 5.12 presents the outcome of the questionnaire survey, the majority of the government officials (55,2%) and ward committee member (56,3%) both believed the reason to be other factors than the ones mentioned, including socio-economic. Figure 5.13 presents the results of the interviews study, the majority of government officials (57,1%) and ward committee member (47,1%) both believed the reason to be government support including rebuilding of the communities' shelters. The data analysis in both the data collection methods showed a balanced split in the middle depending on the method used for the main reason of disaster preparedness or not. There are a few reasons to support the view that socio-economic and other factors were responsible for disaster preparedness. For example, one of the ward committee members interestingly says, *"Such disasters happen when either householders are at work or at a social gathering."* One of the government officials believed that communities are, "*Not very prepared, especially those living in poverty. Informal settlements are prone to fires and description."* However, if the observation that communities were prepared or not because of government support including rebuilding of the communities' shelters is true, this is a worrying factor because it creates community's dependency on external stakeholders to prepare for disasters.

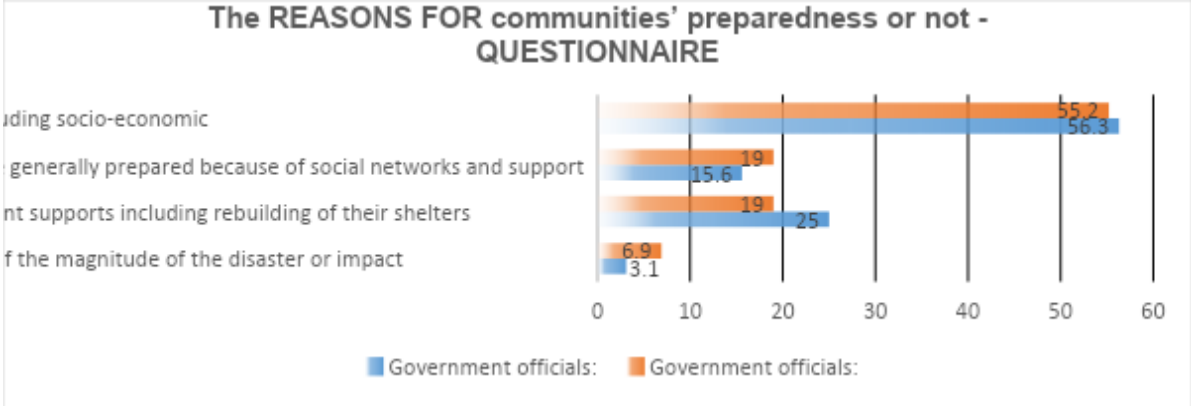


Figure 5.12: The reasons for the communities' preparedness – Questionnaire
Source: Researcher's Design. 2019

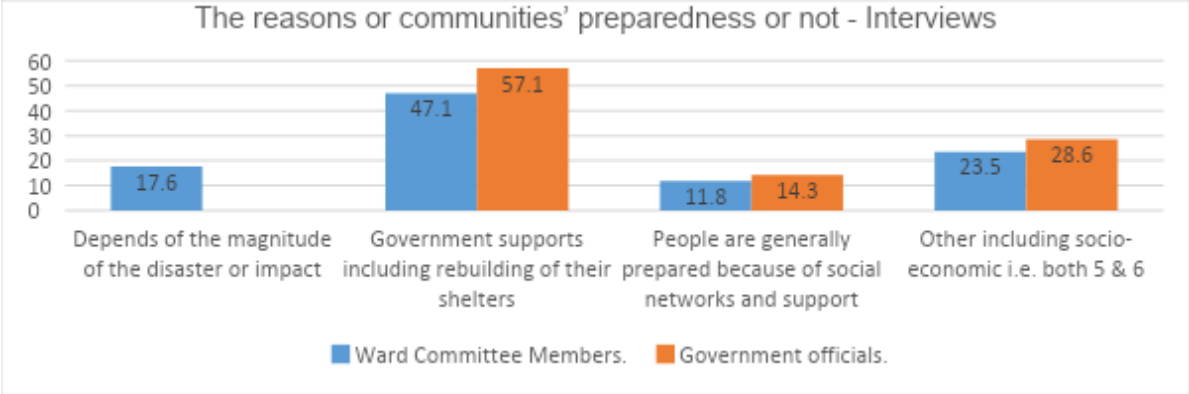


Figure 5.13: The reasons for the communities' preparedness – Interviews
Source: Researcher's Design. 2019

### 5.2.3 Perception of city's disaster preparedness

The data collected and analysed in this section of the combined data collection tools relates to Kent's (1994) nine (9) key components of disaster preparedness framework which are vulnerability assessment, planning, institutional framework, information system, resource base, warning systems, response mechanisms, public education and training, and rehearsal.

30. Knowledge of community vulnerability assessment in the area:

The table below presents ward committee members and government official's knowledge of the existence of community vulnerability assessment in the study area in both data collection methods. Of the government officials that participated in the questionnaire survey, 59,4% believed that there was knowledge of existence of vulnerability assessment whilst ward committee members with a majority of 53,4% saying that there was no knowledge of the existence of the vulnerability assessment in the study area. The table also demonstrated that the majority of ward

committee councillors (64.7%) and government officials (71.4%), in the interviews, knew about the existence of community vulnerability assessment study in the city. The data analysis in both the data collection methods indicated that there was enough knowledge of the existence of community vulnerability assessment study amongst government officials and ward committee councillors than from the ward committee members. The logical reason for the different knowledge between ward committee members and councillors as well as government officials might be related to the fact that ward councillors and government officials have more access and proximity to municipal information than ward committee members.

Table 5.34: Knowledge of vulnerability assessment - Questionnaire – Questionnaire & Interviews

| **Knowledge of vulnerability assessment** | **Questionnaire** | | **Interviews** | |
|---|---|---|---|---|
| | **Government officials** | **Ward committee members** | **Ward committee councillors** | **Government officials** |
| | % | % | % | % |
| Yes | 59,4 | 46,6 | 64.7 | 71.4 |
| No | 40,6 | 53,4 | 35.3 | 28.6 |
| **Total** | **100.0** | **100.0** | **100.0** | **100.0** |

Source: Researcher's Design. 2019

31. The years of existence of the community vulnerability assessment in the area:

Table 5.35 below depicts years of existence of the community vulnerability assessment in the study area based on the respondents in the two data collection methods. In the questionnaire survey, the majority of 43.8% of government officials chose none which indicated that they had no idea how old the community vulnerability assessment was in the study area. The majority of the ward committee members (39.7%) believed that the community vulnerability assessment was 3 to 5 years old. In the interviews, both the sub-groups' majority of government officials (35.7%) and ward committee councillors (35.3%) agreed that the community vulnerability assessment study was 3 to 5 years old. The data analysis from both the data collection tools indicated that there was only a partial agreement from the interviews that the community vulnerability assessment study was 3 to 5 years old beside that there was disagreement in the questionnaire study on the years of existence of the community vulnerability assessment. The majority of the sub-groups of ward committee councillors and government officials that dominantly selected the years of between 3 to 5 years of existence for the community vulnerability assessment seems to

be more knowledgeable and accurate compared to the other participants. According to the last City of Ekurhuleni's Comprehensive Disaster Risk and Vulnerability Assessment Study (2016), it was concluded in 2016.

Table 5.35: Years of existence of the community vulnerability assessment - Questionnaire & Interviews

| **Years of vulnerability assessment** | **Questionnaire** | | **Interviews** | |
|---|---|---|---|---|
| | **Government officials** | **Ward committee members** | **Ward committee councillors** | **Government officials** |
| | % | % | % | % |
| **None (i.e. not knowing)** | 43.8 | 29.3 | 29.4 | 28.6 |
| **1 to 3 Years** | 34.4 | 39.7 | 23.5 | 21.4 |
| **3 to 5 Years** | 18.8 | 17.2 | 35.3 | 35.7 |
| **5 and more Years** | 3.1 | 13.8 | 11.8 | 14.3 |
| **Total** | **100.0** | **100.0** | **100.0** | **100.0** |

Source: Researcher's Design. 2019

32. The municipality's usage of the community vulnerability assessment to prepare for disaster in the area:

Table 5.36 below represents the responses from both the ward committees and the government officials on the usage of community vulnerability assessment in the study area to prepare for disasters. In the interviews, both the ward committee councilors and government officials' majority of 52.9% and 50% respectively and the majority of the ward committee members (36.2%) from the questionnaire survey concurred that the community vulnerability assessment was not used to prepare for disaster in the study area. The split majority of 28.1% of government officials' choices were divided into both somehow and not sure to indicate the doubt in the usage of the community vulnerability assessment to prepare for disasters in study area. The data analysis indicated that the majority of respondents from government officials and ward committee councillors were certain that the municipality was not using the community vulnerability assessment to prepare for disasters whilst less respondents from the government officials were doubting the usage of the community assessment study to prepare for disasters. The perception of the participants that the municipality was not using the community assessment to prepare for disaster might be based on the Ekurhuleni DEMS Risk Committee Report (2017). The City of Ekurhuleni, in the space of 6

years from 2010 to 2016, declared four state of disasters because of climate hazards such as floods, tornado or hailstorm which in the same period the frequency could be viewed as very high with a probability of 0.6 chance for similar declaration per year in that period.

Table 5.36: The usage of the community vulnerability assessment - Questionnaire & Interviews

| **Usage of the community vulnerability assessment** | **Questionnaire** | | **Interviews** | |
|---|---|---|---|---|
| | **Government officials** | **Ward committee members** | **Ward committee councillors** | **Government officials** |
| | % | % | % | % |
| *Definitely* | 9.4 | 0 | 5.9 | 7.1 |
| *Greater degree* | 25 | 22.4 | 29.4 | 28.6 |
| *Somehow* | 28.1 | 10.4 | 11.8 | 14.3 |
| *Not using* | 9.4 | 36.2 | 52.9 | 50.0 |
| *Not sure* | 28.1 | 31 | 5.9 | 7.1 |
| **Total** | **100.0** | **100.0** | **100.0** | **100.0** |

Source: Researcher's Design. 2019

33. The communities' household disaster preparedness planning in the area:

The table below highlights the views of the government officials and ward committees concerning the community's household disaster preparedness planning. In the questionnaire survey, the majority of ward committee members (37.9%) had the impression that in their area such planning was not in use, while the majority of government officials (31.3%) had the perception that the communities' households' disaster preparedness planning was in use. In the interviews conducted, the majority of 50% of government officials believed that somehow the communities' households' disaster preparedness planning was in use. There majority of 35.3% for ward committee councillors agreed with government officials and the other 35.3% of ward councillors agreed with the ward committee members in the questionnaire survey that the communities' households' disaster preparedness planning was not in use. The data analysis indicated that there was some partial convergence and divergence on two positions showed by the respondents which was that somehow the communities' households' disaster preparedness planning was in use and not in use with a small group of ward committee members believing that it was used to a greater extent.

Table 5.37: The communities' household disaster preparedness planning - Questionnaire & Interviews

| **Communities' households planning on disaster preparedness** | **Questionnaire** | | **Interviews** | |
|---|---|---|---|---|
| | **Government officials** | **Ward committee members** | **Ward committee councillors** | **Government officials** |
| | % | % | % | % |
| *Definitely* | 9.4 | 3.4 | 0 | 0 |
| *Greater degree* | 31.3 | 13.8 | 17.6 | 7.1 |
| *Somehow* | 18.8 | 27.6 | 35.3 | 50.0 |
| *Not using* | 15.6 | 37.9 | 35.3 | 28.6 |
| *Not sure* | 25 | 17.2 | 11.8 | 14.3 |
| **Total** | **100.0** | **100.0** | **100.0** | **100.0** |

Source: Researcher's Design. 2019

34. The government undertaking of disaster preparedness planning in the area:

Table 5.38 below depicts the respondents' perception on government undertaking of the disaster preparedness planning in the study area. The questionnaire study showed that the majority of government officials (34.4%) and 50% of the same sub-group in the interviews believed that to the greater degree the government uses disaster preparedness planning in the study area. The ward committees' majorities in both the data collection tools (i.e. 29.3% of ward committee members and 47.1% of ward councillors) also believed that government was not using disaster preparedness planning in the study area. In data analysis, it is indicated that there was an equal split of both sub-groups with each sub-group (i.e. ward committees and government officials) holding their positions in terms of the views of using disaster preparedness planning by government in the study area. Both positions of the sub-groups might be indicative of "Us" and "Them" syndrome than anything else wherein ward committees sees the government officials as doing nothing whilst the government officials view themselves as doing a lot. However, the opposite might also be true that one of the sub-group was actually correct regarding their impression. This would have to be investigated.

Table 5.38: Government undertaking of the disaster preparedness planning - Questionnaire & Interviews

| **Government undertaking of disaster preparedness** | **Questionnaire** | | **Interviews** | |
|---|---|---|---|---|
| | **Government officials** | **Ward committee members** | **Ward committee councillors** | **Government officials** |
| | % | % | % | % |
| *Definitely* | 9.4 | 8.6 | 0 | 0 |
| *Greater degree* | 34.4 | 24.1 | 17.6 | 50.0 |
| *Somehow* | 28.1 | 13.8 | 29.4 | 42.9 |
| *Not using* | 12.5 | 29.3 | 47.1 | 7.1 |
| *Not sure* | 15.6 | 24.1 | 5.9 | 0 |
| **Total** | **100.0** | **100.0** | **100.0** | **100.0** |

Source: Researcher's Design. 2019

35. Existence of disaster institutional structures in the municipality:

Table 5.39 below depicts the scores of the respondents concerning the existence of disaster institutional structures in the city. In the questionnaire study, the majority of government officials (37.5%) and the ward committee members (36.2%) agreed that to a greater degree disaster institutional structures were in place in the municipality. In the interviews study, both the majority of ward committee councillors (47.1%) and half of the majority of government officials i.e. 50% support the same view. The other half of the government officials of 50% also believed that somehow the disaster institutional structures were in place in the municipality. The data analysis highlighted that the majority of both sub-groups' of ward committees and government officials confirmed that there was existence of disaster institutional structures in place in the municipality will minimum doubt from government officials in the interviews. Overall, the high convergence of the sub-groups views, might indicate the high regard that was given to the disaster institutional arrangement of the municipality.

Table 5.39: The existence of disaster institutional structures - Questionnaire & Interviews

| **Disaster institutional structures** | **Questionnaire** | | **Interviews** | |
|---|---|---|---|---|
| | **Government officials** | **Ward committee members** | **Ward committee councillors** | **Government officials** |
| | % | % | % | % |
| Definitely | 31.3 | 15.5 | 5.9 | 0 |
| *Greater degree* | 37.5 | 36.2 | 47.1 | 50 |
| *Somehow* | 18.8 | 12.1 | 29.4 | 50 |
| *Not using* | 9.4 | 22.4 | 11.8 | 0 |
| *Not sure* | 3.1 | 13.8 | 5.9 | 0 |
| **Total** | **100.0** | **100.0** | **100.0** | **100.0** |

Source: Researcher's Design. 2019

36. The opinion of the respondents on the municipality information system for disaster management:

The table below shows the responses of the respondents when they were asked if the government uses any information system for disaster management to record and monitor disasters in the municipality. In response, the majority of government officials (40.6%) in the questionnaire had the impression that the government somehow uses the information system whist the ward committee members' views were ambiguous. The half of the majority of 24.1% had the impression that such systems are not in use and the other 24.1% had the impression that the information system are in use and at a greater degree. In the interviews response, half of the majority of government officials of 28,6% had the impression that the government somehow uses an information system or it does not use an information system. The majority, 47,1% of ward committee councillors' views were that an information system was not in use in the municipality to record and monitor disasters. The information presented indicated that only ward committee members in the questionnaire study had some confidence that to a greater degree an information system to monitor and record disasters was in use in the municipality. On the other hand, all the other respondents' perception oscillated more towards not using and less toward somehow to indicate the doubt on the status of the usage of an information system to monitor and record disasters in the municipality.

Table 5.40: The usage of any information system - Questionnaire & Interviews

| **Usage of any information system** | **Questionnaire** | | **Interviews** | |
|---|---|---|---|---|
| | **Government officials** | **Ward committee members** | **Ward committee councillors** | **Government officials** |
| | % | % | % | % |
| *Definitely* | 25 | 17.2 | 11.8 | 14.3 |
| *Greater degree* | 18.8 | 24.1 | 5.9 | 14.3 |
| *Somehow* | 40.6 | 12.1 | 17.6 | 28.6 |
| *Not using* | 6.3 | 24.1 | 47.1 | 28.6 |
| *Not sure* | 9.4 | 22.4 | 17.6 | 14.3 |
| **Total** | **100.0** | **100.0** | **100.0** | **100.0** |

Source: Researcher's Design. 2019

37. The municipality usage of its full resources to respond to community disasters:

Table 5.41 below depicts the responses given by the government officials and ward committee members in both the data collection tools when asked a question in relation to the usage of the municipality's full resources to respond to community disasters. In the questionnaire, the majority, 31.3% of the government officials were definitely sure that the municipality was using its full resources to respond to community disasters. On the other hand, the majority, 43.1% of the ward committee members believed that the municipality to the greater degree was using its full resources to respond to community disasters. Both ward councillors and government officials in the interviews with 29.4% and 35.7% respectively also shared the same view of the ward committee members. In general, the perception of the all the respondents was confident that the municipality was using its full resources to respond to community disasters. Overall, the majority of participants approved the municipal deployment of its resources when major emergency incidents and disasters were responded to in the communities.

Table 5.41: The usage of municipal full resources to respond - Questionnaire & Interviews

| **Municipal usage of its full resources to respond** | **Questionnaire** | | **Interviews** | |
|---|---|---|---|---|
| | **Government officials** | **Ward committee members** | **Ward committee councillors** | **Government officials** |
| | % | % | % | % |
| *Definitely* | 31.3 | 17.2 | 17.6 | 21.4 |
| *Greater degree* | 21.9 | 43.1 | 29.4 | 35.7 |
| *Somehow* | 28.1 | 6.9 | 17.6 | 28.6 |
| *Not using* | 15.6 | 20.7 | 23.5 | 14.3 |
| *Not sure* | 3.1 | 12.1 | 11.8 | 0 |
| **Total** | **100.0** | **100.0** | **100.0** | **100.0** |

Source: Researcher's Design. 2019

38 The opinion of the respondents on the existence of known early warning systems in the community:

Table 5.42 below depicts the respondents' response when asked about the existence of the early warning systems to inform the community on the pending disaster incident in the city. In the questionnaire, the majority of government officials (37.5%) had the impression that the municipality had to a greater degree early warning systems to inform the community of any disaster. The majority of government officials (35.7%) in the interviews expressed the same sentiments. On the other hand, the majority of ward committee members (31%), in the questionnaire, believed that the municipality does not have an existing early warning system to inform the community of pending disasters in the city. The majority of ward committee councillors (41.2%) shared the same sentiments. The results showed that both the sub-groups of government officials and ward committees were split in the middle regarding the perception that there was an existence of early warning systems to inform the community on the pending disaster incident in the city. The different responses from the sub-groups might indicate their experience with the early warning system of the city, which might mean that government officials have received an early warning at some point whilst ward committee members never received any from the municipality.

Table 5.42: Known early warning systems - Questionnaire & Interviews

| **Knowledge of the early warning systems** | **Questionnaire** | | **Interviews** | |
|---|---|---|---|---|
| | **Government officials** | **Ward committee members** | **Ward committee councillors** | **Government officials** |
| | % | % | % | % |
| *Definitely* | 9.4 | 12.1 | 5.9 | 7.1 |
| *Greater degree* | 37.5 | 25.9 | 23.5 | 35.7 |
| *Somehow* | 25 | 15.5 | 17.6 | 28.6 |
| *Does not exist* | 15.6 | 31 | 41.2 | 28.6 |
| *Not sure* | 12.5 | 15.5 | 11.8 | 0 |
| **Total** | **100.0** | **100.0** | **100.0** | **100.0** |

Source: Researcher's Design. 2019

39. The effectiveness of the response mechanisms for disasters and emergencies in the municipality:

The table below presents the respondents' perceptions on the effectiveness of the response mechanisms for disasters and emergencies in the municipality. In the questionnaire response, the majority. The majority of government officials (50%) believed that the response mechanisms were definitely effective. The majority of the ward committee members (34.5%) believed that the response mechanisms were effective to the greater degree. In the interviews response, the majority of 35.3% of ward committee councillors believed that the response mechanisms did not exist and the government officials with a 42.9% majority thought that somehow the response mechanisms were there in the municipality. Therefore, the views of the participants were divergent and each sub-group had its own belief on the effectiveness of the response mechanisms for disasters and emergencies in the municipality, which ranged from definite to the belief that it did not exist. The different perceptions may be indicating individual judgement that might be true or not based on the experience of the participants, which can be investigated further in future.

Table 5.43: The effectiveness of the response mechanisms - Questionnaire & Interviews

| **The response mechanisms** | **Questionnaire** | | **Interviews** | |
|---|---|---|---|---|
| | **Government officials** | **Ward committee members** | **Ward committee councillors** | **Government officials** |
| | % | % | % | % |
| *Definitely* | 50 | 17.2 | 11.8 | 21.4 |
| *Greater degree* | 28.1 | 34.5 | 29.4 | 21.4 |
| *Somehow* | 9.4 | 15.5 | 17.6 | 42.9 |
| *Does not exist* | 0 | 25.9 | 35.3 | 14.3 |
| *Not sure* | 12.5 | 6.9 | 5.9 | 0 |
| **Total** | **100.0** | **100.0** | **100.0** | **100.0** |

Source: Researcher's Design. 2019

40. Respondents impression on the knowledge of the existence of municipal disaster and emergency public education and training programme in the communities:

The table below presents the respondents' perceptions on their knowledge of the existence of municipal disaster and emergency public education and training programmes in the communities. According to the majority of the government officials (31.3%) who participated in the questionnaire survey, the municipality definitely had public education and training programmes in the community. However, the majority of ward committee members 27.6% is split into the two extremes with some saying it does not exist and the same percentage confirming that it does exist to a greater degree. In the conducted interviews, the majority of the government officials (47.1%) said the municipality in their areas does not have an existing public education and training programmes for disaster and emergencies in the communities. However, the majority, 35.7% of ward committee councillors stated that to a greater degree they have knowledge of the same programmes in the communities. The research findings confirmed that the views of the participants on the existence of municipal disaster and emergency public education and training programme in the communities could not be easily correlated to a single position. However, the results indicated that there was an oscillation of positions from the definite response from government officials confirmed by part of the ward committee members that to a greater degree it did exist.

Table 5.44: The public education and training programme - Questionnaire & Interviews

| **The public education and training programme** | **Questionnaire** | | **Interviews** | |
|---|---|---|---|---|
| | **Government officials** | **Ward committee members** | **Ward committee councillors** | **Government officials** |
| | % | % | % | % |
| *Definitely* | 31.3 | 10.3 | 14.3 | 11.8 |
| *Greater degree* | 21.9 | 27.6 | 35.7 | 17.6 |
| *Somehow* | 12.5 | 22.4 | 28.6 | 11.8 |
| *Does not exist* | 21.9 | 27.6 | 21.4 | 47.1 |
| *Not sure* | 12.5 | 12.1 | 0 | 11.8 |
| **Total** | **100.0** | **100.0** | **100.0** | **100.0** |

Source: Researcher's Design. 2019

41. The impression of the respondents regarding the existence and implementation of the rehearsal's programmes in the communities:

Table 5.45 below presents the respondents' views about their knowledge of the existence and implementation of the rehearsal's programmes in the communities. The majority of government officials (25%) and the ward committee members (31%), in the questionnaire study, have the impression that there is no existence and implementation of the rehearsal programmes in the communities. The outcome in the table below also depicts the interviews results, the majority of 42.9% for the government officials and 58% for the ward committee councillors were not sure of the existence and implementation of the rehearsal's programmes in the communities. In both data collection methods information presented below indicated that both the government officials and ward committee members agree that there was no existence of or were not sure of the existence and implementation of the rehearsal programmes in the communities. In essence, the participants generally viewed the existence and implementation of the rehearsal programmes in the communities negatively.

Table 5.45: The rehearsal programmes in the communities - Questionnaire & Interviews

| **The rehearsal programmes in the communities** | **Questionnaire** | | **Interviews** | |
|---|---|---|---|---|
| | **Government officials** | **Ward committee members** | **Ward committee councillors** | **Government officials** |
| | % | % | % | % |
| *Definitely* | 15.6 | 15.5 | 0 | 14.3 |
| *Greater degree* | 18.8 | 15.5 | 0 | 21.4 |
| *Somehow* | 21.9 | 19 | 17.6 | 7.1 |
| *Does not exist* | 25.0 | 31 | 23.5 | 14.3 |
| *Not sure* | 18.8 | 19 | 58.8 | 42.9 |
| **Total** | **100.0** | **100.0** | **100.0** | **100.0** |

Source: Researcher's Design. 2019

## 5.3 Findings' summary for both data collection methods

### 5.3.1 Hazard, its effect and community re-action

The research findings below were for the hazard (s), its effects and the community reaction to pending disasters.

- The prevalent hazards were identified as storms, which were shadowed by fires and all the other possible hazards in the study area. The reasons given ranged from no reason some stated the specific reason, some identified all the reasons to be the same, others stated the extent of damage, but they also identified bad infrastructure and no service from the municipality.
- The severity of hazards was rated consistently to be moderate or extreme. The reason stated by government officials was that the communities were located in vulnerable areas. However, the ward committees stated different reasons which were equally split into two impressions which were that the hazards' severity was due to areas vulnerable by nature and poverty.
- The study confirmed that there were hazard impacts in the study area. The respondents' main reason for hazard impact was the type of vulnerable structures used by the communities and over population in the areas. The other reason was the location of the communities in the vulnerable areas. However, other reasons could not be specified.

- The research findings confirmed that the hazard(s) in the study area had an effect on both the community infrastructure and people. Besides the unstated reasons, the prevalent reasons given were poorly built people's shelters and service infrastructure.
- The study found that all participants agreed that everyone is equally exposed and vulnerable to suffer loss due to disasters.

### 5.3.2 Factors influencing settlement in hazardous areas

The research also collected data on what can be called the factors influencing settlement in the hazardous areas. These factors justify the communities to either stay or relocate in the perceived unsafe areas. The research findings were noted below for the study area.

- The research also investigated the reason why people were occupying their current areas though they were viewed as unsafe. The research found that there was a greater convergence on the outcomes that socio-economic and other additional factors were key in keeping individuals in current areas. However, the divergent reason given was economic factors. When participants were asked to clarify their reason, it came out again that largely participants agreed that socio-economic and other additional factors were the main reason.
- The research also asked if communities tolerate their areas. The research findings revealed that the participants felt that communities were tolerant of their current areas. The government officials in the questionnaire were the only sub-group that stated that somehow communities were tolerant of their current areas. Technically, all the sub-groups in the administered questionnaire and interviews concurred that the reasons communities were tolerant of their current areas were socio-economic including other factors. This is in spite of the fact that the reasons given by the majority of ward committee councillors in the interviews were equally split between social and economic factors.
- The research asked the respondents if there were any benefits for staying in the areas. The study found that most sub-groups' participants agreed that there were economic benefits in the form of access to work opportunities and livelihoods either formally or informally for staying in the areas. In the questionnaire, both ward committee members and government officials concurred on this benefit. In the interviews, the ward committee councillors divided the majority into economic and social factors while government officials stated the benefits as socio-economic and other factors. When asked about the reason for their choice of the benefits, the respondents in the interviews stressed the importance of economic factors in accessing work opportunities and livelihoods either formal or informal for staying in the areas.

In the questionnaire, the government officials again repeated the same reason but the ward committee members indicated socio-economic and other factors.

- The study asked the respondents in the communities that were perceived to be unsafe areas, were willing or not to be relocated to alternative areas and the reasons for their response. The question proved to be divisive amongst the same sub-groups and between them. The research findings demonstrated a very divergent response to the question with no clear picture on the participants' perception. The reason given for communities' willingness either to relocate or not was also divided into economic and socio-economic including other factors from both sub-groups.
- The research investigated if communities were coping with impact of the hazard(s) in their areas. The study found that the respondents' sub-groups were divided even within themselves. However, the position of the participants leaned more on the view that they were not coping with the impact of the hazard(s) in their areas. There were two general reasons that were shared by the respondents in both the data collection methods i.e. the socio-economic including others factors and the government services including building of shelters for the victims.
- The last question on factors influencing settlement in hazardous areas was whether the communities were prepared for their area's hazard(s). The research findings showed that all the sub-groups unanimously agreed that communities were not prepared for their area's hazards. On the reasons for the communities not to be prepared, the dominate view was because of the socio-economic including others factors. Only government officials in the interviews stated that communities expected government services to include building of shelters for victims.

### 5.4 Key findings on the city's disaster preparedness

The research also collected data based on Kent (1994) Disaster Preparedness Framework, which was tailored for the study area and included in both the questionnaire and interviews' data analysis. The key research findings on the assessment of the City of Ekurhuleni's disaster preparedness framework are stated below.

1. The first question was a generic one relating to the respondents' awareness of the existence of any community vulnerability assessment in the municipality. The research findings confirmed that there was greater knowledge of the existence of community

vulnerability assessment amongst the government officials and ward committee councillors than from the ward committee members.

2. The second question was a follow up of the first question that captured the evaluation of the city's disaster preparedness framework. The question was whether the municipality uses the community vulnerability assessment to prepare for disasters. The study found that the greater majority of respondents from government officials and ward committee councillors were certain that the municipality was not using the community vulnerability assessment to prepare for disasters whilst less respondents from the government officials were doubting the usage of the community assessment study to prepare for disasters.
3. The research also evaluated the communities' households undertaking of disaster planning for preparedness. The research findings proved that participants' views were fluid on the matter with the positions split into that it was in use and not in use with a small group of ward committee members believing that it was used to a greater degree.
4. The study also assessed the government undertaking of the disaster planning for preparedness for possible hazard(s) impact. The findings proved that there were split opinions depending on the background of the respondent. The ward committee members were more negative in their perceptions and government officials more positive on the matter.
5. The study evaluated the existence of disaster institutional structures in the municipality. The findings established that there was existence of disaster institutional structures in the city.
6. The study also tested the impression of the respondents on the usage of an information system in the city to record and monitor disasters. The research findings were dismal and negative with most participants believing that it was not used.
7. The research evaluated the municipal usage of full resources to respond to community disasters. The findings were extremely positive confirming municipal use the full resources to respond to community disasters. In both the data methods, all the sub-groups' respondents held the view that to a greater degree full resources were used for disaster response. In the questionnaire, government officials held the view that definitely the resource were in full use.
8. The research assessed the knowledge of early warning systems of the municipality to inform the community of pending disasters. The research findings proved that all the respondents believed that to a greater degree the respondents know of the early warning

systems of the city. Only ward committee councillors in the interviews who stated that early warning systems were not in existence.

9. The evaluation also looked at the response mechanism for disaster and emergency response in the municipality. The findings confirmed the divided perception by the respondents on the response mechanism for disaster and emergency response in the city depending on the data collection method. In the questionnaire analysis, both the sub-groups positively viewed the response mechanism as either definitely and existing to a greater degree while participants in the interviews believed that it was either not existing or somehow existing.
10. The assessment of the known disaster and emergency public education and training programmes in the communities confirmed that the views of the participants on the existence of the municipal disaster and emergency public education and training program in the communities could not be easily correlated to a single position. The opinions were precariously balanced between the two extremes of positive and negative views.
11. The study lastly evaluated the existence and implementation of the rehearsal programmes in the communities in the city. The research findings proved that outcomes were negative and dismal with the participants believing that the programmes were not existing or only existing to a lesser extent.

### 5.5 Summary

The chapter clarified the planned and the actual response rate of the participants in both the data collection methods i.e. the administered questionnaire and the interviews. The intention was to put the results of the administered questionnaire and the interviews into context. Then, study then provided the findings and the interpretation of the administered questionnaire and the interviews. The last part gave a summary of the combined research findings for both data collection methods, which attempted to triangulate the results of the interviews with the outcomes of the questionnaire. The next chapter will highlight the key findings in relation to the study objective wherein conclusions and the recommendations will be made for the study.

# CHAPTER SIX: CONCLUSION AND RECOMMENDATIONS

## 6.1 Introduction

The chapter gives a summary of the study and the main objective for which the conclusion and recommendations were drawn. The conclusion and recommendations are based on an attempt to resolve the problem statement stated in Chapter 1 which was: what is the level of disaster preparedness in the City of Ekurhuleni in the face of climate related disasters such as flood, hailstorms and tornados. The main objective of the study was to assess the level of disaster preparedness of the City of Ekurhuleni to respond to major emergency incidents and /or disasters using the climate related disaster of 2015. To determine the city's level of disaster preparedness, the study evaluated four out of five sub-objectives. The four sub-objectives were based on the critical four (4) components of Kent's (1994) disaster preparedness framework with a total of nine (9) components. The first sub-objective was to examine the development and implementation of the disaster planning regime of the city. The second sub-objective was to examine the early warning systems of the city. Thirdly, it was to evaluate the response mechanisms of the municipality. The fourth sub-objective was to assess the disaster and emergency public education and training programme in the communities. The methodology applied to investigate the problem statement was a mix method research approach. Based on the primary data collected, alongside the literature review, a conclusion and recommendations were drawn which fulfilled the fifth sub-objective in the study which was to identify any gaps and make recommendations to the City of Ekurhuleni disaster management team.

## 6.2 Study's conclusions

### 6.2.1 Disaster planning regime

The first sub-objective to support the main objective was the examination of the development and implementation of the disaster planning regime of the City of Ekurhuleni. Basolo, Steinburg, Burby, Levine, Cruz & Huang (2008) advised on a four step approach in the disaster planning process which included the identification of potential risk for the community, development of emergency response plans, development and implementation of mitigation plans, and communication of risk, planning process and preparedness measures for the community. Three aspects were evaluated to determine the disaster planning regime for disaster preparedness.

#### 6.2.1.1 Usage of community vulnerability assessment

Quarantelli (1988) advised that community vulnerability assessment should inform the disaster preparedness planning. The study found that all the respondents who participated in the data collection process believed that community vulnerability assessment was not being used to prepare for disasters. The exception was the government officials in the questionnaire analysis who themselves held a divided view on whether it was used or not for disaster preparedness planning. The results, though not in unison, proved that the lager part of the participants believed that the community vulnerability assessment was not in use for disaster preparedness.

#### 6.2.1.2 Households disaster planning

The SA Disaster Management Framework (2005) advocates for community households to institute disaster preparedness planning. In both the data collection methods, the research findings were mostly negative. The responses included replies such as **not using** and **somehow** with only government officials in the questionnaire having a positive perception that households in the community to some extent were undertaking disaster planning for preparedness. In conclusion, the fact that only a minority of the total respondents believed that communities' households were planning for disaster preparedness confirmed that in the city it was not happening or if it was happening it was at a very small scale that was not known by everyone.

#### 6.2.1.3 Government disaster planning

According to the Disaster Management Framework (2005), spheres of government were expected to institute disaster preparedness planning for their area of responsibility. The research findings, to some degree, confirmed that the city was instituting disaster preparedness planning for their area of responsibility.

### 6.2.2 Early warning systems

The early warning system is part of the pinnacle for disaster preparedness in a community faced with pending disaster incidents. Kapucu (2008: 588) phrases this importance of the early warning by saying "*Early warning systems protect the public by combining scientific monitoring and detection systems with social design factors and components to notify the public at risk."* The research findings pointed out that to a greater extent the respondents know of the available early warning systems with the exception of the ward committee councillors in the interviews who stated that early warning systems were not in existence. It can be concluded that the City of Ekurhuleni has some mechanisms to warn communities.

### 6.2.3 Municipal response mechanisms

The SA Disaster Management Act (2002) promulgates that every sphere of government should evaluate the disaster and emergency response mechanisms in their jurisdiction for disaster and emergency preparedness. The findings confirmed the divided perception of the respondents on the response mechanism for disaster and emergency response in the city depending on the data collected. It can be concluded that the views of participants on the response mechanisms of disaster and emergency response mechanisms in the city were equally split with both positive and negative perceptions that suggested that the mechanisms had both elements of ineffectiveness and effectiveness in the system.

### 6.2.4 Public education and training programme

The importance of public education, training and awareness in disaster preparedness in the South African context cannot be over-emphasised. The SA Disaster Management Framework (2005) regards this part of disaster management as a major part of Enabler Two. The results of the study showed the participants' views which were precariously balanced between the two extremes of positive and negative positions with more weight towards the positive. The tilting of the scale towards the positive side was because of the divided ward committee members' belief with some stating that the programmes existed and some saying they do not exist. Based on the split opinion of the respondents, it can be concluded that the city's disaster and emergency public education and training programmes in the communities had a limited impact with regard to disaster preparedness.

## 6.3 Recommendations

Based on the key findings and the conclusions drawn in the study, the following recommendations are made:

### 6.3.1 Disaster planning regime

- The community vulnerability assessment was not used for disaster preparedness planning. It is recommended that the city should involve the internal departments and other stakeholders through the Municipal Advisory Forum and the communities through the process of the Integrated Development Plans to improve on the usage of the disaster community vulnerability assessment to prepare for disasters.
- The communities' households' disaster preparedness planning was taking place at a small scale instead of all the households in the city having their own disaster preparedness

planning. It is recommended that the Disaster Management Service in the city should raise the awareness on this critical aspect of disaster preparedness by communicating communities' risk and what the communities can do to protect themselves.

- The study showed to some extent that the city does institutes disaster preparedness planning for their area of responsibility. However, it is recommended that the city broadens their municipal planning for disaster preparedness similar to the use of the community vulnerability assessment which was stated as the involvement of internal departments and other stakeholders' through the Municipal Advisory Forum and the communities through the process of the Integrated Development Plans.

### 6.3.2 Early warning system

An early warning system in the city was confirmed to be in existence for the communities. It is recommended that the city upgrades and maintains the elements of the early warning strategy to increase the spread of coverage for this system to strengthen disasters preparedness.

### 6.3.3 Municipal response mechanism

The implementation of the response mechanisms for disaster and emergency response in the city is balanced. For this reason, it can either collapse or improve going forward. It is recommended that the response mechanisms of the city should be improved through media communication that will include the communication of community's risks and resources available in the city to respond to the dominant disaster hazards.

### 6.3.4 Public education and training programme

The city's disaster and emergency public education and training programmes in the communities had a limited impact regarding disaster preparedness. It is recommended that the programmes be refined by including the ward committees and non-governmental organisations as partners in the planning and implementation.

### 6.3.5 General recommendations

This study set precedence in terms of assessing the level of disaster preparedness of the City of Ekurhuleni using the climate related disaster of 2015. It also used the two sub-groups of ward committees and local government officials. It is recommended that further studies in the area of disaster preparedness should be conducted in the city to look into all the major emergency incidents and disasters that have occurred in the city since 2008 to date. Similar studies should also include more participants from all the municipal wards not only the ward committee members

and councilors. It should also include more officials from the local, provincial and national sphere of government and non-governmental organisations. A complete approach to the study will give a clearer view on the level of disaster preparedness in the city.

### 6.4 Concluding statement

The study managed to achieve its main objective, which was to assess the level of the City of Ekurhuleni's level of disaster preparedness to respond to major emergency incidents and /or disasters using the case of the 2015 climate related incident. The study evaluation of its four objectives and the whole disaster preparedness based on Kent (1994) model contributed in determining the level of the city's disaster preparedness. The implication study was that the City of Ekurhuleni had some components of disaster preparedness that existed though not at the required level to enable it to respond effectively to major emergency incidents and /or disasters. The city, therefore, might be required to improve its disaster preparedness by deliberately developing a strategy to work of the nine aspects of Kent's (1994) disaster preparedness model to better prepare to response to the challenges of extreme weather incidents and disasters.

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**ANNEXURE 1: PERMISSION TO CONDUCT THE RESEARCH: LEGISLATURE**

# MEMORANDUM

**To:** **Mr. Bafana Mazibuko**
**Cc:**

**From:** Advocate Motshedi Lekalakala
Secretary to Council

**Enquiries**: **Boipelo Makgolo**
Executive Secretary

**Tel No:** (011) 999- 1191
**Date:** 24 August 2020


**LEGISLATURE DEPARTMENT**
SECRETARY TO COUNCIL
OR TAMBO GOVERNMENT PRECINCT CIVIC CENTRE
Corner: QUEEN AND CROSS STREETS,
GERMISTON
P O Box 145
GERMISTON
1400
South Africa
Tel : (011) 999 1191
www.ekurhuleni.gov.za


**Subject: Permission to conduct research in the Legislature**

Permission to conduct research in the Legislature on the area of **Assessing the level of disaster preparedness of the city of Ekurhuleni using the climate related incident in 2015** has been granted.

You are granted access to the type of information you need to fully execute your assignment and utilise the name of the City of Ekurhuleni. You may also give us feedback on the findings of your research.

**Regards**

**……**

**Advocate Motshedi Lekalakala**
**Secretary to Council**
**LEGISLATURE (CoE)**

## ANNEXURE 2: PERMISSION TO CONDUCT THE RESEARCH: CITY MANAGER

# OFFICE OF THE CITY MANAGER

City of Ekurhuleni

To: **Mr Bafana Mazibuko**

Cnr Cross and Roses Streets
Germiston
Private Bag X1069
Germiston 1400
South Africa
Tel: (011) 999-0796
Fax: (011) 999-1811
city.manager@ekurhuleni.gov.za
www.ekurhuleni.gov.za

Enq: Thabo Nzoyi
Thabo.nzoyi@ekurhuleni.gov.za
(011) 999 – 0796

**APPROVAL FOR THE REQUEST TO CONDUCT RESEARCH ASSESSING THE LEVEL OF DISASTER PREPAREDNESS OF THE CITY OF EKURHULENI USING THE CLIMATE RELATED INCIDENT IN 2015.**

The City of Ekurhuleni acknowledges receipt of your request to conduct research assessing the level of disaster preparedness of the City of Ekurhuleni using the climate related incident in 2015.

Permission to conduct the research in the Disaster Management Department is granted, provided it does not interfere with assigned responsibilities. The Intergovernmental Relations Unit will in conjunction with Environmental Management Department provide the necessary administrative and logistical support you may require.

Yours sincerely,

**Mrs Paledi Marota**
**AHOD: STRATEGIC SUPPORT**

26/08/2020
**DATE**

**Dr Imogen Mashazi**
**CITY MANAGER**

02/09/2020
**DATE**

## ANNEXURE 3: ETHICAL CLEARANCE APPROVAL

UNIVERSITY OF THE FREE STATE
UNIVERSITEIT VAN DIE VRYSTAAT
YUNIVESITHI YA FREISTATA
UFS UV

**GENERAL/HUMAN RESEARCH ETHICS COMMITTEE (GHREC)**

08-Sep-2020

Dear Mr Bafana Mazibuko

**Application Approved**

Research Project Title:
**ASSESSING THE LEVEL OF DISASTER PREPAREDNESS OF THE CITY OF EKURHULENI USING THE CLIMATE RELATED INCIDENT IN 2015**

Ethical Clearance number:
**UFS-HSD2020/0891/0609**

We are pleased to inform you that your application for ethical clearance has been approved. Your ethical clearance is valid for twelve (12) months from the date of issue. We request that any changes that may take place during the course of your study/research project be submitted to the ethics office to ensure ethical transparency. furthermore, you are requested to submit the final report of your study/research project to the ethics office. Should you require more time to complete this research, please apply for an extension. Thank you for submitting your proposal for ethical clearance; we wish you the best of luck and success with your research.

Yours sincerely

**Dr Adri Du Plessis**
**Chairperson: General/Human Research Ethics Committee**

AdPlessis

Date:
2020.09.08
11:09:37
+02'00'

205 Nelson Mandela Drive
Park West
Bloemfontein 9301
South Africa

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Bloemfontein 9300
Tel: +27 (0)51 401 9337
duplessisA@ufs.ac.za
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## ANNEXURE 4: CONSENT TO PARTICIPATE IN THIS STUDY

UNIVERSITY OF THE FREE STATE
UNIVERSITEIT VAN DIE VRYSTAAT
YUNIVESITHI YA FREISTATA
UFS UV

**CONSENT TO PARTICIPATE IN THIS STUDY**

I, _____ (participant name), confirm that the person asking my consent to take part in this research has told me about the nature, procedure, potential benefits and anticipated inconvenience of participation.

I have read (or had explained to me) and understood the study as explained in the information sheet. I have had sufficient opportunity to ask questions and am prepared to participate in the study. I understand that my participation is voluntary and that I am free to withdraw at any time without penalty (if applicable). I am aware that the findings of this study will be anonymously processed into a research report, journal publications and/or conference proceedings.

*I understand and agree that the report of the study may be submitted for publication, but my personal information will not be used to identify myself in such a report*

I agree to take part in the data collection method using the questionnaire and/ or recorded interviews as explained by the researcher. I understand that there is no reasonably foreseeable risks of harm or side-effects to the potential participants. Thus, there is no need for the arrangement for indemnity and/or insurance coverage for my participation.

I have received a signed copy of the informed consent agreement.

Full Name of Participant: _____

Signature of Participant: Date:

Full Name(s) of Researcher(s): _____

Signature of Researcher: _____ Date: _____

## ANNEXURE 5: RESEARCH QUESTIONNAIRE

**Research Questionnaire: Assessing the Level of Disaster Preparedness of the City Of Ekurhuleni**

To: Research Participants

**Introduction**

My name is Bafana Mazibuko. I am a Masters' Student in DiMTEC at the Free State University. As a participant, you are invited to participate in my masters' research by answering the questions that are hereunder. The objective of the study is to assess the level of disaster preparedness of the City Of Ekurhuleni. The expected contribution of the study, besides the academic reasons, is to add value in terms of the policy development and the improvement of disaster preparedness in the city.

Participants are requested to complete this questionnaire as objectively as possible. Participants are free to decline to participate in this exercise or to leave out any question that they feel uncomfortable to answer.

The questionnaire consists of 32 questions divided into three (3) parts which might take 30 to 45 minutes to complete. Participation is voluntary and all information provided will be treated with maximum confidentiality. The information that participants will provide will be used for academic purposes only to help improve on the city readiness to respond to future disasters. Participants are not required to include any form of personal identification on this questionnaire as all respondents will remain anonymous.

For any concerns on the questionnaire you are free to contact the undersigned.

I will like to thank you in advance for participating in this study and your contribution is much appreciated.

Kind Regards,

Mr. Bafana Mazibuko

Email: mazibko.bafana@yahoo.com

Mobile: (072) 584 - 6952

**RESEARCH QUESTIONNAIRE**

**PART 1**

***Section 1: General profile of the responder***

Ward Councillor/ Committee member are required to respond to question 1 before proceeding to number 2 in ***Section A: Ward Councillor/ Committee members*** until the last question number 14 in the section. From there on they can answer the whole questionnaire from Part 2 to Part 3 of the questionnaire.

The government official required to respond to question 1 before proceeding to ***Section B: Government official*** number 15 until number 20. From there on they can answer the whole questionnaire from Part 2 to Part 3 of the questionnaire.

1. What is your relation to the study area?

| | | | |
|---|---|---|---|
| Government Official | | Ward Councillor/ Committee members | |

**<u>Section A: Ward Councillor/ Committee members</u>**

2. Please provide the name of your location/ area?

| | | | |
|---|---|---|---|
| Area name | | Ward number | |

3. Please provide your gender.

| | | | | | |
|---|---|---|---|---|---|
| Male | | Female | | Other | |

4. On average, what will be your age group from the ones listed below?

| | | | | | |
|---|---|---|---|---|---|
| 16 to 35 yrs. | | 36 to 65 yrs. | | Above 65 | |

5. On average, how long have you being working as a councillor/ committee member? Please choose from the year categories from the ones mentioned below?

| | | | | | |
|---|---|---|---|---|---|
| 1 to 5 yrs. | | 5 to 10 yrs. | | Above 10 yrs. | |

6. Who is the owner of the house you are staying in? Please chose from below.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Yourself | | Parents | | Rented | | Other/specify | |

7. Do you have any possession that can be classified as an asset except the house? Please choose from below.

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Car(s) | | Extra property | | Live stock | | None | | Other/specify | |

8. On average, what will be your average number of members of your household from the ones mentioned below?

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Less than 3 | | Above 3 but less than 7 | | Above 7 but less than 12 | | 12 and above | |

9. How many rooms does your house have? Please choose from the categories mentioned below.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Less than 3 | | Above 3 but less than 6 | | Above 6 but less than 10 | | Other/specify | |

10. What is your source of income in your household? Please select from the list below.

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Entrepreneur | | Employed | | Government grants | | Other/specify | | None | |

11. What government services do the community have access to from the list provided?

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Running Water | | Electricity | | Sewer | | None | |

12. Do you know the disaster management function in the municipality? Yes or No

| | | | |
|---|---|---|---|
| Yes | | No | |

13. What is your involvement in disaster management?

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Directly involved | | Supporting role | | Not involved | | Not sure | |

14. What government services do the community have access to from the study areas?

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| All the services | | Some of the services | | None | | Other/specify | |

**Section B: Government Official**

15. Please provide your departmental functional responsibility.

| |
|---|
| |

16. Does your department deal directly with the communities?

| | | | |
|---|---|---|---|
| Yes | | No | |

17. On average, how long have you being working in the department? Please choose from the year categories from the ones mentioned below?

| | | | | | |
|---|---|---|---|---|---|
| 1 to 5 yrs. | | 5 to 10 yrs. | | Above 10 yrs. | |

18. What is your seniority in the department?

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Senior Manager | | Manager | | Operations Official | | Other/specify | |

19. What is your involvement in disaster management? If you are directly involved, please also complete question a below.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Directly involved | | Supporting role | | No involved | | Not sure | |

a. Are you a Disaster Management Official? Yes or No

| | | | |
|---|---|---|---|
| Yes | | No | |

20. What government services do the community have access to from the study areas?

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| All the services | | Some of the services | | None | | Other/specify | |

**PART 2:**

***Section 2: Perception of risk***

**This part of the questionnaire must be answered by all participants.**

21. What are the hazards (i.e. disaster dangers) in area(s)? Please select from the list below.

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Storms | | Fires | | Floods | | Extreme weathers (Cold or Hot | | Other specify | |

21.1 Can you please explain?

22. How vulnerable (i.e. exposure to hazards) is the area(s) to the hazards mentioned above?

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Extreme | | Moderate | | Less exposed | | Not exposed | |

22.1 Can you please explain?

_____

_____

23. Will the hazard(s) and vulnerabilities above, impact on the area anyhow? Please provide a Yes or No answer.

| | | | |
|---|---|---|---|
| Yes | | No | |

23.1 Please explain how the area(s) is normally affected.

_____

_____

24. Is the community infrastructure including people's shelters normally affected by the impact of the hazard(s)? Please provide a Yes or No answer.

| | | | |
|---|---|---|---|
| Yes | | No | |

24.1 Explain what community infrastructure is normally affected by the impact of the hazard(s)?

_____

_____

25. What sub-groups (e.g. children, elderly, differently able persons etc.) are normally affected by the impact of the hazard(s)?

| Everyone | | Most children, elderly, disabled persons | | No one | | Other specify | |
|---|---|---|---|---|---|---|---|

25.1 Explain how they are affected by the impact of the hazard(s)?

_____

_____

26. What are the reasons that keep the people from occupying their current area?

| Economic | | Social | | Environmental | | Other specify | |
|---|---|---|---|---|---|---|---|

26.1 Explain your answer above.

_____

_____

27. Do the people generally tolerate their residence to the area?

| Yes | | No | | somehow | | Not at all | |
|---|---|---|---|---|---|---|---|

27.1 Explain your answer above.

_____

_____

28. What are the benefit(s) of staying in the area?

| Economic | | Social | | Environmental | | Other specify | |
|---|---|---|---|---|---|---|---|

28.1 Explain your answer above.

_____

_____

29. In your view, will the people vacate the area if they have an alternative area than this one?

| Yes | | No | |
|---|---|---|---|

29.1 Why?

_____

_____

30. Given your answers above, are the community coping with the impact of the hazard(s) in their area?

| | | | |
|---|---|---|---|
| Yes | | No | |

30.1 Please explain.

_____

_____

31. Are people prepared for the area hazards? Please provide a Yes or No answer.

| | | | |
|---|---|---|---|
| Yes | | No | |

31.1 How prepare or not are the community?

_____

_____

**PART 3:**

***Section 3: Disaster Preparedness***

**This part of the questionnaire must be answered by all participants.**

32. Are you aware of any community vulnerability assessments conducted by the municipality in your area?

| | | | |
|---|---|---|---|
| **Yes** | | **No** | |

31.2 If yes, how long was it done at approximately?

| | | | | | |
|---|---|---|---|---|---|
| **Current to 3 year** | | **3 to 5 years** | | **5 or more years** | |

33. In your understanding, does the municipality uses the community vulnerability assessments to prepare for disaster? If you are to rate the municipal usage of community vulnerability assessments to prepare for disaster planning in the area(s), you can give it which score below from the scale of 1 to 5? (1= Not sure, 2= None, 3=Somehow, 4=To-greater degree & 5= Definitely).

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **1** | | **2** | | **3** | **4** | | **5** | |

34. Is there any household disaster planning undertaken for the possible hazard(s) impact? If you are to rate the preparedness planning in the household, you can give it which score below from the scale of 1 to 5? (1= Not sure, 2= None, 3=Somehow, 4=To-greater degree & 5= Definitely).

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **1** | | **2** | | **3** | **4** | | **5** | |

35. Is the any government disaster planning undertaken for the possible hazard impact in the area? If you are to rate the preparedness planning of government, you can give it which score below from the scale of 1 to 5? (1= Not sure, 2= None, 3=Somehow, 4= To-greater degree & 5= Definitely).

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **1** | | **2** | | **3** | **4** | | **5** | |

36. If you were to rate the existence of the disaster institutional structures in the municipality, which score can you give in this regard from the scale of 1 to 5? (1= Not sure, 2= not existing, 3= Do exist, 4= Exist and but not very effective & 5= Exit and effective).

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **1** | | **2** | | **3** | **4** | | **5** | |

37. According to your knowledge, does the municipality uses any information system for disaster management to record and monitor disasters in the municipality? Please rate from the scale of 1 to 5? (1= Not sure, 2= not existing, 3= Do exist, 4= Exist and but not very effective & 5= Exist and effective).

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **1** | | **2** | | **3** | **4** | | **5** | |

38. In your view, does the municipality uses its full resources to response to community disasters. Please rate from the scale of 1 to 5? (1= Not sure, 2= it does not, 3= It does somehow, 4= It does but not very effective & 5= It does and effective).

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **1** | | **2** | | **3** | **4** | | **5** | |

39. The municipality and community has a known early warning systems to inform the community on the pending disaster incident? Please rate from the scale of 1 to 5? (1= Not sure, 2= it does not, 3= It does somehow, 4= It does but not very effective & 5= It does and effective).

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **1** | | **2** | | **3** | **4** | | **5** | |

40. How effective are the response mechanisms for disaster and emergency response in the municipality? Please rate from the scale of 1 to 5? (1= Not sure, 2= it does not, 3= It does somehow, 4= It does but not very effective & 5= It does and effective).

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **1** | | **2** | | **3** | **4** | | **5** | |

41. Does the municipality have a known disaster and emergency public education and training program in the communities? Please rate from the scale of 1 to 5? (1= Not sure, 2= it does not, 3= It does somehow, 4= It does but not very effective & 5= It does and effective).

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **1** | | **2** | | **3** | **4** | | **5** | |

42. Does the municipality have a known existence and implementation of the rehearsals programmes of the communities? Please rate from the scale of 1 to 5? (1= Not sure, 2= it does not, 3= It does somehow, 4= It does but not very effective & 5= It does and effective).

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **1** | | **2** | | **3** | **4** | | **5** | |

## ANNEXURE 6: RESEARCH INTERVIEW GUIDE

**Research Interview Schedule: Assessing the Level of Disaster Preparedness of the City Of Ekurhuleni**

## PART 1:

### A. INTERVIEWERS INTRODUCTION TO THE RESEARCH PARTICIPANTS

**Introduction**

My name is Bafana Mazibuko (Email: mazibuko.bafana@yahoo.com, Mobile: (072) 584 – 6952). I am a Masters' Student in DiMTEC at the Free State University. As a participant, you are invited to participate in my masters' research by answering the questions that are hereunder. The objective of the study is to assess the level of disaster preparedness of the City Of Ekurhuleni. The expected contribution of the study, besides the academic reasons, is to add value in terms of the policy development and the improvement of disaster preparedness in the city.

Participants are requested to participate this interview as objectively as possible.

### B. PARTICIPANT'S INTRODUCTION

Before, we continue can you please introduce yourself?

Name and Surname:

Your role in the municipality i.e. are you a Councilor or an Official?

| **Councilor** | | **Official** | |
|---|---|---|---|

If you are a Councilor, which Ward:

If you are an Official, which Department:

How long have you being a Councilor or an Official in the city?

| 1 to 5 yrs. | | 5 to 10 yrs. | | Above 10 yrs. | |
|---|---|---|---|---|---|

### C. ACCEPTANCE OF PARTICIPATION

Participants are free to decline to participate in this exercise or to leave out any question that they feel uncomfortable to answer.

The interview consists of three (3) parts which might take 30 to 45 minutes to complete. Participation is voluntary and all information provided will be treated with maximum confidentiality. The information that participants will provide will be used for academic purposes only to help improve on the city readiness to respond to future disasters. Participants are not required to include any form of personal identification on this questionnaire as all respondents will remain anonymous.

For any concerns on the interview you are free to raise the matter with me or escalate it to my Research Supervisor i.e. Dr. Johannes Belle.

Do you therefore voluntary agree to participate in the study?

| YES | | NO | |
|---|---|---|---|

I will like to thank you for participating in this study and your contribution is much appreciated.

Will you like to receive and sign the consent form or your agreement effectively authorize me to assume that you are in agreement with its content?

## RESEARCH QUESTIONNAIRE

**PART 2:**

***Section 2: Perception of risk***

**This part of the questionnaire must be answered by all participants.**

43. What are the hazards (i.e. disaster dangers) in area(s)? Please select from the list below.

| Storms | | Fires | | Floods | | Extreme weathers (Cold or Hot | | Other specify | |
|---|---|---|---|---|---|---|---|---|---|

1.1 Can you please explain?

44. How vulnerable (i.e. exposure to hazards) is the area(s) to the hazards mentioned above?

| Extreme | | Moderate | | Less exposed | | Not exposed | |
|---|---|---|---|---|---|---|---|

2.1 Can you please explain?

_____

_____

45. Will the hazard(s) and vulnerabilities above, impact on the area anyhow? Please provide a Yes or No answer.

| Yes | | No | |
|---|---|---|---|

3.1 Please explain how the area(s) is normally affected.

_____

_____

46. Is the community infrastructure including people's shelters normally affected by the impact of the hazard(s)? Please provide a Yes or No answer.

| Yes | | No | |
|---|---|---|---|

4.1 Explain what community infrastructure is normally affected by the impact of the hazard(s)?

_____

_____

47. What sub-groups (e.g. children, elderly, differently able persons etc.) are normally affected by the impact of the hazard(s)?

| Everyone | | Most children, elderly, disabled persons | | No one | | Other specify | |
|---|---|---|---|---|---|---|---|

5.1 Explain how they are affected by the impact of the hazard(s)?

_____

_____

48. What are the reasons that keep the people from occupying their current area?

| Economic | | Social | | Environmental | | Other specify | |
|---|---|---|---|---|---|---|---|

6.1 Explain your answer above.

_____

_____

49. Do the people generally tolerate their residence to the area?

| Yes | | No | | somehow | | Not at all | |
|---|---|---|---|---|---|---|---|

7.1 Explain your answer above.

_____

_____

50. What are the benefit(s) of staying in the area?

| Economic | | Social | | Environmental | | Other specify | |
|---|---|---|---|---|---|---|---|

8.1 Explain your answer above.

_____

_____

51. In your view, will the people vacate the area if they have an alternative area than this one?

| Yes | | No | |
|---|---|---|---|

9.1 Why?

_____

_____

52. Given your answers above, are the community coping with the impact of the hazard(s) in their area?

| Yes | | No | |
|---|---|---|---|

10.1 Please explain.

_____

_____

53. Are people prepared for the area hazards? Please provide a Yes or No answer.

| Yes | | No | |
|---|---|---|---|

11.1 How prepare or not are the community?

_____

_____

**PART 3:**

***Section 3: Disaster Preparedness***

**This part of the questionnaire must be answered by all participants.**

54. Are you aware of any community vulnerability assessments conducted by the municipality in your area?

| **Yes** | | **No** | |
|---|---|---|---|

a. If yes, how long was it done at approximately?

| **Current to 3 year** | | **3 to 5 years** | | **5 or more years** | |
|---|---|---|---|---|---|

55. In your understanding, does the municipality uses the community vulnerability assessments to prepare for disaster? If you are to rate the municipal usage of community vulnerability assessments to prepare for disaster planning in the area(s), you can give it which score below from the scale of 1 to 5? (1= Not sure, 2= None, 3=Somehow, 4=To-greater degree & 5= Definitely).

| **1** | | **2** | | **3** | **4** | | **5** | |
|---|---|---|---|---|---|---|---|---|

56. Is there any household disaster planning undertaken for the possible hazard(s) impact? If you are to rate the preparedness planning in the household, you can give it which score below from the scale of 1 to 5? (1= Not sure, 2= None, 3=Somehow, 4=To-greater degree & 5= Definitely).

| **1** | | **2** | | **3** | **4** | | **5** | |
|---|---|---|---|---|---|---|---|---|

57. Is the any government disaster planning undertaken for the possible hazard impact in the area? If you are to rate the preparedness planning of government, you can give it which score below from the scale of 1 to 5? (1= Not sure, 2= None, 3=Somehow, 4= To-greater degree & 5= Definitely).

| **1** | | **2** | | **3** | **4** | | **5** | |
|---|---|---|---|---|---|---|---|---|

58. If you were to rate the existence of the disaster institutional structures in the municipality, which score can you give in this regard from the scale of 1 to 5? (1= Not sure, 2= not existing, 3= Do exist, 4= Exist and but not very effective & 5= Exist and effective).

| **1** | | **2** | | **3** | **4** | | **5** | |
|---|---|---|---|---|---|---|---|---|

59. According to your knowledge, does the municipality uses any information system for disaster management to record and monitor disasters in the municipality? Please rate from the scale of 1 to 5? (1= Not sure, 2= not existing, 3= Do exist, 4= Exist and but not very effective & 5= Exist and effective).

| **1** | | **2** | | **3** | **4** | | **5** | |
|---|---|---|---|---|---|---|---|---|

60. In your view, does the municipality uses its full resources to response to community disasters. Please rate from the scale of 1 to 5? (1= Not sure, 2= it does not, 3= It does somehow, 4= It does but not very effective & 5= It does and effective).

| **1** | | **2** | | **3** | **4** | | **5** | |
|---|---|---|---|---|---|---|---|---|

61. The municipality and community has a known early warning systems to inform the community on the pending disaster incident? Please rate from the scale of 1 to 5? (1= Not sure, 2= it does not, 3= It does somehow, 4= It does but not very effective & 5= It does and effective).

| **1** | | **2** | | **3** | **4** | | **5** | |
|---|---|---|---|---|---|---|---|---|

62. How effective are the response mechanisms for disaster and emergency response in the municipality? Please rate from the scale of 1 to 5? (1= Not sure, 2= it does not, 3= It does somehow, 4= It does but not very effective & 5= It does and effective).

| **1** | | **2** | | **3** | **4** | | **5** | |
|---|---|---|---|---|---|---|---|---|

63. Does the municipality have a known disaster and emergency public education and training program in the communities? Please rate from the scale of 1 to 5? (1= Not sure, 2= it does not, 3= It does somehow, 4= It does but not very effective & 5= It does and effective).

| **1** | | **2** | | **3** | **4** | | **5** | |
|---|---|---|---|---|---|---|---|---|

64. Does the municipality have a known existence and implementation of the rehearsals programmes of the communities? Please rate from the scale of 1 to 5? (1= Not sure, 2= it does not, 3= It does somehow, 4= It does but not very effective & 5= It does and effective).

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **1** | | **2** | | **3** | **4** | | **5** | |

## ANNEXURE 7: RESEARCH DATA CAPTURING GUIDE SHEET

**Data Capturing Sheet: Assessing the Level of Disaster Preparedness of the City Of Ekurhuleni**

**PART 1:**

1. The values for Ward Committee Members, Councilor, and Government Officials:

| | | |
|---|---|---|
| a | Ward Committee Members | 1 |
| b | Ward Councilor | 2 |

| | | |
|---|---|---|
| c) | Government Officials | 3 |

2. The value the name of the area the respondent is coming from:

| | | |
|---|---|---|
| a) | Etwatwa | 1 |
| b) | Daveyton | 2 |
| c) | Katlehong 1 | 3 |
| d) | Katlehong 2 | 4 |
| e) | Thokoza | 5 |
| f) | Thembisa | 6 |
| g) | Germiston | 7 |
| h) | Vosloorus | 8 |

3. The value for the gender group of the Ward Committee Members and Councilors:

| | | |
|---|---|---|
| a) | Male | 1 |
| b) | Female | 2 |
| c) | Other | 0 |

4. The value for the age group of the Ward Committee Members and Councilors:

| | | |
|---|---|---|
| a) | 16 to 35 years | 1 |
| b) | 36 to 65 years | 2 |
| c) | Above 65 years | 3 |

5. The value for level of experience for Ward Committee Members and Councilor represented by years of service:

| | | |
|---|---|---|
| a) | 1 to 5 years | 1 |
| b) | 5 to 10 years | 2 |
| c) | Above 10 years | 3 |

6. The value representing the ownership of a house in the area of residents as Ward Committee Members or a Councilor:

| | | |
|---|---|---|
| a) | Owning the house | 1 |
| b) | Parents' house | 2 |
| c) | Renting the house | 3 |
| d) | Other or unspecified | 0 |

7. The value representing the ownership of assets for Ward Committee Members or a Councilor:

| | | |
|---|---|---|
| a) | Owning a car | 1 |
| b) | Extra property | 2 |
| c) | Live stock | 3 |
| d) | None or unspecified | 0 |

8. The value representing the number of members of a household of the Ward Committee Members or a Councilor:

| | | |
|---|---|---|
| a) | Less than 3 rooms | 1 |
| b) | Above 3 but less than 6 | 2 |

| | | |
|---|---|---|
| c) | Above 6 but less than 10 | 3 |
| d) | None or unspecified | 0 |

9. The value representing the size of the house owned by the Ward Committee Members or a Councilor in the area:

| | | |
|---|---|---|
| a) | Less than 3 | 1 |
| b) | Above 3 but less than 7 | 2 |
| c) | Above 7 but less than 12 | 3 |
| d) | 12 and above | 4 |
| e) | None or unspecified | 0 |

10. The value representing the source of income in the household of the Ward Committee Members or a Councilor in the area:

| | | |
|---|---|---|
| a) | Entrepreneur | 1 |
| b) | Employed | 2 |
| c) | Government grant | 3 |
| d) | None | 4 |
| e) | Other | 0 |

11. The value representing the government services that the community have access to according to the Ward Committee Members or a Councilor in the area:

| | | |
|---|---|---|
| a) | Water | 1 |
| b) | Electricity | 2 |
| c) | Sewer | 3 |
| d) | None or unspecified | 0 |

12. The value representing the knowledge of the existence of disaster management services in government by the Ward Committee Members or a Councilor in the area:

| | | |
|---|---|---|
| a) | Knowns - Yes | 1 |
| b) | Not known – No | 2 |
| c) | No answered | 0 |

13. The value representing Ward Committee Members or a Councilor in the area involvement with disaster management services in government:

| | | |
|---|---|---|
| a) | Directly | 1 |
| b) | Supporting role | 2 |
| c) | Not involved | 3 |
| d) | Not sure | 0 |

14. The value representing Ward Committee Members or a Councilor in the area impression of community access to government services:

| | | |
|---|---|---|
| a) | All the services | 1 |
| b) | Some of the services | 2 |
| c) | None | 3 |
| d) | Not sure/ other | 0 |

15. The value representing the respondent's departmental function that directly relate to disaster management:

| | | |
|---|---|---|
| a) | Disaster Management | 1 |

| | | |
|---|---|---|
| b) | Other | 2 |

16. The value representing government official respondent's department directly involvement with communities:

| | | |
|---|---|---|
| a) | Directly - Yes | 1 |
| b) | Not directly – No | 2 |
| c) | No answered | 0 |

17. The value for level of experience for Government Officials represented by years of service and experience in the department:

| | | |
|---|---|---|
| a) | 1 to 5 years | 4 |
| b) | 5 to 10 years | 5 |
| c) | Above 10 years | 6 |

18. The value representing government official respondent's seniority in the department and the municipality:

| | | |
|---|---|---|
| a) | Senior Manager | 1 |
| b) | Manager | 2 |
| c) | Official | 3 |
| d) | Other | 0 |

19. The value representing government official respondent's directly involvement with disaster management services in the municipality:

| | | |
|---|---|---|
| a) | Directly involved | 1 |
| b) | Supporting role | 2 |
| c) | Not involved | 3 |
| d) | Not sure | 0 |

(a) The value representing that the respondent is the actual disaster management functionary in the municipality:

| | | |
|---|---|---|
| a | Disaster Management - Yes | 1 |
| b | Other - No | 2 |

20. The value representing Government Officials in the area's impression of community access to government services:

| | | |
|---|---|---|
| a) | All the services | 4 |
| b) | Some of the services | 5 |
| c) | None | 6 |
| d) | Not sure/ other | 0 |

**PART 2:**

21. The value representing the prevalent hazard in the study area according to the respondents i.e. Ward Committee Members, Councilor and government officials:
**Ward Committee Members & Councilor**

| | | |
|---|---|---|
| a | Storms | 1 |

| | | |
|---|---|---|
| b | Fires | 2 |
| c | Floods | 3 |
| d | Extreme weathers (Cold & Hot | 4 |
| e | Other | 5 |

**Government Officials**

| | | |
|---|---|---|
| f | Storms | 6 |
| g | Fires | 7 |
| h | Floods | 8 |
| i | Extreme weathers (Cold & Hot | 9 |
| j | Other | 10 |

21.1 The value representing the prevalent explanation as categorized in terms of themes from the respondents i.e. Ward Committee Members, Councilor and government officials:

**Ward Committee Members & Councilor**

| | | |
|---|---|---|
| a | Seasonal | 1 |
| b | All seasons and sever | 2 |
| c | The extent of damage | 3 |
| d | Poor victims | 4 |
| e | Bad infrastructure and no service | 5 |
| f | Other reasons | 6 |

**Government Officials**

| | | |
|---|---|---|
| g | Seasonal | 7 |
| h | All seasons and sever | 8 |
| i | The extent of damage | 9 |
| j | Poor victims | 10 |
| k | Bad infrastructure and no service | 11 |
| l | Other reasons | 12 |

22. The value representing the severity of the hazard in the study area according to the respondents i.e. Ward Committee Members, Councilor and government officials:

**Ward Committee Members & Councilor**

| | | |
|---|---|---|
| a) | Extreme | 1 |
| b) | Moderate | 2 |
| c) | Less exposed | 3 |
| d) | Not exposed | 4 |

**Government Officials**

| | | |
|---|---|---|
| e) | Extreme | 5 |
| f) | Moderate | 6 |
| g) | Less exposed | 7 |
| h) | Not exposed | 8 |

22.1 The value representing the reasons given by the respondents i.e. Ward Committee Members, Councilor and government officials:

**Ward Committee Members & Councilor**

| | | |
|---|---|---|
| | All the areas are vulnerable by nature | 1 |
| | Some areas are vulnerable due to their location | 2 |
| | People are expose by poverty and unemployment | 3 |
| | People are expose by the type of the structures and over populated areas | 4 |
| | Other | 5 |

**Government Officials**

| | | |
|---|---|---|
| | All the areas are vulnerable by nature | 6 |
| | Some areas are vulnerable due to their location | 7 |
| | People are expose by poverty and unemployment | 8 |
| | People are expose by the type of the structures and over populated areas | 9 |
| | Other | 10 |

23. The value representing the impact of the hazard in the study area according to the respondents i.e. Ward Committee Members, Councilor and government officials:

**Ward Committee Members & Councilor**

| | | |
|---|---|---|
| a] | Does the impact exit - Yes | 1 |
| b] | Does the impact exit - No | 2 |

**Government Officials**

| | | |
|---|---|---|
| c] | Does the impact exit - Yes | 3 |
| d] | Does the impact exit - No | 4 |

23.1 The value representing the impact of the hazard in the study area according to the respondents i.e. Ward Committee Members, Councilor and government officials:

**Ward Committee Members & Councilor**

| | | |
|---|---|---|
| | All the areas are impacted and vulnerable by nature | 1 |
| | Some areas are impacted and vulnerable due to their location | 2 |
| | People are impacted and vulnerable because of poverty and unemployment | 3 |
| | People are impacted and vulnerable because of the type of the structures and over populated areas | 4 |
| | Other | 5 |

**Government Officials**

| | | |
|---|---|---|
| | All the areas are impacted and vulnerable by nature | 6 |
| | Some areas are impacted and vulnerable due to their location | 7 |
| | People are impacted and vulnerable because of poverty and unemployment | 8 |
| | People are impacted and vulnerable because of the type of the structures and over populated areas | 9 |
| | Other | 10 |

24. The value representing the impact of the hazard to the infrastructure and people's shelters in the study area according to the respondents i.e. Ward Committee Members, Councilor and government officials:

**Ward Committee Members & Councilor**

| | | |
|---|---|---|
| | The impact affects the infrastructure & people - Yes | 1 |
| | The impact affects the infrastructure & people - No | 2 |

**Government Officials**

| | | |
|---|---|---|
| | The impact affects the infrastructure & people - Yes | 3 |
| | The impact affects the infrastructure & people - No | 4 |

24.1 The value representing the community infrastructure that is normally affected by the hazard impact according to the respondents i.e. Ward Committee Members, Councilor and government officials:

**Ward Committee Members & Councilor**

| | | |
|---|---|---|
| | People's shelters | 1 |
| | Government infrastructure | 2 |
| | Both people's shelters and service infrastructure | 3 |
| | Unplanned or poor settlements with no spatial planning | 4 |
| | Proper settlements with good spatial planning | 5 |
| | Other | 6 |

**Government Officials**

| | | |
|---|---|---|
| | People's shelters | 7 |
| | Government infrastructure | 8 |
| | Both people's shelters and service infrastructure | 9 |
| | Unplanned or poor settlements with no spatial planning | 10 |
| | Proper settlements with good spatial planning | 11 |
| | Other | 12 |

25. The value representing the sub-groups that mostly impacted by the hazards in the study area according to the respondents i.e. Ward Committee Members, Councilor and government officials:

**Ward Committee Members & Councilor**

| | | |
|---|---|---|
| | Everyone | 1 |
| | Most children, elderly, disabled persons | 2 |
| | No one | 3 |
| | Other | 4 |

**Government Officials**

| | | |
|---|---|---|
| | Everyone | 5 |

| | | |
|---|---|---|
| | Most children, elderly, disabled persons | 6 |
| | No one | 7 |
| | Other | 8 |

25.1 The value representing the reasons for the choice of the sub-groups that mostly impacted by the hazards in the study area according to the respondents i.e. Ward Committee Members, Councilor and government officials:

**Ward Committee Members & Councilor**

| | | |
|---|---|---|
| | Everyone is equally exposed and vulnerable and suffer losses | 1 |
| | The most suffered are children, elderly and disable as they are most re-disposed materially | 2 |
| | Other reasons | 3 |

**Government Officials**

| | | |
|---|---|---|
| | Everyone is equally exposed and vulnerable and suffer losses | 4 |
| | The most suffered are children, elderly and disable as they are most re-disposed materially | 5 |
| | Other reasons | 6 |

26. The value representing the reason that keep the people in the normally affected areas in the same areas with the potential for or exposure to disaster hazards according to the respondents i.e. Ward Committee Members, Councilor and government officials:

**Ward Committee Members & Councilor**

| | | |
|---|---|---|
| a) | Economic | 1 |
| b) | Social | 2 |
| c) | Environmental | 3 |
| d) | Other or Socio-economic | 4 |

**Government Officials**

| | | |
|---|---|---|
| e) | Economic | 5 |
| f) | Social | 6 |
| g) | Environmental | 7 |
| h) | Other or Socio-economic | 8 |

26.1 The value representing the reason that keep the people in the normally affected areas in the same areas with the potential for or exposure to disaster hazards according to the respondents i.e. Ward Committee Members, Councilor and government officials:

**Ward Committee Members & Councilor**

| | | |
|---|---|---|
| | Access to work opportunities and livelihoods either formal or informal | 1 |
| | Government services | 2 |
| | Proper environment | 3 |
| | Other including socio-economic i.e. both 1 & 2 | 4 |

**Government Officials**

| | | |
|---|---|---|
| | Access to work opportunities and livelihoods either formal or informal | 5 |
| | Government services | 6 |
| | Proper environment | 7 |
| | Other including socio-economic i.e. both 5 & 6 | 8 |

27. The value representing the communities' tolerance of their exposure to the disaster hazards that they are faced with in their areas according to the respondents i.e. Ward Committee Members, Councilor and government officials:
**Ward Committee Members & Councilor**

| | | |
|---|---|---|
| a) | Tolerated – Yes | 1 |
| b) | Not tolerated – No | 2 |
| c) | Somehow tolerated | 3 |
| d) | Not tolerated at all | 4 |

**Government Officials**

| | | |
|---|---|---|
| e) | Tolerated – Yes | 5 |
| f) | Not tolerated – No | 6 |
| g) | Somehow tolerated | 7 |
| h) | Not tolerated at all | 8 |

27.1 The value representing the reason the communities' tolerance or don't tolerate their according to the respondents i.e. Ward Committee Members, Councilor and government officials:
**Ward Committee Members & Councilor**

| | | |
|---|---|---|
| | Economic - Access to work opportunities and livelihoods either formal or informal | 1 |
| | Social - Government services | 2 |
| | Environment | 3 |
| | Other reasons including socio-economic i.e. both 1 & 2 | 4 |

**Government Officials**

| | | |
|---|---|---|
| | Economic - Access to work opportunities and livelihoods either formal or informal | 5 |
| | Social - Government services | 6 |
| | Environment | 7 |
| | Other reasons including socio-economic i.e. both 1 & 2 | 8 |

28. The value representing the communities' benefit in exposing themselves to the disaster hazards that they are faced with in their areas according to the respondents i.e. Ward Committee Members, Councilor and government officials:
**Ward Committee Members & Councilor**

| | | |
|---|---|---|
| a) | Economic | 1 |
| b) | Social | 2 |
| c) | Environmental | 3 |
| d) | Other or Socio-economic | 4 |

**Government Officials**

| | | |
|---|---|---|
| e) | Economic | 5 |
| f) | Social | 6 |
| g) | Environmental | 7 |
| h) | Other or Socio-economic | 8 |

28.1 The value representing the communities' benefit in staying in their areas according to the respondents i.e. Ward Committee Members, Councilor and government officials:

**Ward Committee Members & Councilor**

| | | |
|---|---|---|
| | Access to work opportunities and livelihoods either formal or informal | 1 |
| | Government services | 2 |
| | Proper environment | 3 |
| | Other including socio-economic i.e. both 1 & 2 | 4 |

**Government Officials**

| | | |
|---|---|---|
| | Access to work opportunities and livelihoods either formal or informal | 5 |
| | Government services | 6 |
| | Proper environment | 7 |
| | Other including socio-economic i.e. both 5 & 6 | 8 |

29. The value representing the communities' willingness or predisposition to relocate to an alternative area away from the one exposed to disaster hazards according to the respondents i.e. Ward Committee Members, Councilor and government officials:

**Ward Committee Members & Councilor**

| | | |
|---|---|---|
| | Willingness to relocate to a better area - Yes | 1 |
| | Willingness to relocate to a better area - No | 2 |

**Government Officials**

| | | |
|---|---|---|
| | Willingness to relocate to a better area - Yes | 3 |
| | Willingness to relocate to a better area - No | 4 |

29.1 The value representing the reasons for communities' willingness or predisposition to relocate or not relocate according to the respondents i.e. Ward Committee Members, Councilor and government officials:

**Ward Committee Members & Councilor**

| | | |
|---|---|---|
| | Access to work opportunities and livelihoods either formal or informal | 1 |
| | Government services including free houses | 2 |

| | | |
|---|---|---|
| | Proper environment | 3 |
| | Other including socio-economic i.e. both 1 & 2 | 4 |

**Government Officials**

| | | |
|---|---|---|
| | Access to work opportunities and livelihoods either formal or informal | 5 |
| | Government services including free houses | 6 |
| | Proper environment | 7 |
| | Other including socio-economic i.e. both 5 & 6 | 8 |

30. The value representing the communities' coping capacity for the disaster hazards and impact as it exist in their area according to the respondents i.e. Ward Committee Members, Councilor and government officials:

**Ward Committee Members & Councilor**

| | | |
|---|---|---|
| | People have coping capacity - Yes | 1 |
| | People have no coping capacity - No | 2 |

**Government Officials**

| | | |
|---|---|---|
| | People have coping capacity - Yes | 3 |
| | People have no coping capacity - No | 4 |

30.1 The value representing the reasons the communities' coping or no capacity for the disaster hazards and impact as it exist in their area according to the respondents i.e. Ward Committee Members, Councilor and government officials:

**Ward Committee Members & Councilor**

| | | |
|---|---|---|
| | Despondent and accepted their areas such that it is their new normal | 1 |
| | Government services including rebuilding of their shelters | 2 |
| | People are generally resilient because of social networks and support | 3 |
| | Other including socio-economic i.e. both 1 & 2 | 4 |

**Government Officials**

| | | |
|---|---|---|
| | Despondent and accepted their areas such that it is their new normal | 5 |
| | Government services including rebuilding of their shelters | 6 |
| | People are generally resilient because of social networks and support | 7 |
| | Other including socio-economic i.e. both 5 & 6 | 8 |

31. The value representing the communities' preparedness for the disaster hazards and impact as it exist in their area according to the respondents i.e. Ward Committee Members, Councilor and government officials:

**Ward Committee Members & Councilor**

| | | |
|---|---|---|
| | People preparedness - Yes | 1 |
| | People no prepared for disasters - No | 2 |

**Government Officials**

| | | |
|---|---|---|
| | People preparedness - Yes | 3 |
| | People no prepared for disasters - No | 4 |

31.1 The value representing the communities' preparedness or not for the disaster hazards and impact as it exist in their area according to the respondents i.e. Ward Committee Members, Councilor and government officials:

**Ward Committee Members & Councilor**

| | | |
|---|---|---|
| | Depends of the magnitude of the disaster or impact | 1 |
| | Government supports including rebuilding of their shelters | 2 |
| | People are generally prepared because of social networks and support | 3 |
| | Other including socio-economic i.e. both 1 & 2 | 4 |

**Government Officials**

| | | |
|---|---|---|
| | Depends of the magnitude of the disaster or impact | 1 |
| | Government supports including rebuilding of their shelters | 2 |
| | People are generally prepared because of social networks and support | 3 |
| | Other including socio-economic i.e. both 5 & 6 | 8 |

**PART 3:**

32. The value representing the Ward Committee Members, Councilor and government officials knowledge of the existence of community vulnerability assessment in the area:

**Ward Committee Members & Councilor**

| | | |
|---|---|---|
| | Knowledge of vulnerability assessment - Yes | 1 |
| | Not Knowing of vulnerability assessment - No | 2 |

**Government Officials**

| | | |
|---|---|---|
| | Knowledge of vulnerability assessment - Yes | 3 |
| | Not Knowing of vulnerability assessment - No | 4 |

32.1 The value representing the years of existence of the community vulnerability assessment in the area according to the Ward Committee Members, Councilor and government officials:

**Ward Committee Members & Councilor**

| | | |
|---|---|---|
| a) | 1 to 3 years | 1 |
| b) | 3 to 5 years | 2 |
| c) | 5 and more years | 3 |

**Government Officials**

| | | |
|---|---|---|
| d) | 1 to 3 years | 4 |
| e) | 3 to 5 years | 5 |

| | | |
|---|---|---|
| f) | 5 and more years | 6 |

33. The value representing the municipality's usage of the community vulnerability assessment in the area to prepare for the disasters according to the Ward Committee Members, Councilor and government officials:
**Ward Committee Members & Councilor**

| | | | |
|---|---|---|---|
| a) | Not sure | 1 | 1 |
| b) | Not using | 2 | 2 |
| c) | Somehow | 3 | 3 |
| d) | Greater degree | 4 | 4 |
| e) | Definitely | 5 | 5 |

**Government Officials**

| | | | |
|---|---|---|---|
| f) | Not sure | 1 | 6 |
| g) | Not using | 2 | 7 |
| h) | Somehow | 3 | 8 |
| i) | Greater degree | 4 | 9 |
| j) | Definitely | 5 | 10 |

34. The value representing the impression of the Ward Committee Members, Councilor and government officials on the communities' household disaster preparedness planning:
**Ward Committee Members & Councilor**

| | | | |
|---|---|---|---|
| a) | Not sure | 1 | 1 |
| b) | Not using | 2 | 2 |
| c) | Somehow | 3 | 3 |
| d) | Greater degree | 4 | 4 |
| e) | Definitely | 5 | 5 |

**Government Officials**

| | | | |
|---|---|---|---|
| f) | Not sure | 1 | 6 |
| g) | Not using | 2 | 7 |
| h) | Somehow | 3 | 8 |
| i) | Greater degree | 4 | 9 |
| j) | Definitely | 5 | 10 |

35. The value representing the impression of the Ward Committee Members, Councilor and government officials on the government undertaking of the disaster preparedness planning:
**Ward Committee Members & Councilor**

| | | | |
|---|---|---|---|
| a) | Not sure | 1 | 1 |
| b) | Not using | 2 | 2 |
| c) | Somehow | 3 | 3 |
| d) | Greater degree | 4 | 4 |

| | | | |
|---|---|---|---|
| e) | Definitely | 5 | 5 |

**Government Officials**

| | | | |
|---|---|---|---|
| f) | Not sure | 1 | 6 |
| g) | Not using | 2 | 7 |
| h) | Somehow | 3 | 8 |
| i) | Greater degree | 4 | 9 |
| j) | Definitely | 5 | 10 |

36. The value representing the impression of the Ward Committee Members, Councilor and government officials on the existence of the disaster institutional structures in the municipality:
**Ward Committee Members & Councilor**

| | | | |
|---|---|---|---|
| a) | Not sure | 1 | 1 |
| b) | Not using | 2 | 2 |
| c) | Somehow | 3 | 3 |
| d) | Greater degree | 4 | 4 |
| e) | Definitely | 5 | 5 |

**Government Officials**

| | | | |
|---|---|---|---|
| f) | Not sure | 1 | 6 |
| g) | Not using | 2 | 7 |
| h) | Somehow | 3 | 8 |
| i) | Greater degree | 4 | 9 |
| j) | Definitely | 5 | 10 |

37. The value representing the impression of the Ward Committee Members, Councilor and government officials on the municipality usage of any information system for disaster management to record and monitor disasters in the municipality:
**Ward Committee Members & Councilor**

| | | | |
|---|---|---|---|
| a) | Not sure | 1 | 1 |
| b) | Not existing | 2 | 2 |
| c) | Do exist | 3 | 3 |
| d) | Greater degree exist | 4 | 4 |
| e) | Definitely effective | 5 | 5 |

**Government Officials**

| | | | |
|---|---|---|---|
| f) | Not sure | 1 | 6 |
| g) | Not existing | 2 | 7 |
| h) | Do exist | 3 | 8 |
| i) | Greater degree exist | 4 | 9 |
| j) | Definitely effective | 5 | 10 |

38. The value representing the impression of the Ward Committee Members, Councilor and government officials on the municipality usage of its full resources to response to community disasters:

**Ward Committee Members & Councilor**

| | | | |
|---|---|---|---|
| a) | Not sure | 1 | 1 |
| b) | Not using | 2 | 2 |
| c) | Somehow | 3 | 3 |
| d) | Greater degree | 4 | 4 |
| e) | Definitely | 5 | 5 |

**Government Officials**

| | | | |
|---|---|---|---|
| f) | Not sure | 1 | 6 |
| g) | Not using | 2 | 7 |
| h) | Somehow | 3 | 8 |
| i) | Greater degree | 4 | 9 |
| j) | Definitely | 5 | 10 |

39. The value representing the impression of the Ward Committee Members, Councilor and government officials on the existence of known early warning systems to inform the community on the pending disaster incident:

**Ward Committee Members & Councilor**

| | | | |
|---|---|---|---|
| a) | Not sure | 1 | 1 |
| b) | Not using | 2 | 2 |
| c) | Somehow | 3 | 3 |
| d) | Greater degree | 4 | 4 |
| e) | Definitely | 5 | 5 |

**Government Officials**

| | | | |
|---|---|---|---|
| f) | Not sure | 1 | 6 |
| g) | Not using | 2 | 7 |
| h) | Somehow | 3 | 8 |
| i) | Greater degree | 4 | 9 |
| j) | Definitely | 5 | 10 |

40. The value representing the impression of the Ward Committee Members, Councilor and government officials on effectiveness of the response mechanisms for disaster and emergency response in the municipality:

**Ward Committee Members & Councilor**

| | | | |
|---|---|---|---|
| a) | Not sure | 1 | 1 |
| b) | Not using | 2 | 2 |
| c) | Somehow | 3 | 3 |
| d) | Greater degree | 4 | 4 |
| e) | Definitely | 5 | 5 |

**Government Officials**

| | | | |
|---|---|---|---|
| f) | Not sure | 1 | 6 |
| g) | Not using | 2 | 7 |
| h) | Somehow | 3 | 8 |
| i) | Greater degree | 4 | 9 |
| j) | Definitely | 5 | 10 |

41. The value representing the impression of the Ward Committee Members, Councilor and government officials on knowledge disaster and emergency public education and training program in the communities:
**Ward Committee Members & Councilor**

| | | | |
|---|---|---|---|
| a) | Not sure | 1 | 1 |
| b) | Not using | 2 | 2 |
| c) | Somehow | 3 | 3 |
| d) | Greater degree | 4 | 4 |
| e) | Definitely | 5 | 5 |

**Government Officials**

| | | | |
|---|---|---|---|
| f) | Not sure | 1 | 6 |
| g) | Not using | 2 | 7 |
| h) | Somehow | 3 | 8 |
| i) | Greater degree | 4 | 9 |
| j) | Definitely | 5 | 10 |

42. The value representing the impression of the Ward Committee Members, Councilor and government officials on knowledge of existence and implementation of the rehearsals programmes of the communities:
**Ward Committee Members & Councilor**

| | | | |
|---|---|---|---|
| a) | Not sure | 1 | 1 |
| b) | Not using | 2 | 2 |
| c) | Somehow | 3 | 3 |
| d) | Greater degree | 4 | 4 |
| e) | Definitely | 5 | 5 |

**Government Officials**

| | | | |
|---|---|---|---|
| f) | Not sure | 1 | 6 |
| g) | Not using | 2 | 7 |
| h) | Somehow | 3 | 8 |
| i) | Greater degree | 4 | 9 |
| j) | Definitely | 5 | 10 |

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1. CHAPTER ONE

1 INTRODUCTION

Humankind, of every religion, race, ethnicity and nationality, for centuries have been attracted, and sometimes trapped to cities. According to Van Der Waldt et al. (2014), archaeologists have traced the origins of cities as human settlements to Mesopotamia (about 3500 BC), Egypt (4000BC - China and India (about 3000 – 2500 BC). They indicate that cities were the religious, administrative and political centres where their residents were most land owners whose physical presences were not necessary in their productive rural land. They affirm that these landlords had established a social system that was connected to the rural production and communities. They state that new type of cities as we know them today have their origin in the 19th century industrialization. In other words, the phenomenon of urbanization has been part of humankind for many years now with the ultimate end result probably resulting into the disappearance of rural settlements as we know them today.

The report by Engelke (2017), titled The Disunity of the Cities: Ecology and Conflict in Urbanizing Planet, captures this phenomenon vividly, when it declares that for most part of human history the cities have positioned themselves as a default condition for human settlement that will configure and drive local, regional and international social, political, economic and environmental conditions on all scales. Engelke further contends that urbanization have already attracted half or humankind to the cities with Asia, Africa and the Middle East reading the same numbers as Latin America, Europe, North America and Australia. Engelke (2017) predicts that from 2018 to 2050 the number of people living in the cities will reach three (3) billion. The numbers, as suggested, show means that the cities are becoming the critical human centres for settlement in the 21st century and beyond.

While cities may appear to be attractive and future settlement for the general humankind, cities are also the source of some of the current world problems. Engelke (2018) maintains that cities are the biggest polluters of the world in terms of water and air through 60 to 70 percent consumption of energy and emission of carbon dioxide which increases the impact of climatic change on the poor and marginalized communities through extreme weather disasters' events like floods, landslides, etc. In addition, Engelke (2018) sees cities as the point of intersection between the increase in the urban settlement and the extreme exposure of the poor and many related communities to the impacts of disasters as a results of climate change.

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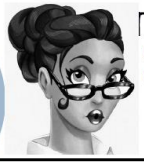
## ANNEXURE 10: EDITOR'S LETTER



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30 January 2021

### LETTER OF CONFIRMATION

I hereby confirm that I have done the language editing for the following dissertation:

Author: Mr Mazibuko

Title: Assessing the level of disaster preparedness of the City of Ekurhuleni using the climate related incident of 2015

Document: Masters in Disaster Management

This letter serves to confirm that I have edited Mr Mazibuko document and I have made appropriate changes. The document was edited using track changes.

I was only responsible for the language editing. The student took care of all the technical aspects of the document. I am not responsible for any additional information that is added to the document after I have edited it. The student is responsible for the final document submitted.

I trust you find the above in order.

Regards

Hazvinei Majonga
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