

University of Zululand



Faculty of Humanities and Social Sciences

**Analysing the impact of and response to the 2019 tornado in Harry Gwala
District Municipality, KwaZulu-Natal, South Africa.**

By

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Master of Arts

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Supervisor: Prof. I Moyo

ORIGINALITY DECLARATION

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In particular, I confirm that I obtained an ethical clearance certificate for my research (Certificate Number UZREC 171110-030 PGM 2021/77) and have complied with the conditions as set out in that certificate.

I further certify that this research thesis is original and that it has not been published elsewhere, or submitted, either in whole or in part, for a degree at this or any other university.

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DEDICATION

I dedicate this research to the communities of the Harry Gwala District Municipality. Specifically, the uMzimkhulu communities, who continuously face severe weather incidences and their impacts, but they resiliently find means to survive under the circumstances. My mates, your struggle was the main motivation for this study, I hope one day the conditions which increase your vulnerability will change and you will live freely.

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LIST OF ACRONYMS

1. GIS: Geographic Information System
2. HGDM: Harry Gwala District Municipality
3. IDP: Integrated Development Plan
4. NASA National Aeronautics and Space Administration
5. NDZ: Nkosazana Dlamini Zuma
6. NGO: Non-Governmental-Organisation
7. NGDP National Gross Domestic Product
8. NRF: National Research Fund
9. RDP Reconstruction and Development Programme
10. RSA: Republic of South Africa
11. SPSS: *Statistical* Package for the Social Sciences
12. USA: United States of America
13. UZREC: University of Zululand Research and Ethics Committee

ABSTRACT

This study aims to analyse the impact of and response to the 2019 tornado disaster in Harry Gwala District Municipality, KwaZulu-Natal, South Africa. To achieve this aim, this research utilized mixed research methods to collect and analyse data. Questionnaires were used to collect data from households while structured interviews were used to gather information from municipal officials. Data was analysed through SPSS and a thematic approach. The findings show that in terms of the occurrence and distribution of tornado disasters in Harry Gwala District Municipality between 1989 and 2019, the most affected municipalities were NDZ and UMzimkhulu. Regarding the socio-economic impacts of the 2019 tornado in the study area, it was discovered that the uMzimkhulu and uBuhlebezwe municipalities had the most adversely affected households because of mud building material used by many households in these municipalities. In terms of coping strategies, the research found that people have no awareness regarding their respective disaster management offices, hence their immediate response was to call their councillors. Concerning the government response, there was a collaboration between all relevant stakeholders from the public and private sectors. The relief provided to households included food parcels and blankets, however, road and network infrastructure were reported to be a challenge, delaying this provision. The results on community perceptions indicate that a large proportion of respondents believed that the tornado was caused by *iNkanyamba* while others believed that it was caused by God's anger, only a few understood that it was a result of climatological conditions. This research suggests the disaster management centre should invest in research on these incidences so that they are well documented and understood. It is also suggested that housing development should also be implemented in rural areas and there is a need for continuous community workshops to educate people on natural disasters and effective response strategies.

Keywords: Disaster, Tornado. Vulnerability. *iNkanyamba*.

CHAPTER 1: INTRODUCTION AND ORIENTATION TO THE STUDY

1.1. Introduction

This chapter introduces the whole study, by explaining the background to the study, and the research problem. It also states the aim, objectives and research questions of this study. The chapter further describes the significance of this research as well as the structure of the whole thesis.

1.2. Background of the study

A disaster is defined as a progressive or unexpected, global or localised occurrence as a result of natural or human causes leading to, or threatening to cause death, injury or disease, destruction to property, infrastructure or the environment as well as major disturbances in the life of a community (RSA, 2002). A disaster may also refer to ‘a sudden event that results in damage, ecological disruption, loss of human life, deterioration of health and health services, and which exceeds the capacity of the affected community on a scale sufficient to require outside assistance’ (Landsman, 2001). Therefore, an event becomes a disaster when there is a need for external organisations' intervention. This is where disaster management comes in, intending to reduce or eliminate where possible, the expected damages from a disaster, provide essential assistance to victims as required and sustainable recovery plans (Sena and Michael 2006).

There are various types of disasters which can be caused by either human or natural acts (RSA, 2002). Natural disasters are a result of sudden or slow onset events which can be geophysical including earthquakes, landslides, tsunamis and volcanic activities (Mohamed 2019). These natural disasters can be classified into; Hydrological events (avalanches and floods), climatological events (extreme weather conditions, drought and wildfires), and meteorological events (cyclones, storms or wave surges), as well as biological disasters such as disease outbreaks. According to Mohamed (2019; 2), “technological or man-made disasters have a human cause and occur in or close to human settlements which include environmental degradation, pollution and accidents”.

However, it should be noted that the neat classification of natural and man-made disasters is not clear-cut as some disasters are a combination of both natural and

human factors. This study focuses on the impact of and response to the 2019 tornado at the Harry Gwala District Municipality.

1.3. Problem statement

According to Grobler (2003), South Africa is not popularly considered an area exposed to major natural disasters. However, the country does experience natural disasters with floods and droughts being the most prominent. The country also faces incidences of meteorological phenomena such as tropical cyclones, tornadoes and severe thunderstorms. These incidences may result in flooding, destruction of buildings and loss of life (Grobler 2003). In South Africa, several studies have been conducted regarding the impact of storms on people's livelihoods, but the focus has been mainly on coastal areas, for instance, Guastella and Rossouw (2009), Davis-Reddy, Vincent and Mambo (2017) and Dube, Nhamo, and Chikodzi (2021). There is a gap in the literature in terms of documenting the impact of tornadoes in localised areas. This is the context within which this study focuses on the impact of the severe tornado on Harry Gwala District Municipality. It is precisely because the area has experienced this severe tornado and no study has been conducted in this respect.

1.4. Aim and objectives

This study aims to analyse the impact of and response to the 2019 tornado disaster in the Harry Gwala District Municipality, KwaZulu-Natal, South Africa.

1.4.1. Objectives

The objectives of the study are to;

- a. Map the occurrence and distribution of tornado disasters in Harry Gwala District Municipality between 1989 and 2019.
- b. Analyse the socio-economic impacts of the 2019 tornado in the study area in terms of effects on livelihoods.
- c. Examine the coping strategies by the communities in the Harry Gwala District Municipality to the 2019 tornado.
- d. Assess government response to the tornado in the study areas.
- e. Explore the perception of the communities towards the tornado disasters.

1.4.2. Research questions

The study research questions are;

- a. How is the occurrence and distribution of tornado disasters in Harry Gwala District Municipality between 1989 and 2019 illustrate?
- b. What were the socio-economic impacts of tornado disasters in the study area in terms of effects on livelihoods?
- c. Which coping strategies were used by the communities in the study area during the tornado attack?
- d. What was the government's response to the tornado disasters in the study area?
- e. What are the perceptions of the communities towards the tornado disasters?

1.5. Significance of the study

Harry Gwala District Municipality is prone to severe weather conditions such as tornados, thunderstorms, lightning, drought, heavy winds and hail (Aurecon, 2012). Therefore, by analysing the impact of and response to the 2019 tornado by the Harry Gwala District Municipality, this study will provide information which will be useful to communities and municipalities in terms of assisting them to respond to disasters in future.

1.6. Outline

This research consists of seven chapters as follows;

Chapter 1 provides the introduction, setting and orientation of the study. Chapter 2 discusses the theoretical frameworks that will be utilised in this research. Chapter 3 reviews the literature on tornadoes and their impacts. This is intended to identify the research gap and thus locate this research. Chapter 4 describes the setting of the study to provide a contextual background of the study area. Chapter 5 describes the research methodology in terms of outlining the research paradigm and design as well as data collection and analysis procedures. Chapter 5 focuses on the analysis and interpretation of the data. Chapter 7 concludes the whole study and also provides recommendations.

1.7. Chapter Summary

This chapter provided the background of the study and stated the main research problem to be addressed by this paper. The chapter also stated the aim and objectives of this study including the research questions. It also clarified the significance of this study and provided the outline of the whole research study. The next chapter discusses the theoretical frameworks.

CHAPTER 2: THEORETICAL FRAMEWORKS

2.1. Introduction

A theoretical framework is defined as a structure that summarizes concepts and theories, which one can develop from previously tested and published knowledge and use to create a theoretical background (Kivunja, 2018). This chapter, therefore, discusses the theoretical frameworks utilised in this research, these being vulnerability theory and the community-based disaster management approach. The first part of the chapter defines the main concepts used in this study and the second discusses the theoretical frameworks and their application in this study.

2.2. Definition of main concepts

The main concepts on which this research is based are;

2.2.1. Socio-economic impact

In Morris and Baartjes (2010), social indicators are explained as measures that can be used as instruments for measuring and determining the level and distribution of welfare in a society. On the other hand, the economic indicators are concerned with economic growth and development issues (Morris and Baartjes, 2010). Based on the above definitions, the socio-economic impact in this paper will refer to the impact of tornadoes on the welfare of society, and economic and developmental issues.

2.2.2. Livelihoods

A livelihood encompasses the capabilities, material assets, social resources and activities that people engage in to maintain their living (Krantz 2001). In this research, this concept is used to describe daily activities that community members engage in to earn income to sustain their living.

2.2.3. Community

Refers to a group of people with different characteristics who are connected by social ties, share common perspectives, and engage in joint action in a geographical location or setting (McQueen et al., 2001). In this chapter, the concept will be used to refer to a group of people in a specified geographical area who are respondents to this research.

2.2.4. Perception

McDonald (2011) states that perception involves the way one sees the world. This research will use this concept to refer to the opinions of respondents regarding the researched phenomena.

2.2.5. Relief

This chapter uses this concept to refer to the temporal measures to cope with disastrous effects of tornado in the study area.

2.2.6. Vulnerability

The concept of vulnerability refers to the degree of risk associated with the physical, social and economic aspects and implications resulting from a system's ability to cope with the resulting event (Haigh & Amaratunga 2014). Vulnerability in this chapter is used to explain the extent to which people are exposed to the negative impacts of a tornado disaster.

2.3. Theoretical frameworks

This research will utilise two theories which are the Vulnerability Theory and Community Based Disaster Management (CBDM) approach.

2.3.1. Social Vulnerability Theory

The Social Vulnerability Theory explains how, as well as the levels to which social groups or society are exposed to possible structural and non-structural losses as a result of hazardous events and disasters (Cutter, 1996). However, Marx et al., (2012), noted that the vulnerability approach changes the emphasis from post-disaster response to pre-disaster mitigations of circumstances that result in a disaster. The definition of vulnerability provided by Rich (2018) draws attention to the role of the state in responding to disasters. This version of vulnerability theory is divided into five components:

2.3.1.1 The rejection of the liberal subject in favour of a vulnerable subject

Vulnerability theory deserts the common liberal subject and supports the vulnerable subject (Rich, 2018). Liberalism asserts that society is made up of separate individuals with each creating self-worth using his/her power to make choices in his/her effort to achieve goals in life (Nussbaum, 1997) However, the vulnerability theory supports

public policy that is based on social relationships instead of separate individuals (Rich, 2018). The underlying reason for this is that the vulnerable subject has no power to dictate the course of his/her life through exercising independent choices (Fineman, 2010).

2.3.1.2 The universality and constancy of vulnerability

This is based on the idea that vulnerability occurs in several forms such as technology, customer and environmental vulnerability (Feldman and Kahan 2007). The belief that vulnerability is universal is based on the assumption that everyone is vulnerable (Rich, 2018). Pettit and Sandel (1998), stated that vulnerability is constant because people continue to face vulnerability throughout their lifetime.

2.3.1.3 The role organizations can play in mitigating vulnerability

This section on vulnerability argues that human lives are regulated by various institutions, from their birth in a hospital, the safety of human lives is determined by the level of safety of that hospital as provided by the state (Rich, 2018). It highlights the role of the state in securing the family structure and legitimizing using marriage and child custody laws (Fineman, 1993). Rich (2018), argued that human lives are continuously intertwined with the state institutions such as schools, universities, and even places of work are regulated by different state and federal laws. These institutions give people the capacity to overcome vulnerability (Rich, 2018).

2.3.1.4 A movement from formal equality to practical equality

Formal equality entails that laws are equally enforced on all individuals and everyone is free to exercise their rights (Hartz, 1955). The vulnerability theory argues that equal treatment is different from equal opportunity (Rich, 2018). The formal and equal treatment style of equity that is popular in America is being rejected by vulnerability theory (Hartz, 1955). The vulnerability theory supports substantive equality which goes beyond the equal right to choose and embraces a positive conception of liberty (Rich, 2018). The substantive equality rest on the assumption that institutions beyond human control are a driving force behind the course of human life (Rich, 2018).

2.3.1.5 A More Responsive State

The main aim of vulnerability theory is to push for a more responsive state in a justifiable manner that does not discriminate against any individual (Rich, 2018). This is because vulnerable subjects are universally and constantly vulnerable, their coping mechanisms depend on state institutions as most human life is regulated and funded by the state (Rich, 2018).

Poverty, health status and economic inequality are said to be the determinants of vulnerability while the number of storm shelters available for the use of coastal communities or the presence of protocols concerning the quality of buildings in areas exposed to disasters is considered as specific determinants (Brooks et al., 2005). This theory argues that some groups of people are more exposed to disaster losses than others because of their geographic location or financial status. This is also emphasised by Marx et al., (2012) who argue that income and access to resources such as information are differentiated between various social groups and are considered as other factors that determine response to hazards.

The vulnerability concept assists in identifying those groups in the community that are at risk during emergencies (Marx et al., 2012). It is a well-known fact that elderly people are more vulnerable to disasters because of weak physical mobility, sensory awareness, chronic health conditions, and other socio-economic boundaries that affect their ability to respond and adapt to disasters (Benson, 2013). On top of these factors that increase vulnerability to disasters, Fothergill and Peek (2004) highlighted the role of education in providing knowledge and skills to cope with disasters where illiterate people are more vulnerable to disasters as they lack access to warning systems or experience more difficulties navigating recovery programs. This research utilises the insights in this theory to map out the occurrence and distribution of tornado disasters focusing on who and which areas are affected. Additionally, the theory will be used to examine the socio-economic impacts of tornado disasters in terms of their effects on livelihoods and also to analyse the coping strategies by the communities in the Harry Gwala District Municipality. This addresses the first, second and fourth objectives of this study, in that it will assist in identifying those communities that are vulnerable and map their geographical location and exposure to disasters. This will then lead to an analysis of the socio-economic status of vulnerable households. As

stated by Brooks et al., (2005) economic inequality is one of the popularly known determinants of vulnerability. Studying the socio-economic impacts will contribute to studying the coping mechanisms, addressing the third component of the vulnerability theory which focuses on the role organizations can play in mitigating vulnerability.

2.3.2. Community-based disaster management approach

This is a disaster management approach at a community level which encourages community involvement in terms of partnership, participation, empowerment and ownership of disaster management projects by the local people (Pandey and Okazaki 2005). In cases where there is minimum participation and activities from affected communities in responding to disasters, command and control methods are employed by external parties resulting in a top-down approach (Pandey and Okazaki 2005). This is also emphasized by Marx et al., (2012) who stated that international agencies and national governments typically provide emergency assistance in a top-down manner that reduces affected people to victims and passive recipients of aid. The top-down approach involves addressing the risk in an overall vision of the company and these risks are identified by members of the executive committee, while the bottom-up approach allows greater freedom in the expression of the vision process and operational risks through the use of open-ended semi-structured interviews and questionnaires (El Arif Fatima Zahra, 2013).

The top-down approach is blamed for failing to deliver necessary humanitarian needs and for the inappropriate utilisation of external resources (Pandey and Okazaki 2005). Even though the government and international communities including donor agencies play a significant role in minimising the disaster impacts, it has been found that a number of the disaster management programmes have failed to be sustainable at a local level after the completion of the project because of lack of community participation (Pandey and Okazaki 2005). Community-based disaster management approaches respond to failures of the top-down approach by promoting a bottom-up approach, working in harmony with the top-down approach, to address the challenges and difficulties (Pandey and Okazaki 2005). This approach argues that communities are directly impacted by both small and major disasters and they have more to lose if they do not address their vulnerability. However, they have a lot to gain if they were to reduce the impact of disasters in their community (Shaw and Okazaki 2004).

The Community-Based Disaster Management (CBDM) approach emphasises participation as the key principle, by providing people with more access and control over resources and basic social services. However, CBDM does not ignore the importance of scientific and objective risk assessment and planning as well as the involvement of other stakeholders (Shaw and Okazaki 2004). This approach will assist in addressing the third and fourth objectives of this research. The third objective is based on examining the coping strategies of communities, therefore, this approach will assist in determining the role played by community members in responding to the impacts of disasters in their community. It also assists in addressing the fourth objective of this study, which analyses the role played by the government in responding to the effects of disasters. Since this approach operates at a community level, it can assist in addressing the fifth objective of the study which is based on exploring the perceptions of the community towards tornado disasters.

2.3.3. Chapter Summary

The chapter discussed two theoretical frameworks that underpin this study. The key concepts that are used in this thesis were discussed in the paper. The next chapter will be reviewing the literature regarding the researched phenomena.

CHAPTER 3: LITERATURE REVIEW

3.1. Introduction

This chapter reviews the existing literature on disasters. It starts by describing the distribution of tornadoes in the world, their socio-economic impacts, and coping strategies that have been adopted by communities around the world. It concludes with an analysis of the response of the different organisations to disasters.

3.2. Distribution of tornado disasters in the world

A tornado is a meteorological natural disaster which appears as a narrow, violently rotating column of air that extends from the base of a thunderstorm to the ground and is considered a most violent storm (Balasubramanian, 2018). Exposure to tornadoes as well as their distribution differs from one country to another and also from one region of a country to another. The United States of America (USA) has many tornadoes above all countries in the world, for instance in the year 2015 there were 1178 confirmed tornadoes, which resulted in 36 deaths and up to 321 million financial costs (Lian et al., 2017).

Several studies on tornadoes and their distribution are based in the United States. For example, Kovach and Konrad (2014) researched the spatial distribution of tornadoes in the southeastern United States. This study used first-order weather stations affected by each storm. Results showed that many tornadoes and high wind impacts take place in the right-forward sector of the tornadoes cyclone. Added to that, the majority of tornadoes result in impacts that occur in other areas far from the centre of circulation (Kovach and Konrad, 2014). Fricker et al., (2017) studied a dasymetric method to spatially apportion tornado casualty counts. The results of that study show that there is an equal spatial distribution of tornado-induced casualties. However, rates are higher in the mid-south, mainly in northern Mississippi and Alabama, and also in many other metropolitan areas (Fricker et al., 2017). These studies conclude that either way, the USA is vulnerable to tornadoes, this may be a result of her geographic location in the world. In 2017, Lian et al., (2017) researched a cloud-based system for exploring tornado events. Their paper provided a novel system which uses cloud-based

technology for integrating, storing, exploring, analysing, and visualizing meteorological data associated with tornado outbreaks.

The recent study by Swienton et al., (2021) which focused on studying the direct injuries and fatalities of Texas tornado outbreaks from 1973 to 2007 revealed that a sum of 5,288 tornadoes resulted in 223 direct fatalities and 4,486 direct injuries. The same study also showed tornado distribution in the country. The results indicated that the Texas Panhandle, north-central Texas, and the eastern half of the coastal plain all display higher frequencies of reported tornado hazards. They used a Getis-Ord Gi tool to identify clustering patterns for tornado severity outbreaks, fatalities, and injuries without major outliers. The results of this tool showed that high tornado severity hotspots were dominating in east Texas, with a small hotspot in the Northeast Panhandle (Swienton et al., 2021).

There is a gap in terms of mapping the recent occurrence of tornadoes in several places of the world including Africa, even though Davis-Reddy, Vincent and Mambo (2017) reported that Southern Africa is exposed to extreme weather events such as floods, droughts, fires and large storms. There are limited recent studies which have mapped such incidences. Based on EM-DAT CRED (2016), the Southern African Development Community experienced 491 recorded climate-related disasters which affected about 140 million people, killed 110 978 while 2.47 million lost their homes. Mather and Stretch (2012), reported that South Africa, Mozambique, Tanzania, Madagascar and the small island states like Mauritius, which constitute the south-eastern coastline of Southern Africa, are usually affected by cyclones and other significant weather events that result in storm surges. These storm surges result in major destruction to settlements and infrastructure (Mather and Stretch, 2012).

A study was conducted by Kimambo (2018) aimed at understanding tornadoes in South Africa using a case study analysis. This study revealed that South Africa experiences continuous episodes of tornadoes, however, they are not usually captured in literature (Blamey et al., 2017). The study aimed to provide an overview of the occurrence of tornadoes in South Africa using the case of Klerksdorp tornado, which occurred on March 4, 2007, in the Northwest Province of South Africa (Kimambo, 2018). The study found that in the case of Klerksdorp, the occurrence of a tornado was linked to the prevailing frontal system and the cut-off low. Goliger and

Milford (1998)'s study showed that in South Africa, tornadoes dominate in the southeast of the country, where the Harry Gwala district is also located. However, the more recent tornadoes remain unmapped hence this research will use the NASA Disasters Mapping Portal for viewing, analyzing, and downloading the latest near real-time and tornado disaster-specific products in Geographic Information Systems (GIS) format. This information will be used to map the occurrence and distribution of tornado disasters in the Harry Gwala District Municipality between 1989 and 2019. This will help in closing the gap that exists in terms of reporting and mapping tornado disasters in the study area.

3.3. Socio-economic impacts of tornadoes

Natural disasters including floods, tornadoes, wildfires, and mudslides, are surprisingly unusual events, however, they affect communities at unpredictable times and have a huge impact on human life and infrastructure (Subasinghe et al., 2020). In most cases, tornadoes usually lead to death or injury, cases similar to those caused by earthquakes, tsunamis, and hurricanes. Tornadoes have a direct effect on various community spheres such as the economy, agriculture, food security, water, sanitation, the environment and health each year (Lone and Subramani, 2016). This occurs when disasters destroy important agricultural assets and infrastructure, which results in losses in crops, livestock and fisheries production (Livelihoods, 2015). Disasters have the potential of changing agricultural trade figures, resulting in a loss in agricultural secondary and tertiary industries such as the textile and food processing industries (Livelihoods, 2015). This means a decrease in the economic growth of countries whose economies largely depend on agriculture and are a major contributor to the National Gross Domestic Product (NGDP) (Livelihoods, 2015).

According to the National Centres for Environmental Information (2019a), tornadoes are responsible for nearly a third of disaster-related fatalities in the United States since 1950. Almost 20% of U.S. billion dollars was spent on disasters between 1973 and early 2007. A study conducted by Kantamaneni, Alrashed, and Phillips (2017), focused on the cost of rebuilding houses after tornadoes and that of building tornado-resistant homes. The study revealed that the United States experience an average of more than 1200 tornadoes yearly and in 2013, there were 54 deaths and damage of \$3.6 billion as a result of 742 tornadoes. Added to that are the structural damage cost at a global and regional scale of more than \$8 billion and \$1.5 billion respectively, which make up

60% of annual insurance losses (Kantamaneni, Alrashed, and Phillips, 2017). As emphasized in the distribution of tornadoes, the United States takes the lead, even in the socio-economic impacts of tornadoes.

However, a tornado in one part of the world can also affect other parts. For example, a study by Mukhtar et al., (2014) which focused on the effects of hurricanes and tornados on socio-economic development, noted that the 2012 Hurricane Sandy affected the Caribbean (Jamaica, Cuba, The Bahamas, Haiti, The Dominican Republic), the eastern seaboard of the United States of America, and also the Nigerian coastlines and shores. In the same paper, a commissioner for Waterfront Development and Infrastructure, Lagos State, Mr Adesegun Oniru further confirmed that Lagos always gets ripple effects of such incidences. This represents a global interconnectedness, meaning that what happens in one part of the world may affect what happens in another. This study (Mukhtar et al., 2014) noted both positive and negative socio-economic effects of a tornado on development, which also opens a gap for the current study to look at both positive and negative effects of tornadoes.

According to Mukhtar et al., (2014), apart from the destruction caused by hurricanes and tornadoes, such incidences are usually followed by a significant amount of rainfall which can be of agricultural benefit, environmental sanitation and supplement hydro-electrical power. These incidences also present opportunities for development in a society because the society learns to develop new technologies such as tracking a hurricane's life by satellite as well as issuing watches and warnings, and in the case of a tornado, its radar is detected and predicted. This enables the warning and evacuation of people before a landfall (Mukhtar et al., 2014).

Reddy et al., (2017) focused on reporting the socio-economic impacts of extreme weather events in Southern Africa. They reported that climate events are responsible for the largest percentage (67%) of natural disaster deaths (Reddy et al., 2017). This part of the continent is said to be exposed to extreme weather conditions such as floods, droughts, wildfires and storm surges, and these are expected to increase in the 21st century. It is anticipated that this will impact negatively on the infrastructure, transport, agriculture, health, tourism and insurance sectors (Reddy et al., 2017). The study by Kimambo (2018) focused on understanding tornadoes in South Africa using a case study analysis. The results of the study included characteristics and ingredients

of different storms. This study did not present the damages and socio-economic costs of these tornadoes. The possible explanation for this is the one provided by Grobler (2003) who argues that tornadoes are given less attention by researchers because of the localities (rural areas) and also due to the nature of the loss (mainly crops and occasionally buildings). This research will address this gap by studying the socio-economic impacts of the tornadoes in rural households of the Harry Gwala district.

3.4. Coping strategies that have been adopted by communities around the world.

Tornadoes are strong and destructive weather phenomena (Kantamaneni, Alrashed, and Phillips, 2017). This means that communities need to come up with measures to live and continue with their daily lives even after the tornadoes. Generally, the coping strategies against disasters are those that were developed by the government or other affected individuals to protect people from future disasters (Kantamaneni, Alrashed, and Phillips, 2017). In addition, it has been advanced that, there is a need for designing practices which will produce tornado-proof homes, in particular, 3D CAD models in tornado-prone zones in current climatic scenarios. This includes building stronger homes to prevent future damages as a way of coping with tornado disasters (Kantamaneni, Alrashed, and Phillips, 2017). Additionally, people must apply or use the strategies of responding to or coping with the impacts of tornadoes. This is important, given that some people do not implement measures aimed at addressing tornadoes. For example, the study conducted by Paul and Stimer (2015), which aimed at exploring tornado survivors' compliance with the safety features suggested by the Joplin city authorities in Missouri, found that 43% of all respondents applied at least one recommended tornado measure in rebuilding or repairing their destroyed homes.

Rasaki (2019) investigated disaster management practices in selected university libraries in Nigeria. The findings revealed that there were no ready planned disaster management practices within the investigated libraries. Rasaki (2019) recognized the importance and the role that is played by libraries in Nigeria and noted their exposure to different disasters. The author suggested that library workers must be taught and trained to have the necessary skills so they will be able to successfully respond to disasters and minimize their impacts. The study also noted a role that can be played by social media in universities to create awareness, and share experiences of disaster with disaster teams, management and other stakeholders. The study also proposed

that university libraries must have the necessary tools and equipment for monitoring, detecting and executing any plan to achieve the goal of disaster management (Rasaki, 2019). The study only focused on impacts and coping strategies for university libraries without looking at communities within which those libraries exist. This opens a gap for this study to look at coping strategies by all affected community structures including schools and churches.

The literature shows that in South Africa there is minimal reporting on tornado cases. The 21st October 1999 severe thunderstorm received little media attention as it was regarded as a "freak tornado" because its trail crossed areas with low population density (De Coning et al 2000). This tornado developed in the southern areas of Johannesburg where 40 people were injured, 10 were hospitalized while 300 people were left homeless and 400 houses and farm dwellings were damaged (De Coning, et al 2000). The study also focused on characteristics and weather conditions associated with tornado formation. The paper did not mention how the affected communities had to cope with the effects of the tornado. A later study by Faling, Tempelhoff, and Van Niekerk (2012), focused on measures taken by local municipalities in South Africa to plan for climate change. The study was based on Khara Hais Municipality in the Northern Cape Province and George Municipality in the Western Cape Province. The study collected popular memories of previous climatic conditions and also investigated how the present changes are being interpreted among the rural farmers in Khara Hais Municipality (Faling, Tempelhoff, and Van Niekerk, 2012). However, the study also did not focus on coping strategies by these farmers against previous climatic conditions, hence this research will study the coping strategies by communities in Harry Gwala District Municipality.

3.5. The response of different organizations to disasters

Disaster management is the readiness and ability of an organization to take action of mitigating response or rescue, rehabilitation and recovery after a disaster while ensuring the sustainability of all pillars of sustainable development, namely; social-economic; and environmental development (Eden and Matthews, 1996). Vermaak and Van Niekerk (2004) argued that finding effective methods where all-inclusive and multisectoral participation of professional disciplines and public interests, can contribute to reducing disaster risk is the current challenge for risk and disaster management. To achieve this goal both political commitment, and public

understanding to motivate local community involvement are required (Vermaak and Van Niekerk, 2004).

Disaster management in its international form involves the combination of both pre- and post-disaster activities such that human lives and properties are protected against disasters that may arise (Vermaak and Van Niekerk, 2004). A study by Silver and Matthews (2017) studied the use of Facebook for information seeking, decision support, and self-organization following an F3 tornado that impacted the community of Goderich, Ontario, on the 21st of August 2011. The study revealed that Facebook can be used to assist communities during and after a tornado by sharing among others, safety information. However, there was misleading information and gossip which occurred, this is where local officials intervened by reducing misleading information and encouraging public confidence (Silver and Matthews 2017).

A study conducted by Lu and Li (2020), on how Chinese local government and NGOs collaborate in responding to a crisis such as the Funing tornado. The Chinese disaster relief system formulated a city-level government with Yancheng municipality as the main player in responding to disasters occurring in areas within its authority (Lu and Li, 2020). The study revealed that there was an informal and formal working relationship between the government and NGOs working to respond to disasters in the area. However, the local government was leading the role of responding to natural disasters and had the responsibility to integrate all NGO activities. The study identified 12 government agencies who played different roles in this disaster, from warning the community about the expected weather phenomena, reporting the tornado from a village to a provincial level following a bottom-up approach, to rescuing people and providing temporal help. There were also 58 NGOs that were working on the case, grouped into 13 charity foundations, 28 professional and voluntary associations and 17 rescue groups (Lu and Li, 2020) This research will follow the path of Lu and Li, (2020) in identifying the NGOs and government departments that were involved in responding to the tornado disaster and their responsibilities in Harry Gwala District Municipality National Gross Domestic Product (NGDP) (Livelihoods, 2015).

In the case of Africa, Edoun, Balgah, and Mbohwa (2015) studied the impact of effective management of natural disasters on Africa's development. The study criticized the narrowed focus on states and markets when responding to natural

disasters while ignoring the role of social and informal agencies in the community. They argued that this contributes to an increase in the negative effects of natural disasters and their perverse implications on Africa's development. This paper argued that natural disasters must be viewed as a social phenomenon where there will be decreased participation of all affected parties hence, they proposed a multi-sector framework that can be used for modelling natural disaster management in Africa. This framework is said to have the potential of reducing the negative consequences of disasters (Edoun, Balgah, and Mbohwa, 2015).

In South Africa, the National Disaster Management Act requires all government spheres, together with civil society, to undertake to protect people, infrastructure and other national assets from the impact of disasters (RSA, 2002). According to Bulkeley and Betsill (2005), it is the responsibility of the government to plan for climate change adaptation and mitigation to reduce the vulnerability of people, infrastructure and other national assets to climate change and to protect the existing benefits of development. However, this research will further look at the response by community-based organizations and non-governmental organizations following the recognition by Doerfel, Chewning and Lai (2013) of the importance of the role played by these organizations, especially at a community level.

3.6. Community perceptions regarding disasters

Individuals usually have different opinions and perceptions regarding their surrounding environment and incidences including tornadoes. Bolton, Dirks, and Neuwelt (2014) studied the child and community perceptions on natural hazard preparedness in an Auckland community. In their study, they recognized children as important community members who can play a significant role in community preparedness (Bolton, Dirks, and Neuwelt, 2014). The findings of this research (Bolton, Dirks, and Neuwelt, 2014) indicated that students are certain that they can be effective in promoting preparedness in their schools, homes and community. Community leaders indicated that preparedness actions should be culturally relevant, and should allow active community and child participation. This shows an important role of involving communities when taking decisions about their environment, this is emphasized by Spialek and Houston (2019) who stated that citizen disaster communication is an essential part of the disaster response and recovery ecosystem. The focus of Spialek and Houston (2019), was on studying the perceptions and experiences of K-12

educational leaders in response to the 27 April 2011 tornado in the USA which affected their school. The study argued that exploring the perceptions and experiences of those who are responsible for returning organizations to normality after a disaster can help others to face problems that they usually do not have answers for. Leaders highlighted the importance of sharing their stories with others so that the lessons they learned in response to the tornadoes would not soon be forgotten.

As shown in the preceding parts, a high number of studies based on tornadoes are based in the U.S.A, because of the high tornado incidences in the area. In Africa studies on tornadoes are scarce, however, this does not mean that the continent does not experience negative impacts of such hazards. Like any incidences which happen in communities, people have different perceptions about tornadoes. In the Eastern Cape Province in South Africa, a tornado is known as *Inkanyamba*. This term does not only mean a climatic phenomenon as the English word 'tornado' does, but it refers to the tornado as a snake (Wood, 2000). On the 15th of December 1998, Hogsback experienced a severe tornado which resulted in many deaths and damage to buildings, including Crab Bush Primary School, attended by children from Hogsback's black community (Wood, 2000). The Eastern Cape people had different opinions about continuous incidences of tornadoes in their province. One belief was that tornadoes were a result of Hintsa's missing head. The residents argued that tornadoes in the Eastern Cape province will continue until Hintsa's head (who was the king of amaXhosa) is restored to its proper resting place. Some claim that tornadoes were looking for Nelson Mandela because he did not follow the traditionally proper method when he married Graca Machel (Wood, 2000). Recent studies barely focus on studying the community perceptions of tornado disasters. The focus of many studies is on general perceptions of climate change and natural hazards such as Kiwanuka-Tondo, Semazzi, Nkoana (2020) and Pettiway (2019) and Li, Cao, and Shi (2021). Therefore, this study will address this gap by studying the community's perceptions about the 2019 tornado disaster which took place in the Harry Gwala District Municipality.

3.7. Chapter Summary

The chapter focused on reviewing the literature regarding natural disasters, more specifically the occurrence of tornadoes. The chapter also reviewed the socio-economic impacts of tornadoes in different countries of the world. Methods and

strategies that have been used by affected communities in the world to cope with the impacts of tornadoes were also reviewed. The chapter further analyzed the response of governments and other interested parties to communities that are affected by tornadoes in different parts of the globe and community perceptions regarding tornado hazards. The next chapter will focus on presenting the research methodology.

CHAPTER 4: RESEARCH METHODOLOGY

4.1. Introduction

This chapter explains the methods that were followed in this research to collect and analyse data. It starts by presenting the study setting which includes a description of the physical, demographic and socio-economic characteristics of the study area. There is then a discussion on the research paradigm, research design and data collection as well as the analysis methods that were used in this research. The chapter further outlines the ethical considerations and limitations of the study.

4.2. Setting of the study

Harry Gwala District Municipality, is located in the south-eastern part of South Africa, in KwaZulu-Natal province as shown in Figure 4.1 below, and occupies an area of 10 386 square kilometres (Harry Gwala District Municipality 2020). This district was previously known as the Sisonke District Municipality, and it shares a border with Lesotho to the north-west, boundaries with uMgungundlovu District Municipality to the north-east, Ugu District Municipality to the south-east, and Alfred Nzo District Municipality to the south (HGDM, 2020). It has a total population of 510 685 people (Statistics South Africa; 2016) found in four municipalities namely; Umzimkhulu Local Municipality, Ubuhlebezwe Local Municipality, Dr Nkosazana Dlamini Zuma and Greater Kokstad Local Municipality.

The Dr Nkosazana Dlamini Zuma is the largest municipality in the district, occupying an area of 3 602 km² with a total population of 118480(Stats SA, 2016). The main economic activities in this municipality are agriculture and tourism. It is followed by UMzimkhulu Local Municipality which occupies an area of 2 436 km² and is considered to be the most populated in the district (197 286). The main economic activities are agriculture, forestry, community, social and personal services, trade and tourism. Ubuhlebezwe Municipality which is located at Ixopo and is the home of the Harry Gwala District offices has a population of 118 346. Agriculture, mining, manufacturing, construction, utilities, business services and tourism are the economic drivers of this municipality (Ubuhlebezwe Integrated Development Plan; 2021/22). Greater Kokstad has a low population of 76 753 when compared to other municipalities in the district. Its main economic activities are agriculture (36%), trade (20%),

community services (18%), finance (16%), transport (4%), manufacturing (3%), electricity (2%) (HGDM; 2020).

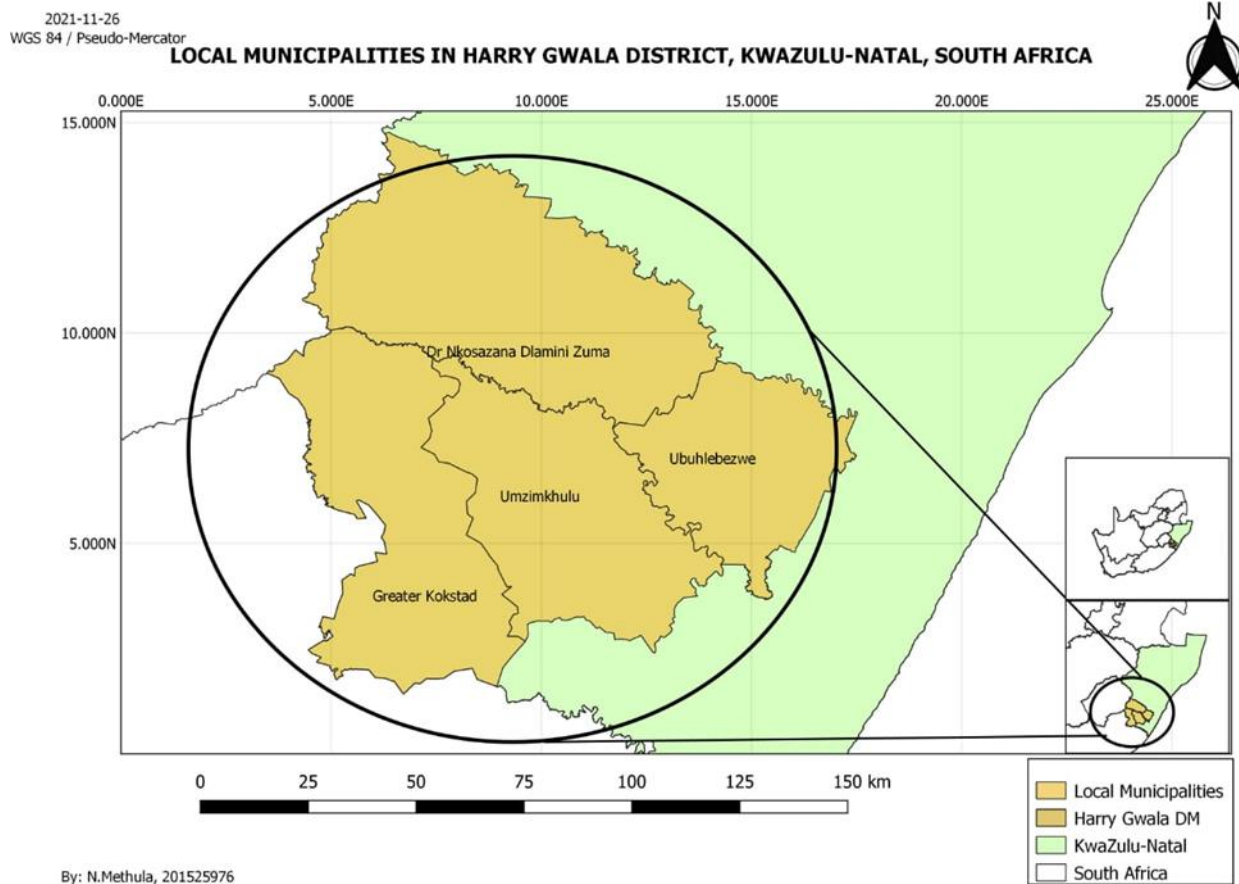


Figure 4.1: Map of the study area

4.3. Research paradigm

A research paradigm is “the set of common beliefs and agreements shared between scientists about how problems should be understood and addressed” (Kuhn, 1962). It is the way to understand the world that we live in using ontology, epistemology and methodology (Rehman and Alharthi 2016). This research uses a pragmatism research paradigm. This paradigm argues that rational cognition and rational purpose should not be separated as the beliefs of people and their knowledge cannot be separated from the context of use and possibilities of action (Clegg and Bailey 2007). The underlying principle is that our understanding of the world is made by people who live in that world (Clegg and Bailey 2007). This assists the researcher to understand the phenomena under study by interacting with people in the study area. Pragmatists believe that studying human actions is the fundamental way of understanding the social world (Goldkuhl 2004). In terms of data collection and analysis, pragmatism

posits that researchers should adopt what works at any given time (Kaushik and Walsh 2019).

4.4. Research design

The purpose of a research design is to provide an appropriate framework for a study (Sileyew, 2019). It is the plan that articulates the required data, the methods used to collect and analyse the data, and the way all of this assists in answering the research question (van Wyk, 2012). This research uses a case study as a research design because it allows an investigation to maintain holistic and meaningful characteristics of real-life events (Yin 2003). A case study research design is defined as an empirical inquiry that investigates the 'case' in depth and within its real-world context (Yin, 2014). The case study depends on some similar techniques such as history, but it has direct observation and systematic interviewing as additional sources of data (Yin 2003). This will allow direct communication with affected people and responsible officials. Using a case study will allow this research to deal with a wide variety of data sources such as documents, articles, interviews, and observations, beyond what might be available in the conventional historical study (Yin 2003).

All this suggests that this research uses mixed research methods to collect and analyse data. This is a procedure for collecting, analysing, and mixing both quantitative and qualitative research methods in a single study to understand a research problem (Fischler 2014). The mixed methods approach includes convergent parallel, explanatory sequential and exploratory sequential designs (Fischler 2014). This research follows an explanatory sequential. The explanatory sequential research design is most appropriate because it allows the researcher to collect and analyse quantitative data first, followed by qualitative data in the second phase as a follow-up to the quantitative results (Fischler 2014).

4.5. Methodology

In line with the explanatory sequential design explained above, the following part explains the quantitative and qualitative aspects of the research.

4.5.1. Quantitative research

4.5.1.1 Population and sampling

A sample is a group of people, objects, or items that are taken from a larger population for measurement (Taherdoost, 2016). Harry Gwala District Municipality, has a total of 122 973 households, of which 17 842 households belong to the Greater Kokstad Local Municipality, while 26 801 households are at Ubuhlebezwe Local Municipality. UMzimkhulu Municipality has 49 616 households and Dr Nkosazana Dlamini Zuma Local Municipality has 28 714 households (Final Integrated Development Plan (IDP), 2019-2020). Using a Rao soft sample size calculator, where a margin of error is 10%, level of confidence is 90%, and response distribution is 50%, the sample size for each municipality is 68 households. This means that the total sample size is 272 households.

4.5.1.2 Instrumentation and data collection

Households from each municipality under the Harry Gwala district were selected using convenience sampling technique. This method allows the researcher to select readily and easily available households (Taherdoost, 2016). Convenience sampling technique is the best for this research because the respondents can be selected easily (Taherdoost, 2016). Questionnaires were used to conduct household surveys while observations were used to determine the extent of damage by the tornado per household. The questionnaire has 3 sections with questions which address the focus of the study. Section one covers the demographic characteristics of respondents, section two focuses on the effects of the 2019 tornado on each household while section 3 investigates coping strategies and responses by relevant organisations. These questionnaires were administered face to face as this helped in explaining some of the interview questions to those who encountered problems with understanding what was being asked. Google Earth engine was used to track changes such as infrastructure destruction and erosions in the study area before and after the tornado.

4.5.1.3 Data analysis

Data collected by questionnaires were coded and different questions and answers in a questionnaire were given different numerical codes which were then entered in Statistical Package for the Social Sciences (SPSS) for further analysis. Image comparing and interpretation was used to analyse the observed data while the Google Earth engine captured images. ArcGIS mapping was used to demarcate the affected

areas and Google Earth assisted in determining the geographical location of affected areas to see their proximity to each other and the origin of the tornado. Graphs and tables which show among others, the demographic characteristics and percentage of impact by tornadoes were constructed using Microsoft Excel.

4.5.1.4 Quantitative reliability and validity

Validity is the degree to which a concept is correctly measured in quantitative research (Heale and Twycross 2015). In this research, validity was ensured by reviewing questionnaires used to collect information before data collection commenced. In addition, a pilot study was undertaken to assist the researcher to ensure that, relevant and authentic data was collected. The other important component that ensured the quality of research is reliability, which is the degree to which a research instrument consistently produces similar results if it is used in the same situation on repeated occasions (Heale and Twycross 2015). To ensure reliability, this study used similar questionnaires throughout the process of data collection. This means that the questionnaires that were used to collect data at UMzimkhulu Local Municipality are the same as the questionnaires that were used to collect data at Ubuhlebezwe, Greater Kokstad and Dr Nkosazana Dlamini Zuma local municipalities.

4.5.2 Qualitative research

4.5.2.1 Sampling

A qualitative sample was attained through purposive sampling methods because this method allows people to be selected intentionally to provide important information that cannot be obtained from other choices (Maxwell, 2012; Gentles et al., 2015). To get information on the response of the government to the tornado disaster, government officials in disaster management offices of various municipalities were selected, followed by traditional leaders to understand the impact of the tornado in areas under their jurisdiction. NGOs were selected to determine their role and challenges in responding to the tornado incident while households provided information to determine the impacts, perceptions and responses to the tornado incident (Refer to Table 1 below).

4.5.2.2 Instrumentation and data collection

Structured interviews were the data collection instruments. A structured interview includes the researcher preparing questions and similarly asking respondents the same questions (Rashidi et al., 2014). Structured interviews were considered important because they ensure that the answers can be arranged to respond to the objectives of the study as they are prepared according to the study objectives. Kumar (2018), adds that using a structured interview is beneficial to the study because it provides uniformity in the answers, which enables comparison of data. Structured interviews were conducted face to face with disaster management officers, traditional leaders and other stakeholders in disaster management to determine their role in the management of disasters and the challenges they face. Structured interviews helped the researcher to ask each respondent similar and specific questions (Mathers, and Hunn, 1998). Documents such as municipal reports and IDPs were consulted to check methods that are used by the municipality to cope with different disasters in areas under their jurisdiction.

Table 4.1: Summary of qualitative sample

Sampling method	Respondent(s)	Number of respondents	Reasons for selection
Purposive	Disaster officer	5	To determine the government's response to the tornado, in each municipality and district office.
Purposive	Traditional leaders	12	To understand the impact of tornadoes in areas under their jurisdiction, and their role to assist communities.

Purposive	NGO	1	To determine their role and challenges in responding to community disasters.
Purposive	households	272	To determine impacts, perceptions and response to tornado disaster

4.5.2.3 Data analysis

Data collected from structured interviews were analysed using the thematic approach. This is a qualitative data analysis method whereby a researcher searches within a data set with an aim to identify, analyse, and report repeated patterns (Braun and Clarke 2006). Thematic analysis involves interpreting data while selecting codes and constructing themes (Kiger and Varpio, 2020). This analysis method includes the following six steps as outlined in Braun and Clarke (2006);

Step 1: Familiarizing yourself with the data

This is where the researcher reads through the entire data set to familiarise himself with the data before coding and creating themes. In this study, the researcher read through the interview data which included responses and opinions from selected research participants. This assisted in understanding similarities and differences in the responses making it easy to create codes and themes.

Step 2: Generating initial codes

The researcher took notes on those areas she was interested in as this acted as a guideline to develop codes. This is emphasized by Kiger and Varpio (2020), who stated that once the researcher has familiarized themselves with data, they can take

notes on areas of interest, questions and connections between data items to produce codes.

Step 3: Searching for themes

In this stage, the researcher used the notes that were initially used to generate codes to create themes. The researcher carefully analysed the generated codes by looking at similarities and differences. The codes with similarities were combined into one theme then those that showed differences were separated to generate independent themes. Kiger and Varpio (2020) explained this stage as a stage of looking for themes within the codes and collected data. The researcher created these themes by analysing, combining, comparing, and also by looking for a relationship between the codes (Kiger and Varpio, 2020).

Step 4. Reviewing themes

The researcher revisited the generated themes, to check whether all responses were included in the themes. It was confirmed that all responses were included. This is a significant stage because the researcher revisits the themes created to look for gaps and make necessary adjustments where necessary. This is done following a two-level analytical process provided by Braun and Clarke (2006). The first level of analysis examines whether the coded data within each theme is relevant or not. The researcher responds to this by either adding, dividing or removing some themes to match the coded data. This level of analysis is complete when the researcher has confirmed that the revised thematic map covers all coded data (Braun and Clarke, 2006). In the second level of analysis, the research proofreads the whole data set with the purpose of re-examining themes and then re-codes if there is additional data that belongs to newly formulated themes so that the thematic map will be readjusted accordingly (Braun and Clarke 2006).

Step 5: Defining and naming themes

In this stage, the researcher defined and named themes to give a clear idea of the data included in these themes. These themes were reviewed to ensure that they were brief and adequately descriptive (Braun and Clarke 2006).

Step 6: Producing the report/manuscript

The researcher finally produced a report of thematic analysis which includes all stages. This report assisted to produce the results of this study and enabled the researcher to give recommendations on the researched phenomena. Braun and Clarke (2006, 2012) argue that the report should weave a narrative that provides a clear, concise, and logical account, not only of how a researcher interprets the data but also of why the researcher's selection of themes and interpretation of the data is important and accurate.

4.5.2.4 Qualitative reliability and validity

Data triangulation ensured the reliability of the study. This is the process where a researcher uses multiple methods or data sources in qualitative research to formulate a comprehensive understanding of phenomena, and to test validity through the combination of information from different sources (Patton, 1999). The multiple methods include questionnaire surveys, municipal documents, interviews and case studies. All these methods support and create arguments to get an understanding of the researched phenomena.

4.6. Ethical considerations

The researcher applied for and was granted an Ethical Clearance Certificate by the University of Zululand Research and Ethics Committee (UZREC). Another permit was acquired from the traditional leaders of communities where data was collected. This is also supported by Fleming and Zegwaard (2018) who noted the significance of approval by the institution where the researcher is registered, before data collection from human participants because human research ethics committees cannot approve research after the data has been collected. Reliable tools to collect and analyse data were used and respondents were required to sign the informed consent form as an agreement to the terms of the research. Informed consent means that respondents are well informed of what will be asked of them, how the data will be used, and what risks if any should they agree to participate (Fleming and Zegwaard, 2018). The informed consent acts as a contract between a researcher and a respondent, where the respondent has a right to withdraw at any stage of the research. This research was conducted during the Covid-19 pandemic. As a result, the Covid-19 regulations and protocols relating to among others; social distancing, wearing face masks and continuous washing of hands were strictly followed.

4.7. Limitations of the study

This study collected data under the restrictions of COVID-19, which limited communication with some respondents. However, the researcher did every reasonable effort to implement Covid-19 protocols such that all people were free and safe to participate in the research.

4.8. Chapter Summary

This chapter discussed the research methodology that this study followed. It did so by discussing the research paradigm and designs which guided this study. The chapter also explained the data collection and analysis procedures as well as the ethical considerations and limitations of the study. The next chapter analyses the research findings.

CHAPTER 5: ANALYSIS AND INTERPRETATION OF DATA

5.1. Introduction

The focus of this chapter is on the analysis and interpretation of data. The responses from the selected research participants which included ward councillors, municipal disaster management officers and community members of affected communities are interpreted in this section. The results from community members came from 120 households which was the number where researcher reached a saturation point, and is different from the initially proposed 272 households. This chapter analyses among others, the demographic characteristics of respondents (community members), followed by the analyses which respond to the research objectives in their sequential order.

5.1.1. Demographic characteristics of respondents

This section analyses the age, marital status, employment status and household size of community members who were respondents to this study within Harry Gwala District Municipality. In terms of age, the results show that a larger proportion (27,5%) is between the age of 31-40 years, this proportion is followed by those who are 51 years and older (25,83%). Those who are between the age of 41-50 constitute 25%. Younger respondents between the age of 19-30 form 20% of respondents, followed by a lower proportion (1,66%) of those who are 18 years and younger (see Figure 5.1)

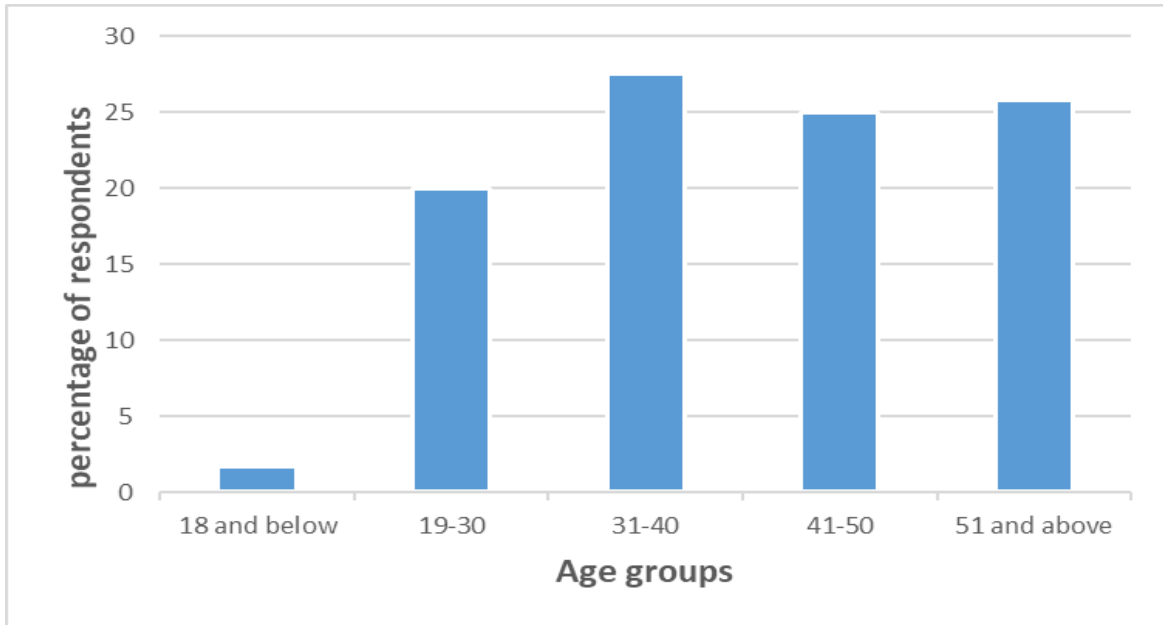


Figure 5.1: **Age distribution of respondents**

The marital status of respondents (Figure 5.2) shows that more than half of respondents (54,16%) were married, followed by those who were single (41,67%) and divorced (5,15%).

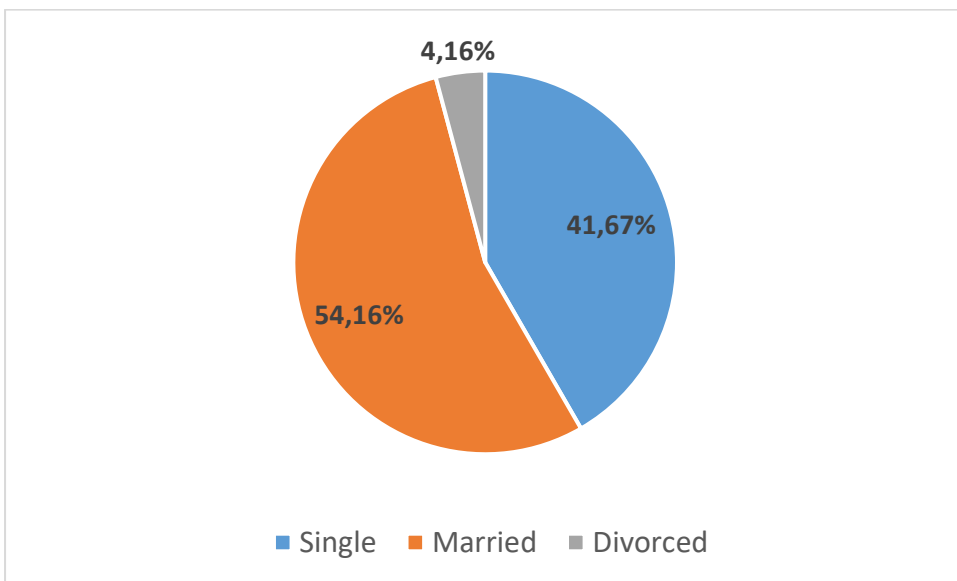


Figure 5.2: **Marital status of respondents**

In terms of gender, the results show that a significant number of respondents (75%) are females while males make up 25% of respondents (Figure 5.3). The time in which the researcher visited households may be the underlying reason for the low number of male respondents, they could have been at work. This resonates with the case study

by Wentzel, Diatha, and Yadavalli (2016) in which females constituted a larger percentage of respondents based on the fact that data collection happened during the day when men were away at work. Another explanation could be that the households are possibly headed by women as is indicated by the 2016 Community Survey within the district which established that 53,9% of households were headed by women (Harry Gwala, 2020).

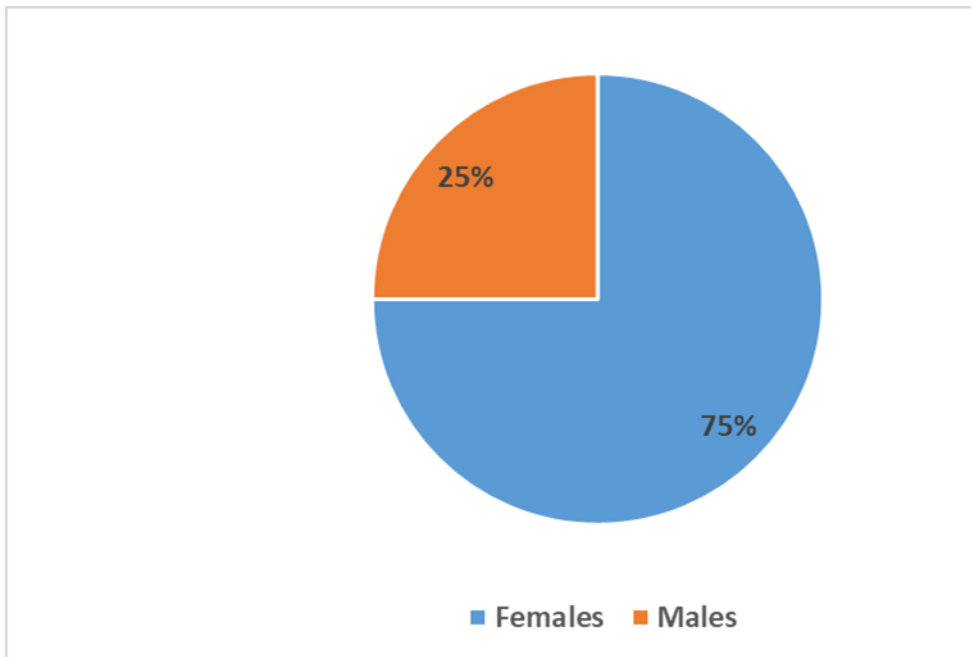


Figure 5.3: **Gender of respondents**

On the question of household size, it was established that 41,67% of households had 6-10 members and 30% of households had 11-15 members. These results show that there is a higher percentage of households with many family members. However, households that had above 16 members were 10, 83% (Table 5.1 below).

Table 5.1: **Household sizes of respondents**

Household size	Frequency	Percentage
5 and below	21	17,5%
6-10	50	41,67%
11-15	36	30%
16 and above	13	10,83%
Total	120	100

5.2. Employment status

The results show that 50% of respondents are unemployed while 41,66% can be equally divided into the unemployed and self-employed groups. The self-employed group included those who own *spaza* shops ¹, traditional healers, street vendors and builders among others. The retired group represents the smallest proportion of 8,33%, (see Figure 5.4 below). The 2020 community survey in Harry Gwala District Municipality indicated that there has been an increase in the unemployment figures from 29 100 in 2009 to 42 200 in 2019 (Harry Gwala, 2020). The high unemployment rate in the district means that people who were affected by the tornado found it difficult to replace their damaged items. The tornado incident increased the financial burden on residents of the Harry Gwala District Municipality.

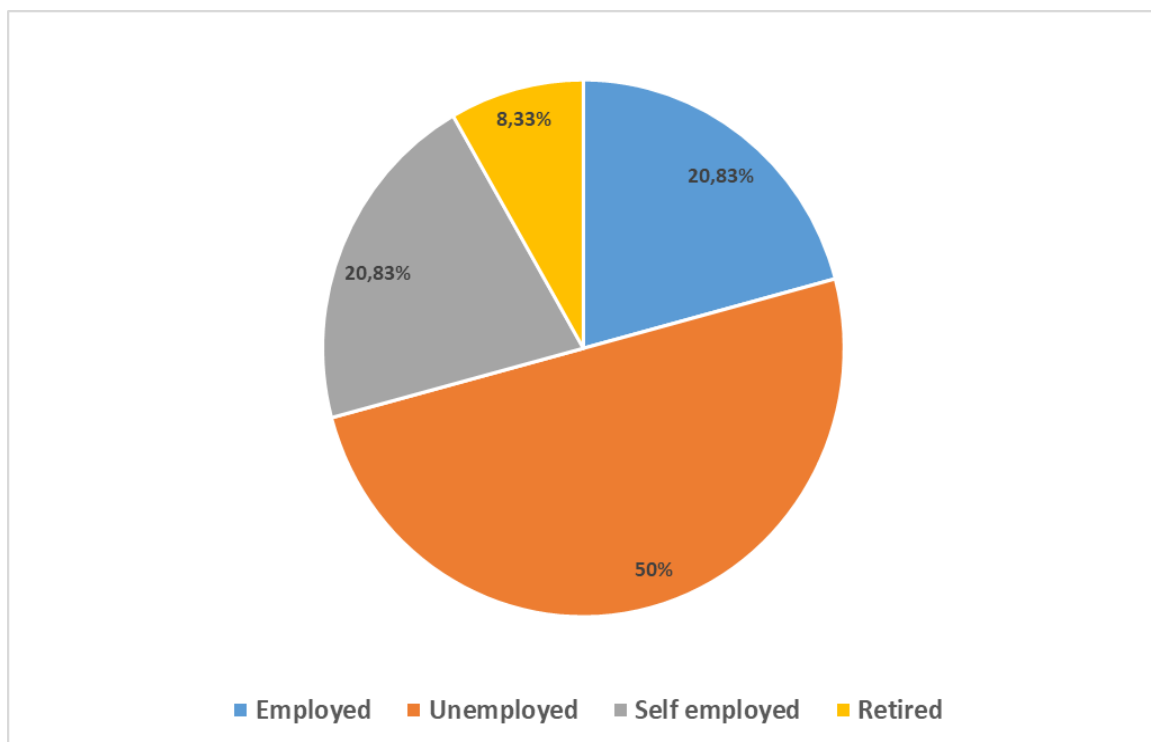


Figure 5.4: **Employment status of respondents**

More than 90% of people indicated that they rely on social grants as another source of income for their households (see Table 2). Hajdu, Neves and Granlund (2020) note that social welfare played a big role in rural South Africa in minimising the rapid increase of poverty. The Child support grant is the most popular one with 87%

¹Small informal grocery shops in South Africa that are usually operated within house hold yards. The name spaza came from township slang which refers to an imitation of a real shop

beneficiaries. This is followed by an old-age pension grant at 27%, while 8% of respondents indicated that they are receiving other forms of grant which was the COVID 19 relief grant. An additional 6% of respondents indicated that they were receiving a disability grant, while the other 6% were not receiving any form of a grant. Only 2% were receiving all indicated forms of grant in their household (see Table 5.2 below).

Table 5.2: **Types of a grant received by respondents**

Type of grant	Percentage of respondents
Child support grant	87%
Old-age pension grant	27%
Disability grant	6%
Other	8%
All of the above	2%
None of the above	6%

5.3. The occurrence and distribution of tornado disasters in Harry Gwala District Municipality between 1989 and 2019.

The results of this study show that the district has experienced numerous tornado disasters. Data from South African Weather Services (SAWS) and records from the Harry Gwala District Municipality show that they experienced twelve tornadoes between 1989 and 2019 (see Table 5.3). In 1997, a tornado originated at Donnybrook under uBuhlebezwe municipality, where 26 homes were destroyed and 8 people injured. Early in 2004, a tornado occurred at Underberg within Dr Nkosazana Dlamini Zuma (NDZ) municipality. Again in 2008, 181 homes were destroyed and 3 fatalities were reported as a result of a tornado. The following year 2009, NDZ recorded 89 affected households and uMzimkhulu municipality reported 3 fatalities as a result of a tornado incident. In 2010, Ubuhlebezwe municipality reported 5 wards that were affected by another tornado incident. Yet another tornado occurred at UMzimkhulu municipality in 2011 which affected 3 wards. The following year, in 2012 a tornado was accompanied by lightning, leading to four fatalities. The most recent tornado is the one which occurred in December 2019. Figure 5. 5 summarises the distribution of these tornadoes in the district between 1989 and 2019. The Dr Nkosazana Dlamini Zuma

municipality and uMzimkhulu recorded 4 tornado incidences followed by Ubhlebezwe municipality with 3 tornadoes then Kokstad with had a single incidence.

Table 5.3: Occurrence and distribution of tornado disasters in Harry Gwala District Municipality between 1989 and 2019.

Year	Event	Local Municipality
2019	Tornado	NDZ, uMzimkhulu, UBuhlebezwe and Greater Kokstad
2012	Tornado	UMzimkhulu
2011	Tornado	UMzimkhulu
2010	Tornado	UBuhlebezwe
2009	Tornado	NDZ
2009	Tornado	UMzimkhulu
2008	Tornado	NDZ
2004	Tornado	NDZ
1997	Tornado	UBuhlebezwe

DISTRIBUTION OF TORNADO DISASTERS IN HARRY GWALA DISTRICT, KWAZULU-NATAL, SOUTH AFRICA (1989-2019)

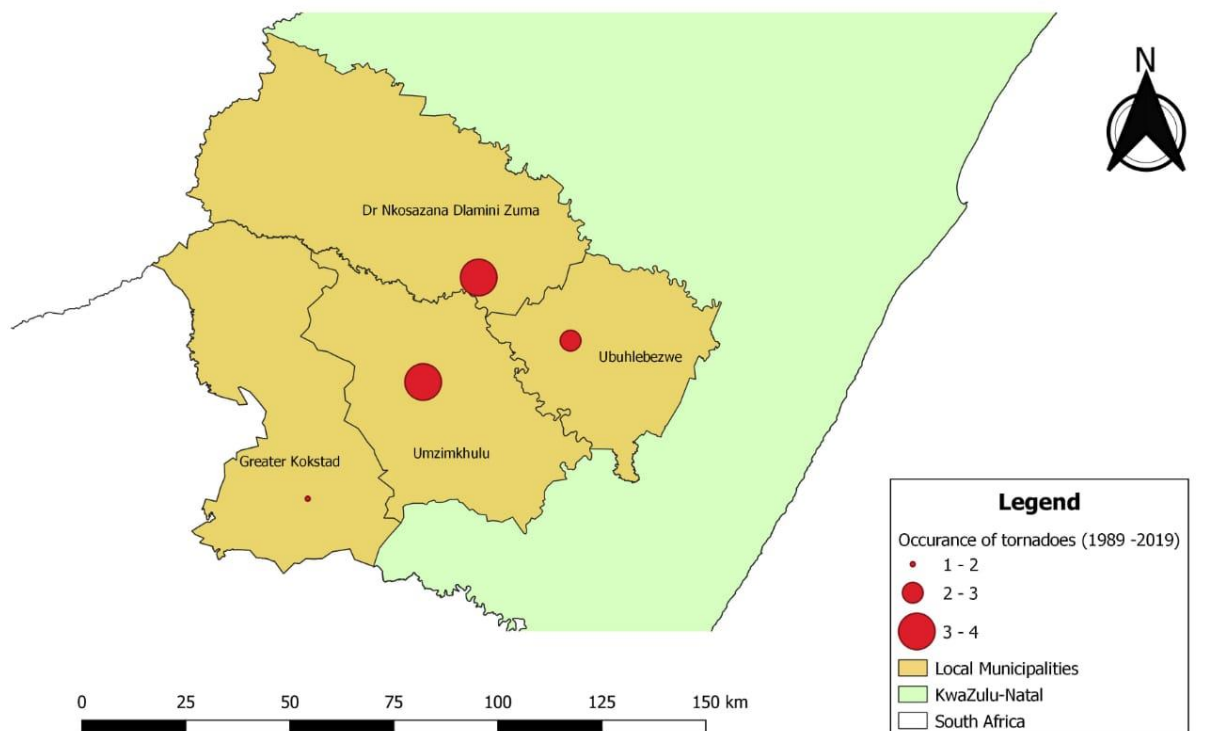


Figure 5.5: Occurrence and distribution of tornado disasters in Harry Gwala District Municipality between 1989 and 2019.

The results of this study are consistent with those of Goliger and Milford (1998), which show a concentration of tornado incidences along the south-eastern side of South Africa between 20°S and 40°S, where Harry Gwala District Municipality is located. A possible explanation for this is the ongoing climate change and sea level rise which affects the south-eastern coastline of southern Africa, including South Africa, Mozambique, Tanzania and Kenya. These countries often experience cyclonic and other significant weather events as a result (Mather and Stretch, 2012).

5.4. Socio-economic impacts of tornadoes in Harry Gwala District Municipality

The 2019 tornado disaster in the Harry Gwala District Municipality had a significant negative impact on all four municipalities within this district. UMzimkhulu and Ubuhebezwe were the most adversely affected local municipalities amongst the four which constitute the district. There were 500 affected households in addition to 112 homeless people at uMzimkhulu and an estimated 612 affected people in 99 assessed households. At Greater Kokstad municipality there were 80 affected households and most of them were located on flood plains which increased their vulnerability to the

tornado. Dr Nkosazana Dlamini Zuma municipality had the least number of affected households (17) from Sbazane, Ngxola, uMzimkhulu, Mpumlwane and Kilimount areas. In these areas, schools, bridges, churches, electricity infrastructure and community halls were damaged as a result of the tornado. The reasons which can be advanced as to why the municipalities were differently affected relate to the high number of people who have mud houses at UMzimkhulu and Ubuhlebezwe as compared to Kokstad and NDZ (see Figure 5.7). UMzimkhulu and Ubuhlebezwe municipalities are largely composed of rural traditional communities such as Nokweja and Kwameyi (where data was collected). These rural areas are extensively using traditional building materials such as mud and grass hence they are vulnerable to extreme weather conditions (this is explained in detail in Section 5.3.2 below). The study found that the socio-economic status of respondents also had an impact on their vulnerability to tornado disasters.

To study the socio-economic status of respondents, the researcher determined the monthly income of households. The results show that a larger proportion of households have a monthly income of less than R7000. Half of the respondents receive a monthly income of between R3000-R6000, and 39,16% receive a monthly income of less than R3000. Most of these people are unemployed as indicated in (Figure 5.4) and depend on various social grants indicated in (Table 5.1). The unemployment was higher at uMzimkhulu and uBuhlebezwe municipalities which explains why they were vulnerable and could not effectively respond to the tornado incidence. This is confirmed by the vulnerability theory which outlines that poor financial status increases vulnerability to the community (Rich, 2018). The results show that the remaining 10,83% of respondents have access to higher income for instance: 8,33% receive R7 000-R10 000, 1,67% receive R11 000-R14 000 and only 0,83% indicated that they earn above R15 000 (see Figure 5.6). Looking at household sizes in Table 1, the majority of respondents had a household size of 6-10 people, then linking this to the estimated R3000-R6000 monthly income, this means that majority of respondents are living below the R840 lower-bound poverty line as of Stats SA 2020 (RSA, 2020).

The damage to houses automatically meant damage to furniture, clothes, food, appliances and important documents such as identity documents. The damage was similar to one reported by Siyongwana, Heijne, and Tele (2015). They reported a loss

of furniture, electricity infrastructure and food. Some affected houses were fixable while others were not, especially the mud houses. This meant that people had to incur extra costs related to repairing or rebuilding their houses and buying new furniture among others. The Vulnerability Theory (see Chapter 2, Section 2.3.1) highlights poverty, health and economic status of individuals as the commonly regarded determinants of vulnerability while the presence of aspects concerning the quality of buildings in areas exposed to disasters is considered as specific determinants of vulnerability. In the light of this research, communities are facing both general and specific determinants of vulnerability. This is because there is a high unemployment rate which indicates poor economic status and poverty, which explains the poor building material used. In the study area, there are no regulations regarding the quality of buildings. The result is that most people construct their houses using mud which is easily affected by disasters like tornadoes (see Figure 5.7). This is one of the reasons communities will remain vulnerable to disasters. Hence, Vulnerability Theory calls for a more responsive state because vulnerable subjects are universally and constantly prone and weak, and their coping strategies depend on state institutions.

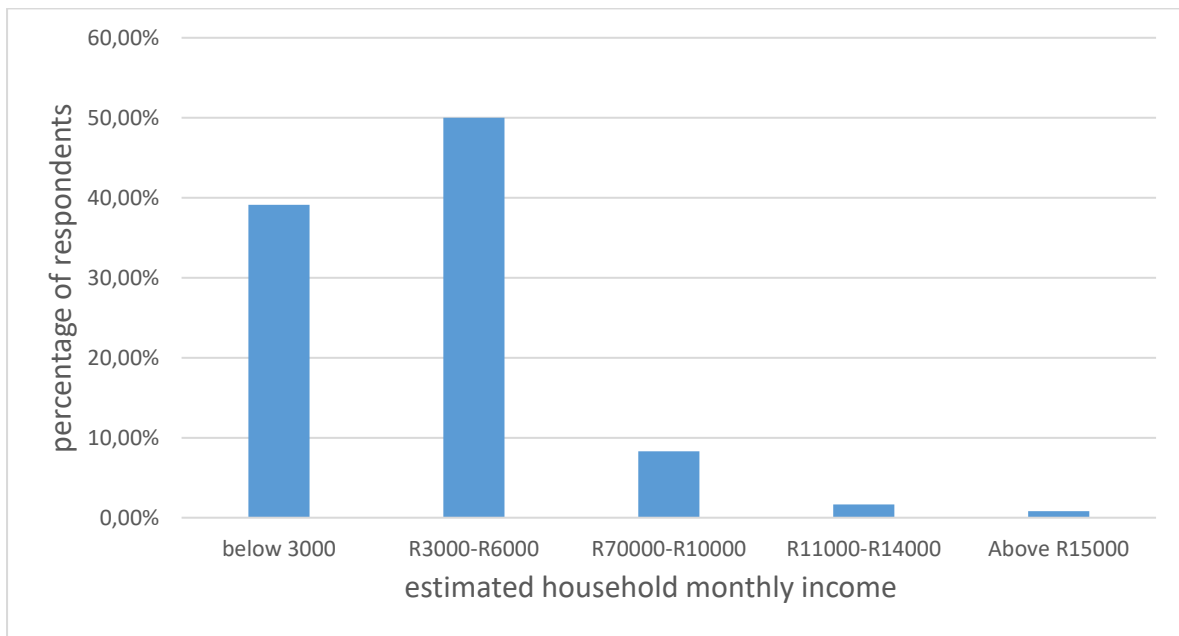


Figure 5.6: **Estimated household monthly income**

5.4.1. Household building material

The 2019 tornado also destroyed buildings and this was worsened by the fact that the majority of households (67,5%) have mud houses (see Figure 5.7) and most of these are located in uMzimkhulu and uBuhlebezwe municipalities. The research results show that most people who had permanently damaged structures were those who had mud houses (see Figure 5.8). Only 31,67% indicated that they have brick structures and their houses were partially damaged, either the roof or windows were damaged. A further 5,8% indicated that their houses are made of other materials such as stones, zink metal or iintingo (wood and mud) (see Figure 5.9).

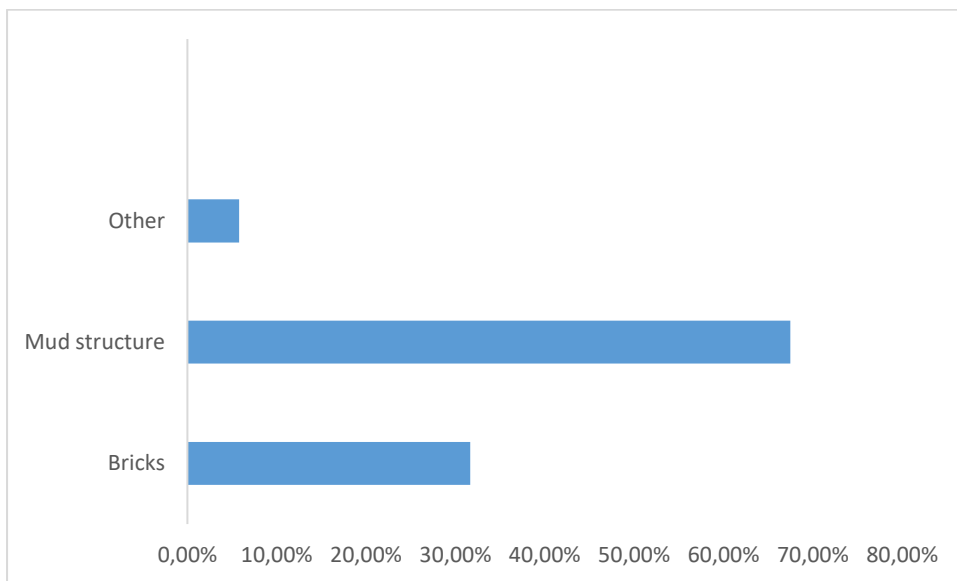


Figure 5.7: **Building material used by households**



Figure 5.8: **Mud houses affected by the tornado at uBuhlebezwe local municipality** (source: Municipal Disaster Management Officer ubuhlebezwe local municipality, December 2019).



Figure 5.9: **Houses made from iintingo** (Source, Municipal Disaster Management Officer ubuhlebezwe local municipality, December 2019).

If these reasons for the differential impact of the tornado in the study area are viewed through the Social Vulnerability Theory, it becomes evident that some groups of people are more exposed to disaster losses than others because of their geographic location or financial status. Hence the results indicate that even though Kokstad was least affected as compared to uMzimkhulu and uBuhlebezwe, households situated in flood plains (Bhambayi) were mostly affected in Greater Kokstad municipality. The

Kokstad Municipality decided to build temporal houses for these households from the Bhambayi area to Shayamoya to minimise their vulnerability.

Excluding the physical damage to human property, the tornado had negative emotional harm to citizens. The emotional harm includes shock as a result of the incident, debts that community members incurred and the anxiety around the restoration of their property and livelihood to the pre-2019 tornado condition. Most of the respondents stated that they still owe builders who assisted in re-constructing their homes after the tornado. Some stated that when their houses were damaged, they had to be congested in one room as a family regardless of age and gender. In addition, people had to change their way of living, working, worshipping and socialising in buildings, sites and landscapes. The majority of UMzimkhulu respondents indicated that places of worship were among the damaged community infrastructure, and they had to discontinue their weekly spiritual meetings. This clashes with human rights, as noted in the report by Colette et al., (2007), who outlined that disasters like tornadoes which are induced by climate change can impact both tangible and intangible heritage aspects. All this indicates the extent to which the tornado disrupted the social life of beings.

5.5. Coping strategies by communities

The third objective was to examine how communities and households cope with the effects of a tornado. The community members responded in many ways. The first step involved seeking assistance from the Ward committee or Ward councillor (54%) while 46% indicated that their immediate response was to try to repair or rebuild the damaged structures. Figure 5.10 shows the period it took for respondents to fix their houses and 17% of these have not been fixed to date. The tendency of calling councillors to report the incident shows that most respondents are not aware of disaster management offices in their areas. Edet, Bullem, and Okeme (2015), related this to illiteracy and old age. Uneducated and elderly people are considered to be more vulnerable to disasters as they lack access to warning systems or experience more difficulties navigating recovery programmes (Fothergill and Peek, 2004).

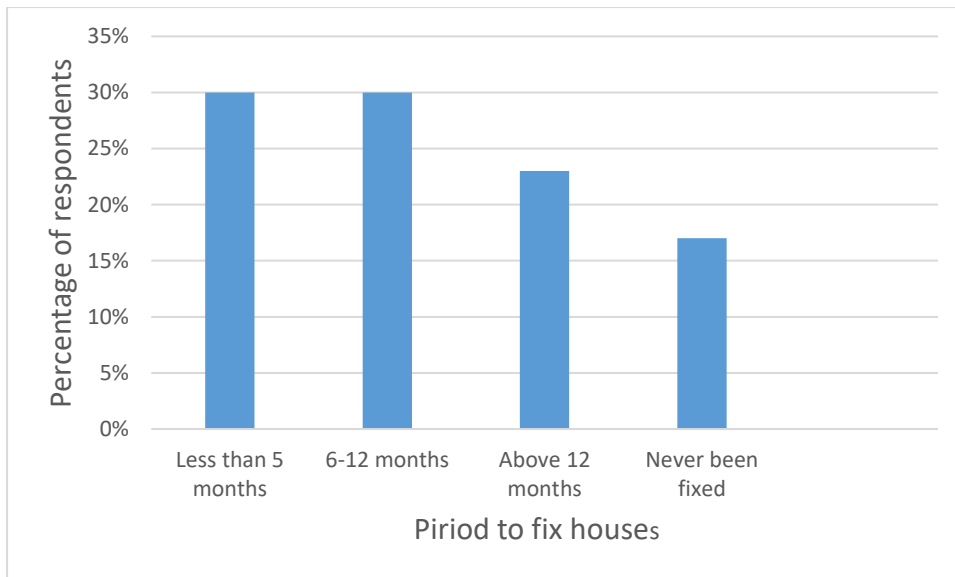


Figure 5.10: The period it took for respondents to fix their houses

Furthermore, the community's reliance on councillors suggests that they are dependent on the government for assistance or believed that the government needed to intervene in case of such a disaster. Using the insights of the Social Vulnerability Theory as discussed in Chapter 2, it can be suggested that vulnerable people tend to depend on state institutions as their coping mechanism. This is because most of their lives were regulated and funded by the state (Rich, 2018). As shown in Table 2 above, most people are dependent on social grants such as child support grant and old-age pension grant. Many respondents were unemployed, which meant that they were vulnerable subjects dependent on the state. While respondents were waiting for a government response, they moved in with relatives and neighbours in unaffected areas. This indicated a humanitarian action which is required to save lives as suggested by Pringle, Hunt, and Ten Have (2015).

5.6. Government response

The fourth objective was based on assessing the government's response to the 2019 tornado incident. The researcher assessed the form of aid provided by government representatives (disaster management officers) and also assessed the aid received by households in affected communities. There were several other stakeholders involved such as NGOs (Gift of the Givers, Tricycle and Mpande Engineers), Department of Human settlements, Department of Social Development, Department of Home Affairs, South African Social Security Agency and Department of Education.

Human Settlements assisted those who lost their houses by providing temporal structures while they waited for RDP houses. However, none of the respondents indicated that they have received their RDP houses, and only 4.1% indicated that they received temporal homes as assistance. However, at Greater Kokstad Municipality some houses were built at Shayamoya for people who lost their homes as a result of the tornado. However, these houses had not been handed over to them by the time of data collection. For uMzimkhulu and uBuhlebezwe local municipalities, respondents stated that they received building materials such as zink metal, roof decking, cement and blocks from their respective municipalities. For relief purposes, food parcels, blankets and community tents were provided by disaster management officers, with the aid of NGOs to adversely affected households (see Figure 5.12 and Figure 5.13). Disaster management officers highlighted poor road infrastructure in rural areas of the Harry Gwala district, political interference, resource shortage and shortage of disaster unit staff members as the main challenges which delayed them from providing relief. Other government departments such as Social Development and Home Affairs assisted people who lost their documents such as identity documents, birth certificates and passports. Social workers provided counselling to all affected residents as highlighted.

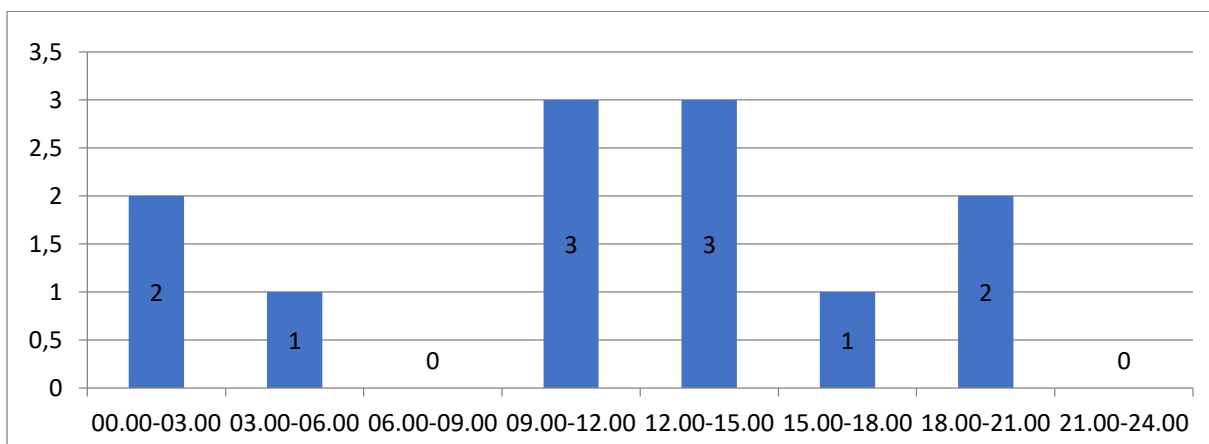


Figure 5.11: Times and number of calls reporting the heavy storms at uBuhlebezwe municipality (source: uBuhlebezwe Local Municipality December month-end report).

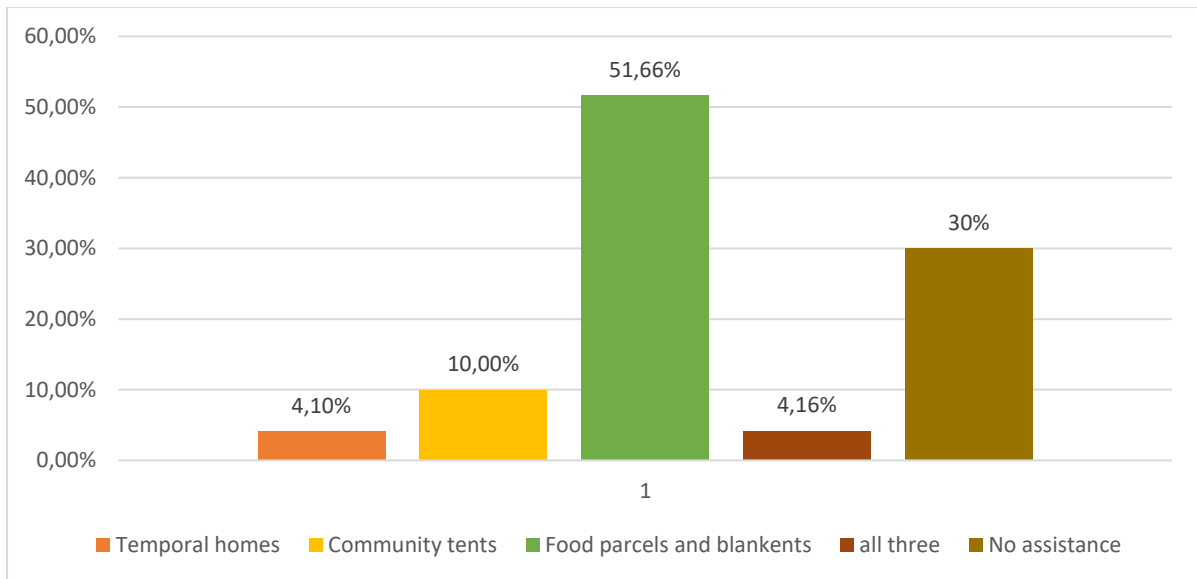


Figure 5.12: **Government relief provided to affected households**



Figure 5.13: **MEC for Public Works Mr Khoza providing relief to affected people KwaNokweja area under uBuhlebezwe municipality.** (Source: uBuhlebezwe Local Municipality December 2019-month end report).

If the above government response to the 2019 tornado disaster in the study area is assessed through disaster management theory, it is visible that the government response was limited since some community members did not receive aid. This is because this approach encourages community involvement in terms of partnership, participation, empowerment and ownership of disaster management projects by the local people (Pandey and Okazaki 2005). The government response showed passive participation by community members, who were only involved in collecting relief items.

The decision and planning of disaster management projects did to include local people, hence they are not satisfied with some government relief programmes. For instance, those who were given building material reported that it was not enough hence their houses remain unfixed. Some were given the material they did not need and this shows poor communication and non-ownership of disaster management projects by local people which is opposed to the values of the disaster management approach.

According to disaster management officers, they provided aid as soon as they received calls from community representatives (councillors). For example, the uBuhlebezwe municipality recorded calls at different times when damage was reported (see Figure 5.11). However, a damage assessment was conducted in all municipalities before providing the aid. This assessment before providing aid is in line with the community disaster management approach because it shows that officials are following a bottom-up approach, consulting with people before providing the relief. According to disaster management officers, this helped in identifying priority cases, where there is severe damage. However, the vulnerability theory rejects this, arguing that people must not be treated as separate individuals with each using their power to make choices (Nussbaum, 1997). This theory calls for public policy that is based on social relationships (Rich, 2018), meaning that aid should be provided to all affected individuals in a community as opposed to a list of priority cases.

5.7. Community perceptions

The fifth objective focused on identifying community perceptions regarding the tornado disaster. People always have different opinions about their environment, and they find a way to relate the incidents to their everyday life. The results of this study show that 70% of respondents believed that it was a kind of snake (*inkanyamba*) which was travelling in the sky and caused heavy wind and rain. People in the Eastern Cape referred to the tornado as *inkanyamba* which was caused by Hintsá's missing head (Wood, 2000). Hintsá was the 4th supreme Chief of the Gcaleka sub-group of the Xhosa tribe between 1820 and 1835. It is believed that he was beheaded by the British troops on the banks of the Nqabarha River in 1835 (Lalu, 2009). Therefore, the link between *inkanyamba* and the tornado is that the tornado is defined as a violently rotating column of air touching the surface of the earth, either hanging from or below

a cumuliform cloud. When this all happens, it resembles a shape of a snake moving in the clouds (Agee, 2014).

In addition, 17% believed that the tornado was caused by the anger of God because they had sinned while 13% reported that it was a climatological condition (see Figure 5.14).

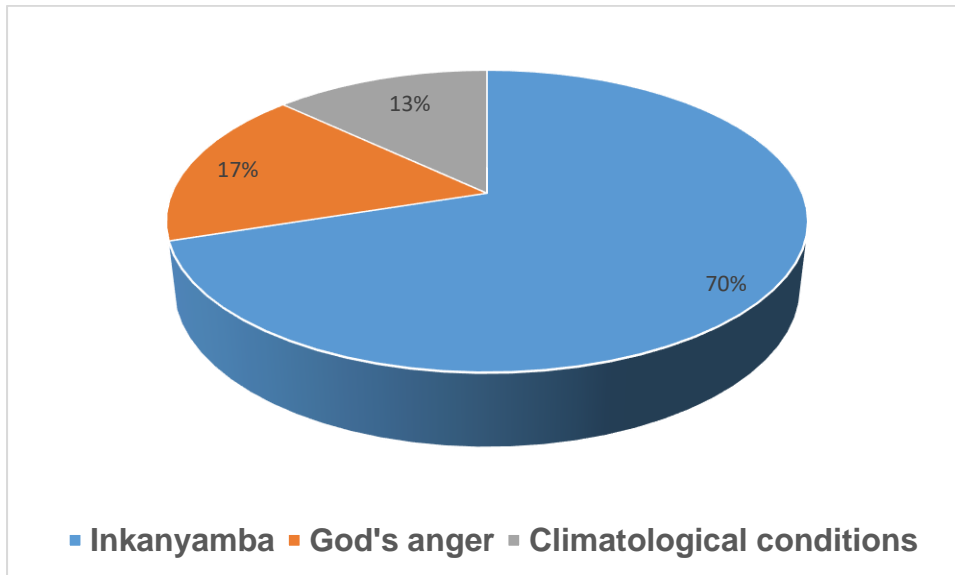


Figure 5.14: **Community perceptions regarding the tornado disaster.**

These community perceptions suggest that there is a high level of illiteracy among respondents and only a few people understand that tornadoes are weather related. This will affect how people respond to future similar incidences and that these communities remain vulnerable as they hold to such beliefs. For instance, those that believe that a tornado is caused by God's anger will change their behaviour into one that 'pleases God', instead of changing the building material in their households. The belief that tornado is *Inkanyamba* affects how people respond to weather warning systems. People opt for traditional medicine that prevents *Inkanyamba* from passing by their homes instead of following precautionary measures against severe weather phenomena. The belief that a tornado is *Inkanyamba* is common in other parts of South Africa. For instance, Inanda residents in Durban believe that it is a 'spiritual' snake that lives in water sources in KwaZulu-Natal, and causes disasters (Sutherland et al., 2016). These perceptions highlight a need for community awareness workshops regarding causes and mitigation measures against severe weather incidences such as the tornado.

5.8. Chapter Summary

The chapter focused on analysing the results and interpreting their meaning in the real world. In terms of points of occurrence of tornadoes in the district, the results show that many incidences are located within UMzimkhulu and NDZ municipalities, followed by uBuhlebezwe and Greater Kokstad municipalities. The tornadoes had a significant impact on the socio-economic life of respondents. Most of them lost their houses and property. They spent a significant amount of money trying to re-construct their houses and some ended up in debts which have not been paid up to date. As severe as this tornado was, the community's perceptions vary, most of them believed that it was caused by a snake moving in the sky, some believe that God is angry because of our sins and only a few understood that it was a climatological incident. The disaster management officers together with other government and non-governmental organisations provided relief to affected families. This relief was not enough because some respondents indicated that they got nothing from the government. The disaster management officials reported challenges on their side when responding to such incidents. Poor road infrastructure, lack of resources and shortage of staff members were common challenges among the 4 municipalities in the district. The next chapter concludes the study and provides recommendations.

CHAPTER 6: CONCLUSION AND RECOMMENDATIONS

6.1. Introduction

This study was constituted of six chapters. Chapter 1 introduced the whole study by laying out a study background, research aim and specific objectives in line with the research questions. The significance of the study and study outline are also discussed in the first chapter. Chapter 2 analysed the social vulnerability and community-based disaster management approaches as theoretical frameworks that were used in this research. Chapter 3 reviewed the literature on tornadoes around the world and in different areas within South Africa as well as the socio-economic impacts of these incidences. The chapter also examined ways that have been used by communities around the world to cope with disasters and how governments have been responding to these incidences. Chapter 3 further explored the community perceptions regarding natural disasters such as tornadoes that have been occurring in their areas. Chapter 4 focused on describing the study's setting and explaining the physical, demographic and socio-economic characteristics of the study area. The chapter also elaborated on research methodology by discussing the research paradigm, research design, data collection and analysis instruments that were utilized throughout the research. Chapter 5 provided a critical analysis and interpretation of the data in response to the objectives of the study. This chapter summarises the whole study by highlighting the following issues which emerged from the data analysis.

6.2. Distribution of tornadoes in the Harry Gwala district

The results showed that uMzimkhulu and NDZ recorded the highest frequency of tornado incidences from 1989-2019 as compared to other municipalities in the district. However, there is a gap in terms of capturing these incidences by responsible organizations such as the South African Weather Services and the Harry Gwala District Municipality.

6.3. Socio-economic impacts of tornado

The tornadoes have worsened the economic status of households with already high unemployment status. The major impact was damage to houses, especially those made from mud. The damage to houses also extended to damage to their furniture, food, clothes and appliances. The adversely affected households came from uMzimkhulu and uBuhlebezwe municipalities in the rural areas of KwaMeyi and

KwaNokweja because the communities largely used mud structures. Tornadoes also destroyed community infrastructures such as roads, schools, churches and electricity lines. This affected government response since officials found it hard to reach the affected households. Several community gatherings such as church services, teaching and learning were also affected. On top of physical damages, the tornado also affected the emotional well-being of community members since some of them reported that they incurred debts and suffered anxiety when faced with the attempts to reconstruct their houses. Human dignity was also affected since in some families, they were forced to live in congested rooms regardless of their age and gender.

6.4. Coping strategies by the communities

Most people rely on their respective ward councillors for relief. Some preferred to pick up the pieces and try to reconstruct their houses immediately after the storm, but without any success. Those who had permanently damaged structures opted to move in with neighbours and relatives while some preferred to be congested in non-affected rooms within the homesteads. The community members struggled to cope.

6.5. Government response

The immediate response from the municipality and local non-profit organizations was the provision of food parcels and blankets after an assessment was done. There was a low percentage of provision of temporal structures and community tents. In other words, the government has not adequately responded to the impacts of the disaster in terms of assisting the communities either to recover from or successfully cope with the disaster.

6.6. Community perceptions

A great proportion of respondents perceived tornadoes as *Inkanyamba*, indicating that there is little understanding of them being climatological phenomena. Those who had a different opinion perceived them as acts of anger from God. This contributes to their continuous vulnerability to tornadoes because the communities do not change conditions which increases their exposure to tornadoes.

6.7. Recommendations

Based on the findings of the study, it is evident that there is a gap in capturing and mapping the occurrence of tornadoes in the country, which influence the extent of

government preparedness for such incidences. People are continuously suffering from the effects of tornadoes, mostly because of poor building materials. They also lack knowledge about the emergency services available to them in times of disaster. It is also evident that the government response is a short-term relief, the conditions that increase human vulnerability such as their housing structures remain unchanged. The government continuously spends a significant amount of money on relief instead of permanent solutions. It is also clear that people lack knowledge of climatological conditions, mitigations and adaptation measures. For these reasons, it is recommended that;

a) The Harry Gwala District Municipality Disaster Management Centre should invest in research on climatological disasters that are experienced within the district, and capture and keep records of such incidences. This will help in coming up with effective ways of dealing with these incidences in future.

b) There should be housing development in rural areas and continuous assessment of community infrastructures such as bridges and roads.

c) The local disaster management offices should conduct community awareness workshops to educate people about natural disasters such as tornadoes so that they will have more understanding. This will help them to respond accordingly.

6.8. Suggestions for further research

The study was delimited to a particular scope and therefore other elements encountered during the study fell outside of the study's intended investigation. For these reasons, the following are suggested as possible areas for future research;

a) Mapping the distribution of tornadoes within the district and measuring the point of their origin and the extent of damage by each tornado incident.

b) Measuring the amount spent on disaster relief as compared to a permanent solution.

c) The effectiveness of community awareness workshops on disasters.

d) The effectiveness of government relief measures and areas of improvement.

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APPENDICES

Annexure A: Questionnaire



UNIVERSITY OF ZULULAND

FACULTY OF SCIENCE & AGRICULTURE

DEPARTMENT OF GEOGRAPHY AND ENVIRONMENTAL STUDIES

QUESTIONNAIRE FOR HOUSEHOLDS

Research topic: Analysing the impact of and response to the 2019 tornado in the Harry Gwala District Municipality, KwaZulu-Natal, South Africa.

Researcher: **Nozuko Methula.**

I am a student in the Department of Geography and Environmental Studies at the University of Zululand. I am researching the impact of and response to the 2019 tornado in the Harry Gwala District Municipality. The main aim of this research is to analyse the impact of the 2019 tornado incident on your home and area of residence, and also to determine the response by respective responsible organisations and departments. Your cooperation will be appreciated as it will contribute to the success of this research. The results of this research will be used for academic purposes only and confidentiality will be ensured. I kindly ask you to answer all the questions.

Consent form for participation

I _____ the respondent, have been asked to voluntarily participate in this research. I have read and understood the research purpose and give my consent to participate in the research. I also understand that I have a right to pull out at any stage of the research without being penalised. It has been explained to me that I will not be compensated for taking part in the study and I will remain an anonymous source.

Signature of a respondent..... Date.....

Signature of a researcher..... Date.....

SECTION 1: DEMOGRAPHIC CHARACTERISTICS

Please respond to the following questions by selecting the most appropriate answer using [X]. Choose only one answer to each question.

1.1. Please select your age range

Age in years	
18 and below	
18-30 years	
31-40 years	
41- 50 years	
51 - and above	

1.2. Please indicate your marital status

Single	
Married	
Divorced	
Separated	
Other	

1.3. Please indicate your employment status

Employed	
Unemployed	
Self-employed	
Retired	

1.4. What are other sources of income in this household?

Child Support Grant	
Old-age Pension grant	
Disability grant	
All of the above	
None of the above	

1.5. How much is the total household monthly income?

Less than R3 000	
R3 000-R6000	
R7 000-R10 000	
R11 000-R14 000	
Above R15 000	

1.6 Your household size is.....

1.7. How many bedrooms do you have in this homestead?

.....

1.8. What material is your homestead made of?

Bricks	
Zinc material	
Mud structure	
Other	

1.9. If you selected 'other' in the above question, please specify.

.....

SECTION 2: EFFECTS OF THE DECEMBER 2019 TORNADO ON HOUSEHOLDS

2.1. Is there anyone in your household who got physical injuries as a result of the tornado?

Yes	
No	

2.2 If yes, how many people were injured in this family?

.....

2.3. Please explain how the tornado affected this family e.g destruction to houses /emotional harm e.t.c.

.....

2.4. What other household property got destroyed by the storm?

.....

2.5. Which community services got disrupted by the tornado and how did you cope?

.....

2.6. What is the estimated financial cost of the damage caused by the tornado in this homestead?

Below R5000	
R6000-R10000	
R11000-R15000	
R16000-R20000	
Above R20000	

2.7. Do you have school-going children in this home?

Yes	
No	

2.8. If the answer to the above question is yes, please elaborate on how the tornado affected them.

.....
.....

2.9. What is your perception concerning the storm incident?

.....
.....

2.10. Please share any additional effects/impacts of the 2019 tornado on your household.

.....
.....

SECTION 3: COPING STRATEGIES

3.1. How did you respond to the impact of the tornado in your household?

.....
.....

3.2. How did the government assist your household in coping with the effects of the tornado?

Temporal homes	
Community tents	
Food parcels and blankets	
All of the above	
None of the above	

3.3. Did the government rebuild or promise to rebuild your homes?

Yes	
No	

3.4. If yes, are you satisfied with the new house that was built for you?

Yes	
No	

3.5. If not, what follow-up measures did you take regarding the matter?

.....
.....
.....

3.6. If the government has not yet replaced the houses that were destroyed by the storm, how have you been coping, especially regarding the COVID-19 government regulations that require social distancing? Please explain fully.

.....
.....
.....
.....
.....

3.8. What have you learned from the 2019 tornado attack? What mitigation measures will you take in the future should the incident reoccur?

.....
.....

3.4. How long did it take for your houses to be fixed?

Less than 5 months	
6-12 months	
Above 12 months	
Never been fixed	

Annexure B: Interview questions for municipal officers



UNIVERSITY OF ZULULAND
FACULTY OF SCIENCE & AGRICULTURE
DEPARTMENT OF GEOGRAPHY AND ENVIRONMENTAL STUDIES
INTERVIEW QUESTIONS FOR MUNICIPAL OFFICIALS

Research topic: Analysing the impact of and response to the 2019 tornado in Harry Gwala District Municipality, KwaZulu-Natal, South Africa.

Researcher: **Nozuko Methula**.

I am a student in the Department of Geography and Environmental Studies at the University of Zululand. I am researching the impact of and response to the 2019 tornado in the Harry Gwala District Municipality. The main aim of this research is to analyse the impact of the 2019 tornado incident on your home and area of residence, and also to determine the response by respective responsible organisations and departments. Your cooperation will be appreciated as it will contribute to the success of this research. The results of this research will be used for academic purposes only and confidentiality will be ensured. I kindly ask you to answer all the questions.

Consent form for participation

I _____ the respondent, have been asked to voluntarily participate in this research. I have read and understood the research purpose and give my consent to participate in the research. I also understand that I have a right to pull out at any stage of the research without being penalised. It has been explained to me that I will not be compensated for taking part in the study and I will remain an anonymous source.

Signature of a respondent..... Date.....

Signature of a researcher..... Date.....

Questions

1. How many areas were affected by the tornado in this municipality and what is their geographical location?
2. What was the effect of disasters on these areas?
3. What was the municipal response to the effects of the tornado attack?
4. Which challenges did you face when responding to those effects?
5. Are there communities or households that didn't receive the municipal aid on this matter, if so, what were the underlying reasons for this?
6. What is the stipulated waiting period to respond to the effect of disasters in this municipality?
7. Looking at the responses to disasters since 2019 to date, can you say you are satisfied with the progress made?
8. Which community infrastructure was destroyed by the tornado?
9. Which measures were taken by the municipality to respond to the destruction?
10. What is the municipality's plan for the backlog of unfixed infrastructure?
11. Which other stakeholders were involved in the recovery plan for the December 2019 tornado?