Thantaswa Usisipho Mfingwana

215033720

College: Humanities

School: Built Environment and Development Studies

Supervisor: Dr Isaac Khambule

TOPIC: Assessing the relationship between poverty, vulnerability and natural disasters on urban informal settlements of developing countries: A case study of Quarry Road West informal settlement, Durban.

Table of Contents

DECLARATION

I, Thantaswa Usisipho Mfingwana, declare that this research study is not plagiarised and fully belongs to me as part of my degree in master's in development studies under the school of Built Environment and Development Studies (SoBEDS), University of KwaZulu-Natal (UKZN).

30-09-2020

ACKNOWLEDGEMENT

I would like to acknowledge and thank my supervisor Dr I Khambule for the assistance that he has given me during the whole research process. He went beyond his responsibility in ensuring that I am able to finish my research in one year, despite the difficulties. He would call when I did not have data to attend formal zoom meetings, suggest books and other documents to use to make my arguments stronger and even suggest proper words to use. It is for that reason that I managed to work well and finish my work on time.

ABSTRACT

The aim of this study was to assess the relationship between poverty, vulnerability and natural disasters in Quarry Road West informal settlement in Durban, KwaZulu-Natal. The informal settlement is located in Newlands East, near the Palmiet River, which overflows and results in flooding conditions in the settlement. The people from the settlement already live under poor and vulnerable conditions as they experience problems such as poverty, unemployment and informal housing structures, which makes this settlement the ideal study area for the research. Objectives of the study include exploring and investigating the impacts that floods have in this area, how the eThekwini municipality tries to minimize the impacts floods in the area, and what are the problems that the municipality encounters in trying to minimize the impacts of floods in Quarry Road West settlement.

Qualitative research methods and due to the Corona virus (COVID 19), secondary data analysis was used to collect and analyse the secondary data. The results indicated that there is a direct relationship between poverty, vulnerability and floods in Quarry Road West informal settlement. Floods in this area resulted in deaths, collapsing housing structures, loss of possessions and most importantly, loss of land. All his resulted in the people being trapped in a cycle of poverty and vulnerability that is almost impossible, as the people struggle to respond and recover to floods properly. As the floods keep striking, more people are getting affected, which means more people are struggling to recover from floods. The municipality tries to assist the community, however there are many challenges still being faced. This indicates that more efforts are required from the municipality in order to improve resilience in the area.

Key words: poverty, vulnerability, natural disasters, floods, informal settlements, municipality, resilience, response, recovery.

CHAPTER ONE: INTRODUCTION

1.1 INTRODUCTION

Climate change is currently the world's biggest issue, affecting everyone and everything that exists on planet earth. We are not only experiencing the extinction of fauna and flora, but we are now slowing experiencing the extinction of human beings through the deaths that occur in the hands of natural disasters. While scientists around the world are working on trying to remedy the problem, the harsh reality we are faced with now is to be resilient and prepare for the worst that is yet to come. For the wealthy, this might not be a problem, but what about the poor?

According to De risi et al (2013) processes like urbanization and industrialisation are responsible for both the increase in the number of informal settlements there are in urban areas and climate change. Mindscape (2016) states that the increase in demand for energy and modernity have been the main reasons for increased emissions, and thus, increasing the rate at which the earth warms. This results in global warming that has caused a change in climate that is not only drying areas, but also melting the poles that increases flood chances. On the hand, increase in industries and modernity meant that more labour is needed, meaning more people migrating to areas where these industries and businesses are found.

Currently, cities are overcrowded and are unable to accommodate everyone that lives on them, and the use of machinery is slowly replacing human labour. This means more people will be poor as they are unable to cater for themselves and become vulnerable for any shocks that might strike. Being unable to fend for themselves also means they will build informal settlements to secure a home that is both cheap and easy to build. These settlements are not only a health risk but also vulnerable to disasters that might occur, as they are easily destroyed. The poor are constantly trapped in a cycle of poverty and vulnerability, and if nothing is done to change this cycle, the poor will not be able to survive. The study area being studied is the Quarry Road West informal settlement located in Newlands east, Durban, South Africa.

In the research, the relationship between poverty, vulnerability and natural disasters is explored, as natural disasters are now occurring more frequently and intensely. These disasters are not only destroying infrastructure that may cost millions of rands to recover, but also claim lives of millions of people around the world, especially the vulnerable and poor.

The frequent occurrence of disasters has also increased the vulnerability of the poor. The main argument made in this study is that we are currently experiencing the wiping out of the human specie, through lives being lost in the hands of natural disasters (Population matter 2020). It will soon be a survival of the fittest between the wealthy and poor, as natural disasters occur more frequently and intensely.

The natural disaster that will be focussing on is floods, which is the one natural disaster that affects South Africa the most, as it is not a seasonal disaster. Causes floods, factors that can lead to flooding and areas that are prone to flooding will be explored, in order to have a better understanding of this phenomenon. In this way, we might be able to avoid deaths and also provide better disaster management services to the people to ensure that they are prepared when disasters strike, and can bounce back after the disasters, decreasing their vulnerability. Ways in which the municipality deals with such disasters will also be explored, following the Disaster Management Act of 2003.

1.2 BACKGROUND

The apartheid history of this country had a huge impact on not only the poverty rates of this country, but also the livelihoods of people. under the past apartheid laws, different race groups were placed in different areas according to their race, forming homelands that are still visible even two decades after the apartheid was overthrown. Majority of the population still resides in these areas with little land but over-populated. In some of the areas, we can still see people living in informal settlements of urban areas, trying to run away from the poverty and lack of opportunities of these areas. These structures are not strong enough to withstand the current flood problem that we are experiencing, as these settlements are built with materials that are not strong enough. This increases the resident's vulnerability.

Durban is the second largest city in South Africa (Latitude 2020). This therefore means that for years, it has been attracting immigrants from other parts of the country and the world, with hopes of bettering their lives. This has increased the number of informal settlements in the city. These settlements lack basic services and are poor in structure. When natural disasters strike, they are the most vulnerable to be washed away. The city has been always experienced floods, however, the floods have been occurring more frequently and intensely.

According to Williams et al (2018) climate change and urbanization are increasing the vulnerability of flooding for the urban poor, especially for developing countries in the global

South. De risi et al (2013) states that this is because urban informal settlements are associated with high population density and poor quality of structures. When floods therefore strike, the weakest structures are destroyed easily, and because more people reside in these areas, more people are then vulnerable and affected. This study is motivated by the ever-increasing occurrence of natural disasters that leaves millions displaced, injured and thousands dead. The problem is even worse in the developing countries, rural areas and informal settlements where people have little or no means to respond and recover from the effects of natural disasters.

1.3 MOTIVATION

It is said that poverty is like punishment for a crime you did not commit. This is because many people that are currently labelled as poor, are not in that situation because of their own doing, but due to a system that continuously traps them in a cycle of poverty. The poor usually lack many socio-economic factors to improve their lives, leaving them vulnerability to any shocks or disasters that might strike. This also threatens their chances of survival, during the time of disaster. According to Statistics S.A (2018) more than half of the country's population lives under poor conditions, while some live under the poverty line (which, according to StatsSA is R800 per month per person per month). This is the number of people vulnerable to shocks in this country.

When natural disasters like floods strike and early disaster warnings are given, people usually do not know how to prepare for such a shock. For those who can afford, they may relocate to an area that is not in danger or buy necessary supplies for preparedness, but the poor have no choice but to wait for the worst that is yet to come. The real motivation of this study is to not only provide awareness of climate change and the effects of natural disasters, but to also investigate if the intensification and frequent occurrence if natural disasters is a reality or not. This will be achieved by looking at previous information and case studies of different natural disasters that have occurred around the city. According to United nations office for disaster risk reduction (2015) between the year 2005 and 2015, more than 700 000 people have lost their lives in the hands of natural disasters, while 1.4 million were left injured and displaced.

The city of Durban is known for its warm weather and beautiful beaches, attracting thousands of tourists every year, from all over the country and world. The city is also known for being the country's busiest port. It is for this reason that the city is an interesting area to study. If

nothing is done to ensure resilience of the city and its citizens, not only will we lose more lives, but the country will experience a huge hit in the tourism and trade sectors as infrastructure will continue to be damaged and the ecosystems will be lost. My motivation for this study is to not only raise more awareness of the seriousness of natural disasters and its effects, but to also learn about how people are prepared to deal with such issues and learn about how other countries are ensuring that their citizens are resilient.

Muttarak & Lutz (2014) strongly argue that education can be a key to minimizing the effects of climate. This means that more awareness about global issues like climate change, global warming and natural disasters has to be available for people. People have to be regularly and strongly educated about these issues and how they can minimize the effects. They also must be equipped with knowledge that will be effective when floods occur, ensuring that they are able to prepare for floods before they strike and be able to build back after disasters. People should also know which areas to build their settlements on. This study tries to tackle those issues.

1.4 RESEARCH PROBLEM

Tas et al (2013) states that the countries and people who experience the worst impacts of natural disasters are usually those that contribute less emissions or have a lower carbon footprint. Natural disasters affect everyone and everything that exists on Earth, however, those that experience the worst are the poor (El-Masci & Tripple 2013). This is because they are already facing high levels of poverty and vulnerability due to factors such as poor building structures, people already struggling to make a decent living and lacking monetary resources (Tas et al 2013). This is a concerning problem as they are now paying for a crime they did not commit, while the wealthy and developed countries respond and recover better during disasters.

One of the most important problems currently being experienced is the number of people losing their lives, become displaced and injured during natural disasters (Brunkard et al 2008). According to the United Nations Office for disaster risk reduction (UNISDR) (2016) every year, millions of people are becoming even more vulnerable to the impacts of natural disasters, as they are killed, injured and displaced by these disasters. This is why there is a growing need to improve the resilience and preparedness strategies of cities, especially the

highly populated vulnerable cities, because the worst that is yet to come. This is why there is a need for studies such as these, to try to understand the problem in greater detail.

Another problem identified by Williams et al (2018) is the issue of the affected people being excluded from decision making of risk reduction measures. De risi et al (2013) also emphasize that although qualified people can come up with tested ways of reducing the impacts of natural disasters, but the local people have to be included, to ensure and promote inclusion and relevant strategies. These authors argue that the people mostly affected by natural disaster, know exactly what they want.

1.5 AIM

To assess the relationship between poverty, vulnerability and natural disasters in urban informal settlements of developing countries.

1.6 OBJECTIVES

- To explore the relationship between poverty, vulnerability and natural disasters in Quarry Road West informal settlement
- To examine the impacts of natural disasters in Quarry Road West informal settlement
- To examine the municipality's role in trying to minimize the effects of natural disasters in Quarry Road West informal settlement
- To explore challenges faced by municipalities in minimizing the effects of natural disasters in Quarry Road West informal settlement.

1.7 RESEARCH QUESTIONS

- What is the relationship between poverty, vulnerability and natural disasters in Quarry Road West informal settlement?
- What are the impacts of natural disasters in Quarry Road West informal settlement?
- What is the municipality's role in trying to minimize the effects of natural disasters in Quarry Road West informal settlement?
- What are the challenges faced by municipality in minimizing the effects of natural disasters in Quarry Road West informal settlement?

1.8 RESEARCH METHODOLOGY

The research methodology used in this study is the qualitative research approach. According to Galafshani (2003) qualitative research refers to a method of obtaining data through the use of non-numeric data, to get more information and understanding about the phenomena being studied. The qualitative approach is good for the study as it allows the researcher to obtain in-depth information about the issues being studied. This will be an advantage, as the more information received from the secondary, the better the reliability of the study. The information will not be limited, which will also allow the researcher to add whatever they feel is necessary and relevant to the study.

In order to ensure reliability of the study, I will be using the purposive sampling technique, which seeks to include people only relevant to the phenomenon being studied. The people that will be included in my study will have to be from informal settlements that are frequently affected by floods. In this way, all the information that I receive from my participants will be information that is related to having a clear understanding about the impact of floods on informal settlements that are both poor and vulnerable.

1.9 SIGNIFICANCE OF STUDY

The importance of this study is to firstly understand and create awareness of the seriousness of natural disasters such as floods. Looking at other case studies where floods had a very catastrophic impact, may also give people living in other cities, an idea of how disastrous these naturally occurring phenomena can be if not well prepared for. Investigating the causes of floods and areas vulnerable to flooding, may also help the informal settlers see the dangers that might face them in the future if the government does not help them or if they do not move to a safer area.

Another significance to my study is improvements in policy making, through inclusion of all relevant stakeholders in risk reduction policies. Including the affected individuals in policy decision-making will increase relevancy in the policy being implemented and may also improve some of the already existing policies. If the policies are effective, thousands of lives may be saved. If policies are not changed or improved, this could mean that more lives are expected to be lost, as natural disasters are only going to occur more frequently, but also more intensely.

1.10 CHAPTER OUTLINE

This study is six chapters long. Chapter one is the introduction that details all the parts that the research focusses on. Chapter two is the literature review for poverty and vulnerability, which looks in detail an explain what the terms poverty and vulnerability refer to, what are the causes and drivers for these terms in South Africa. The third chapter is the literature review for natural disasters, which starts by looking at what causes natural disasters (global warming and climate change). The chapter further focusses on the disaster being focussed on (floods), their causes, factors that increase flood damage, areas that are prone to flooding and the impacts that floods have on people. Chapter four is the research methodology, which detail the methods of research used for this study, paradigm and the case study being used. Chapter five is the data evaluation, analysis and discussions, which aims at obtaining data for the study through the use of research questions. The sixth and final chapter is the recommendations and conclusions, which discusses key findings of the study, provide recommendations for the problems being experience and later provide conclusions about the study.

1.11 CONCLUSION

There is no doubt that although we have knowledge of climate change and natural disasters, however, there is so much more that we are yet to learn about these phenomena. There is an urgent need to continuously raise awareness and teach people about ways that they can prepare for natural disasters before and after they occur. We do, furthermore, need to improve the lives of those who are economically challenged, as they are the ones who suffer the most impacts of disasters. Poverty needs to be addressed in order to ensure that their existence is not threatened. Disaster management strategies and policies need to be invested on more, especially in informal settlements as majority of the people in these areas cannot even afford to put food in the table. It is very much obvious that they will sure struggle to relocate when they are being warned about approaching dangers. It will be even harder to rebuild after all their property and goods have been washed away or destroyed in floods. The government, therefore, should invest in trying to improve the living conditions of the poor, in order to help them break from the cycle of poverty and hopefully survive the disasters.

CHAPTER TWO: LITERATURE REVIEW ON POVERTY AND VULNERABILITY

2.1 INTRODUCTION

According to the United Nations habitat (2010), Williams et al (2018) and Mindscape (2016) more than half of the earth's population currently resides in urban areas, and it is it is predicted that about 70% of the total population will reside in urban areas by the year 2050. As more people migrate to urban areas for a better life, the more urban poverty the world is going to witness. This is because cities are failing to accommodate and cater for the needs of all residents, due to the growing demand in housing opportunities, jobs and access to services. For those who can afford, they are guaranteed to survive, as they are able to provide for themselves without the government's assistance. For the poor, however, every day is a struggle to survive, as shocks and stress continue to strike and only the fittest can survive.

This section will explore more about the relationship between poverty and vulnerability in urban spaces. I will do this by defining poverty and vulnerabilities, look at the causes of poverty and the types of vulnerabilities that people usually experience. I will further look into the concept of urban poverty, that is being used frequently now due to the increase in the number of people living under poor conditions in cities, and has resulted in the increase in the number of informal settlements. This is done to assess the relationship that exists between poverty and vulnerability, where poor conditions can leave people extremely exposed or vulnerable to any stresses or shocks that might occur.

2.2 POVERTY

There is no one definition to poverty, this is because there are many different types of poverty Brynard (2011). However, the general consensus is that poverty is a lack of something (Lardechi et al 2003). Poverty is said to be an interdimensional and interdisciplinary, complex concept, where one can define according to what they lack. One person can define poverty and a lack of economic and material resources, while another can define it as a lack of basic services necessary for survival Brynard (2011). As complex as the concept of poverty is, it is one of the world's major issues. According to the World bank (2020) about 736 million people live under extremely poor condition. This source states that countries with the highest poverty rates are Bangladesh, Ethiopia, Congo, Nigeria and India, which are all developing countries. In South Africa, 13.8 million people were living under the poverty line in 2015.

Lardechi et al (2003) state that although there are many definitions of poverty, but each definition is important because poverty reduction policies and strategies are derived from the definition. For example, suppose you define poverty as lack of monetary resources, then the policies should aim at providing monetary resources to the people by introducing policies such as unemployment funds, universal or basic income, social security policies. Brynard (2011) states that individuals or groups that are usually poor are the elderly, the unemployed, women, the low wage income earners, the disabled and people living in poor areas. These poor areas include: rural areas, townships and informal settlements. This, however, is not always true.

There are two dimensions to poverty: chronic poverty and episodic poverty (Brynard 2011). Chronic poverty refers to poverty that is passed down from generation to generation, due to lack of socio-economic resources, in order to escape of the cycle of poverty. These patterns are usually associated with low income and unemployment in developing countries. Episodic poverty refers to short term or sudden poverty that might occur due to drivers like natural disasters. Natural disasters do not only affect the poor, but can increase the number of people living in poverty (Bui et al 2014). Some people are able to recover, but for the extremely affected who previously had no social security insurance or asserts to mitigate the vicious outcomes, they may find themselves in chronic poverty (Muttarak & Lutz 2014).

2.3 APPROACHES TO DEFINING AND MEASURING POVERTY

Brynard (2011) defines poverty as an individual or groups deficiency and deprivation of socio economic capabilities, Lardechi et al (2003) also highlights the lack of socio-cultural and socio-political capabilities as poverty, because they look at poverty in a holistic view. These authors looks at defining and measuring of poverty by using four approaches, namely: the participatory, monetary, capabilities and social inclusion approach.

2.3.1 Participatory approach

The first is the participatory approach, which is about getting people involved in defining poverty, measuring poverty and coming up with poverty reduction policies. This approach believes that people understand their own situations very well and should therefore, tell us what they need. An example of this approach is when development projects such as building of taps in a local area are being implemented, the people are to participate in all stages of the

project to the last. This is done to ensure that people will also gain skills and knowledge that might empower them.

2.3.2 Monetary approach

The second approach is the monetary approach, which is the dominant measure, as it looks and defines poverty as the lack of monetary resources such as income (Lardechi et al 2003). This is because the leading drivers of poverty is monetary deprivation from the lack of job opportunities. It observes poverty by looking at people living below the poverty line, which according to the United Nations (2015) is US$2 per day. This is because When people do not have enough money, they will be unable to buy all the basic needs and services one requires for survival. While some may get the services, as countries like South Africa does provide services for citizens as their basic rights, but Handmer et al (2007) question the quality of services provided by the government. This author claims that some services are not of good quality and can deteriorate easily, throwing the people back to poverty.

2.3.3 Capability approach

The third approach is the capability approach which contradicts the monetary approach, as it defines poverty as a lack of basic services and capabilities people require for survival (Lardechi et al 2003). Du Bois and Rousseau (2018) have argued that increased and uninterrupted access to quality services increases capabilities, because these capabilities are the most important determinant in accessing the labour market and subsequently improving socio-economic conditions. The Nussbaum's (2000) list of features essentials for human life explain the capabilities people require for survival.

These include: good physical, emotional and mental health, being able bodied, being able to reason and having access to services such as housing, healthcare and education. when people are educated, they have better chances of finding employment (Muttarak and Lutz 2014). Khandhlela & May (2006) however, argue that services are easily lost and destroyed during disasters, leaving people poor and vulnerable again. My counter-argument is that while these services may be lost during disasters, they nonetheless play an essential role in preparing to cope with the disasters. For example, stocking up on services before a disaster helps people cope.

2.3.4 Social inclusion approach

The last approach is the social inclusion approach, which was initially designed and implemented by developed countries that were trying to address the problem of discrimination and marginalization of certain individuals and groups in society (Lardechi et al 2003). The marginalized groups include the disabled, women, non-whites and the poor. This approach defines poverty as being excluded in decision making that takes place in society, as this deprives the people voice and power to decide on policies that are implemented in their communities (European Commission 1995). This approach looks at social inclusion as a poverty reduction strategy, because when people are included in decision making, the dignities, opportunities and abilities improve, especially for the minority groups such as the poor.

Brynard (2011) states that poverty is monitored through constant research and surveys, as everything changes over time. This reflects the importance of updating available data. This, means that in order to create effective and relevant policies, there should be a clear understanding of the problem. Understanding the concept of poverty from the root causes will also mean that we can prevent the problem from occurring in the first place, as it is famous famously known that prevention is better than cure. Preventing people from being poor in the first place, is better than coming with poverty reduction strategies later on in life, to remedy the problem. For example, the capability approach through the provision of access to services ensures that people are mitigated against the risk of poverty

2.4 VULNERABILITY

2.4.1 Defining vulnerability

There are various definitions of vulnerability. Ayala (2002) defines it as exposure of individuals or groups to stresses and shocks. Varley (1993) defines it as availability of self and social protection of individuals or groups from risks. Maskey (1993) defines vulnerability as the pace and the ways people are able to respond and recover from shocks. All of these definitions define vulnerability by looking at dangers that people are exposed to and how those people are able to prepare and recover from those stresses and dangers.

Cannon (1993) divided vulnerability into three categories in order to get a clear understanding and ensure that vulnerability is decreased. The first category is the livelihoods resilience, which looks at ways that communities improve their resilience by strengthening

their coping strategies. The second is the health category, which is related to the health of the people. People who have proper healthcare are able to survive more than those who do not have or receive proper health care (Khandhlela & May 2006). The last category is preparedness, which looks at how people prepare for danger. If we ensure that we are always prepared for any shocks that may result, we will experience a decrease in vulnerability (De risi et al 2013).

Some of the factors that increase vulnerability include little or no income, unemployment and lack of savings and lack of liquid asserts (Muttarak & Lutz 2014). Tus et al (2013) also highlights the quality of the structure of the houses as one of the factors that increased vulnerability. The Discussion document (2008) points out the importance of location in determining how vulnerable people may be. Choosing to reside in a low-lying area, may be a flood hazard, while living in a hilly and steep area is exposing people to landslides, which are also associated with mudslides (Gaafar 2017). These factors can determine what type of vulnerability class one falls under. The different classes of vulnerability are discussed below.

2.5 TWO CLASSES OF VULNERABILITY

2.5.1 Human vulnerability

According to Ayala (2002) there are two classes of vulnerability: human and natural vulnerability. The human vulnerability is related to vulnerability caused by social, economic, political, cultural lacks and limitations. It includes the economic, social, educational, attitudinal, political, physical, and organizational vulnerabilities. These vulnerabilities may be caused and controlled by the people themselves and the society in which they live in (Ayala 2002). The second class form is natural vulnerability, which is associated to exposure of people to the impacts of natural disasters and forms part of this study. The different types of human vulnerabilities are defined in greater detail below.

- ***a) Economic vulnerability***

Economic vulnerability is the mostly known and used type of vulnerability, as it is associated with the monetary approach of defining and measuring poverty and vulnerability (Lardechi et al 2003). It refers to exposure of the people to dangers and shocks due to lack of monetary resources (Aysan 1993). It rests on the belief that when people are not economically secure, they are always vulnerable to social, economic and natural stresses. Survival or decrease in

vulnerability is therefore, associated with savings, investments and liquid resources (Khandlela & May 2006, Bui et al 2014).

- ***Social vulnerability***

Social vulnerability refers to people's exposure to stresses due to lack of social patterns and networks (Aysan 1993). Khandhlela and May (2006) and Tas et al (2013) emphasize the importance of strong social capital and networks, which refers to the relationships and connections people have with each other. Stronger social bonds mean that people have somewhere to seek help to, in times of troubles and stresses. Deveruex (1999) however, argues that social networks offer limited help in times of disasters. This is because in most cases, the people who are expected to help, are also in the same situations. The government, therefore, needs to play an essential role in helping socially vulnerable people.

- ***c) Organizational vulnerability***

Organizational vulnerability refers to people's exposure to shocks due to lack of intervention and assistance from the government (Aysan 1993). Khandhlela and May (2006) and Tas et al (2013) highlight the importance of the government's role in ensuring that residents are economically, socially and physically ready for any shocks that might come. The people cannot always help themselves during disasters, the government is equally responsible to rescue the people aftershocks. Lack of involvement of government authorities worsen the livelihoods and survival of the people. Desai (2002) emphasizes the importance of financial assistance from the government to decrease vulnerability, as the money given to the people can be invested in ensuring that people are resilient to upcoming shocks.

- ***d) Educational vulnerability***

Educational vulnerability refers people's exposure to stresses due to lack of education and access to information about how people can better prepare themselves for any shocks (Aysan 1993). Ayala (2002) emphasizes the importance of education and access to information to improve the people's adaptive capacity. This is because, when people are equipped with knowledge about risks and shocks, they are able to respond better and survive. Muttarak and Lutz (2014) also support this idea, as they stated that education and a better social capital can decrease vulnerability to shocks and disasters. Improved human and social capital decreases the risks to shocks and the risk increase in the absence of capital.

- ***e) Attitudinal and motivational vulnerability***

Attitudinal and motivational vulnerability refers to people's exposure to stresses due to their attitudes towards the dangers that they are exposed to (Ayasan 1993). It is related to how aware people are to possible dangers that might possibly affect them. Ayala (2002) emphasizes the need for ample research, improved technologies and methodologies in trying to provide clear information about possible risks, and ensuring that the information is easily accessible to the public. The more aware the people are to impact of risks, the better the preparedness and risk reduction strategies there will be. This will, therefore, decrease vulnerability. An example of this is Japan, where people are well aware of the possible dangers they face due to earthquakes, and know how respond to these disasters (Ayala 2002).

- ***f) Political vulnerability***

Political vulnerability refers to people's exposure to risks due to lack of access to political power and representativeness (Aysan 1993). Williams et al (2018) states that access to political power gives a voice to the people and increases their participation, empowerment and involvement in policies that have to be implemented. Tas et al (2013) state that community participation is essential, ensuring that each community outlines their own problems and possibly coming up with their own effective solutions. This also ensures relevancy in solutions provided, as people know what they need the most rather than the government deciding for the people.

- ***g) Physical vulnerability***

Physical vulnerability refers to people's exposure to risk due to weak structures of buildings that they live in (Aysan 1993). Tas et al (2013), De risi et al (2013) and Khandhlela and May (2006) all state that poor infrastructure increases vulnerability in times of disasters such as floods, earthquakes and fires, as the structure is easily destroyed, posing a huge risk on people. when settlements get destroyed by disasters, the building material can injure the occupants, sometimes causes permanent paralysis (Khandhlela 2006 and Brunkard et al 2008). Tas et al (2013) emphasizes the importance of improving informal settlements to minimize the number of deaths and injuries caused by collapsing structures.

2.5.2 Natural vulnerability

Natural vulnerability refers to people's exposure to stresses due to the occurrence and impacts of natural hazards (Aysan 1993). When natural hazards such as the 2017 Sierra Leone floods and mudslides occur, the poorest people living in the most vulnerable areas

suffer the most, especially those that live in informal settlements (Gaafar 2017). This is because there are many houses, and they are built very close to each other. During one of the 2019 Durban floods, there was a case whereby a man died when one house fell over another house. The house was situated in a slope, and fell due floods and mudslides. When rains cause the area to flood, the floods resulted in mudslides that cause the house to collapse (Dawood 2019). This is why Ayala (2002) and Muttarak and Lutz (2014) emphasize the importance of educating people about where to and where not to settle.

2.6 THE RELATIONSHIP BETWEEN POVERTY AND VULNERABILITY

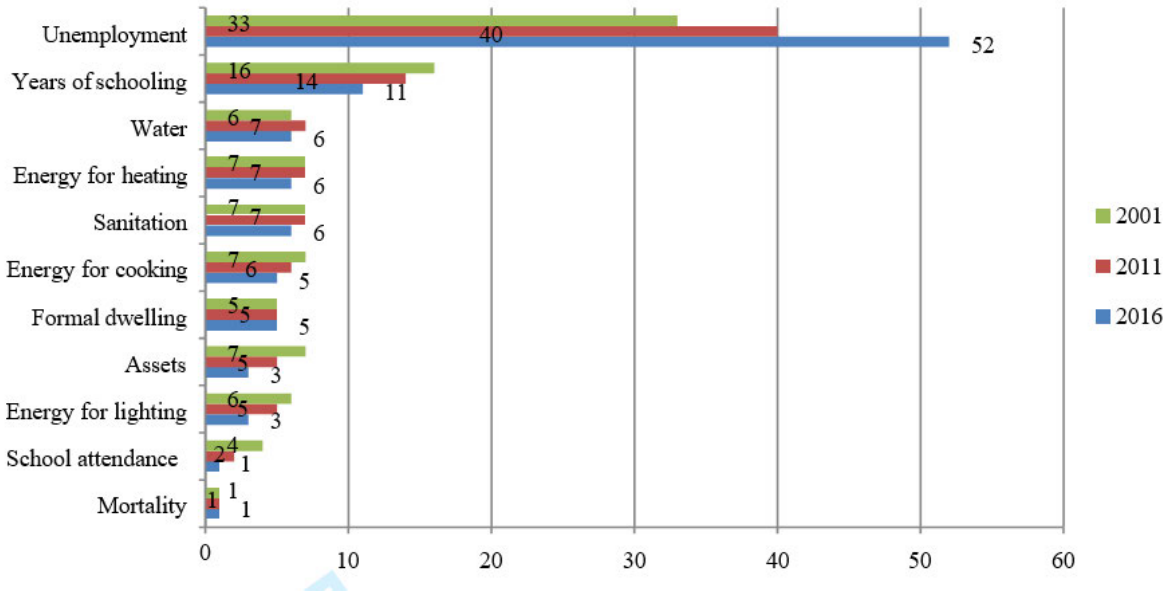
Ayala (2002) state that poverty results in vulnerability to risks and stresses, and also vulnerability can lead to poverty. Muttarak and Lutz (2014) support this by making an example of education as a form of protecting and preparing yourself for any risks that might strike. These researchers argue that people who do not receive good quality education might end up not obtaining a good job, thus not being able to prepare themselves for risks and stresses. This might lead to cycle of poverty and vulnerability that is passed down from generation to generation, that is hard to escape. This is referred to as chronic poverty (Brynard 2011).

Du Bois and Rousseau (2008) state that limited access to basic services and capabilities might lead to poverty, which in the long run, increases vulnerability. When people have no access to basic services like proper houses, healthcare and education, and capabilities such as good mental health, being body abled and having access to good social capital and networks, their vulnerability increases as their chances of recovery are lower. This means that people who have access to good quality services and capabilities have a higher chance of surviving, as they are prepared those that lack quality services.

Inaccessibility to services such as a properly built housing structures might lead to people building their own informal and poorly-built settlements that can easily be destroyed by natural disasters. These housing structures are also not good enough to withstand extreme weather conditions, thus not suitable for human beings to live in them (Tas et al 2013). This source also argues that local governments should focus more on ensuring that people are residing in safe areas and that the housing structures are good enough, rather than investing on response and recovery. This is because these researchers believe that investing in preparedness processes decreases poverty and vulnerability.

2.7 MULTIDIMENSIONAL POVERTY IN SOUTH AFRICA

Figure 1: A graph indicating the different measures that make up multidimensional poverty



source: Statistics South Africa (2018)

According to Statistics South Africa (StatsSA) (2018) poverty is not unidimensional, meaning that it does not have one measurement or cause. The unidimensional perspective only looks at monetary resources as poverty, not acknowledging other causes of poverty, such as availability of capabilities, rights and freedom (Brynard 2011). Therefore, we currently using the multidimensional perspective to view and measure poverty, as poverty is not caused by one factor. The Multidimensional perspective looks at four dimensions with ten indicators to measure poverty in South Africa. The first dimension is health and the indicators to measure a person's health, to determine if they are poor or not, include nutrition and child mortality. A person is considered to be healthy if they have a proper nutrition and low child mortality rates in the family or area. The graph above indicates that that mortality has been extremely low in the country from 2001 to 2016, contributing only 1% to multidimensional poverty. This indicates that the health of the country is better.

The second dimension is education, measured by years of schooling and school attendance. If people have less years of schooling or have never attended school, they are considered to be poor. Mutarrak and Lutz (2014) state that education is able to open more opportunities of success for people, which may improve their lives and their resilience. The graph above

indicates that illiteracy is decreasing in South Africa, although it is still high. In 2001, number of schooling years was at 14% and in 2016 it is at 11%.

The third dimension is the standard of living, which is measured through the access of services such as cooking fuel, asserts, sanitation, floor and electricity. The person is said to be poor if they do not have access to such services and benefits, which make life easier. The graph above indicates that there is a number of people in the country, that have limited access to these services (although the number decreased from 2011 to 2016). The fourth dimension is economic activity, measured by employment. If a person is not employed or receiving any income, then the person is considered to be poor (StatsSA 2018). unemployment contributed to 31% to multidimensional poverty, while in 2016 it increased to 52%. Unemployment is extremely high in South Africa and continues to be on the rise. This is very concerning, as this will mean that people will not be able to meet their daily needs, as they have limited financial capabilities.

Other causes of poverty are discussed below.

2.8 CAUSES OF POVERTY

2.8.1 The apartheid system

One of the worst historical causes of poverty in South Africa was the apartheid system that lasted for four decades, oppressing and excluding non-whites from good quality and high standard socio-economic advantages (Khandhlela & May 2006). The 1913 Native land act was an apartheid law that deprived non-whites from land ownership, as more than 80% of the productive land was reserved for whites only (Singh et al 2008). This resulted in high population densities in non-white areas. It also resulted in land degradation, over cultivation and landlessness for the majority of the country's population (Modise & Mtshiselwa 2013). The non-whites were also excluded from some job and business opportunities, which resulted in high rates of poverty for the non-whites (Singh et al 2008).

The 1913 homelands and self-governing states and the 1951 group areas act also perpetuated poverty, as non-white areas were associated with overpopulation, poor infrastructure and lack of proper service provision. In some areas, such trends are still visible today (Modise and Mtshiselwa 2013). White areas were located near cities, towns and closer to coastal areas. The opposite was seen for the non-whites, whose areas were the furthest. This meant high transport costs to go to cities and towns, fewer business opportunities, lack of recreational

facilities, lack of services and lack of access to quality facilities like schools, healthcare and housing (Singh et al 2008).

According to the capabilities approach, one is said to be poor if they do not have to access to basic services such as good quality education and healthcare (Du Bois and Rousseau 2008). During the apartheid era, non-whites did not have access to good quality of such services, thus exposing them to generational poverty that was almost impossible to escape, as each generation was exposed to poor quality of services (Singh et al 2008). This meant deprivation and chronic poverty for these racial groups, which can still be noticed currently. Majority of the population that resided in the homeland areas, still reside in those areas even decades after the end of the system. Lack of good governance and corruption that is currently witnessed, is also one of the reasons that these groups are still poor (Webster online 2019).

Lardechi et al (2003) list social exclusion as a type of poverty. These theorists argue that social inclusion promotes participation and empowerment to the people, giving them power and a voice to choose what they want in their communities and who they want to elect in positions of leadership and authority. This is was the type of poverty that non-whites were experiencing during the apartheid era, as they were not allowed to vote, depriving them of not only a voice, but also freedom and power (Modise and Mtshiselwa 2013). This is why inclusion, participation and empowerment are included in poverty reduction strategies (Lardechi et al 2003).

2.8.2 Structural adjustment programs (SAPs)

Structural adjustment programs are loans attached with policies, granted to countries under economic or social crisis by international institutions, such as the International Monetary Fund (IMF) and World Bank (Konadu-Agyemang 2000). When these countries fail to repay these loans, which are in US dollars, with their weak currencies, they have no choice but to obey the conditions. In some cases they even go back to seek more loans. The loans come with conditions that force these countries to reduce subsidies, minimize the government's role and intervention, minimize trade and promote free markets. This was another Historical cause of poverty in many developing countries there were previously colonized. Konodu-Agyemang (2000) also argues that SAPs are the reason for the “arrest” in African economies.

2.8.3 Dependency

The dependency theory highlights the relationship between Developed and developing countries, that Andre Gunder frank defined as two sides of the same coin (Slideshare 2020). This means that under-development in one side is due to the development of the other side. This is seen when major companies have their industries in developing countries, while the headquarters are in developed countries (Singh et al 2008). The problem with this relationship is that industries will result in problems like pollutions that only affects residents in the developing country, while all the profits end up in the developed countries. Employment opportunities are, however, provided but developing countries also experienced the issue of cheap labor and exploitation (Brynard 2011).

The dependency theory is supported by the Marxian theory of development and underdevelopment, which states that the wealthy (core countries), always seek to maximize the production and profits. This theory argues that since the poor (periphery) are at the bottom and are poor, they are easily exploited as they are the source of labour (Warke 1993). When the core countries seek to maximize their profits, they will want to build their factories and shops in many peripheral countries, as they need as much labour force as possible in order to increase production and capital.

2.8.4 The 2008 global economic crisis, lack of food and food inflation

The 2008 global economic crisis was one of the major contributions to the rate of poverty in the world, and developing countries suffered the most, as the crisis meant that exports will decrease (Brynard 2011). This was a major problem for developing countries, as majority usually export raw materials that are cheaper (Singh et al 2008). Before the 2008 global economic crisis, the global poverty rate stood at 950 million people living under the poverty line. After the crisis, more than 50% of the global population lived below the poverty (Brynard 2011). According to the International Labour organization (2020) the Global Financial Crisis led to 2 million jobs losses and spiking food prices. The loss of jobs means more people will be unable to afford to buy food, increase in food prices only worsens poverty and hunger around the world.

Food is the most basic service and need necessary for survival. In countries like South Africa and the state of Kerala in India, it is a person's right to have access to food (Frank 1990 and Handmer et al 2007). While some people may have access to food, the major concern is the

quality of food they consume. Lack of proper nutritious food leads to diseases like malnutrition and Kwashiorkor, which are two of the African's major issues (Singh et al 2008). Household income, distribution of food, agricultural production as well as population growth and distribution are one of the indicators used to determine access to food (Brynard 2011).

Food inflation refers to the increase in food prices (Todaara & Smith 2009). It can be caused by a number of factors such as natural disasters, like floods and droughts, that lower the production and supply of food available (Singh et al 2008). The ever-increasing standard of living is another cause of increase in food prices. This threatens food security, which refers to affordability, accessibility and availability of food, as this will mean that some people cannot afford food, threatening their security for food (Brynard 2011). The challenge the poor experience is affordability, as some are unemployed and receiving low income.

2.8.5 Unemployment and low income

South Africa does not only have high unemployment rates but also high graduate unemployment rates (Mncayi 2016). According to Trading Economics (2020) the unemployment rate in South Africa is 32,70%, and is expected to rise to 33.60% by the end of the year 2020. When people are without employment, this means that they are also not earning and will therefore be unable to afford to meet their basic needs, increasing the number of people living under poor conditions. Inability to afford basic needs like food, decreases food security, which can lead to diseases like malnutrition (Brynard 2011). Olivier (1994) states that the biggest causes of unemployment is the ever-increasing number of people that exists in one space, due to population growth, refugees and rural urban migration. Mncayi (2016) argues that unemployed is affected by subject choices and qualifications one has, with engineering graduates having higher chances of being employed than humanities graduates.

Khandhlela and May (2006) emphasizes on the impact of cheap labor in increasing poverty rates. This also increases the inequality rates in the country, as the rich (business owners) are getting richer, while the poor (workers) are getting poorer. With the ever-increasing standard of living, this also means that the poor are fighting to survive. The indicators used to determine unemployment and low income rates include: Gini coefficient, personal per capita income, employment rate, economic growth versus population growth and the ratio of job

seekers (Brynard 2011). According to statistics South Africa, Gini co-efficient of South Africa is 0.67, making it the most unequal country in the world.

2.8.6 Bad governance and corruption

According to Webster online (2019) South Africa is the most unequal country in the world. Confucius (2009) states that in a country that is well managed, poverty should be a shame, and in a country that is badly governed, wealth should be a shame. February (2018) states that South African local governments are extremely corrupt and dysfunctional, as we always witness those in power misuse and steal millions of rands that are set aside to improve service delivery and living standards of the residents. Matshediso (2014) however, argues that some services such as housing, are being provided and delivered to the people, but some citizens still sell or rent out their houses for extra income, while they go back to living in informal houses. This means that people can also deprive themselves.

2.8.7 Lack of service delivery

- ***a) Health***

Olivier (1994) defines health as the absence of sickness or diseases. Proper health is very hard to attain for the poor as poverty also contributes to increasing diseases. Diseases like malnutrition and cholera are caused by consuming improper and unhealthy nutrition and unclean water, and this is associated with poor living conditions. These diseases are caused by poverty, meaning that improper health is not only the cause of poverty but also poverty can cause improper health and diseases. Indicators commonly used to measure health status include: life expectancy and infant mortality (Brynard 2011).

The current corona virus (COVID-19) pandemic has been one of the biggest threats that the world has ever faced. In South Africa, the pandemic has revealed how much the country lacks preparedness for such disasters, as the country was experiencing a problem of running out of protection supplies such as gloves, masks and sanitizers (Isaacs 2020). This is why researchers like Tas et al (2013) and De risi et al (2013) emphasize the importance of investing in preparedness, as they believe that in any situation, prevention is better than cure.

Gibson and Rush (2020) highlight the challenges that countries in the global south face during times of epidemics, due to informal settlements living conditions that do not allow social distancing and quarantine. This is because such areas are over populated and people are highly dependant on each other for survival, as they have created their own communities

and families for support (Tas et al 2013). Gibson and Rush (2020) also highlight the issue of distances between the settlements and the number of people in each settlement as being one of the major threats, as this could mean that more people are infected easily due to lack of sufficient space.

Gibson and Rush (2020) conclude that social distancing is a major challenge in informal settlements, as many informal settlements are less than a meter or 2 meters apart from each other. This means that if one person is infected by the virus, there are chances that more than half of the population of the entire settlement might be infected. The reasons for this could be seen in Tas et al (2013), where emphasis is placed on the strong social bonds that exists between the people in these areas and how much they interact with each other. This also shows how the poor are always vulnerable to risks.

- ***b) Education***

Every year In South Africa, the Minister of Finance and the President address the nation in the State of the Nation Address the (SONA) and the budget speech. Each year millions of rands are invested in the education sector to improve access and quality of education, as the rights of the citizens of South Africa state that basic education is a right for every citizen of the country. The country, however, is still poor, even with all the investments. Brynard (2011) argues over the quality of education received as being the reason why we are still witnessing poverty. Muttarak and Lutz (2014) states that education does not only open up employment opportunities, which will mean more income, but also improves people's mentalities, perceptions and survival strategies. The multi-dimensional poverty graph also indicates that years of schooling determine employment opportunities.

- ***c) Housing***

Having a roof over your head is one of the most basic needs and services we all need to ensure safety and security from stresses like crime and natural disasters (Khandhlela & May 2006). A process such as urbanization has forced people to not only build in extremely dangerous zones, but other people in formal settlements also build with cheap and weak materials that can be hazardous for humans to live in. In times of floods and fires, these settlements are easily washed away or caught on fire, resulting in people losing their possessions and property. Brynard (2011) also highlights the issue of difficulties in access to basic services such as sanitation, water and electricity in such settlements. Other settlements

in other areas, such as Mud houses, also face similar problems of being vulnerable to being destroyed by natural disasters (Brynard 2011).

- ***d) Water***

Water is the one of the most essential resources that all living organisms require for survival. Inaccessibility to water leads to diseases such as cholera and diarrhea (Khandhlela & May 2006). This is another cause of poverty that can also be caused by poverty, as no access to clean water causes one to be sick and poor, but on the other side, poverty can hinder one from having access to clean water. Water and vector borne diseases are other problems associated with unclean and contaminated water (Albretch 2013). Other problems experienced in vulnerable areas is the issue of distance that residents have to travel to get water, due to services not being provided to the people (Singh et al 2008). This supports the capabilities approach, as lack of water as a basic service, exposes the people to poverty and diseases.

2.8.8 Landlessness

According to Modise and Mtshiselwa (2013) landlessness is a major cause of poverty, as this means that people have nowhere to build their houses and ensure stability and tenure for their lives. Lack of access to land can also mean that people cannot plant their own food, as people who cannot afford to buy food resort to farming their own food through subsistence farming (Singh et al 2008). The main problem, however, is not only access to land but also the quality of land accessible to the people, as some people do have land, but little can be done to build or farm on it, as it may be unproductive and/or in steep slopes (Modise and Mtshiselwa 2013).

2.8.9 Natural disasters

Bui et al (2014) state that Natural Disasters must be listed as a cause of poverty, as they destroy infrastructure, and crops, kill people and livestock, leaving hundreds of thousands of people vulnerable for any stresses or shocks that might come in future. This means that natural disasters can increase the number of people living under poor and vulnerable conditions, due to people being unable to respond and recover from these shocks (Khandhlela & May 2006). Bui et al (2014) therefore, emphasizes on the need to list disaster management and prevention under poverty reduction strategies and policies, in order to improve resilience and reduce the number of lives lost in the hands of natural disasters. Full details about the impacts of natural disasters is covered in the next chapter.

2.9 URBAN POVERTY AND INFORMAL SETTLEMENTS

Research from StatsSA (2018), indicate that poverty continues to be on the rise in South Africa, with rural areas and informal settlements experiencing the worst types of poverty, such as Chronic poverty. Many rural areas in the country still face slow development, poor service provision and lack of educational and employment opportunities. The only solution they resort to is migrating to urban areas, with hopes that their lives will change for the best (Singh et al 2008). This, however, does not always happen. When some get to the urban areas, they experience what is referred to as urban poverty

Rural-urban migration leads to urban poverty. Urban poverty simply refers to poverty that is experienced in urban areas (El-Mascri & Tipple 2013). It is associated with informal settlements, crime, prostitution, lack of service provision, participation in the informal economy and exclusion from decision-making (Singh et al 2008 & Williams et al 2018). El-Mascri and Tipple (2013) and Mindscape (2016) state that urbanization, modernization and industrialization have been the main reasons why people chose to migrate to urban areas, as more employment opportunities were available in these areas, due to the number of businesses and factories. Due to high numbers of people migrating in these areas, cities are slowly being over populated and can no longer support everyone that lives in them (Mindscape 2016).

This problem is expected to increase, as Williams et al (2018) and Mindscape (2016) state that by the year 2050 more than 70% of the world's population will be residing in urban areas. El-Mascri and Tipple state that urban poverty has forced people to reside in vulnerable conditions and areas, due to the increase in the number of informal settlements that major cities have. The authors argue that vulnerable conditions such as high levels of poverty, high population densities, poor construction and urban sprawl, are the reasons that cities always experience intense impacts of natural disasters, as people are exposed to vulnerable conditions.

When people who were previously poor in rural areas migrate to urban spaces, where almost everything is expensive, they have no choice but to reside in and build informal settlement (De risi et al 2013). Informal settlements are usually associated with poor service delivery, vulnerable conditions, lack of hygiene, poor building structures and easy spread of diseases (De risi et al 2013, Tas et al 2013 & Singh et al 2008). Informal settlements are mainly

constructed with poor building materials such as iron, timber, cardboard and plastic (Singh et al 2008). It is for this reason that informal settlements are the most vulnerable to natural disasters such as floods. These areas are also located in areas that are not only illegal to build in, but also prone to dangers of natural disasters (Tas et al 2013 & Singh et al 2008)

According to Singh et al (2008) informal settlements are usually found near water sources (rivers), industries for employment opportunities and roads for easy access to transportation. Other reasons why people choose to reside in these areas is because there is no rent to pay and they do not have to buy the land (Tas et al 2013). The structures are easy to build and even rebuild after disasters, this therefore means that it is cheaper to build in these areas (De risi et al 2013 & Tas et al 2013). This research focuses on this issue because the urban poor are the most vulnerable to natural disasters like floods, while they are already vulnerable because their coping strategies are poor. They also reside in vulnerable places, and while others are well aware of the possible dangers they face, but they have no choice but to continue living in these settelements.

2.10 CONCLUSION

The data discussed above proves a direct relationship between poverty and vulnerability, where when people are poor, they are vulnerable to any risks, stresses and shocks. If nothing is done to improve the livelihoods and living standards of people, they face a threat of being trapped in a cycle of poverty that is known as chronic poverty. This is why Brynard (2011) proposes that poverty be studied and monitored in order to fully understand the causes and come up with possible solutions, because if poverty is decreased then vulnerability will also decrease.

The next chapter will focus on understanding more about global warming that leads to natural hazards, how natural hazards become disasters and provide more understanding about the causes and impacts of floods in informal settlements. The following chapter will provide a clear understanding on how poverty, vulnerability and natural disasters link, thus helping in determining the relationship that exists between these concepts.

CHAPTER THREE: LITERATURE REVIEW ON NATURAL DISASTERS

3.1 INTRODUCTION

According to De risi et al (2013) informal settlements of major cities are the most vulnerable to the impacts of natural disasters like floods, due to various factors such as high levels of poverty, vulnerability and high population densities. When floods occur, therefore, more people are affected by the floods, as there are more people in the same space. This is why these researchers emphasize the importance of doing flood risk assessments in informal areas. Ayala (2002) emphasizes the importance of doing geomorphological assessments about the underlying rocks and soils in order to decrease flood damage, while Tas et al (2013) emphasize the importance of improving the quality of settlements.

This section looks at natural disasters and how they affect the poor, thus increasing vulnerability. It will first look at the concept of natural disasters and its causes, underlying causes, impacts, factors that increase flood damage and areas prone to flooding). It will also look at previous case studies of cities in the Global south that have been affected by floods and how international institutions and other cities ensure resilience and risk reduction will be undertaken. The information presented in this section will help in determining the relationship between poverty, vulnerability and natural disasters.

3.2 GLOBAL WARMING

Global Warming refers to the increase in the Earth's temperatures as a result of overpopulation, urbanization, deforestation and emissions of harmful gases to the atmosphere (Singh et al 2008). Some harmful greenhouse gases emitted in the atmosphere include Chlorofluorocarbons (CFCs), which are used in the cooling of refrigerators and can sprays, and nitrous oxide that is burnt and released in the atmosphere by Cars and power stations every day (National geographic 2017). The process of deforestation also contributes to the emission of harmful greenhouse gasses, as carbon dioxide is released when trees are cut down (Singh et al 2008). Overpopulation in the world and especially in cities increase the rate at which global warming is occurring, as this means that the demand for energy is also increasing. People want to build more, buy more cars, produce more in order to make a living and increase profits. All this unfortunately, exerts more pressure on the earth and its atmosphere, which may result in disastrous impacts. These include extremes in temperatures, which have also resulted in changes in season temperatures (Singh et al 2008).

These extreme changes in temperatures have also resulted in extreme weather patterns, where we are currently noticing the melting of ice capes in the poles, resulting in increasing sea levels. This has made scientists predict that most coastal cities in the world will be underwater by the year 2100 (National geographic wild 2017). Extreme temperatures by equatorial regions are leading to processes such as desertification, which also threaten the availability of water in these regions (Singh et al 2008). In coastal cities with high precipitation, the effects of flooding can even be more catastrophic (Albrecht 2017). Hazards are naturally occurring, but due to climate change and global warming, they turn into disasters (Singh et al 2008).

There is a confusion about the terms “natural disasters” and “natural hazards” as these two terms are used interchangeably. Natural hazards are naturally occurring events that have occurred long before the human species came to existence on the planet. The problem that the world is now experiencing, however, is the intense and frequent occurrence of these hazards (National geographic wild 2017). Natural disasters are natural hazards that have intensified due to climate change and global warming, causing disastrous impacts. This is why they are referred to as natural disasters, as they are naturally occurring, but pose danger due to its intensity and frequent occurrence that result in disasters (El-Mascri & Tipple 2013).

The results of climate change have not only resulted in respiratory diseases, extreme temperatures but also the intensification of natural hazards (El-Mascri & Tipple 2013). Natural disasters such as veld fires are caused by dryness and more extended periods of high temperatures. When forests are burnt, they release not only carbon dioxide but also limit the oxygen available for us to use and can even spread to areas where people live. Earthquakes, floods, volcanoes, monsoons, cyclones, avalanches, wind storms and tsunamis are other natural disasters that have intensified and occurred frequently due to climate change and global warming (Albrecht 2013). The natural disaster that this study focuses on is floods and its relation to poverty and vulnerability

3.3 UNDERSTANDING THE CAUSES OF FLOODS

To provide an in-depth understanding about floods as a natural disaster, information about its causes, results have to be understood too. Some of these causes, such as rainfalls and storms, are intensified by global warming. Looking at factors such as factors that increase flood damage and areas prone to flooding, also helps in ensuring that people are placed in safe

areas and structures that are both resilient and sustainable. That might help in decreasing the impacts of floods, as these areas will be avoided and structures improved.

The Bureau for meteorology (2019) identifies six causes of floods. The first cause is rainfall with relation to volume, density and distribution. When rain pours at a higher volume, intensity and distributed in one area for a long period of time, it will result in flooding. The intensification of rain can also be caused by global warming, especially in tropical and sub-tropical regions with high humidity (Singh et al 2008). When rain falls last for longer periods in one area, they result in an accumulation of water that can even submerge houses (Javaid 2019). This may be due to the ground being saturated, as it can no longer absorb any more water, results in flooding conditions. Soft soaking rains may be infiltrated by the oil, while the rains with thunderstorms cause surface runoff, which is known as flooding (Singh et al 2008).

The second cause of flooding is weather conditions (Bureau for meteorology 2019). Weather conditions like storm surges, cyclones and tropical storms do not only bring about rainfall but also strong winds that can push the sea or rivers water or rainfall to rip apart houses and wash away cars. Strong windy weather conditions highly drive natural disasters like storm surges, that push large quantities of water offshore, creating flooding conditions by the shores. People residing near coastal areas or rivers such as the people of Freetown in Sierra Leone experienced these catastrophic conditions during the 2017 floods and mudslides, where more than one thousand residents living the closest to the river died (Gaafar 2017).

One of the most significant causes of floods is the ground cover or the underlining rocks and soil (Bureau for meteorology 2019). Rocks that are permeable and porous allow water to pass through and allow for more infiltration to occur, while harder rocks are impermeable allowing for little or no infiltration to occur. How moist soils are determines whether a flood will occur or not. Soft and moist soils that already have more water (saturated soils), may not allow water to infiltrate, while dry soils are able to soak up large quantities of water to (Singh et al 2008). This is why Ayala (2002) emphasizes the need to know the underlying landforms, soils and rocks before building in an area. Many Asian countries like Bangladesh, Pakistan and India experience floods every year because they build in flood plains that cannot soak in large quantities of water (Javaid 2019).

Another cause of flooding identified by (Bureau for meteorology 2019) is typography, which refers to how steep or gentle the surface of the land is. Singh et al (2008) state that gentle areas can allow infiltration, while surface runoff (flooding) occurs in hilly and steep areas, depending on the underlying ground cover discussed above. Gaafar (2017) and Jaswal (2019) also state that residing in steep areas can be a major risk during flooding, as these areas are the ones that usually experience landslides that are as equally disastrous as they can bury houses, cars, livestock and people in huge chunks of mud and rocks.

Dam construction is seen as one of the ways to decrease flooding, as the water is channeled to flow into the dams, minimizing water that runs off and destroys infrastructure and drown people (Singh et al 2008). This is why the Bureau for meteorology (2019) states that maximum carrying capacities of water bodies can cause flooding if the water bodies (such as dams or river) reaches their full capacity. When the water bodies reach their maximum carrying capacity they start to overflow resulting in flooding. Oceans do not have a carrying capacity, however, National Geographic wild (2017) states that sea levels are slowly increasing due to melting of areas such as Greenland and Antarctica. This source claims that this will result in flooding of many coastal cities in the next 100 years to come.

Another cause of flooding identified by the Bureau for meteorology (2019) is urbanization. According to Williams et al (2018), El-Mascri and Tipple (2013) and De risi et al (2013), urbanization refers to the ever-increasing number of people living in urban areas, perpetuated by modernization and the Industrial Revolution. With urbanization comes development, that is associated with tarred road surfaces and concrete pavements (Singh et al 2008). In this case, the natural vegetation and trees, which can absorb large amounts of water through their roots, are removed. Soils that also have the ability to soak up water is covered by these man-made surfaces, resulting in a greater chance for surface runoff.

3.4 AREAS PRONE TO FLOODS

Floods can occur everywhere, but some areas are more in danger of being hit by a flood than others. This is due to their location, topography and close proximity water bodies. Knowing the dangers of residing in these areas, may decrease vulnerability and flood damage. This is why Albrecht (2017) emphasizes the need to identify areas that are not safe for people to reside in, as they are the most prone to the worst effects of flooding.

3.4.1 Low-lying areas

There are some areas that are more prone to the risks of being hit by floods and results in the worst impacts. These includes low lying areas surrounded by steep areas (Bureau of meteorology 2019). Water comes down gushing from the steep areas and accumulates in the lower-lying areas, especially if the underlying rocks and soil does not allow infiltration or is saturated. When rocks are not porous, the water just rests on the ground, due to the flat land. This results in large quantities of water accumulating till it becomes disastrous, as it submerges buildings under water.

According to Singh et al (2008) and Jaswal (2019) some informal settlers are people who come from rural areas and have knowledge about farming methods. This could be the reason why some choose to settle on flat slopes, as they can also farm their own food, as they may not be able to afford food in the cities. When floods occur, they do not only wash away crops but also submerge houses under water, leaving hundreds of people displaced (Singh et al 2008). This was witnessed in informal settlement of the town of Mingora in Pakistan, which is also associated with high levels of poverty and population density. The people who reside in areas where land is flat were the most affected in this town, as the water accumulated there, causing people and livestock to drown (Jaswal 2019).

3.4.2 Coastal areas

One of the most prone areas to flooding are coastal areas or areas that are built near rivers, oceans and dams (Bureau of meteorology 2019). During extreme weather conditions like storms, cyclones and rainfalls, not only can strong winds and high tides push water offshore, but rivers and dams can get full and overflow, resulting in floods (Javaid 2019). Other natural disasters like Tsunamis and hurricanes affect coastal areas the most because these phenomena are usually created over warm sea temperatures. Tsunamis are usually triggered by earthquakes, that push up the underlying sea floor, resulting in large quantities of water to be pushed offshore (Singh et al 2008). An example of coastal cities that frequently flood is Sierra Leone's capital city, Freetown. The city has informal settlements that are near a river and is a coastal city, where storm surges and over-flowing of rivers frequently causes floods, causing more deaths and leaving people vulnerable (Gaafar 2017).

Singh et al (2008) state that people choose to migrate or reside in coastal cities because of the employment opportunities there may be due to trade and tourism. For the poor, this is an ideal

area to make a better living, which may be why there are many informal settlements in many coastal cities like Freetown in Sierra Leone (Gaafar 2017). A high number of poor and vulnerable people living in high risk areas, in settlements built with weak materials, means that we are bound to witness the worst impacts of natural disasters, as thousands will be left even more vulnerable and poor, injured, death or displaced.

3.4.3 Areas with poor drainage

Bureau of meteorology (2019) states that areas of poor natural or man-made drainage cab be easily flooded. Natural drainage refers to how much water is able to be drained and seeped into the soil (Singh et al 2008). This source states that drainage or infiltration and surface runoff are influenced by four factors: vegetation, topography, rock type and moisture of soils. Areas with dense vegetation are able to absorb more water with the roots of the vegetation. Steep topography allows more surface runoff. Dry soils are able to soak up much more water than saturated soil and rocks that impermeable.

Man-made drainage systems are pipelines that can be able to redirect flood waters to safer areas, resulting in less disastrous impacts (Jaswal 2019). Poor manmade drainage systems have been the reason for flooding in Asian countries like India and Pakistan (Javaid 2019). According to Jaswal (2019) many floods that occur in informal settlements are due to poor built or absence of drainage systems. Pillay (2019) KwaMashu in Durban experienced a flood due to the drainage systems being logged, as waste that was thrown in the drainage systems prevented a free-flow of water. De risi et al (2013) state that this results in water infiltrating the houses, causing damage.

3.5 FACTORS THAT INCREASE FLOOD DAMAGE

3.5.1 Trees growing within the rivers

There are four factors identified by Tas et al (2013) that increase flood damage. The first factor is trees and bushes that grow within the stream or river. Those trees grow very fast as they are fed by the fertile and productive soils that are within the rivers (Singh et al 2008). These trees hinder the normal movement of water, which flows downstream. During floods, these trees can cause large quantities of water to flow off stream and increase the chances of flooding, as the water moves at a greater speed. Such trees have to be removed as they pose as a serious threat for those residing near rivers, which are mainly the poor.

3.5.2 Illegal land extraction

Another factor that increases flood damage is the issue of illegal land extraction near rivers and seas (Tas et al 2013). when soil is not extracted properly or is extracted in areas that are not supposed to be extracted in, this can cause the remaining soil to be loose and erode easily. When flooding occurs in these areas, it will result in landslides. An example of this is seen in the city of Freetwon in Sierra Leone during the 2017 August floods, that triggered mass movement of land, that claimed the lives of over one thousand people (Gaafar 2017). This is a huge threat to people residing in these areas because they will only they will not only lose they their houses but also lose their land. This becomes a problem when people have to rebuild after disasters.

3.5.3 Narrowing of streams

Narrowing of river channels is another factor that increases flood damage Tas et al (2013). Singh et al (2008) state that the better option to resort to is widening the river. This is because narrow rivers can cause flooding in the lower courses of the river. Widening rivers allows for water to flow at a slow pace, allowing water to pass through without it being disastrous to areas near these water sources. The flooding risks are minimized when the buildup or accumulation of water in one area, is decreased. Widening of rivers might also mean that houses built nearest to the river are removed, also minimizing the risks of flooding even more (De risi et al 2013).

3.5.4 Illegal buildings and poor infrastructure

The most troubling factor that increases flood damage is the poor structure and materials used to build the informal settlements (Tas et al 2013). Building with weak and cheap materials means that the houses will not only be washed away easily, but can cause injury to the inhabitants, when the structure is collapsed (Brunkard et al 2008). Khandhlela and May (2006) states that people had more injuries from houses collapsing, then dying from being drowned in the 2006 Limpopo floods. Mud houses are easily destroyed with water as they are made with mud that can easily be dissolved and fall apart if in contact with large quantities of water. Zinc, wood and cardboard are some of the weak materials that are used in many informal settlements (Singh et al 2008).

3.6 IMPACTS OF FLOODS ON THE POOR AND VULNERABLE

3.6.1 Soil erosion and mudslides

When disasters strike, they result in a number of catastrophic impacts. One of them is soil erosion and mudslides due deforestation and soil being washed away or falling off due to gushing floodwaters (Singh et al 2008). Raging flood water removes tons of productive top soils even in farms that are used for both commercial and subsistence farming (Singh et al 2008). Not only does this mean that the food sources of subsistence farmers are destroyed, but also commercial produce decreases, resulting in increase in prices. This may also mean scarcity of food for the poor, who are already struggling to afford food, resulting in food insecurity and diseases associated with it like Kwashiorkor and malnutrition (Singh et al 2008 and Brynard 2011).

India faces soil erosion and floods that leads to mudslides every year during the monsoon season, where plantations are submerged by flood waters, affecting their main source of food (Jaswal 2019). This affects the poor the most as they are the ones who usually farm for their own needs and cannot afford to buy food, if food prices increase. Floods also affect the wealthy, but not as much as it affects the poor who are already struggling to provide for themselves and their families (Singh et al 2008). Lack of food exposes the poor to diseases to be vulnerable to diseases and hunger, which might threaten their survival and well-being.

3.6.2 Loss of human lives

According to De risi et al (2013), the most threatening part about the intensification and frequent occurrence of natural disasters is that it threatens the survival of the human species. This is because hundreds of thousands of people are killed by these catastrophes each year. According to Khandhlela and May (2006) and Brunkard et al (2008), many people are not necessarily killed due to drowning, but due to injuries caused by the debris that are collected and moved downstream by the raging floodwaters or by structures collapsing on them.

Tas et al (2013) state the importance of improving housing structures that people live in, to decrease flood damage during floods. For the poor, who cannot afford to buy proper and resilient building materials, they are always vulnerable to the worst impacts of collapsing structures that can even kill them. During a flood that occurred on the 12th of December 2019 in Durban, one man was killed due to a house collapsing on top of another (Dawood 2019).

On another flood that occurred on the 24th of April 2019 in Durban, one man lost eight family members during mudslides and flood that buried their home (BBC News 2019).

3.6.3 Diseases and injury

During floods, many things get destroyed, including places that store and dispose harmful chemicals and waste. When these chemicals are washed away by flood waters, they end up in water sources used for human consumption (Singh et al 2008). This could result to vector and waterborne diseases (Khandhlela and May 2006). According to Albrecht (2013) vector borne diseases refer to diseases that are spread through insects like mosquitoes that have had contact with contaminated water. Water borne diseases are those diseases that result when people directly consume or use water that has been contaminated. This could mean deterioration of health and more medical bills for the people. For the poor, this means more problems as they cannot afford good quality healthcare. If the head of the family cannot work due to health conditions, then the whole family could struggle (Khandhlela and May 2006).

Albrecht (2013) also highlights the injuries endured by the people during floods, some are permanent, leaving people paralyzed forever. Bui et al (2014) highlights how such injuries deprives the poor even further, as this does not only means that more hospital visits and bills for those who cannot afford, but also mean that those who are previously working could no longer work, decreasing household incomes. Some of the health problems noted by Albrecht (2013) are open wounds that people get in times of disaster, which can also be easily infected and can sometimes be fatal. Brunkard et al (2008) highlights psychological and emotional illness that people face due to trauma that results when people lose loved ones and all their possessions during floods.

3.6.4 Infrastructure destruction

De risi et al (2013), Tas et al (2013) and Muttarak and Lutz (2014) all state that the most expensive impact of natural disaster is seen in the destruction of infrastructure. Roads, harbors, railways, bridges, houses, sewage and water pipes are destroyed during disasters (Jaswal 2019). This leaves countries with billions of dollars in repair costs. De risi et al (2013) argue that majority of the damage that floods cause happens because flood risk assessments are not being made during the planning, designing and construction stages. These researchers argue that less damages would be witnessed if proper assessment are done, while using resilient building materials.

During floods that occurred in April 2019 in Kwa-Zulu Natal province, the city of Durban experienced damages in infrastructure that equaled to a total of six hundred and fifty million rands. These included storm water pipe, electricity, human settlements and healthcare facilities repair (Singh 2019). According to South South News (2014) whenever the municipalities are constructing new building or improving infrastructure, this might mean an increase in taxes. This source highlights how the poor suffer the most, as when taxes increase, then their salaries will decrease. This leaves less money for them to provide and protect their families, increasing their vulnerability and poverty state.

3.7 CASE STUDIES

3.7.1 The 2018 and 2019 Indian monsoon seasons

Many Asian countries like Bangladesh, Pakistan and India experience the monsoon season during the months of June to August. It is during this season that the poorest people living in rural areas and informal settlements expect the worst impacts of floods (Jaswal 2019). During the end of the 2018 monsoon season, a total 325 lives were lost due to catastrophic floods and mudslides in India alone, in what meteorologist ranks as the worst flooding in 100 years (Austons 2018). More than 200 000 people were displaced, as the floods triggered mudslides that buried people's houses, destroyed their communities and bridges. This meant that many people were trapped in flooded areas, with nowhere to go, which was the reason for the high number of deaths (Jaswal 2019).

The end of the 2019 monsoon season, a total of 250 lives were lost in India (CGTN 2019). According to Jaswal (2019) the provinces that always get affected the most are: Mahastra, Karnataka and Kerala, while Kerala mostly experiences the worst impacts every year. In 2018 the state of Kerala alone had lost more than 200 lives during the monsoon season. This means that from the 2018 monsoon season mentioned above where 325 lives were lost, about 200 of those lives were lost in the state of Kerala alone. This is because this state is associated with high poverty rates, high population densities, informal settlements and rural areas (Austons 2018). Whenever more people reside in prone areas, the results always mean that many people will be affected and left vulnerable.

The Indian government deployed soldiers to rescue people in boats and helicopter. The people however, did not want to be rescued as they claimed that they do not want to leave their livestock and crops, as they were reaching the harvest season (Javaid 2019). This is an

example of what Aysan (1993) defines as attitudinal or motivational vulnerability, where people are not aware of the dangers that they are faced with, and choose to not vacate areas even when they see that the situation is escalating. This also shows the extent of poverty in these areas, where people would rather die than to leave their food sources, livestock and home, because it is all that they have (Jaswal 2019).

3.7.2 The 2017 Sierra Leone floods and mudslides

Although natural disasters occur naturally, the intense impacts of these disasters can be perpetuated by human activities (Gaafar 2017). The city of Freetown in Sierra Leone did not have as many houses or settlements as it did 30 years back, as majority of the town was covered in forests. Currently, the city has about two million inhabitants, with the Kroo Bay informal settlement being the most densely populated. Processes such as urbanization and urban sprawl has resulted in people cutting forests and natural vegetation in order to build the houses (Cui et al 2014). When trees are cut down, the roots of the trees that hold the soil particles together are also removed, meaning that when floods occur, land mass movements such as mudslides occur easily (Singh et al 2008).

According to Gaafar (2017) the city of Freetown is not only a coastal town, but has poor drainage systems that are either broken or were never built in the first place. These are 2 of the 3 areas most prone to flooding, identified by the Bureau of meteorology (2019). This only means that the impacts will be more disastrous. Some of the informal settlements like the Kroo Bay, are near river that always overflow due to high rainfalls. On the 14th of August 2017, high rainfalls resulted in floods and mudslides that claimed 500 lives due to housing collapsing on them, drowning and being buried alive by the mudslides (Gaafar 2017). This is why Tas et al (2013) emphasize the importance of ensuring a good quality structure that is resilient to disaster impacts.

3.7.3 The 2019 Ezikheleni informal settlement floods

The 2019 April floods in Durban left the people of Ezikheleni informal settlement traumatized, as over thirty people lost their lives during floods that triggered mudslides that buried and destroyed people's houses (Binda 2019). The residents of Ezikheleni claimed that they face the same problem every year around this time. This is because the City of Durban experiences high rainfalls during the summer months of December to April (Climate data

2020). This proves Tas et al (2013)'s argument, that poor quality of housing structures can increase flood damage, killing the people inside the houses.

The people of Ezikheleni complained that their ward councilor was not assisting them in their time of need (Binda 2019). Here we see an example of bad governance that can deprive the people and leave them vulnerable. According to the Basel Institute (2020) good governance must have positive attributes such as transparency, accountability, efficiency in service provision and no corruption. The councilor failing to provide post-disaster supplies meant failure to meet an attribute of good governance, which is efficiency in service delivery. This leaves the people poor and displaced, exposing them to any risks that might strike in the future.,

3.8 DISASTER RESPONSE GLOBALLY AND IN SOUTH AFRICA

When disaster strike, people have no choice but to respond according to what they have, instead of waiting for the government. According to Tas et al (2013) the people of Bursa in Turkey, place sandbags, cushions and clothes in front of doors, to prevent water from getting in their houses. In Limpopo, the communities habitually help each other relocate to safer areas (Khandhlela and May 2006). In the 2018 and 2019 Indian floods, the victims who agreed to leave their homes, helped each other cross to safety by using a rope to form a human chain. Others stay behind and waited for the worst that might come. (Auston 2018, Jaswal 2019 and Javaid 2019).

While the government does offer some sort of help by deploying soldiers and disaster response teams to rescue people with boats and helicopters, that is generally an insufficient response as these areas are highly populated (Jaswal 2019). In South Africa, Disaster response teams like the Cooperative governance and Traditional Affairs (COGTA), are responsible for management and prevention of disasters (Kubheka 2017). For example, the eThekwini municipality response team is responsible for services that include: prevention, reduction of risks, mitigating the harshness of disasters, preparedness, a quick response and recovery from disasters (eThekwini municipality 2016). All these services are prepared in compliance with the 2002 Disaster management act, which demands that all municipalities to have a proper and functioning disaster management plan and teams. It is implemented on all levels of government, to ensure that help is closer to the people (South African Government 2020).

According to the 2002 Disaster management act, each municipality is required to: prepared people before and after disaster strike, in order to minimize the severity of impacts of natural disasters, especially the loss or lives and damage in infrastructure (South African Government 2020). This is an example of how people can use the law to protect them from risks, however the problem is always enforceability of the law due to problems like funds (Handmer et al 2007). This is why Muttarak and Lutz (2014) state that people should be educated and have access to important information that may help them in risk reduction. This means that informal settlers should have access to such information about the disaster management act, in order to force the government to help them.

3.9 RECOVERY

The recovery process is the hardest part for disadvantaged population living in informal settlements (Tas et al 2013). This is because floods do not only wash away their houses, but also the land that the houses were built in, during mudslides (Hittingh 2017). The materials they use to build their houses may be cheap and easy to find, but they are mainly faced with a problem of finding a new area to rebuild in (Singh 2019). Finding another piece of land, however, often hard due to the unavailability of land. Which means that they will be forced to rebuild in the same area that is prone to floods, increasing their vulnerability status (Tas et al 2013).

A key reason that the people might not want to relocate to another area, may be because of the relationship that the people have with their neighbors and community members, as they now have formed a new family and community that is able to deal with problems collectively (Tas et al 2013). An example of this was seen in India, where people refused to evacuate a flooded are because they wanted to be moved together, while others wanted to stay in their land, despite the floods. According to this source, this was one of the main reason why people chose to stay in these prone areas, as their real families may be very far. Khandhlela and May (2006) also highlight the importance of stronger social bonds between the poor, in order to recover and survive.

3.10 BUILDING RESILIENCE

The reality that we are now faced with is to ensure resilience and climate adaptation, in order to ensure that less lives are lost during disasters. One of the most effective ways argued to minimize the impacts of disasters, while promoting development, is the introduction of

resilient and risk reduction through global sustainable cities (SACN 2019). These refer to cities that prioritizes environmental protection and economic development (Green TV 2014). This includes using cleaner forms of energy, emitting less harmful gases and relying less on natural resources for survival (Towers, 2011). Below are some of Global programs implemented to not only reduce emissions, but also the lives lost.

3.10.1 New urban Agenda

Created in 2014 by the United Nations Habitat, the New Urban Agenda shows cities how to plan, manage and build "green cities" to promote economic growth, social inclusion and environmental protection (South South news 2014). Great attention is placed on the planning and design of buildings in the city, to ensure that structures do not collapse easily, minimizing injuries and deaths that occur when building structures collapse during disasters (United Nations 2014). One downfall or negative with this Agenda however, is that funds for such projects will be taken from the people, in the form of taxes and increased rates to services like water and electricity (South South News 2014). This will be a problem for people poor who are already struggling to have access to such services.

3.10.2 The Paris agreement

On the 12th of December 2015 in Paris, under the United nations, 195 countries gathered together and signed a global agreement to reduce global temperatures well below 2 degrees Celsius (Figueres 2016). This agreement was made due to the ever-increasing global temperatures that have resulted in the catastrophic natural disasters that threaten the survival of human beings. According to Mindscape (2016) global temperature were -0.04 degrees Celsius in the 1940s, in 2016 the temperature was 0.99 degrees Celsius. The aim of this Agenda is to ensure that the global temperature kept below 2 degrees. This will be achieved by reducing emissions and building sustainable green cities (Figueres 2016). To ensure that we achieve this goal, the developed countries are to donate 100 billion dollars per year to developing countries, as these countries are already struggling financially (UNFCC 2016).

3.10.3 The Sendai for disaster risk reduction

The Sendai framework for disaster risk reduction is a sustainable framework that was adopted in Sendai, Japan on the 15th of march 2015 (European Commission 2016). It was introduced to try to make the world a safer place, by reducing risks that are both natural or man-made (United nations 2015). It aims to: understand disaster risks, strengthen disaster risk

governance, invest in disaster risk reduction and build resilience and disaster preparedness (UNISDR 2015). This program emphasizes the need for disaster preparedness more than anything, especially for developing countries that already experience the worst impacts of disasters. If people are resilient and are always prepared for any disasters that may occur, maybe we could witness a decrease in the number of lives lost during disasters (European commission 2016).

3.11 CONCLUSION

The literature discussed above shows a direct relationship between poverty, vulnerability and natural disasters. As more people migrate to urban areas and flood prone areas that have houses built with poor material, the more vulnerable they will be to flooding. Bui et al (2014) state that natural disasters are not only a cause of poverty, but they also perpetuate poverty, this why more research is still needed in this field. Brynard (2011) state that constant research is required in order to not only produce relevant information, but also come up with effective risk reduction plans.

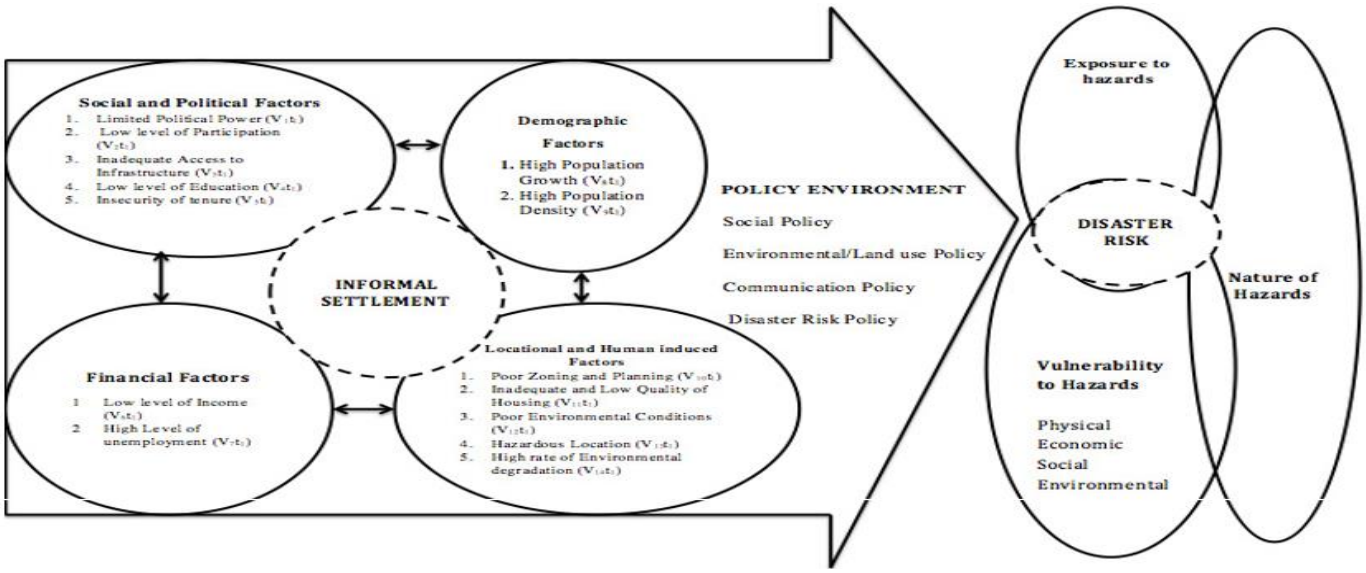
While Muttarak and Lutz (2014) emphasize the importance of knowledge and access to information to improve people's adaptive capacity, Brynard (2011) emphasize the importance of defining concepts such as poverty and vulnerability, as the solutions are derived from the definition. This therefore, highlights the importance of constantly doing researches like this one, in order to update our existing knowledge and understanding of the dangers we are faced with. Not doing enough research about the relationship between these three concepts may not only cost countries hundreds of millions in infrastructure repair, but also threaten the survival of the poor and vulnerable. There is no doubt that the occurrence of disasters will increase and intensify in the future, but we need to be prepared and resilient.

3.12 CONCEPTUAL FRAMEWORK

The term conceptual framework refers to a guideline or map that indicates how the researcher aims to explore the research question and analyze the data obtained in the data collection stage. The purpose of a conceptual framework is to indicate the main themes that will be explored in the study. It is seen as a foundation of the research (Swaen 2015), as it shows the ideas, concepts and hypothesis of researchers who have conducted research in the similar study, by including quotations from those researchers. It discusses ideas and hypothesis used to structure the literature review and analyze the data that will be collected in the study. The conceptual framework, therefore, should directly link to both the literature included in the study and data collected.

The conceptual framework used in this study is the one identified by Abunyewah et al (2018), where they state that natural hazards are naturally occurring phenomena that cannot be stopped. They have been occurring long before human beings came into existence, however, they only become disastrous only if they are met with poor and vulnerable socio-economic, political and environmental conditions.

Figure 2: A diagram indicating how disaster risk reduction policies should be analyzed and designed



Source: Abunyewah et al (2018)

*"Vulnerability reduction should be the centre of policies and strategies for building resilience in informal settlements" (*Abunyewah et al 2018: 243)

Abunyewah et al (2018) state that since disasters cannot be stopped from occurring, the best way to ensure that people survive during disasters, is to reduce vulnerabilities. In this context, vulnerabilities are reduced only when capabilities are improved and provided to the people. When people's living standards are improved, they will be less poor and vulnerable, as they will be able to respond and recover better. This, therefore, means that in order for vulnerabilities to be reduced in informal settlements, their capabilities (listed in under the different factors in the diagram above) should be prioritized by policy makers and officials, in order to ensure that the people are resilient and recover better. This conceptual framework is complemented by the capability approach theory, which also states that people have better chances of surviving if they have sufficient and improved capabilities.

These researchers argue that all factors (listed in the diagram above) are related, therefore, a lack of one factor could result in a lack of another. For example, lower level or poor quality of education may result in people being exposed to fewer and low paying employment opportunities. Low paying job would mean that people reside in areas such as informal settlements, which are highly populated and located in extremely vulnerable areas. This interrelation of these sectors, therefore, means that when trying to reduce the risk to the effects of natural disasters such as floods, the officials need to address the deficiencies in these factors. Policies and strategies implemented and adopted should therefore, analyze these deficiencies in order to ensure effectiveness and relevancy, this is important because different informal settlements have different needs (Abanyewah 2018).

For example, in order to decrease risk for the informal settlers, improved education, better employment opportunities, increased incomes, better political power, relocation to safer areas with good quality infrastructure and services is required. This indicates that better socio-economic, political and environmental conditions lower the vulnerability of the people residing in these areas, which improves the way they respond and recover from natural disasters. The basic assumption made in this journal is that better socio-economic capabilities improves the response and survival of the people. This is why this conceptual framework

compliments the capability approach theory, as emphasis is placed on capability provision in trying to reduce vulnerability, through the use of policies, strategies and projects.

It is therefore, important to clearly understand the relationship between poverty, vulnerability and natural disasters in informal settlements in order to ensure that disaster risk reduction projects and policies that are planned and implemented are both relevant and effective. Understanding how the poor are the most vulnerable to natural (due to their socio-economic deficiencies), results in an urgent need to prioritize the poor and vulnerable when implementing policies. Ensuring that the people from informal settlements are equipped and provided with improved social, economic, political and environmental protection and development means a decrease in vulnerability, which increases resilience in informal settlements. This also emphasizes the role of the local government, as they are responsible for the planning and implementation of policies (Abunyewah et al 2018).

This conceptual framework is relevant to this study because the study aims to assess the relationship between poverty, vulnerability and natural disasters in informal settlements. The main focus is on how the poor are the most vulnerable to the effects of natural disasters due to lack of capabilities, and how these people should be protected from the ever-changing climate and its natural disasters. The conceptual framework suggests that risk reduction is achieved when vulnerability is decreased, making it relevant in this study as the study also focuses on how the poor are unable to respond and recover from disasters due to increased poverty and vulnerability.

The following chapter is the research methodology, which outlines the different methods and approaches that are used to complete the study.

CHAPTER FOUR: RESEARCH METHODOLOGY

4.1 INTRODUCTION

According to Neuman (2011) research methodology refers to the ways, processes and methods used to acquire information in a research study. The information acquired is used for two main reasons: to get more information about a certain phenomenon (Basic research) and for finding solutions to problems being faced in society (Applied research). The reason for this study is to find and provide a better understanding on the relationship between poverty, vulnerability and natural disasters in informal settlements of developing countries, making my study a basic research. This will be done by using the case study of Quarry road west informal settlement in Durban, KwaZulu-Natal, South Africa.

This section looks at all the methods and processes that are used to obtain, analyze and view data, and where the study will be conducted. Methodological processes such as research approach, sampling, data collection and analysis are included and defined, with reasons as to why such methods are relevant for this particular study. This chapter further includes ways to ensure and enhance reliability and validity for the study.

4.2 RESEARCH APPROACHES

The research approach refers to the approaches or techniques used to properly obtain data in a study (Neuman 2011). There are two mainly used research approaches: qualitative and quantitative (Galafshani 2003). According to this source, quantitative research approach allows the researcher to make generalizations as it uses quantified data obtained through data collection methods such as Likert scales and questionnaires. Qualitative research approach requires the most information, as it cannot make generalization, but draws conclusions from the responses or information received and analysed. This study used qualitative research approach.

4.2.1 Qualitative research approach

The qualitative research approach is said to be exploratory in nature (Anderson 2006), meaning that it seeks to explore more in-depth information in order to construct a new reality and provide a better and well-detailed responses to better understand the study. Qualitative research approach believes that authenticity is the key, which is the best approach to use when trying to find more detailed understandings, leaving less room for generalisation

(Neuman 2011). New reality and truth about people's experiences and opinions is constructed during the research process, making the study to be highly valid and reliable.

The research method that will be used in this study is the qualitative research method, specifically secondary data analysis. According to Galafshani (2003) qualitative research refers to a method of obtaining data through the use of non-numeric data, to get more information and understanding about the phenomena being studied. The qualitative approach is suitable for this study as it gives as much information as possible about the study (the relationship between poverty, vulnerability and natural disasters) in depth. Using secondary data may not be the best option to obtain data for this study, however, the current lock down has meant that researchers cannot go to the field to obtain data. Therefore, past journals, books, videos, reports, Integrated Development Plans and newspaper articles written about the topic and study area are used, making it easier to gather and analyse data. The data was sampled according to its relevancy to the topic and study area.

4.2.2Quantitative research approach

Known as the easiest and mostly used approach, the quantitative research approach is known as an approach that quantifies data to make the interpretation process easier (Neuman 2011). In this approach, the researcher is detached from the construction of knowledge, reality and truth as it uses techniques such as Likert scales, surveys and questionnaires (Anderson 2006). The respondents are given the questions or documents and simply pick an answer from the ones provided by the researcher. This is unlike the qualitative approach, where the researcher and respondent converse, and in the process, follow up questions may arise.

According to Neuman (2011) the quantitative approach allows the researcher to include more people in the research because the responses are not in great details. This allows the researcher to make generalizations, based on the responses chosen by the respondents. Questionnaires and Likert scales provide a number of options that respondents can pick from as their responses. This may affect the validity of the study, as the options that the respondents choose from are selected by the researcher. This is why Galafshani (2003) argues that qualitative research approaches are more reliable than quantitative approaches.

4.3.3 Mixed-method

According to Neuman (2011) a mixed method research approach refers to a research approach that uses both qualitative and quantitative research techniques to acquire data. This

means that the study will use qualitative techniques such as interviews and oral history, and quantitative techniques such questionnaires and Likert scales. This approach allows the researcher to make generalizations, and later prove or discard them later in the research, if it does not correlate with the data collected (Anderson 2006). The qualitative approach is used for exploratory reasons, while the qualitative is used for incorporating a larger sample. This can make the study to be more valid and reliable but can also be expensive and more time consuming. Qualitative research methods were used in the study.

4.4 RESEARCH DESIGN

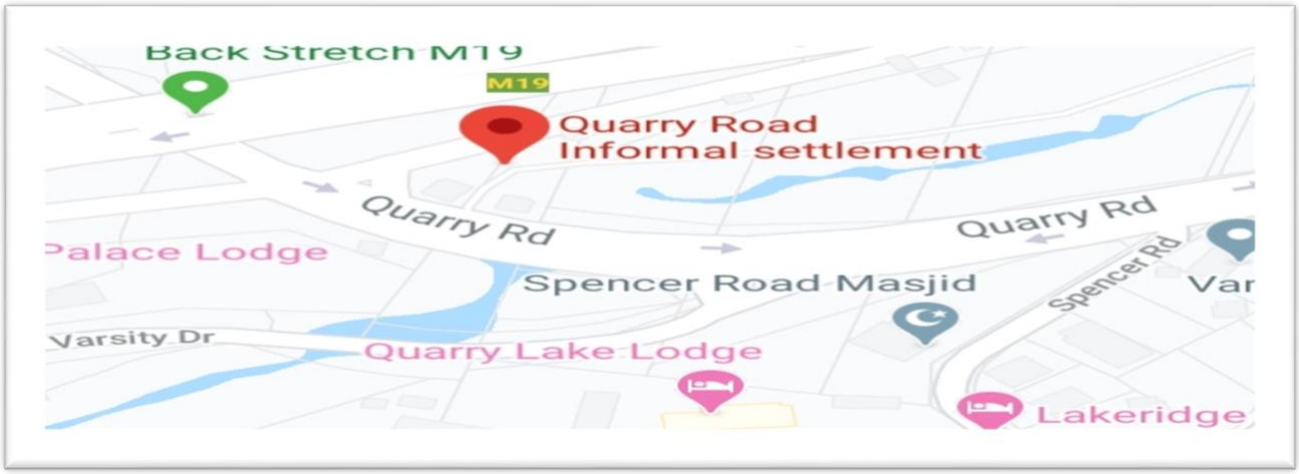
According to Leonard (2019), a research design refers to a strategy that states ideas of a study, and also providing guidelines about how and what is to be done to achieve those ideas. According to this source, there are many research designs. These are: Descriptive, exploratory, historical, experimental, action research, causal, cohort, cross-sectional, longitudinal, observational, philosophical, sequential and case study research designs. The research problem determines the type of research design one chooses in their study. The research design used in this study is the case study research design.

Leonard (2019) defines the case study research design as one that require in depth information about not only the phenomenon being studied but also the group, area or community being studied. Focusing on one area means that you are making conclusions about that area only, respecting the fact that information and situations vary from area to area, meaning less generalizations. This may ensure a higher reliability of the study (Neuman 2011). Data collected from a case study could be very effective in trying to find solutions and make improvements, due to the detailed information provided by the respondents. The case study being focused on in this study is Quarry road informal settlement.

4.5 CASE STUDY

The area of focus for this research is the city of Durban. The city of Durban is a coastal city located South of KwaZulu-Natal province. It is located on the east coast of the country with GPS coordinates of 29. 8587’ S, 31.0218’ E (Google Maps, 2020). The focus will be in the Quarry road west informal settlements, located by Quarry road in Newlands west (Williams et al 2008).

Figure 3: A map of Quarry Road West informal settlement



Source: Google Maps (2020)

4.5.1 Quarry Road West informal settlement

The Quarry Road West informal settlement is an informal settlement that comprises of about 1083 houses and that is located in Newlands East by the Palmeit River, in the city of Durban (Sutherland et al 2019). This settlement, just like many, faces problems such as poor service deliver, lack of land tenure and low income levels and poor housing structures. Another rising issue that informal settlers are being faced with, is being excluded in local government decision making on risk reduction measures (Williams et al 2018). Tas et al (2013) emphasize the importance of including the communities affected by disasters, as this will address the social inclusion approach to poverty, that has already been discussed in the literature review. The social inclusion approach does not only address the issue of exclusion, discrimination and marginalization of the poor in decision making, but also give these groups power and a voice to express their opinions (Lardechi et al 2003). This is extremely important in democratic countries like South Africa.

4.6 RESEARCH PARADIGM

The research paradigm that will be used in this study is the social constructivism paradigm, which rests its belief in the society constructing their own reality, according to their own opinions and personal experiences (Amineh & Asi 2015). This paradigm belies that reality can be constructed by any person that exists in society. This therefore, means that there is one true reality, as each person or group or community constructs their own reality. During research processes, reality is constructed by the respondents and the researcher, as the researcher asks questions he or she feels are relevant and the respondent answers according to

their own experiences. In the case of the use of secondary data, reality is constructed by the researcher analysing all data exactly from the study area.

This creates new realities about the phenomena being studied and the underlying issues. These include important factors such as problems where the people originally come from (rural areas) and the areas where they currently reside in (informal settlements), the reasons why people live in these settlements despite the dangers and how they prepare, respond and recover from disasters. Further questions about who assists them in these processes will be investigated and assessed. In this way, we can draw and outline problems and relevant solutions and recommendations.

4.7 DATA COLLECTION TECHNIQUES

The data collection methods that will be used are from secondary data and techniques. The secondary data will be obtained from past research papers, academic books, journals, newspapers and videos, to assess data that is already is available, generate an understanding around the phenomena being studied, especially in other areas that face similar problems. The secondary data will also assist in drawing questions that will be asked on the interviews. Other data collection techniques that are used in qualitative research include oral history, participant observation and focus groups, as all these techniques allow the participants to give more detailed information (Neuman 2011). Anderson (2006) states that these techniques are the best to use in qualitative research, as it can lead to follow up questions that are based on the response of the respondents, thus receiving more detailed data

4.8 DATA ANALYSIS

According to Sisense (2020) the data analysis process refers to a process that searches and arranges data obtained from secondary data methodically. The complex data from the secondary data sources is arranged in a way that makes it easier for the researcher to view, analyse and interpret data. There are five types of data analysis under the qualitative research approach, these are: narrative analysis (where respondents narrate their stories about a phenomenon being studied), discourse analysis (where there is only written responses), framework analysis (known as the most advanced method, the data is analysed in different stages for an even more easy interpretation), the ground theory analysis (where data is analysed in order to form a new theory), and secondary analysis. The data analysis method that will be used in this study is the content analysis technique. According to Sisense (2020),

it is the best analysis method to use when dealing with secondary data that consist of lengthy data. This data analysis categorizes all the obtained data in order to note the common problems and themes that need to be addressed.

4.9 CONCLUSION

The methods used in this study are relevant to it. The qualitative research approach is a huge advantage for this study, as the study requires as much information as possible in order to determine the relationship between the three concepts being studied: poverty, vulnerability and natural disasters, in the Quarry Road West informal settlement. Using secondary data is the best and safest option of obtaining data during the COVID-19 pandemic, and will also make the data collection process easier, as analyzing secondary data means using data that specifically focuses on the topic and study area. The data is sampled according to how relevant they are to the topic and study areas. This makes the data to be valid and reliable to the study. The paradigm used is also relevant for this study, as the people are to construct their own truth and reality according to their own problems, reasons, opinions and personal experiences, providing us with an understanding that comes directly from the people being affected by the issue being studied.

The following chapter is data evaluation and analysis, where the, data collected will be evaluated and analyzed, to draw conclusions to the research questions set out for the study.

CHAPTER FIVE: DATA ANALYSIS AND EVALUATION

5.1 INTRODUCTION

This chapter analyses and discusses the data informed by the study's objectives and research questions. The Corona virus (COVID-19) has led to a lockdown that prevented researchers to go on the field to collect primary data, this therefore, meant that the study was to be done using secondary data. Secondary data is used to meet the aim, which is to assess the relationship between poverty, vulnerability and natural disasters (floods) in Quarry road west informal settlements in Durban, South Africa. Data on the ways that the municipality tries to minimize the impacts of floods, was also obtained from journals, newspapers and books that have already been written about the study area and floods. The data used was chosen according to its relevancy to the topic and study area. Data was analyzed by answering research questions. Data will be analysed using the conceptual framework, that seeks to assess the people's capabilities in determining the relationship between the concepts being studied and the people's responses.

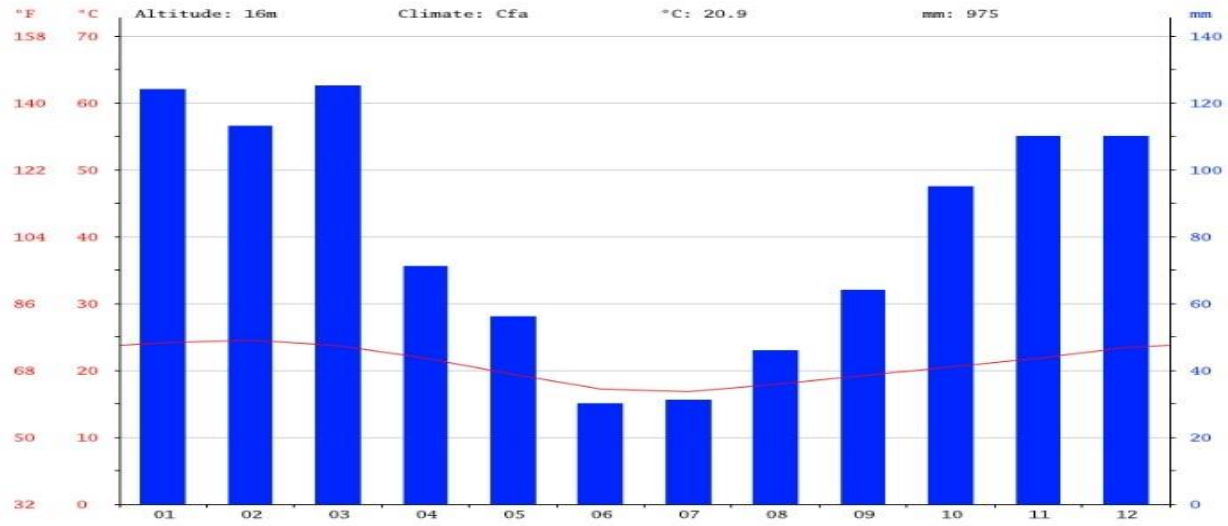
5.2 The relationship between poverty, vulnerability and natural disasters in Quarry Road West settlements

The relationship between poverty, vulnerability and natural disasters is quite complex, yet very visible in major cities of developing countries such as Durban in South Africa. Quarry Road West settlement is an informal settlement that is located in Newlands East, in Durban and it is home to approximately two thousand people. Just like many informal settlements it is associated with high levels of poverty, unemployment, informal housing structures, inaccessibility to services and vulnerability to environmental disasters (Williams 2019). Majority of people that reside in this settlement are people who come from rural areas, where they were previously disadvantaged and came to the big city in search of a better life and improved opportunities (Singh 2019). When and they cannot afford housing in the city, they are forced to live in informal settlements and build their houses with inappropriate and weak materials.

According to Williams et al (2018) climate change and urbanization are increasing vulnerability in of the poor in Durban. This is because poverty, poor quality of the informal settlement structures and high population density increase the number of people living under vulnerable and poor conditions. According to Green Tv (2014) and El-Mascri and Tipple (2013), by the year 2050 more than 70% of the earth's population will be residing in urban

spaces. This can only mean that urban poverty in cities like the city of Durban, will increase. Increasing levels of global warming and climate change will therefore, mean an increase in the occurrence and intensity of floods, meaning more people losing their lives and properties if nothing is done to build resilience.

Figure 4: A graph showing annual rainfall for the city of Durban.



Source: Climate data (2020)

The city of Durban in South Africa is a coastal city associated with good and a warm weather, but just like all coastal cities, it is prone to flooding as it receives high rainfalls throughout the year (Bureau of meteorology 2019 and Latitude 2020). When floods occur, they affect every person in the area that the flood is striking. However, those living in the most prone and vulnerable areas, are the ones that are easily and mostly affected. The location of informal settlements is an important factor in determining flood damage and vulnerability, Quarry Road being located near the Palmiet river increases the vulnerability of the people living in this settlement during the flood season. The floods that occurred in April 2019 affected people all over the city of Durban, however informal settlements such as Quarry Road West were affected the most. Especially those living the closest to the rivers (Williams 2019). Their houses were washed away, together with all their belongings, leaving them poorer than they previously were. This is why Bui et al (2014) state that natural

disasters can increase the number of people living under poor conditions and also perpetuate poverty.

In an interview carried by news reporters, one of the residents of Quarry road settlement stated that the people from the settlement are very poor and lack basic things like mattresses, blankets and clothes. When floods strike, therefore, they are just pouring fuel in the fire and making the poverty and vulnerability rates be even higher in this settlement (Singh 2019). This is why Williams et al (2019) states that natural hazards only become disasters when there is high poverty and vulnerability, because floods strike everyone but the poorest experience the worst impacts of floods. For those who have better capabilities, they may be able to respond and rebuild from the disaster, as per conceptual framework by Abunyewah et al (2018). For the poor, however, the situation can only get worse as they were previously poor and have little or no capabilities to respond and recover from these disasters. This means that the poor are the most vulnerable to any shocks and stresses (especially natural disasters).

From the consulted data, trends indicate that climate change and governance are recognized as the two main factors that increase vulnerability to flooding in Quarry Road West settlement (Williams et al 2019). The governance side increases vulnerability by failing the community of Quarry road by being unable to provide better education, healthcare, housing, basic infrastructure and other services such as water and electricity. Inaccessibility to these necessities exposes the residents to low economic status, lower or restricted capabilities, poverty and sensitivity. Being poor and unemployed means that people do not have access to high quality education, which can mean a lower adaptive capacity. Muttarak and Lutz (2014) argues that proper and high quality of education does not only improve adaptive capacity, but also coping strategies during disasters, awareness of the dangers that the residents are facing and cognitive skills in responding to the disaster. For example, the floods on 19th of August 2019 led to people losing their homes and belongings, further plunging them to poverty and vulnerability in Quarry Road West settlement, due to having little capabilities with little or no risk reduction measures.

The housing structures in Quarry Road West settlement compose of metal, wood, cardboard and plastics. Lack of provision of proper housing means that the informal housing (that is built with improper and weak material) washes off or collapses easily during the floods, together with all the belongings of the residents. The residents of Quarry road are already

poor and struggling to purchase necessary household appliance such as refrigerators, irons and televisions, however they suffer the most when floods destroy their houses with those appliances, that will take longer to repurchase after the floods. This further decreases their recovery power, as some may not be able to re-purchase those appliances, as they might have to worry more about rebuilding their houses than regaining all their possessions. The lack of proper housing has also meant no provision of electricity, leading to residents making their own illegal connections that become a major hazard during floods (Williams et al 2019).

According to Williams et al (2019) the Palmeit River is not the only cause of flooding in Quarry Road. Lack of provision of infrastructure such as proper drainage systems and no collection of waste means that there will be more surface runoff, that will lead to flooding in this area. Unmanaged and uncontrollable water (combined with waste from the settlement and the surrounding areas) flowing from the surrounding roads gushes to the Quarry Road West settlement with great intensity and volume that can cause damage and increase flood damages. Bureau for meteorology (2019) identifies three main areas that are prone to flooding, these are low-lying areas, areas near rivers of or coastal areas, and areas with poor drainage. Quarry Road West settlement has two attributes that make it vulnerable to flooding, it has poor drainage systems and it is near a river, making it a very vulnerable area that will always require urgent help and research. This supports the ideas from the conceptual framework that state that vulnerability increases natural disaster impacts.

Another factor that increases vulnerability to flooding in Quarry Road West settlement is climate change, that has increased and intensified the occurrence of floods that triggered other disasters such as landslides (Williams et al 2019). For example, the floods that occurred on the 29th of April 2019 triggered landslides that left people with no land to rebuild on (Hittingh 2019). The frequent occurrence of floods and the settlement being located in the flood plain of the Plamiet River means that the underlying soil is very moist and will therefore be impermeability, increasing chances of flooding. The Bureau of meteorology (2019) explain how important the underlying rock, landforms and soils are in determining floods and landslides prone areas. When soils are saturated, they will be unable to soak in anymore water, resulting in surface runoff (floods) and landslides. According to Hittingh (2019) urbanization and high population density has resulted in soil erosion that also leads to

landslides during floods, as natural vegetation that hold soil particles together is removed. This has also been evident in the city of Freetown in Sierra Leone (Gaafar 2017).

Flood related fatalities are identified as the highest in all disaster related deaths in South Africa (Williams et al 2019). This alone proves how much of a threat the vulnerable groups are facing during the flood months of March and April. The city of Durban usually receives 975 millimeters of rains per year. Even the driest months can experience rainy days due to the warm weather and high humidity (Climate data 2020). According to this source, June is the driest month, receiving about 30 millimeters of precipitation. The summer months (October to March) receive the highest rainfalls, which may be the reason why the city experience high number of floods during this season (Dawood 2019 and Singh 2019).

The relationship between poverty and vulnerability in the wake of natural disasters can be described using the capability approach theory discussed in the literature review. People who have better socio-economic status tend to have better capabilities to help them cope during natural disasters, but those who have poorer socio-economic surroundings are likely to be vulnerable (Du Bois and Rousseau, 2008). In Durban surroundings, the residents from better-resourced and well-built structures and settlements are likely to mitigate and protect themselves against the shocks of natural disasters by using their capabilities to help them respond and recover from disasters. The poor people in areas like Quarry Road West settlement, However, find themselves in vulnerabilities because of a lack of suitable and sustainable infrastructure capable that is resilient to natural disasters. This leads to increased vulnerability and displays the relationship between poverty and vulnerability

It is evident that more lives are claimed, and significant damage is caused by the natural disasters in informal settlements and poorer areas like Quarry Road West settlement. This is because of the flood prone areas they are situated in, poor quality of the housing structures and infrastructure. Essentially, the difference is that those who are poor lack the capabilities to cushion them against shocks and risks associated to natural disasters, while the wealthy may have all this and therefore respond and recover better. This also occurs in other developing countries like India and Sierra Leone and requires immediate attention. These trends will continue to be witnessed if nothing is done to improve the socio-economic status of the poor, which would improve their capabilities and later help them to respond, recover and be resilient to more disasters that might strike in the future.

5.3 The impacts of natural disasters in Quarry Road West settlement

Natural disasters have historically been accompanied by vicious and damaging outcomes for the poor and vulnerable. This has resulted in the need to focus on the importance of delineating the impact of natural disasters on these groups of people, as learning more about the impacts might help in coming up with effective solutions to this problem. This section analyses objective two, which investigates the impacts of natural disasters (floods) in Quarry Road West settlement, as it has been discussed above that the people of this settlement are associated with lack of capabilities and vulnerability, which further exposes them to the harsh impacts of natural disasters.

5.3.1 Collapsing housing structures

During the 2011 November floods in KwaZulu-Natal, the main cause of deaths and injuries in many informal settlements (including Quarry Road settlement), was the collapsing of housing structures on people or the houses collapsing while people are inside (Abahlali 2011). A total of 8 people died in the province of KwaZulu-Natal during these floods, while 300 informal settlers were affected by floods. Some totally lost their homes, while some experienced damages to their properties caused by water. In November of 2003, floods in Quarry Road West left hundreds displaced, as approximately 300 shacks were destroyed by the raging flood waters, leaving the people of this community poorer than they previously were (IOL 2003).

During the 2019 April floods in Durban, approximately two hundred and forty (240) houses were lost, as the Palmiet river overflew, destroying everything closer to its banks in Quarry Road West settlement (UNEP 2020). The consulted data indicates that increased flood damage is caused by a number of factors that result in increased poverty and vulnerability. These include lack of geomorphological analysis, flood risk analysis, risk reduction measures and poor housing structures, which threaten the lives of the people living in the informal settlements. This is why De risi et al (2013) emphasize the importance of flood risk analysis before and after disasters and improvement in the structure of informal settlements, in order to reduce risks, damages in housing structures and lives lost during floods.

5.3.2 Loss of employment and possessions

There are further socio-economic challenges that accompany natural disasters, these include people losing their possessions, employment and children being disturbed at school, which

can lead to them to stop attending school or affect their performance. In an article by Singh (2019), one of the interviewed residents of Quarry Road West settlement talked about how the April 2019 Durban floods destroyed his house entirely and in the morning, he could not go to work because he had to try and rebuild the house for his children. This resulted in him losing his job, as his employer did not believe his excuse for missing work that day. The man continues to talk about how his situation has worsened, as he is now unemployed and homeless, leaving him poor and vulnerable to any flood that might occur next in the area. He will also not be able to provide for his family (as he was the bread winner) and would have to rely on neighbours to assist where they can.

This can be very difficult, as the neighbours may also be facing similar problems, which is why Maseko (2011) argues that often times social networks offer limited help as they may also be facing the same hitches. Loss of other valuables like identity documents (ID) were lost in the flood, which meant that people will not be able to look for other jobs. This indicates how floods cripple people who were already living in harsh conditions, which can trap them in a cycle of poverty that would be difficult to escape. Losing their identity documents will mean that they will not be considered even when the government provides important and live saving services like proper and well-built low-cost housing, as the IDs prove that the residents are South Africans that have a right to receive such services as per rights of this country.

Flood distruct households as a whole, which also buries the people further in poverty.Singh (2019) also highlight how floods caused some of the children from Quarry Road West settlement to miss school, as their uniforms were washed away with their houses. This led to children being unable to attend school for weeks, and with parents and breadwinners losing jobs, the children could even miss school for an entire semester or even a year.

Some of the public schools are free of charge in South Africa, and government offers stationary free of charge as well. However, uniforms are not given for free and schools require leaners to wear full school uniforms, meaning that they will be suspended if they do not wear full uniform. Floods also wash away the free books and stationary provided by the government, which means that the children will even be unable to continue learning from home. This can cause children to fail, slowing them in their academic life. In such situations, parents are forced to take their children out from school because they cannot afford to re-

purchase all the school necessities destroyed and washed away by the floods. Some children quit school early to seek employment to assist their families, while some may turn to the life of crime as they may give up on having a good life through school (Khandhlela and May 2006).

5.3.3 Loss of lives, injury and spread of disease

Floods result in other health related challenges such as loss of lives, injury and spread of diseases that are worsening due to the increase in frequency and intensity of floods. According to Latitude (2020), Durban usually receives the highest rainfalls from November to April. This is the reason why the November 2011 Durban floods were devastating, as the city recieved 209.6 millimeters of rain that led to flooding that claimed the life of a 45-year-old man in Quarry Road West settlement, when floods triggered mudslides that collapsed his house while he was inside (Abahlali base mjondolo 2011). The location of the Quarry road makes it very easy for floods to trigger mudslides, as this settlement is built on the floodplain of the Palmeit River, making the areas very much vulnerable to both floods and mudslides. People residing in close proximity of the river are always the most vulnerable to injury and even death. This can mean that more lives are expected to be lost in this settlement, as floods are intensifying and occurring frequently, exposing the people to greater risks to other disasters.

Quarry Road West settlement experiences a huge problem of waste that is not collected. When floods occur, this waste is moved to drainage systems by the raging flood waters, which causes blockages in these storm drain systems, resulting in greater flooding. The waste also accumulates in the rivers, posing extreme water quality environmental hazards (Williams et al 2019). The waste that accumulates in these rivers contains different chemicals compositions that can pollute the river, compromising the quality of the Plamiet river and the aquatic life that lives in it. Rivers being polluted also means that the people (who already have no access to water) will be unable to use the river water even for carrying out basic domestic activities such as cleaning and doing laundry. Poor quality of water due to contamination and pollution from the waste has also resulted in water bourne diseases, which can result in health problems (Albrecht 2017). More health problems mean more hospital bills and visits for the people. If people are sick, they may also be unable to work, meaning that they will be unable to work (Khandhlela and May 2006).

5.3.4 Loss of land

Another problem experienced in Quarry Road West is the issue of residents losing land due to mass movement and erosion caused by the raging flood waters. The April 2019 Durban floods destroyed 37 homes in this area, while some were literally centimetres away from being swept away, as the floods and mudslides were destroying and removing houses and the land the houses are built in (Hittingh 2019). The Bureau of meteorology (2019) identified rainfall in relation to volume, density and distribution, is one of the causes of floods. Rainfall of a volume of 165 millimetres in 24 hours, was the primary cause of the overflowing of the Palmiet River that displaced the people of Quarry road (Hittingh 2019). Loss of land due to landslides has also meant that the people of Quarry road lose land where they can rebuild after the floods have wrecked.

The impacts of the floods on the people of Quarry Road West settlement indicate how people are somehow trapped in a cycle of perpetual poverty and vulnerability due to climate change and failures from the government to efficiently provide services and infrastructure. Improvements in the settlement structures or even relocation of the people is urgently required, as the people are living in extremely vulnerable conditions and their settlements are located in flood prone areas (that have poor drainage systems and near the river banks). Each year the people of this settlement always expect the worst possible impacts of floods during the summer months of November and April, as little is done to improve their living conditions. Such impacts will still be witnessed in the future, if nothing is done. This means that the future generations of the people residing in this settlement will still be residing there and facing the same problems, which might threaten their survival as climate change is worsening and standard of living is also increasing.

5.4 The municipality's role in trying to minimize the effects of natural disasters Quarry Road West settlement

This section analyses the interventions that the eThekwini municipality has suggested and attempted in Quarry Road West settlement, as means of trying to minimize the impacts of floods and improve the livelihoods of the people in order to minimize poverty and vulnerability. This is extremely important because only the municipality has the power to save the lives of the people that reside in this informal settlement by improving their lives. This is because when people are less poor and vulnerable, they may be able to respond and recover better from floods, as they will have improved services and capabilities.

5.4.1 Ex ante and Post-ante Disaster strategies

The data from the eThekwini municipality 2017/2018 Integrated Development Plan (IDP) indicates that the municipality is well aware about how vulnerable they are to disasters related to climate change, especially floods. These vulnerabilities are highly prioritized as they do not only threaten the development of the city and surrounding areas, but also the lives of the people. This is why the municipality has the Municipal Disaster Management center, which was established in 2011, as a way of managing and minimizing disasters. The center consists of different units that attends to different kinds of disasters (technological, environmental and social). One of the units of the center is the emergency mobilizing and communication center, where the local people can call to report any form of disaster that they might be facing, this is done to ensure that the municipality responds in time to rescue and assist the people in danger (eThekwini municipality 2017/18)

Before disasters strike, the South African Weather Services (SAWS) warns all people about possible dangers that might occur due to the weather, which is why the eThekwini municipality also put out more warnings at a local scale. This is done to ensure that the warnings reach all people, even those that might not have access to things like radios and televisions. For those who can, these warning are extremely useful, as they can relocate to safer areas during the time the disaster is predicted to strike. For people in informal settlements, rural areas and townships, that is challenging due to limited capabilities that might allow them to relocate. This means they have to rely on the local public halls where people are usually relocated during disasters, or stay in that vulnerable area, as they cannot leave their homes with all their possessions without supervision (Singh 2019 and eThekwini municipality 2017/2018).

The 2002 Disaster management act is a national policy that forces all municipalities to aid the residents before and after disasters strike, to ensure that they prepare, respond and recover better to disasters (eThekwini municipality 2011). In the floods that took place in April 2019, the former May of eThekwini, Zandile Gumede, stated that they provided temporary shelter to the flood victims. The shelter that was provided in a form of 11 community halls (Singh 2019). Although temporary shelter is not that much help, as the victims still have to rebuild for themselves, it is better than tents. This is because Maseko (2001) states that tents are not suitable for flood victims due to lack of safety and privacy. Other services offered by

eThekwini municipality and private companies include psychological therapy, blankets and food parcels (Singh 2019).

5.4.2 Low-cost housing project and upgrading slums

The eThekwini municipality has introduced various measures of upgrading slums, as ways of minimizing the risks of people being exposed to disasters. In 2003, the eThekwini municipality stated that they had introduced a low-cost housing project in the city, which aimed to relocate people living in informal settlements to proper and well-built houses. In Quarry Road West, 150 families were already moved to low-cost houses, 500 families were still left in the settlement and were to be relocated in the following year (IOL 2003). While there have been some merits from this, more people keep migrating to this settlement, making it almost impossible for the municipality to assist and relocate all the people living there. The project also aims at upgrading slums or informal settlement, as the city may not be financially able to relocate every single family residing in these settlements. Slum upgrading ensures that the existing settlements are resilient to any disasters that might occur. The project is still ongoing in 2020, however things like rapid urbanization are slowing the process, as the city cannot manage to help everyone.

5.4.3 Inclusion of local people in water management

One of the ways that the eThekwini municipality tries to minimize the impacts of natural disasters is through inclusion of the settlement residents in the water management project and processes. In this way, the people will be aware of how vulnerable they are in the areas that they live in and what they can also do to minimize the flood damage (William et al 2018). Things like dumping waste closer to the river, later result is catastrophic impacts, as the waste pollutes the river diverts flood water from the roads to the settlement (Williams et al 2019). This can even give the residents of the settlement a responsibility to not only care for the environment (by ensuring the river is not polluted), but also be involved in minimizing the impacts of flooding in their community. One of the challenges with this program include lack of trust between the people and the officials, which may result in miscommunication and limited assistance from the municipality. Another challenge was the language barrier between the different stakeholders, however that was quickly resolved by simply having someone to translate and simplify things for the local people.

The above discussed information proves that the municipality is prioritizing the people of the Quarry road community in trying to minimize the impacts of floods. Projects like the upgrading of settlements and moving people from the vulnerable area (Quarry road settlement) and into a safe and less vulnerable area is the most effective way of decreasing vulnerability. When people are located in safer areas, they are exposed to less chances of being negatively impacted by floods. New and well-built houses also mean less chances of houses being washed away by floods and mudslides. Other projects like the inclusion of the people of Quarry road in water management, means that they are protecting the environment, while also protecting themselves. This promotes awareness and education about how waste that is not disposed properly can be an environmental problem and also increase the destructiveness of floods.

5.5 The challenges faced by municipalities in minimizing the effects of natural disasters in Quarry Road West settlement

While the municipality has tried many efforts along the years and continues to try and help the most vulnerable groups like the people of Quarry Road West settlement, they also encounter problems even when they are trying to help the people. These problems are the reason why the programs and projects introduced to be slow and sometimes unsuccessful. This section seeks to identify some of the challenges that the eThekwini municipality face when trying to minimizing the effects of floods in Quarry Road West settlement.

5.5.1 Rapid urbanization

Ndebele-Murisa et al (2020) highlight the issue of rapid urbanization as being one of the major challenges of slowing down the process of helping the vulnerable people living in informal settlements. This is because while projects such as the low-cost housing and relocation of the people in informal settlements is done, more people keep migrating in those areas. These researchers claim that this is a problem experienced in all informal settlements in the city of Durban, as this is motivated by the growing need of people wanting to reside in cities but being unable to afford formal housing. Quarry Road West informal settlement started with one woman named MamSuthu in 1987, but currently it is home to over one thousand people and the settlement seems to be growing. This is why it is almost impossible for the eThekwini municipality to get rid of informal settlements, as they are extremely vulnerable.

Rapid urbanization also means that more people are going to be needing vital services such as water and sanitation, and provision of such services will be a long process as there are more people to cater for (Ndebele-Murisa et al (2020). Rapid urbanization therefore, becomes a problem as there are not enough funds for the municipality to ensure that all informal settlements (and all the people living in those informal settlements) have access to safe and accessible drinking water and sanitation. As more people keep migrating to informal settlements, the ability of the municipality to reduce vulnerability is minimized. Other problems associated with rapid urbanization is waste that is not disposed of correctly and environmentally friendly. The waste has been identified as one of the reasons why drainage systems get blocked and water not moving in one direction and therefore causing destructive flooding (Singh 2019). This therefore means that rapid urbanization is a challenge that results in other challenges

5.5.2 Lack of trust and relationship between government and people

UNEP (United Nation environment programme) (2020) states there is a lack of trust between the people of Quarry Road West and the municipality. This was due to the promises that are usually made by the municipality, to the people. Lack of fulfillment of these promises by the municipality has led to the people not wanting to interact with the municipality. According to this source, the officials from the municipality have been physically beaten and chased away from the settlement previously. Some of the distrusts are due to people from the settlements being removed from the areas because it is unsafe due to their proximity to the Palmiet River. For the people, who already do not have much, being removed from the settlement leaves people with more problems, as they cannot afford residing in formal areas. UNEP (2020) therefore, states that the distrust between the municipality and the people hinders the process of coming up with effective projects.

Working with researchers from the University of Kwa Zulu Natal (UKZN) however, has solved this problem, as the researchers from the university act as mediators in trying to help build resilience in this community. These researchers have built a bridge between the two parties, which Is how the people of Quarry road are now also included in meetings of water management. Ensuring inclusiveness ensures relevancy in projects implemented in the area, as the local people have also have a say in projects introduced. However, problems like rapid urbanization continue to slow down the process of ensuring that vulnerability is reduced in

this informal area. When more people keep migrating to this settlement, it will be difficult to ensure that vulnerability is reduced to every single person living in this, as the Plamiet River keeps sweeping away houses that are the closest.

5.6 CONCLUSION

In conclusion, there is a direct relationship between poverty, vulnerability and natural disaster in Quarry Road West settlement, as the Plamiet River always threatens the living conditions of the people in this area. The floods that have occurred in the area have caused people to be stuck in a cycle of poverty and vulnerability that is almost impossible to escape. This is because their houses are constantly washed away by the floods, leaving people even poorer than they previously were. Some people lose more valuable things that took them longer to buy or own in the first place, like refrigerators and televisions. Losing houses and possessions are the reasons why people take longer to rebuild and recover, as these people living in this settlement are people who are already faced with problems such as poverty and unemployment. Some people who were employed, have lost their jobs, as they were trying to rebuild from the destructive impacts of floods and could not leave their families or children alone. The data discussed in this section complements the conceptual framework which states that lack of capabilities deprives people more if there are little or no risk reduction measures in place.

The municipality does try to meet the people halfway, by providing post disaster assistance and trying vulnerability reduction through housing projects. Moving people to safer has been a very effective project, however, such projects usually take a very long time because of funds and rapid urbanization. Funds are always limited, which means building proper low-cost housing for the people is going to be difficult due to the number of people living in this settlement. More people that keep moving to these settlements also slow down the process of moving the people to less vulnerable areas. All this however, indicates that the municipality does assist the people of Quarry road in trying to minimize vulnerability to floods. Although there are difficulties that slow the process, however progress is being made. The next chapter is the final chapter which will discuss key findings to the study, provide recommendations to the problems being experienced and later draw conclusions for the study.

CHAPTER SIX: RECOMMENDATIONS AND CONCLUSIONS

6.1 INTRODUCTION

The data provided and discussed in the previous chapter provided answers for the research questions of the research questions, which indicated a direct relationship between poverty and floods in Quarry Road West informal settlement. People are constantly being put under poor and vulnerable conditions even further each year, as floods always strike the settlement frequently during the flood season. As much as the municipality was implementing projects to try to minimize vulnerability for the people in this area, however more is still required. This chapter, therefore, provide recommendations that ca be implemented in Quarry Road West settlement in trying to minimize vulnerability and the impacts of flooding. Conclusions will later be discussed in order to evaluate if the data reached its aims and answered the research questions well.

6.2 KEY FINDINGS

With the data collected, analysed and discussed, this section outlines and summarizes the key finding that each objective found in the study, which will help draw out conclusions about the entire study. Each objective has a key finding that has also helped in answering the research questions of the study.

6.2.1 Objective 1: To explore the relationship between poverty, vulnerability and natural disasters in urban Quarry Road West informal settlement

The data collected indicates that there is indeed a direct relationship between poverty, vulnerability and natural disasters (floods) in Quarry Road West informal settlement. The higher the poverty and vulnerability rates, the higher the damage caused by natural disasters (floods). As the conceptual framework by Abunyewah et al (2018) state that natural hazards are naturally occurring phenomena that cannot be stopped. They have been occurring long before human beings came into existence, however, they only become disastrous only if they are met with poor and vulnerable socio-economic, political and environmental conditions. This therefore, means that disaster related to natural hazards is higher in areas where people are poor, vulnerable and with limited capabilities.

The people of the Quarry Road West informal settlement experience problems such as poverty, unemployment, poor housing structures and located near the Palmiet River. These are all the factors that make the people living in this settlement to be extremely vulnerable to floods, especially during the flooding season which is between the months of November to

April. The area being located near a river makes it even more prone to being flooded, as the river overflows and floods the settlement, washing away the houses that are the closest to the river. The surrounding areas also have poor drainage systems (storm-water drains), which also means that when it rains there will be more surface runoff that will also increase flooding in the are. Below are some of the impacts that flooding has on the Quarry Road West informal settlement.

6.2.2 Objective 2: To examine the impacts of natural disasters in Quarry Road West informal settlement

The devastating impacts that the people of the Quarry Road West informal settlement face include losing their houses, possessions, land and lives. When floods strike, the number one negative impact that the people experience is losing their houses, together with all their possessions such as appliances and furniture, which are washed away by the floods by the rain and the Plamiet river. A few instances have also indicated the people experience injuries and sometimes lose their lives when the housing structures collapse on them while they are inside the houses. When the houses are washed away by the powerful gushing flood water, the land which the houses are built in is also washed away, leaving the people with no houses and no land to rebuild in. This means that the people will have to also search for land to rebuild in.

All this due to the fact that they are already poor and vulnerable, which means that they are more exposed to the risks and negative impacts of floods. The consulted data shows that the people of this settlement are stuck in a cycle of poverty. This is because they are poor and vulnerable and become even more poor and vulnerable after floods strike, as the floods destroy the little that they had. This makes it extremely difficult for them to rebuild after the floods, as they have limited capabilities. The people in settlement will continue experiencing such impacts if nothing is done to improve their capabilities, which will in turn improve their lives, resilience and survival.

6.2.3 Objective 3: To examine the municipality's role in trying to minimize the effects of natural disasters.

The key findings for this objective indicated that the eThekwini municipality has introduced a number of projects (related to improving housing structures and relocating people to low cost housing) and introduced disaster management units, as means of making the response to be faster during disasters. The municipal disaster management center is a municipal center that

is aimed at ensuring that disaster assistance is made available on time during disasters. They offer pre and post disaster assistance that includes early disaster warning, relocation of people , rescue during disasters and a call center where people can call to report disasters. The housing projects have been active since the early 2000s and still aim at revamping the informal settlements and in some instances, relocate people to safer areas with well built low-cost houses which are commonly known as the RDP houses. All these projects are still ongoing, however are slowed down by reasons that are discussed below. This indicates that the municipality is aware of the issue of disasters and is working extremely hard to ensure that the people are safe and protected from the harsh impacts of climate change and its disasters.

6.2.4 Objective 4: To explore challenges faced by municipality in minimizing the effects of natural disasters.

One of the challenges faced by the municipality when trying to minimize the impacts of floods in Quarry Road West informal settlement is the issue of rapid urbanization, which refers to the increased number of people who keep migrating to urban spaces. This is because the settlement was started by one woman in 1987, but today it is home to over a thousand people. More people keep migrating to the area, making it extremely difficult for the municipality to relocate all the people to safer areas with well-built housing structures. This will therefore slow down the progress of this project, as the results about the success and effectiveness of such projects are unclear because the municipality builds the houses but there are still more people living in these informal settlements. This can give the impression that the municipality is not doing the work at all.

Another challenge experienced in the settlement is the issue of the lack of trust between the people and the municipal officials, which makes it difficult for the municipality to really understand what exactly the people want and need. This is because participation of all stakeholders when implementing projects and plans is important, as the people have the opportunity to speak for themselves, making the plans and projects to be more reliable and relevant to problems experienced by the people. The data consulted indicated that people do not trust municipal officials due to “empty promises” made by the officials, which in the end , never happen. However the municipality is working on improving the relationship with the people of the settlement, as they are also working together in projects such as the Palmeit rehabilitation project.

6.3 RECOMMENDATIONS

6.3.1 Investing in skills development

Muttarak and Lutz (2014) and Abunyewah et al (2018) emphasize the importance of reducing vulnerability by ensuring that people have access to things like good quality education, skills development and employment opportunities. Ensuring that people have access to good quality education increases their chances of finding better and well-paying employment opportunities. When people earn better, they are able to provide for themselves without relying much on the government, which means that they may be able to help themselves to respond and recover better from disasters. People can even choose to reside in a less vulnerable area when they are earning better, as they now have the freedom of choosing where it is mostly safe to reside.

Skills development programs are extremely important for people living in vulnerable areas, which is why part of inclusiveness and participatory development projects aim at employing the people that reside in the area where the development is being implemented. This is because the people do not only benefit jobs that might help them earn better, but can also benefit skills that can also help them either start their own businesses or be more employable. The employment opportunities from these development projects also invests in skills development, where the people are trained well before the project and work starts. This is extremely beneficial as this means that people will still be able to improve their lives even after the project has ended.

6.3.2 Providing and investing on infrastructure

Since one of the contributing factors to increased flooding in Quarry Road West informal settlements is poor drainage systems, Pillay (2019) suggests that improves in the drainage systems needs to be attended to in order to reduce the impacts of flooding. This responsibility is placed on the municipality, as one of the main reasons for the blockage of drainage systems is waste that is not properly disposed. This waste is moved by the raging flood waters during floods and end up on the drainage systems, causing blockages that result in the flood water running of in the surface, causes disastrous impacts. Ensuring that waste is properly disposed and is collected frequently and ensuring that all storm drain systems have no other blockages, means that the water will safely and easily move to the drainage systems, resulting in less disastrous impacts.

6.3.3 Inclusion of people in policy designing, development and implementation

One of the most important recommendations suggested by Abunyewah et al (2018) about vulnerability reduction, is involving the affected people in decision making and policy implementation processes, as these people know and understand their situation better. They will know where the floods do the most damage in the area, who are the people who are most vulnerable in the area and how solutions should be implemented. Abunyewah et al (2018) strongly argue that the affected people should be included in policy formulation, especially because each settlement faces different challenges. For example, not all settlements are negatively affected by floods and mudslides, therefore, policies should be effective and relevant to each settlement.

6.4 CONCLUSIONS

In conclusion, there is a direct relationship between poverty and natural disasters (floods) in Quarry Road West informal settlement. The people from the settlement are people who are already living under poor and vulnerable conditions, the floods that strike the settlement multiple times a year, leave the people even poor and vulnerable. This threatens the survival of the people in urban spaces, as they lack resilience and are unable to respond and recover from these floods. Some people do not recover from such shocks, which means that people are not only kept and trapped in a cycle of poverty that is extremely difficult to escape, but they are also further impoverished.

The people of Quarry Road West settlements experience negative impacts such as losing houses (and everything inside their houses) and in some cases, they even lose their land. This leaves the people with a problem of needing land to rebuild on, as they may try to rebuild (as informal houses such as shacks are easy to build and rebuild because the material is cheap and easy find), but they have no site. This is due to the fact that floods in Quarry Road West washes off large chunks of land that is the closest to the banks of the river. The people living the closest to the rivers are the most vulnerable to losing their land, which could force them to either leave the area or find another piece of land that is still vulnerable to being washed off by floods. All this means that the people will still be experiencing the same problems, as living in these areas is not by choice but by force due to their socio-economic circumstances.

The role of the municipality becomes extremely important, therefore, because the solution for the current problem being experienced in Quarry Road West is to reduce vulnerability. This

can be achieved efficiently by the municipality, as they are responsible for service and infrastructure provision. Projects such as the relocation of the people to safer and well-built low-cost housing are extremely important, as they move people away from vulnerable areas. Ensuring that infrastructure such as storm drainage systems are working well and waste is collected in time and disposed of well is also important in ensuring that vulnerability is reduced for the people living in the area, as there may not be enough state funds to ensure that all people residing in informal settlements are relocated.

Globally, natural disasters claim thousands of lives and leave hundreds of thousands displaced and injured each year. While there have not been that much people who have died in the hands of floods in Quarry Road West settlement, however floods do negatively impact the people living in these areas. The people in Quarry Road are still lucky to survive through the floods, however if vulnerability is not reduced in this settlement, the impacts are going to be more disastrous as the floods are only going to occur more frequently and intensely. More is still required to reduce vulnerability in this settlement in order to ensure that people survive and become more resilient, as if nothing is done, the people are going to be more vulnerable and possibly lose their lives.

REFERENCES

Abahlali base mjondolo. (2011). Daily news: downpour kills eight. https://abahlali.org/taxonomy/term/term/quarry_road/

Abunyewah, M. Gajendran, T. Maund, K. (2018). Profiling informal settlements for disaster risks. *Procedia Engineering.* 212: 238-245.

Albrecht, W. (2013). Impact of natural disasters. https://You.tube/6k4UBtMpUJE

Anderson, J.D. (2006). Qualitative and quantitative research. Imperial COE.

Austons, K. (2018). Worst floods in 100 years. https://You.tube/SJ5-HcYL2HW

Ayala, I. (2002). Geomorphology, natural disasters, vulnerability and prevention of natural disasters in developing countries. Geomorphology. Vol 47: 107-124.

Aysan, Y.F., 1993. Vulnerability assessment. In: Merriman, P.A., Browitt, C.W.A. (Eds.), Natural Disasters: Protecting Vulnerable Communities. Thomas Telford, London, pp. 1–14.

BBC News. (2019) South Africa floods: death toll after Durban rains rises to 60. https://www.google.com/amp/s/www.bbc.com/news/world-africa-48036252.amp

Binda, M. (2019). Ground up. Protest after informal settlement floodd in Durban. https://www.groundup.org.za/article/protest-after-infromal-settlement-flooded-durban/

Bui, A.T. Dungey, M. Nguyen, C.V. Pham, T.P. (2014). The impacts of natural disasters on household income, expenditure, poverty and inequality: Evidence from Vietnam. Applied economics. Vol 46(15): 1751-1766.

Brunkard, J. Namulanda, G. Ratard, G. (2008). Hurricane Katrina deaths, Louisina, 2005. Disaster medicine and public health preparedness. Vol (1): 345-364.

Bureau for meteorology. (2019). Understanding floods. https://You.tube/ivUKLr8q4SE.

Bynard, P.A. (2011). Policies and poverty in South Africa. Journal of public affairs. Vol 6(2).
Cannon T (1994) Vulnerability analysis and the explanation of natural disasters. In: Varley A (ed.) Disasters, development and environment. Wiley, Chichester, pp 13–30.

Climate data. (2020). Average temperature, weather by month, Durban water temperature. Climate-data.org. https://en.climate-data.org/Africa/south-africa/kwazulu-nataldurban-511/

Cui, Y. Cheny, D. Choi, E.C. Jin, W. Lei, Y. kargel, J.S. (2019). The cost of rapid and haphazard urbanization: lessons learned from Freetown landslides disaster. Landslides. Vol 16: 1167-1176.

Dawood, Z. (2019). One dead, roads floodedas heavy rains continue to lash Durban. https://www.google.com/amps/www.iol.co.za/amp/dailynews/kwazulu-natal/one-dead-roads-flooded-as-heavy-rains-continue-to-lash-durban-39116357.

De risi R. Jalaya, F. Paola, D. Iervolino, I. Giugni, M. Tapa, M.E. Mbuya, E. Kyessi, A. Manfredi, G. Gasparini, P. (2013). Flood risk assessment for informal settlements. Nat Hazards. 63: 1003-1032.

Devereux S (1999) Making less last longer. In: Informal safety nets in Malawi. IDS Discussion Paper 373, Institute of Development Studies, Brighton.

El-Masri, S. Tipple, G. (2013). Urbanization, poverty and natural disasters: vulnerability of settlements in developing countries. Issues and practices.

eThekwini municipality. (2018). Integrated Development Plan: 5 year plan (2017/18 to 2021/22). https://www.urban.gov.za/city_vision/IDP/pages/default.aspx.

European Commission. (2016). Sendai Framework for Disaster Risk Reduction 2015-2030. https://ec.europa.eu/echo/partnerships/relations/european-and-international-cooperation/sendai-framework-disaster-risk-reduction_en. (19 April 2020).

February, J. (2018). Daily Maverick. https://www.dailymaverick.co.za/opinionista/2018-04-26-local-government-in-south-africa-mostly-corrupt-largely-dysfunctional/ .

Frank, A.W. (1990). Bringing bodies back in: A decade review. Theory, culture and society. 7, 131-162.

Gaafar, L. (2017). Freetown flood disaster was '90 percent man-made'. https://www.aljazeera.com/news/2017/11/freetown-flood-disaster-90-percent-man-171114102736398.html.

Global adaptation network. (2020). Students discover solutions to help Durban slums adapt to climate change. https://www.unenvironment.org/gan/news/story/students-discover-solutions-help-durban-slums-adapt-climate-change.

Golafshani, N. (2003). Understanding reliability and validity in Qualitative research. The qualitative report. Vol 8(4): 597-606.

Google maps. (2020). Map of Quarry Road West informal settlement, Durban, 4090. https://mp.app.goo.gl/6KbpTDXEboELMFh8.

Handmer, J.; Loh, E.; Choong, W. (2007). Using law to reduce vulnerability to natural disasters. Georgetown Journal on Poverty Law and Policy. 14(1):13-38.

Hittingh, M. (2019). Where can we rebuild? KZN floods displace shack dwellers. https://www.news24.com/amp/citypress/news/where-can-we-rebuild-kzn-floods-displace-shack-dwellers-20190429.

IOL. (2003). Flood flushes Durban informal settlement. https://www.google.com/amp/s/www.iol.co.za/amp/news/south-africa/flood-flushes-durban-informal-settlement-117964.

Jaswal, N. (2019). More than 140 dead in India-monsoon floods. https://You.tube/Oc9FWUrm-IY.

Javaid, O.B. (2019). Scores of people evacuated. https://You.tube/GFN-IHJozzu.

Jeanne, C. (2017). Comparing the right to the city concepts of Lefebvre and Harvey. New York, Oxford university.

Khandhlela, M., May, J. (2006). Poverty, vulnerability and the impact of flooding in the Limpopo Province, South Africa. Nat hazards. 39: 275-287.

Kubheka, T. KZN floods declared a provincial disaster- COGTA. Https://www.google.com/amp/s/ewn.co.za/2019/05/03/kzn-floods-declared-a-provincial-disaster-cogta/amp

Latitude. (2020). Latitude and longitude of Durban. https://latitude.to/map/za/south-africa/cities/durban.

Lardechi, C.R., Saith, R. Stewart, F. (2003). Does it matter that we do not agree on the definition of poverty? A comparison of four approaches. Oxford development studies. 31(3). September 2003.

Maseko, S. (2001). Shelter for the poor. Sowetan, 16 March 2000.

Maskey, A., 1993. Vulnerability accumulation in peripheral regions in Latin America: the challenge for disaster prevention and management. In: Merriman, P.A., Browitt, C.W.A. (Eds.), Natural Disasters: Protecting Vulnerable Communities. Thomas Telford, London, pp. 461–472.

Mindscape. (2016). Paris agreement simplified. http://www.youtube.com/watch?v=1DdfNU5iATU. (30 February 2020).

Mncayi, P. (2016). An analysis of the perceptions of graduate unemployment among graduates from a South African university. The international journal of social sciences and human studies. 8(1), 67-83.

Modise, L. Mtshiselwa, N. (2013). The native land act of 1913 engineered the poverty of black South Africans: a historico-ecclesiastical perspective. University of South Africa, Pretoria.

Muttarak, R. Lutz, W. (2014). Is Education a Key to Reducing Vulnerability to Natural Disasters and hence Unavoidable Climate Change? Education and Differential Vulnerability to Natural Disasters. 19(1):42.

National geographic wild. (2017). National geographic earth under water HD nature documentary. https://youtu.be/eKTdxXUFTWo

Ndebele-Musira, M. Mzime, R. Mabuya, C.P., Pretorius, L., Mamobe, R., Lipinge, L., Nchito, W., Mfune, J.K., Siame, G., and Mwalukanga, B. (2020) City to City learning and knowledge exchange for climate resilience in Southern Africa. Plos one. 15(1), pe0227915.

Neuman, W.L. (2011). Social research methods: qualitative and quantitative approaches 7th edition. University of Wisconsin, Whitewater.

Nussbaum, M.C. (2000). Women and human development: The capabilities approach. Cambridge university press, United Kingdom.

Olivier, S.J. (1994). Addressing poverty in South Africa: A strategy for social welfare development. University of Pretoria, Pretoria.

Oxford university. (2004). South African school dictionary. Cape Town: Oxford university press.

Pillay, K. IOL. (2019). Debris clogs coat after Durban floods. https://www.oil.co.za/mercury/news/debris-clogs-coast-after-durban-floods-22166248.

Population matters. (2020). The sixth mass extinction- Earth's loss of biodiversity. www.populationmatters.org/anthropocene.

Singh, K. (2019). We want to live and we want to keep moving: Durban rebuild after flooding. https://www.news24.com/amp/news24/southafrica/news/watch-we-want-to-live-and-we-want-to-keep-moving-durban-residents-rebuild-afteflooding-20190426.

Singh, K. (2019). Durban floods damage estimated at over R650M. https://www.news24.com/amp/news24/southafrica/news/durban-floods-damage-estimated-at-over-r650m-20190426.

Singh, M. Pillay, V. Chandrabhaon, S. (2008). Excel in geography. Durban: TESS Publishing CC.

Sisense. (2020). What is data analysis? https://www.sesense.com/glossary/what-is-data-analysis/

South South news. (2014). UN-Habitat Presents Blueprint For The Future We Want, The City We Need. https://www.youtube.com/watch?v=4Tbbb05pA80. (8 October 2019).

Statistics South Africa. (2018). Annual report- statistics South Africa. www.statssa.gov.za/?page_id=368.

Statistics South Africa. (2016). Subjective poverty in South Africa:findings of living conditions survey, 2008/2009. https://www.statssa.gov.za/?page_id=1854&PPN&=report-03-10-01

Sutherland, C. Mzeka, B. Buthelezi, S. Khumalo, D. (2019). Making informal settlements visible through datafication: A case study of Quarry Road West informal settlement, Durban, South Africa. Manchester center for development informatics: working paper 83.

Swaen, B. (2015). Conceptual framework. https://www.scibbr.com/disseration/conceptual-framework/ (accessed 8 August 2020).

Tas,M., Tas, N., Durak, S., Artanur, G. (2013). Flood disaster vulnerability in informal settlements in Burrsa, Turkey. Environment and urbanization. 25(2). 443-463.

TED. (2016). The inside story of the Paris climate agreement | Christiana Figueres. https://www.youtube.com/watch?v=MIA_1xQc7x8. (8 October 2019).

Todara, M.P. Smith, S.C. (2009). Economic development. New York, Peason.
Trading economics. (2020). South Africa- economic forecasts- 2020-2-22 outlook. https://tradingeconomics.com/south-africa/forecast

United Nations. (2016). The Sendai for disaster risk reduction. http://www.youtube.com/watch?v=izpDdnaSxN0. (30 February 2020).

United nations. United nations secretariat (2010). The millennium development goals report. New York: United nations.

United Nations environment programme. (2020). Students discover solutions to help Durban slums adapt to climate change. https://www.unep.org/gan/news/story/students-discover-solutions-to-help-durban-slums-adapt-to-climate-change

United Nations office for Disaster Risk reduction. (2016). UNISDR annual report 2016. https://www.undrr.org/publication/unisdr-annual-report-2016

Williams, D.S. Costa, M.M. Celliers, L. Sutherland, C. (2018). Informal settlements and flooding: identifying strengths and weaknesses in local governance for water management. Water. 10(871).

Williams, D.S. Costa, M.M. Sutherland, C. Celliers, L. Scheffran, J. (2019). Vulnerability of informal settlements in the context of rapid urbanization and climate change. Environment and urbanization. 31(1).

Williams, D.S. (2019). The manifestation of climate injustice. https://africasacountry.com/2019/08/how-will-informal-communities-cope-in-a-ne-climate.

Varley, A., 1991. Disasters: vulnerability and response. Disasters. 15 (3): 285–287