

**THE SOCIO-ECONOMIC IMPACTS OF FLOODS IN KUDUBE INFORMAL SETTLEMENT
IN THE CITY OF TSHWANE, GAUTENG PROVINCE OF SOUTH AFRICA**

By

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DECLARATION

I, Raasetje Evelyn Moraba, with student number 2007020635, herewith declare that this thesis entitled “**The socio-economic impacts of floods in Kudube informal settlement in the City of Tshwane, Gauteng Province of South Africa**” is my own work and was never submitted to any university for any qualification neither will it be submitted to any university for any qualifications.

A handwritten signature in black ink, appearing to read 'Raasetje Evelyn Moraba', with a stylized, overlapping initial 'R'.

Moraba R.E

Date: 30/11/2021

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DEDICATION

This thesis is dedicated to my late dad, Moroakoma, “papaka”, my mom, Hunadi and my husband, children and everyone who supported me.

ABSTRACT

Flooding is a common natural disaster around the world, and the City of Tshwane is not excluded from this commonality. Both informal and formal settlements in the city are affected by flooding though the impacts are not the same. Flooding has a potential to damage properties, disrupt normal daily activities, and is responsible for loss of life. It is against this background that this study assessed how flooding affects the Kudube Unit 9 community socially and economically. Data was collected using semi structured questionnaires, observations and focus group interviews. This study utilised two conceptual models namely the Community Capitals Framework (CCF) and Pressure and release (PAR). CCF model examined the seven capitals for analysing Kudube informal settlement conditions. On the other hand, PAR models examined the flood vulnerability conditions of Kudube informal settlement. The raw quantitative data was analysed using SPSS statistical model. The research findings show that the most vulnerable groups are people living with disabilities as reported by participants (questionnaire). This is contrary to focus group, which reported children as the most vulnerable group in this community. Furthermore, this study found that most of the respondents are unemployed and rely on either temporary jobs or some social grants for survival. This study established that flooding has negatively affected the residents economically and socially as floods were found to be contributing to severe economic loss in this community.

Keywords: Flood, disaster risk, socio-economic, vulnerability, impacts

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ACRONYMS

APFM	Associate Programme on Flood Management
CCF	Community Capitals Framework
CoT	City of Tshwane
DMA	Disaster Management Act
EIA	Environmental Impact Assessment
IPD	Internally Displaced People
NGO's	Non-Governmental Organisations
PAR	Pressure and Release Model
SADC	Southern African Development Countries
SPSS	Statistical Packages for the Social Sciences
StatSA	Statistics South Africa
UFS	University of the Free State
WMO	World Meteorological Organisation

CHAPTER 1: INTRODUCTION AND BACKGROUND TO THE STUDY

1.1 Introduction

Natural disasters are major hazards to human life and economy of the world (Guo, 2010). Wisner, Blaikie, Cannon, et al. (2004) argue that natural hazards can affect anyone, anywhere. Flooding, according to Euripidou and Murray (2004), is the most common natural disaster worldwide. In explaining the effects of floods, Hu, Pant, Hall, et al. (2019) explain that flooding has a huge impact on the socio-economic well-being of nations around the world. Furthermore, Istomina, Kocharyan, et al. (2004) report that floods rank first as compared to other natural disasters in their adverse effects. These findings are supported by Fiasorgbor, Wiafe, Tettey, et al. (2018) as they reported that flooding is the most frequent type of disaster, especially in developing countries.

In South Africa, the flood disaster that was declared in 2011 where 8 of the 9 provinces were severely affected by floods (BBC, 2011; TNH, 2011), where there was loss of lives and livelihoods, damage to properties, services disruptions and about 20 000 people were displaced across the country (IFRC&RCS, 2011), was amongst the worst floods the country has ever experienced. Following that, flood disasters were declared in several provinces, including the Eastern Cape, Free State, KwaZulu Natal, some parts of the North West and in Gauteng Province in the year 2019 (Singh, 2019).

In the City of Tshwane (CoT), floods affect most of the people residing next to riverbanks, wetlands and informal settlements (ESD, 2019). The recent floods that occurred in 2019 in the CoT resulted in loss of lives, damage to property and the degradation of the environment (Ndlazi, 2019). Subsequent to the destruction of the housing infrastructure, flood victims across the city were given the option to move to temporary shelters (ESD, 2019). On the other hand, other residents who were displaced by these floods refused to relocate, as they feared for the loss of their personal belongings (ESD, 2019).

There are a number of proactive measures that can be put in place to prevent and reduce flooding. For example, if residents in flood-prone areas can adapt to self-protective behaviour, the financial cost of flood damages can be reduced by 80%. This practice will also reduce the need for public risk management (Grothmann and Reusswig, 2006). In this regard, disaster preparedness will ensure minimal impacts of disasters. This study assessed the socio-economic impacts of flooding in Kudube informal settlement. Kudube informal settlement is flood-prone and assessing the socio-economic impacts of flooding

will assist with recommending proactive measures that can be implemented in the city to prevent and reduce flooding.

1.2 Background of the study area

The City of Tshwane (CoT) consists of seven regions. The study will be limited to region 2, ward 74 at Kudube Unit 9 informal settlement (Figure 1). This informal settlement was established in 1994, according to the community member interviewed. According to studies by Svetlana, Radovan, and Jan (2015), people settle near rivers for different reasons such as access to fertile soils for subsistence farming and access to water. Located in the CoT, Kudube informal settlement, like most informal settlements, is also no exception to the above reasons for settling next to Apies River and Tshwane Dam (Figure 1). There is a high possibility that water from either the river or dam can overflow during times of heavy rains. This is what makes this informal settlement vulnerable to flooding and a good case study for this research.

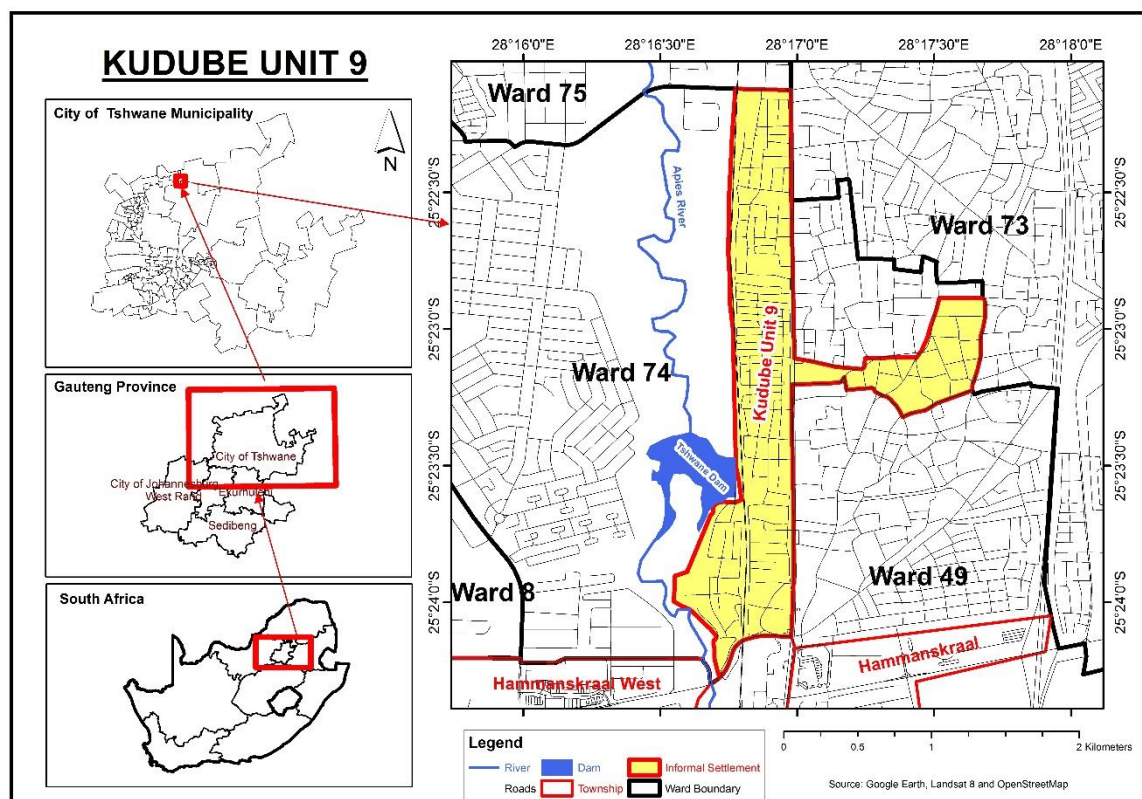


Figure 1.1: Kudube informal settlement
Source: VB Geeks, 2020

StatSA (2011) indicates that the population of the CoT was approximately 290 1874. Kudube informal settlement had 10 725 residents, of which 5 041 were males and 5 684 were females (StatSA, 2011). The education profile shows that 28% of the population are

matriculants, 13% have higher education qualifications and only 4% did not attend school (StatSA, 2011). Furthermore, 4826 community members had no source of income, whereas 966 people received an annual income of between R1 and R4800. It is against the above socioeconomic characteristics that the study will investigate the socio-economic impact of flooding in this community.

1.3 Research problem

With the changing climate and increasing frequency of natural disasters, particularly floods, informal settlement communities find themselves adversely affected by the effects of floods (Nassar and Elsayed, 2017). Informal settlements, in particular those that are situated next to water bodies, are vulnerable to floods (Flower, Fortnam and Kol, 2017). The Kudube community, like other communities in the CoT, for example, Mamelodi, is affected by flooding most of the time when it rains because of its location in the CoT (Fiasorgbor et al., 2018). Most informal settlements, especially in South Africa, have to adapt to flooding consequences mostly because of decrease in safer locations for the marginalised (Williams, Costa and Sutherland, 2019). In addition, also due to lack of resources, such as proper education on flood vulnerabilities (Frankenberg, Sikoki, Sumantri, et al., 2013). As a result, informal communities become vulnerable to climatic hazards, in particular floods, and may not be able to cope with the adverse socio-economic effects of these floods. Although there is no evidence of their direct contribution into the economy, informal settlements in South Africa are a common phenomenon and are very important in sheltering the previously poor and disadvantaged South Africans (Van der Westhuizen and Swart, 2015). With persistent floods happening in South Africa, informal settlement dwellers continue to face the adverse impacts of these floods. It is in this context that this study will investigate the socio-economic effects of flooding in this community in order to sensitise the CoT of these effects on the community.

1.4 Research questions

The main research question that this study sought to answer was:

- What are social and economic impacts of flooding on the Kudube Unit 9 informal settlement?

The following sub-questions emanating from the main study question were answered by this study:

- Which groups are the most vulnerable to the impacts of flooding?
- What is the level of vulnerability of Kudube Unit 9 informal settlement residents?

- What are coping strategies used by residents of Kudube Unit 9 informal settlements?
- What mitigation strategies were adopted by the community of Kudube to reduce flood risks?

1.5 Research objectives

The main objective of this study was to assess the socio-economic impacts of floods on the community of Kudube informal settlement in the CoT. The objective was achieved by addressing the following sub-objectives:

- To establish the social and economic effects of floods on the community of Kudube informal settlement.
- To assess the vulnerabilities of the Kudube community to flood disasters.
- To assess available flood-related coping mechanisms within the community of Kudube informal settlements.
- To ascertain how the communities of Kudube mitigate the impacts of flood disasters.

1.6 Significance of the study

The study assessed the socio-economic effects of floods on the community of Kudube informal settlement.

In light of the above, this study is significant in the area of Disaster Management in three ways:

Firstly, the study sought to produce information that could be used to improve the socio-economic status of the community. The economy is important in most informal settlements in South Africa, and without a proper economy, these settlements, especially in the CoT are volatile (Allaire, 2018). There are not many businesses in the area and level of unemployment is high. The CoT Local Economic Development must work closely with community of job creation.

Secondly, the final document could be utilised to capacitate community members with significant knowledge that can be applied should community members experience flooding again. Knowledge will be transferred to the community members through training and workshop, public awareness campaigns.

Thirdly, it is assumed that the findings of this study will be useful to the CoT disaster management centre, the department of roads and transport, department of housing and human settlements to implement the acts (Disaster Management Act, 57 of 2002 and Constitution of the Republic of South Africa, Act 108 of 1996).

1.7 Conceptual models

This study adopted two conceptual models, namely, CCF and PAR. The CCF model was used to examine and understand the socio-economic conditions and development of Kudube informal settlement. According to Mattos (2015), it is important to understand the socio-economic development dynamics of the community. The CCF model advocates for the transformation of the communities. This is explained in terms of various capitals such as human, financial, built, natural, cultural, social and political capitals (Mattos, 2015). This study explored how these capitals relate to one another. This model focuses on the resources of the community and how they can be used for transformation and development.

The PAR model looked at the flood vulnerability conditions of Kudube informal settlement. It has been established that the vulnerability of a society is influenced by a number of factors. It is explained by three elements, namely, root causes, dynamic pressures and unsafe conditions (Wisner, Blaikie, Cannon and Davis, 2004). According to this model, a disaster occurs due to the interaction of socio-economic pressure and physical exposure to a flood. The PAR model was used to examine vulnerability and hazard situations. In the root cause element, the study looked at power dynamics, allocation of resources, political ideologies and economic dynamics. Secondly, dynamic pressures looked at rapid urbanisation, lack of local institutions and deforestation. Thirdly, unsafe conditions examined dangerous locations and groups at risk.

1.8 Research design and methodology

This study adopted the mixed methods approach because mixed method reduces weaknesses that stem from using a single research design (Kabir, 2016). The mixed method approach chosen by this study was applied in the case of Kudube informal settlement to address the socio-economic impact of floods in this community.

A case study design allows researchers to conduct an in-depth investigation of intricate phenomena within a specific context (Rashid, Rashid, Warraich, et al., 2019). The advantage of using a case study is that it allows the study to explore solutions for complex issues and the application of recent knowledge and skills (Harrison, Bricks, Franklin, et al., 2017). The disadvantage of using a case study is that inadequate information can lead to inappropriate consequences (Harrison *et al.*, 2017). The most important advantage of this is

that a study can combine different approaches such as qualitative and quantitative approaches which will be extensively discussed in chapter 4 of this study. The mixed method approach, which is the focus of this study, is briefly addressed below and will also be extensively addressed in chapter 4.

1.8.1 Mixed methods

Johnson, Onwuegbuize and Turner (2007) discuss three reasons for combining qualitative and quantitative research. Firstly, mixed research method enables the confirmation of each method through triangulation. Secondly, mixed research method allows for analysis to provide richer data. Finally, mixed research method initiates new modes of thinking by attending to paradoxes that emerge from the two data sources, namely, quantitative and qualitative. Regnault, Willgoss, Barbic and ISOQOL (2017) report that mixed methods allow the study to collect and analyse data, integrate results and draw conclusion utilising quantitative and qualitative methods.

1.9 Population and sampling technique

Garg (2016) defines population as a group of people from which a sample is taken for measurement. The population of this study were community members of Kudube informal settlement. Population refers to a group of individuals of the same species occupying a particular geographic area (MacMillan, 2007). According to StatSA (2011), the total population of Kudube Unit 9 informal settlements is 10 725 people, of which 5 041 are male and 5 684 are female. According to Taherdoost (2016), sampling is a technique that can be utilised to select a representative part of the population in order to determine characteristics of the entire population. Francis, Johnson, Robertson, et al. (2010) justified sample size as conducting interviews until data saturation is achieved.

Teddlie and Yu (2007) discussed different sampling procedures that are used in social and behavioural sciences. The probability sampling technique is primarily used in quantitative research and involves the selection of a number of units from either specific sub-groups or population. This selection is done in a random manner where the probability of including every member of the selected population is determinable. The purpose of probability sampling is to select a representative sample of the selected population. The other sampling technique is purposive sampling, which is used in qualitative research, and can be defined as selecting units based on a specific purpose associated with answering research questions. Purposive sampling is further defined as a type of sampling in which “particular settings, persons, or events are deliberately selected for the important information they can provide that cannot be deduced from other techniques” (Teddlie and Yu, 2007). This study

adopted the non-probability purposive sampling technique to sample the population of Kudube non-randomly. Data was collected from 100 participants.

1.10 Data collection

Data is collected to capture quality evidence that seeks to answer every research question (Kabir, 2016). Therefore, this study used the following data collection tools:

1.10.1 Focus groups discussion

Focus groups, using face-to-face interview were utilised to gather information. Oatey (1999) highlights that this method allows the researcher to gather preliminary information about the topic. According to Oatey (1999), focus group interviews are cheaper and easier to conduct and the response is more complete and less inhibited. The study gathered information from 10 group members once throughout the study to obey COVID-19 regulations no 69.

1.10.2 Questionnaires

A semi-structured questionnaire developed by the study and approved by the University of the Free State Human ethics committee was used to collect data of this study. The structure and details of the questionnaire used are outlined in Chapter 4 of this study and a clean questionnaire template is attached as Appendix A.

1.10.3 Observations

Direct observations were another method used to collect the primary data of this study, and to supplement the structured questionnaire as the primary data collection method of the study. Photographs were taken as evidence for this method, and they are used and analysed in chapter 5 of this study.

1.11 Data analysis technique

The study will analyse socio-economic impacts of flooding in the Kudube informal settlement using descriptive and inferential statistics described comprehensively in Chapter 4 of this study. What is of utmost importance is that this study analysed photographs taken during data collection. Microsoft Excel and SPSS were the two softwares used to analyse the data of this study.

1.12 Data validity and reliability

The data collection tool (the questionnaire) selected for this study was used as a measure to test the validity and reliability of data collected. Lueng (2015) outlined that data validity determines whether research questions are valid for the desired outcomes. It also determines whether the methodology utilised is appropriate for answering the research

questions, whether sampling and data analysis is appropriate and whether results and conclusions are valid for the sample and context.

1.13 Limitation and delimitations of the study

The study was conducted in Kudube Unit 9 informal settlement known as Portion 9 of the CoT and conducted within the context of the socio-economic impacts of flooding. Goes and Simon (2018) argue that every study has limitations that are beyond the researcher's control. The researcher reduced obstacles that could have limited participation in this study to the best of his or her ability. For example, the researcher used research assistants that spoke the languages of the Kudube community. Comprehensive limitations and delimitations of this study are recorded in Chapter 4 of this study to avoid repetition.

1.14 Ethical consideration

The respondents were asked permission to be interviewed. Indeed, Mouton (2006) emphasises that ethical consideration should not be ignored while conducting interviews. The UFS ethical policy for research was adhered to throughout the study. The ethical considerations of this study that the researcher applied included signed informed consent form with information sheet about the details of the study (Attached as Appendix C), anonymity, privacy and confidentiality (Connelly, 2014). The researcher promised the potential participants privacy and confidentiality. The research avoided internet plagiarism and ensured that all sources used in-text are acknowledged in the Reference list.

1.15 Chapter summary

This chapter summarised how the research for this study was conducted, and includes preliminary literature study, background about the study area, problem statement, objectives, research questions, research methodology, data analysis, validity and reliability, limitations and delimitations of the study and ethical considerations.

The socio-economic impacts of flooding in Kudube informal settlement can be reduced. The City of Tshwane and the residents must work together to eradicate the impacts of floods in the area. The Disaster Management Centre must develop disaster risk reduction projects together with residents and make them part of the IDP projects.

CHAPTER 2: LEGISLATIONS AND CONCEPTUAL FRAMEWORKS

2.1 Introduction

The previous chapter looked at introduction, description of the study area, research problem, research questions, objectives, significance of the study, research methodology, limitations and delimitations of the study, ethical considerations and conclusive remarks. The current chapter explores the conceptual and legislative frameworks applicable to this study. The conceptual framework of this study is mainly built on two models, namely, the Community Capitals Framework (CCF) and Pressure and Release Model. These models were used to frame research on the socio-economic impacts of flooding in Kudube informal settlement, City of Tshwane, South Africa.

City of Tshwane has experienced floods in the past few years. This has resulted in loss of lives, destruction of property, damage of road infrastructure and disruption of daily activities. It is for this reason that this study investigated the social and economic impacts of floods at Kudube informal settlement in the City of Tshwane. In order to do this, it is important to understand the progression of vulnerability of the community. In addition, it is also important to conduct community analysis to establish the social, economic, human and other capitals. This study presents two models to assess the social and economic resilience to floods in Kudube informal settlement community.

Basically, the first section of this chapter introduces the conceptual framework. The section starts by providing an overview of the conceptual framework and provides background on the models that were adopted in the study. Two models, namely, Community Capital Framework (CCF) and Pressure and Release Model (PAR) were employed in the study. The CCF model looked at the seven capitals of analysing community conditions. On the other hand, PAR model investigated the flood vulnerability conditions of Kudube informal settlement. In the second section, the researcher explains the pieces of legislations relating to disaster management and disasters. The study discussed international, national and local legislative framework that guide flood management.

2.2 Significance of the conceptual framework

A conceptual framework is a foundation for any research. According to Adom, Hussein and Agyem (2018), a conceptual framework enables the study to identify and construct her or his worldview pertaining to the social phenomenon being studied. In this way, the researcher was able to answer the research problem. Adom et al. (2018) argue that “theoretical and

conceptual frameworks guide the paths of a research and offer the foundation for establishing its credibility”.

Camp (2001) cited in Adom et al. (2018) defines a conceptual framework as “a structure which the study believes can best explain the natural progression of the phenomenon to be studied”. In this study, the researcher used a conceptual framework to explain the natural progression of the socio-economic impact of flooding in Kudube informal settlement community. Furthermore, a conceptual framework enables the researcher to come up with solutions to solve the problem being explored. The problem is solved by investigating the relationship that exists between independent and dependent variables. It appears that there are several designs for conceptual frameworks that studies can employ in their respective studies (Adom et al., 2018). In addition, Adom et al. (2018) state that “it is a researcher’s own constructed model that s/he uses to explain the relationship that exists between the main variables in his/her study”. Furthermore, a study may adapt an existing model to explain the phenomenon being investigated.

Adom et al. (2018) are of the view that “The most important thing to understand about your conceptual framework is that it is primarily a conception or model of what is out there that you plan to study, and of what is going on with these things and why—a tentative theory of the phenomena that you are investigating”. Polit and Tatano (2004) cited in Adom et al. (2018) explain that conceptual frameworks are continually created by researchers. With the conceptual frameworks, figures are constructed with the intention of explaining constructs and variables relating to the study (Adom et al., 2018). Adom et al. (2018) further avers that the diagrams that have been constructed are critical to explain the relationships, and this is mostly shown by arrows.

According to Fisher (2007) cited in Adom et al. (2018), a good conceptual framework must be presented in writing so that it can be understood clearly. Fisher adds that a good conceptual framework must also be expressed in writing for it to be understood evidently. In other words, after a researcher has constructed a diagrammatic representation showing the relationships between variables, he or she must then explain how these variables are related. This relationship will assist the researcher to solve a research problem.

There are many theories and models that are used in studies. It is the responsibility of the researcher to select the model or theory that will enable her or him to augment their arguments.

2.3 Models for understanding social and economic impact of flood disasters

The City of Tshwane face a number of disaster risks in both urban and informal areas. However, informal settlement communities are more vulnerable to disasters. One of the reasons for their susceptibility is that they are established on hazardous locations. In addition, most informal settlement dwellers are in dire poverty and fail to cope with the effects of disasters.

This section introduces two models or theories that were utilised in this study. Many authors have written about conceptual frameworks that are applied in the studies. Authors such Flora and Arnold (2012), Emery and Flora (2006), Jacobs (2007), Anglin (2015) and Mathos (2015) have written about conceptual frameworks. According to Bantjes, Langa and Jensen (2012), there are a number of theories or conceptual frameworks or tools that examine community development. This study utilised two models, namely, CCF and PAR (figure 2.4). The models are briefly explained below.

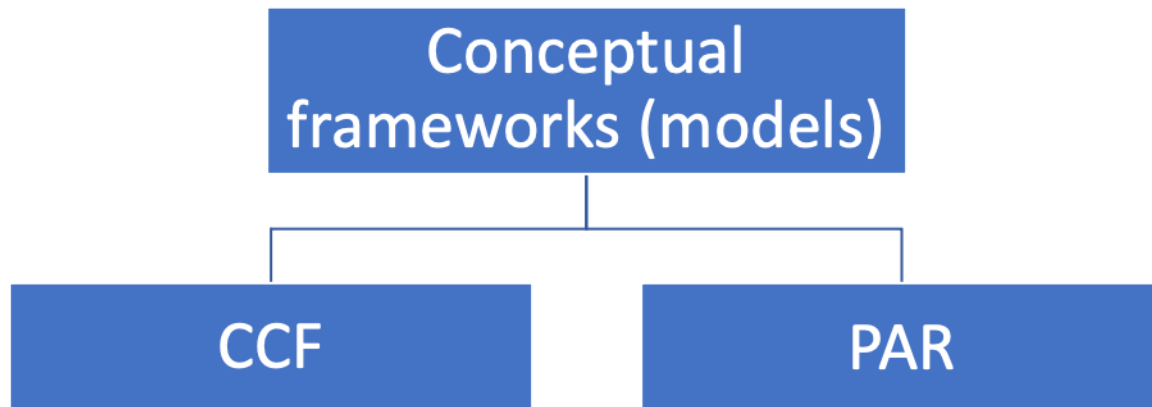


Figure 2.1: Conceptual frameworks/models
Source: Authors own composition

2.3.1 The Community Capitals Framework (CCF)

This framework examines socio-economic changes within the community. In light of this, the researcher will be able to understand the social, economic and political dynamics of community change during flooding. According to Mattos (2015), CCF has gained popularity

and is one of the most preferred conceptual frameworks, particularly in community analysis and development. In explaining the evolution of CCF, Mattos (2015) explains that:

This framework was first developed by Cornelia and Jan Flora (2013) as an alternative strategic planning and measurement approach and has been used by groups such as the North Central Regional Center for Rural Development, Great Plains IDEA Community Development, Extension across the U.S., NGO's, and by individual researchers.

The CCF offered a way to analyse developmental efforts of both community and economic development from a systems perspective by identifying assets in every capital, type of capital invested, interaction amongst the capitals and resulting impacts across capitals (Emery and Flora, 2006). It outlines the interactions between different parts of a community. Community capitals can be best understood as community banks with seven bank accounts. Studies showed that regardless of the community capitals being divided into seven capitals, there is a link to each capital type (Jacobs, 2007). Capital refers to a resource capable of producing additional resources (Jacobs, 2007). This model is presented below as a diagrammatic representation that explains the relationship between various variables relating to this study.



Figure 2.2: CCF model showing seven capitals

Source: Adapted from Mattos, 2015

Mattos (2015) advances the view that “social and economic changes are transforming rural and regional communities, making critical the understanding of the dynamics of community change”. In line with this view, it is imperative to understand the social and economic dynamics of communities, which enables community development practitioners to change rural communities positively. For this, CCF has gained popularity as one of the primary research approaches in understanding the social and economic dynamics in the communities.

Mattos (2015) states that CCF comprises seven types of capitals, namely, natural capital, cultural capital, human capital, social capital, political capital, financial and built capitals. As Mattos (2015) explains, CCF looks at the relationships among these seven capitals and how they support one another. These seven capitals enabled the study to understand how Kudube informal settlement community functions. Each of these capitals is briefly explained below.

2.3.2 Natural capital

Tarpeh (2017) asserts that this capital comprises natural resources and assets that are found in the community, which can be invested to generate additional assets or opportunities. These natural resources include soil, water, nature’s beauty, air, landscape, minerals and vegetation. This assertion is supported by Mattos (2015), who affirms that natural capital covers aspects such as the environment, rivers, lakes, forests, wildlife, soil, the weather and natural beauty. Flora, Flora and Gasteyer (2016) quoted in Tarpeh (2017) argue that “natural capital also includes the biodiversity of both plants and animals”.

Kudube informal settlement community has a duty to protect natural resources. This includes preventing deforestation, which is one of the driving forces for floods.

2.3.3 Cultural capital

Jacobs (2007) refers to cultural capital as a shared identity, some of the aspects that make people feel like a community, consisting of symbols and language, events, festivals and celebrations. The cultural capitals give a community a unique distinctive character. Cultural capital is part of our identity, our tradition and our understanding of one another. It is everything that shapes our lives, our families, our spirituality, our history, and our ethnicity. This study investigates the socio-economic impacts of flooding at Kudube informal settlement community. It is important to understand how cultural capital relates to this study. In this study, the researcher will use this element to understand the culture of Kudube informal settlement community. This includes understanding the languages spoken in the

area, ethnic composition, tradition and other aspects. For example, the languages spoken in the area might include Tshivenda, Sepedi, Setswana and others. People in this area could still practise their cultural tradition such as rituals etc. Cultural capital influences the groups that are influential in the area. In addition, the researcher will be able to understand the heritage of the people in the informal settlement.

2.3.4 Human capital

Human capital, according to Mattos (2015), includes the skills and abilities of residents and the capacity to access outside resources and knowledge in order to increase understanding and to identify promising practices. Jacobs (2007) describes community capitals as individuals' attributes that contribute to their ability to earn a living, and strengthen community organisations to their families, and to self-improvement. The greatest human capital that a community can possess is leadership.

It is of utmost imperative to identify the skills, abilities and capacity of the residents at Kudube informal settlement. This will assist the researcher to understand human resource capacity in the area. The vulnerability of the residents is dependent upon the resources that they have in order to bounce back in the aftermath of the flood. This capital will also enable the researcher to understand the education, health, creativity, youth and others.

2.3.5 Social capital

Social capital is regarded as connections among community members and organisations that allow people to come together to foster change either positively or and negatively. Mattos (2015) argues that social capital be established by encouraging community adaptability, initiative and responsibility, and by promoting interactions that strengthen commitment. According to Emery and Flora (2006), social capital highlights the connections among people and organisations that make things happen. Social capital can be described as bonding social capital (refer to close ties that build community cohesion) and as bridging social capital (refers to weak ties that create and maintain bridges among organisations and communities) (Emery and Flora, 2006). In terms of social capitals, the researcher looked at existing community committees and structures in the community, with more focus on structures that will encourage community members.

2.3.6 Political capital

Jacobs (2007) describes political capital as a capital that affects how decisions are made in the community and how outside resources are brought in. Anglin (2015) reports that political capital is a capital that demonstrates community members' abilities to engage in community betterment and to ensure that community issues are well addressed. According to Mattos

(2015), political capital is based on connections, organisations, voice, power and ability to influence distributions of resources. In line with this, Anglin (2015) argues that political capital outlines power distributions and communities' access to organisations, shared resources and power brokers.

In this capital, the researcher will explore how Kudube informal settlement community engages on community issues affecting the betterment of their area. It is also important to know the power dynamics in the area. This includes political organisations that are dominant and how they contribute towards the socio-economic development of the area. For instance, the researcher will identify political organisations such as ANC, EFF, DA and others and how these political ideologies influence the community.

2.3.7 Financial capital

Mattos (2015) describes financial capital as both private and public financial resources that are available to invest in building capacity of the community. In essence, financial capitals can be utilised to measure other community capitals (Jacobs, 2007). Anglin (2015) argues that although financial capital is often translated to money, money is not always financial capital and versa vice. According to Jacobs (2007), financial capitals are money used for investment and not for consumption. Anglin (2015) outlines examples of financial capitals as tax abatements, micro loans that can be used as an aid for community economic development, etc. (Jacobs, 2007).

This study established whether the community can access a loan for community economic development. This includes funds that the local government has set aside for the economic development within the vicinity of the area. This, of course, includes the building of new malls and industries, which will be job creation drive for the local community. In this way, the community will be empowered as they will be earning an income.

2.3.8 Built capital

Built capital is regarded as the foundation of a community (Jacobs, 2007). According to Mattos (2015), built capital is regarded as infrastructure that supports the community such as industrial parks, telecommunications, roads, sewer and water systems, etc. In addition to this, Mattos (2015) reports that built capital includes diverse human objects and systems like sewers, water system, electronic communication, soccer fields, etc. Mattos (2015) argues that built capital is a focal point for community development efforts.

The researcher investigated the built capital available in the area. This includes buildings, companies and road infrastructure. This provided an insight into the researcher on how built capitals can be used to withstand flood in the area. Some buildings in the area can be used

as temporary shelter in case of floods. It is also important to establish if the road infrastructure can withstand floods. This can be an opportunity to upgrade road infrastructure so that when it rains, it does not get washed away.

2.3.9 Applying CCF to Communities

The seven capitals of CCF have been briefly explained above. There are various ways in which rural or informal communities invest their resources in order to accomplish economic, social and environmental sustainability (Mattos, 2015). Mattos (2015) indicates that by analysing the investments in each of the seven capitals, CCF enables government officials, researchers and practitioners to gain a deeper understanding of the dynamics in the community.

The application of CCF on communities is explained in terms of context, process and outputs and outcomes.

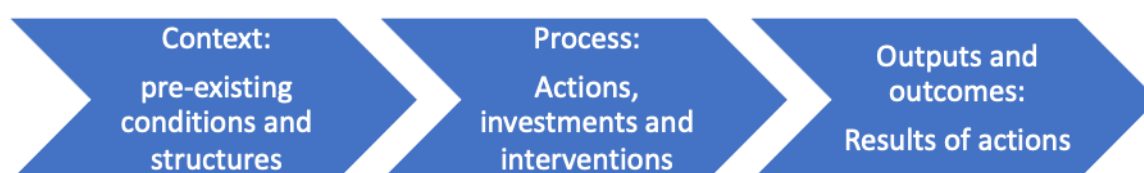


Figure 2.3: The process of tracing the changes in the seven capitals of CCF
Source: Adopted from Mattos 2015

The above diagrammatic representation shows the process which leads to the outputs and outcomes of the assessment of the seven capitals of CCF. It begins with the context where the pre-existing conditions and structures are assessed. This is followed by the actions and interventions to make positive changes to the seven capitals. According to Flora, Emery, Fey, et.al. (n.d.), CCF is a very valuable instrument which enables government officials and researchers to trace how an investment in the seven capitals change. In terms of the social capital, government officials are able to trace the bond between community members and leadership programmes (Flora et al., n.d.). Furthermore, changes in the social capital would include increased networks, communication, cooperation and trust (Flora et al., n.d.). For human capital, government officials evaluate aspects such as leadership training, knowledge and skills of the community members. The changes in the human capital will be indicated by the increased use of skills and abilities of local people (Flora et al., n.d.). In addition, changes in the human capital enable community members to get new skills, training programmes, access to education and improvement in healthcare provision. A classic example would be developing a computer training programme where members of Kudube

informal settlement are trained on computer skills. This human capital may influence the financial capital as members of the community who are trained in computer competence might get jobs and contribute towards the economic development. Financial capital changes would include how community members are able to obtain new funds for socio-economic development. Government officials would assess the political capital by exploring how the political system works and how it contributes towards access to resources. According to Flora et al. (n.d.), the changes in the political capital would be indicated by the ability of the elected to secure resources for the community. Cultural capital, as the name suggests, would entail tracing changes on how people learn to value the voices and heritages of others (Flora et al., n.d.). According to them, the changes in the cultural capital will be indicated by the cultural consciousness of community members. According to Flora et al. (n.d.), built capital focuses on housing structures, transportation infrastructure, telecommunications infrastructure and hardware, utilities and buildings. The outcome of this capital would be construction of the standard houses which comply with building codes. The road infrastructure must be able to withstand the effects of floods because the damage to roads would disrupt the daily activities of the Kudube community.

The analysis of capitals above enabled the researcher to understand the dynamics of community change at Kudube informal settlement. The changes in the seven capitals of CCF transform the rural and informal communities. CCF instrument enabled the researcher to identify different elements, resources and relationships at Kudube informal settlement. The outcomes of the community analysis will assist the City of Tshwane in its future planning. In fact, the City of Tshwane will have profile of Kudube informal settlement and will channel the necessary resources accordingly. For the capitals that are lacking, efforts will be made to strengthen the community to address the gaps. In this way, Kudube informal settlement will experience positive social and economic growth as well as good health. The second model is known as Pressure and Release (PAR) model.

2.4 PAR model

PAR is a second conceptual framework that was employed in this study. The purpose of this study was to investigate the socio-economic impacts of flooding in Kudube informal settlement, City of Tshwane, South Africa. The socio-economic impacts of flooding on vulnerable societies are directly influenced by the lack of access to political power, decision making, resources, insecure livelihoods, environmental degradation, and ineffectiveness of the state approach to disaster risk reduction. In other words, the PAR model explains that a disaster occurs owing to the interaction of socio-economic pressure and physical exposure to hazard, which in this case is flooding.

Hammer, Brainard, Innes, et al. (2019) argue that this model was originally intended to understand the manifestation of risk, which is believed to be a product of hazard and vulnerability of the community. In explaining the criticisms of this model, Hammer et al. (2019) argue that:

While not clearly conceptualised, the original PAR model does include aspects of exposure, but it does not directly associate these with susceptibility as a part of vulnerability. This could be seen as a critique of the original model. Due to the slight differences of global health emergencies to disasters associated with natural hazards, the adapted version explicitly includes aspects of heightened exposure in the progression of vulnerability.

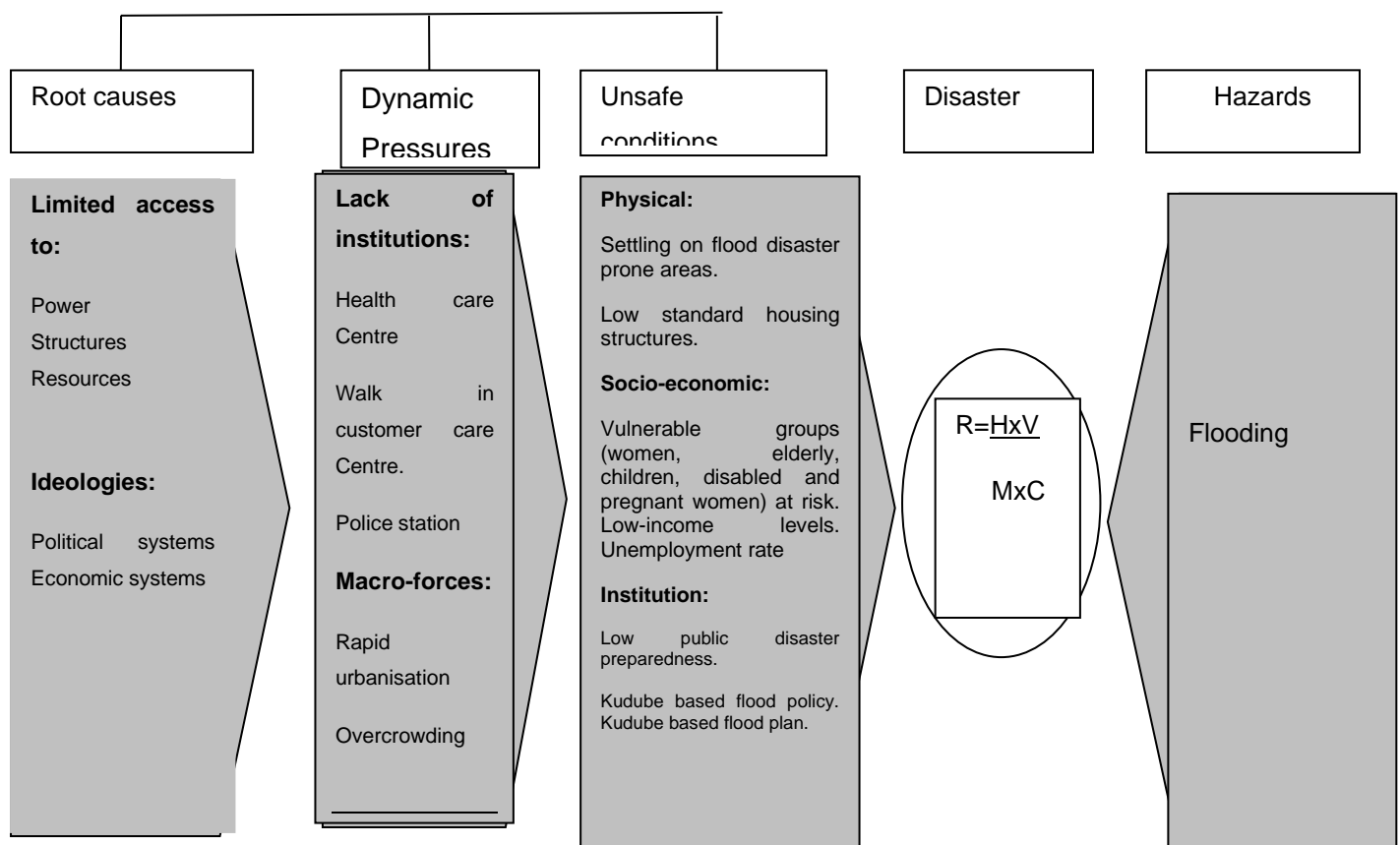


Figure 2.4.: PAR model of socio-economic impact for Kudube informal settlement
Source: Own draft (based on Wisner et al., 2004)

This model was developed by a prominent group of researchers (Wisner, Blaikie, Cannon and Davis). From the diagram above, it is apparent that a disaster occurs when the vulnerability of a community is exposed to the hazard. This PAR model was modified to suit the context of Kudube informal settlement (Figure 2.4.). Wisner, Blaikie, Cannon and Davis

(2004) state that the vulnerability of people is embedded in the social processes and the underlying roots which are relatively distant from the disaster event itself. In other words, this conceptual framework was developed to explore how social and economic factors are linked to the vulnerability of the society. The PAR model provides a framework for the City of Tshwane Disaster Management Centre to get a deeper insight and understanding of the vulnerability of the Kudube informal settlement society to disaster and how to come up with disaster risk reduction measures.

Before discussing the components of the PAR model, it is important to define some concepts such as vulnerability, hazard, disaster and others. This is to ensure that there is common understanding of these terminologies as used in the PAR model. As Wisner, et al. (2004) explain, a disaster is a phenomenon where many vulnerable people experience a hazard resulting in the disruption of the normal functioning of the community to an extent that a particular community would need external assistance to recover. As Hajat, Ebi, Kovats, et al. (2005) note, “vulnerable groups within communities to the health impacts of flooding are the elderly, disabled, children, women, ethnic minorities, and those on low incomes”. In defining vulnerability, a policy framework for disaster risk management in South Africa (2005) says that it is an extent at which a person, family, society or development is negatively affected by the impact of a particular hazard. It is important to establish how Kudube informal settlement society is adversely affected by flooding. A hazard is as policy framework for disaster risk management, South Africa (2005) defines it, an event or phenomenon that has potential to cause disruption to normal functioning of a society, injuries, loss lives, property and environmental damage.

In this study, the researcher used the PAR model in order to understand risk which is a function of vulnerability and hazard situations. Furthermore, this tool enables the researcher to investigate the interaction of natural hazards with vulnerable people which results in a disaster situation.

In explaining the PAR model, Wisner et al. (2004) say that:

The basis for the PAR idea is that a disaster is the intersection of two opposing forces: those processes generating vulnerability on one side, and the natural hazard event (or sometimes a slowly unfolding natural process) on the other. The image resembles a nutcracker, with increasing pressure on people arising from either side – from their vulnerability and from the impact (and severity) of the hazard for those people.

Wisner et al. (2004) add that “The ‘release’ idea is incorporated to conceptualise the reduction of disaster: to relieve the pressure, vulnerability has to be reduced”.

As indicated in the diagrammatic representation, the PAR model consists of three components, namely root causes, dynamic pressures and unsafe conditions. These three aspects are briefly discussed below.



Figure 2.5.: Components of progression of vulnerability

Source: Own draft (based on Wisner et al., 2004)

2.4.1 Root causes

Wisner et al. (2004) assert that the root causes of vulnerability are power dynamics in the society which encompasses the exercise and distribution of power. It is believed that people marginally economically such as those who live in the informal settlements or those who live in environmentally ‘marginal’ environments such as those habituating flood-prone area turn to be of marginal importance to those who hold economic and political power (Blaikie and Brookfield, 1987). The communities at risk tend to settle on disaster-prone areas, thereby increasing their vulnerability to hazards such as floods. Hajat et al. (2005) say that people who earn low incomes are more likely to be vulnerable to the impacts of floods as they may not have sufficient insurance and finances to bounce back from the effects of these floods. It is believed that people who have lack of or limited resources are vulnerable as they may not have resilience to disasters (Hajat et al., 2005).

In explaining the socio-economic factors as root causes of vulnerability, Wisner et al. (2004) say that “changing social and economic factors usually means altering the way that power operates in a society”. According to Wisner et al. (2004), people with insecure livelihoods and resources experience high levels of vulnerability to disasters. According to them, these people are normally not prioritised for government interventions to deal with hazard mitigation. Furthermore, it is believed that people who are economically and politically marginalised have low esteem in their own local knowledge. Hammer et al. (2019) argue that “limited access to power, structures and resources arises from lack of an inclusive and democratic society and political system”. City of Tshwane experienced international immigrants and also people from other provinces in South Africa. This is due to economic

opportunities that are available in Gauteng Province. This results in rapid urbanisation and the government's inability to cope with the housing needs. Most of the people end up settling on flood-prone and wetland areas. Furthermore, informal settlements are characterised by substandard houses, insufficient infrastructure such as roads, stormwater drainage, water systems, waste removal.

The second component of progression of vulnerability is dynamic pressures, which is briefly explained below.

2.4.2 Dynamic pressures

Wisner et al. (2004) define dynamic pressures as “processes and activities that ‘translate’ the effects of root causes both temporally and spatially into unsafe conditions”. According to the diagrammatical representation of the PAR model, dynamic pressures include rapid urbanisation, lack of education, training, local markets, early warning, risk preventive, preparedness and mitigation, and unemployment. The manifestation of these pressures results in unsafe conditions of the society.

2.4.3 Unsafe conditions

Wisner et al. (2004) define unsafe conditions as “the specific forms in which the vulnerability of a population is expressed in time and space in conjunction with a hazard.” Wisner et al. (2004) state that “dynamic pressures channel the root causes into particular forms of unsafe conditions that then have to be considered in relation to the different types of hazards facing people”. Unsafe conditions could include people who settle on hazardous or disaster-prone areas because they are incapable of paying for safe buildings (Wisner et al., 2004). Disasters are not only of natural origin; some are caused by the social, political and economic environments (Wisner et al., 2004).

2.4.4 Disaster and/or risk

According to Awal (2015), a disaster is defined as a phenomenon in which there is disruption of the normal day to day functioning of a society, which causes human, material, economic or environmental losses, which surpass the capacity of the affected society to handle it using its own resources. Disaster risk is the likelihood that a flood disaster may occur. From the diagrammatical representation of the PAR model, when unsafe conditions are exposed to a particular hazard, a disaster occurs. In order to explain the vulnerability to floods, the PAR model was used. The model recommends ways in which the risk of disasters can be reduced by implementing disaster risk reduction measures. The PAR model starts by identifying the root causes and how these impact on the dynamic pressures. These two components lead to unsafe conditions that are critical for the vulnerability of the society. It is

at this stage that the community should be well prepared to deal with a disaster. The level of disaster risk can be measured using a formula, $\text{disaster risk} = \text{Hazard} \times \text{Vulnerability} / \text{Coping capacity}$ (Awal, 2015). Based on this, it is critical to measure the level of disaster risk that Kudube community can be exposed to so as to come up with disaster risk reduction measures. It is common knowledge that in order to reduce the disaster risk, one has to reduce vulnerability.

2.4.5 Strategies to reduce flood impact

It is understood that there are various strategies that may be put in place to reduce the impact of floods. Stakeholders are required to come up with disaster risk reduction interventions before, during and post flood incidents or disaster in order to prevent and reduce the impact of the flood. Hajat et al. (2005) explain that the most common interventions of reducing floods are engineering and urban planning measures. In addition, the enforcement of building codes, relocation, and planning appropriate land use are other interventions necessary to prevent and mitigate floods (Hajat et al., 2005).

2.5 Applying PAR to Kudube community

Disasters occur as a result of vulnerable conditions combined with hazards, resulting from the interactions of hazards and vulnerability conditions. Kudube informal settlement faces flood threats that have a potential to disrupt their normal functioning, loss of lives, injuries, asset and environmental damage. The most vulnerable groups to floods are children, the disabled, women and the elderly. Affected groups of people include women, children and the elderly. There are a number of interventions that Kudube informal settlement can put in place to reduce their vulnerability to floods. Some of them include indigenous flood forecasting, raising the foundation of the houses, using building materials that can withstand floods, increased access to financial resources, and constructing houses away from flood-prone areas and others.

This study was based on the PAR model, which was developed by prominent scholars, Wisner, Blaikie, Cannon and Davis. The PAR model explains how Kudube informal settlement is vulnerable to flood hazards. This study investigated the social and economic impact of flooding in Kudube informal settlement. This community is located on a hazardous location. The settlement is on a flood-prone area, which makes the community more vulnerable to floods. The progression of vulnerability was assessed in terms of three components, namely, root causes, dynamic pressures and unsafe conditions.

In terms of root causes of vulnerability, the researcher explored lack of infrastructure such as roads, bridges and stormwater drainage as factors that may cause dynamic pressures on

Kudube informal settlement community. In addition, other root causes that make Kudube informal settlement more vulnerable to floods are lack of government support, land degradation, deforestation and climate change. According to Hamis (2018), deforestation is a critical issue in the water cycle. It is for this reason that vegetation cover should always be maintained to reduce evaporation rate, retain soil moisture, store water and provide moisture to the atmosphere through transpiration (Hamis, 2018). In other words, deforestation activities contribute to more evaporation and reduction in the soil moisture. As a result of deforestation activities, Kudube informal settlement experiences changes in the rainfall pattern and the community becomes more vulnerable to floods.

2.5.1 Dynamic pressures

Wisner et al. (2004) define dynamic pressures as “processes and activities that ‘translate’ the effects of root causes both temporally and spatially into unsafe conditions”. According to the diagrammatical representation of the PAR model, dynamic pressures include rapid urbanisation, lack of education, training, local markets, early warning, risk preventive, preparedness and mitigation, and unemployment. The manifestation of these pressures results in unsafe conditions of the society.

2.5.2 Unsafe conditions

As Hamis (2018) states, lack of proper houses is prevalent in the rural or informal communities. Most of the houses are built with substandard building materials that do not comply with building codes. This makes the houses more vulnerable to floods. Most of the people who live in the rural or informal areas are in dire poverty. This makes them more vulnerable to floods as they cannot even rapidly recover in the aftermath of floods. Lack of mitigation strategies has been proven to be one of the factors that reduce the vulnerability of the communities. It appears that Kudube informal settlement does not have mitigation strategies in place to mitigate against floods.

2.5.3 Advantages and disadvantages of PAR model

2.5.3.1 Advantages

Tearfund (2004) cited in Sanderson (n.d.) is of the view that the PAR model has gained popularity, and it is one of the models used by practitioners. Sanderson (n.d.) further argues that “this model has found resonance among many practitioners”. In explaining the benefit of the PAR model, Sanderson (n.d.) argues that it is the best model to explore the stages of post disaster recovery, and for highlighting mitigation and preparedness. Sanderson (n.d.) further states that “concerning vulnerability, the implicit assumption is that good recovery will lead to preparedness and mitigation, i.e., activities that reduce vulnerability”. The PAR model

gives an indication on the preventative measures that must be put in place to prevent a disaster from occurring (Sanderson, n.d.).

2.5.3.2 Disadvantages

According to Awal (2015), the disadvantage of the PAR model is that it explains the progression of vulnerability without actually measuring the level of vulnerability of the society. In addition, Awal (2015) says that “the model cannot be applied operationally without a great deal of data collection and analysis”. According to Hammer et al. (2019), the PAR model fails to provide disaster risk reduction measures. Hammer et al (2019) further argue that instead, it seeks to contribute to a discussion on terminology and the implications of terminology for understanding, analysis, and action.

2.5.4 Criticism of PAR model

A number of researchers have criticised the PAR model as they believe that it has several inadequacies and shortfalls. Awal (2015) states that the PAR model explains the progression of vulnerability without actually measuring the level of vulnerability of the society. Furthermore, Awal (2015) adds that “the model cannot be applied operationally without a great deal of data collection and analysis”. According to Hammer et al. (2019), the PAR model fails to provide disaster risk reduction measures; “instead, it seeks to contribute to a discussion on terminology and the implications of terminology for understanding, analysis, and action.”

2.6 Legislation framework

Flooding has turned out to be of the biggest challenges, particularly for developing countries. This has prompted the enactment of international, national and local legislative framework to regulate flood management. The development of various pieces of legislations is critical in the management of the adverse impacts of floods, especially in communities at risk. From the South African context, the traditional approach to flood management was reactive in nature. In the post 1994, there was a paradigm shift towards a proactive approach. Floods cause adverse impacts, particularly on vulnerable societies. In light of this, prevention and mitigation measures need to be put in place to prevent and reduce the adverse effects of floods. Laws need to be enacted to guide the management of floods. Based on this, several pieces of legislations such as Sendai framework, Water convention, the Constitution of the republic of South Africa, the Disaster Management Act, Act 57 of 2002, and the City of Tshwane flood response plan are briefly discussed (Figure 2.6).

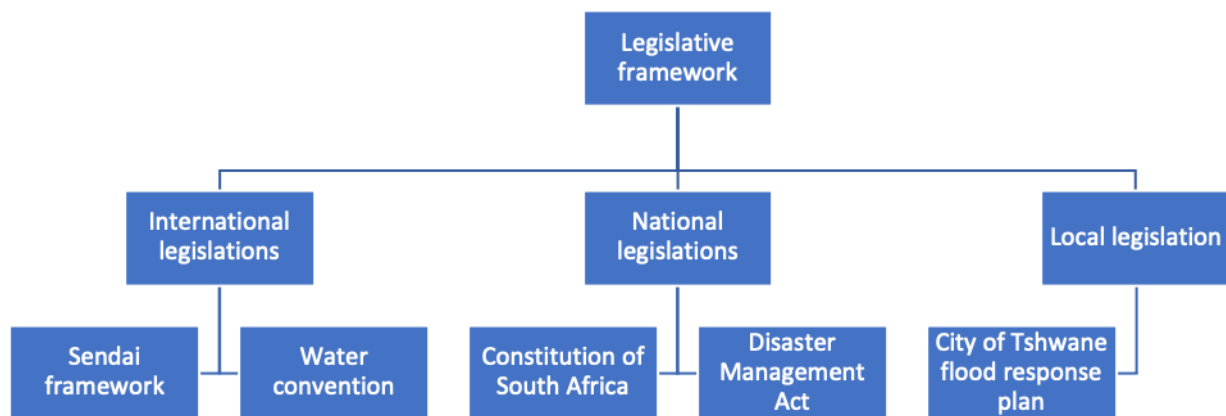


Figure 2.6: An overview of the various pieces of legislations
Source: Own composition

2.7 The Sendai Framework for Disaster Risk Reduction (2015-2030)

The Sendai Framework for Disaster Risk Reduction (2015-2030) is considered to be the most recent international legislative framework adopted by the United Nations on the 18th of March 2015 during the Third United Nations world conference in Japan (United Nations, 2010). The Sendai is the most recent legislative framework which came after the Hyogo Framework for Action 2005-2015: Building the Resilience of Nations and Communities to Disasters, which was adopted in 1994.

According to the United Nations (2010), this framework puts more emphasis on the promotion of disaster risk management and adopted seven global targets. Furthermore, the Sendai framework also advocates for good understanding of disaster risk, vulnerability and hazard, governance, accountability and others. The United Nations (2010) states that the aim of the Sendai Framework for Disaster Risk Reduction (2015-2030) is:

The substantial reduction of disaster risk and losses in lives, livelihoods and health and in the economic, physical, social, cultural and environmental assets of persons, businesses, communities and countries.

This in essence shows that the Sendai framework focuses on the proactive approach rather than the reactive one. In line with this viewpoint, this study recommends ways in which the flood disaster risk can be reduced at Kudube informal settlement. It is understood that if disaster risk can be reduced, there would not be loss of lives, livelihoods, disruption of normal functioning and environmental degradation.

According to the United Nations (2010), the Sendai Framework for Disaster Risk Reduction (2015-2030) has identified four key priorities, namely, understanding disaster risk, strengthening disaster risk governance to manage disaster risk, investing in disaster risk reduction for resilience and enhancing disaster preparedness for effective response and to “Build Back Better” in recovery, rehabilitation and reconstruction. From these four priorities of the Sendai framework, priority 1 is the most relevant in this study, which investigated the social and economic impact of floods at Kudube informal settlement. Two models were used to understand the flood disaster risk and the level of vulnerability of Kudube informal settlement community. The second priority looks at strengthening disaster risk governance. In relation to this study, it is critical for the City of Tshwane to collaborate with various stakeholders such as non-governmental organisations, civil bodies, various municipal departments, some provincial departments, and others to better understand the disaster risk at Kudube informal settlement. The third priority promotes investment in disaster risk reduction for resilience. The City of Tshwane, in collaboration with all relevant stakeholders, can come up with disaster risk reduction measures for Kudube informal settlement to make the community resilient to flood disasters.

2.8 Water convention

Cirillo and Albrecht (2015) state that international bodies enacted a water convention law that addressed water management issues. This law was enacted in 1992 and came into force in October 1996 (Cirillo and Albrecht, 2015). The aim of this water convention law was “to protect and to ensure a sustainable usage of transboundary water resources by facilitating cooperation” (Cirillo and Albrecht, 2015). In explaining cooperation of governments and government levels, Cirillo and Albrecht (2015) assert that “in the basic principle, the Water Convention affirms the importance of cooperation at governmental levels and coordination of different policies to deal with flood which is a natural event and only the human intervention or interference can cause worst consequences or amplify the damages”. Furthermore, the United Nations (2013) states that “the Convention has played a crucial role in the region in supporting the establishment and strengthening of cooperation and serving as a model for a number of bilateral or multilateral agreements”.

The water convention encourages the cooperation of various stakeholders in relation to water management. It recommends the development of policies to deal with floods. Based on this, City of Tshwane should have flood policies in place to deal with flood management issues. Furthermore, the city has an obligation to collaborate with various stakeholders in order to find solutions for Kudube informal settlement.

2.9 The Constitution of the republic of South Africa, Act 108 of 1996

The Constitution of the Republic of South Africa, Act 108 of 1996 is the highest legislation in the land. All legislations must be consistent with it. Zuma, Luyt, Chirenda and Tanlich (2012) state that “the 1996 Constitution of South Africa defined the law-making powers and the responsibilities at the national, provincial and local levels of government”. Chapter 3 of the Constitution of the Republic of South Africa, Act 108 of 1996 stipulates that all three spheres of government must enforce the principles of co-operative governance. In the post-1994 dispensation, the democratic government changed, amongst other things, governance structure, intergovernmental relations and co-operative governance. The Constitution of the Republic of South Africa, Act 108 of 1996, makes provision for the principles of intergovernmental relations and co-operative governance which makes South Africa a unique country. The principles of intergovernmental relations and co-operative governance are enshrined in the Constitution of the Republic of South Africa. According to the Constitution, the governance system is divided into three spheres of government, namely, national, provincial and local. The responsibilities amongst various spheres of government are clearly spelt out in the Constitution of the Republic of South Africa. The intergovernmental relations are enshrined in Section 40(1) of the Constitution of the Republic of South Africa, Act 108 of 1996, which stipulates that that “the three spheres of government are distinctive, interdependent and interrelated.” In essence, intergovernmental relations are of course a means to achieve intergovernmental goals. Section 152 (1) (c) of the Constitution of the Republic of South Africa, Act 108 of 1996 entrusts local government to promote a safe and healthy environment. In the same vein, the DMA focuses on an integrated and coordinated disaster risk management policy with strong emphasis on disaster risk reduction.

2.10 Disaster Management Act, Act 57 of 2002

South Africa, just like other countries, is exposed to various disasters. Disaster management has undergone legislative reform with the intention of moving from a reactive to a proactive approach to disaster management. Zuma et al. (2012) explain that the Civil Protection Act No. 67 of 1977 was the first legislation that governed disaster management. According to Zuma et al. (2012), this legislative framework failed to significantly address disaster management issues. This was proven by a disaster situation which occurred where 104 people died at Lainsburg floods in the year 1981. The 1994 floods in the Cape Flats prompted the South African government to promulgate the Disaster Management Act (DMA) No. 57 of 2002. As part of the legislative reform, a green paper on disaster management was promulgated. This was followed by a white paper which was promulgated in 1998. In 2001, a

draft bill was developed which led to the promulgation of the Disaster Management Act, Act 57 of 2002.

Van Niekerk (2014) avers that “South Africa was one of the first African countries to legislate disaster (risk) management comprehensively”. The Disaster Management Act, Act 57 of 2002 states that the aim of the DMA is:

to provide for an integrated and co-ordinated disaster management policy that focuses on preventing or reducing the risk of disasters, mitigating the severity of disasters, emergency preparedness, rapid and effective response to disasters and post-disaster recovery; the establishment of national, provincial and municipal disaster management centers; disaster management volunteers; and matters incidental thereto”.

Van Niekerk (2014) explains that “the DMA calls for the development of an integrated and coordinated policy for disaster risk reduction, in which the main emphasis is on disaster risk reduction and certain aspects of post-disaster recovery”. The DMA puts emphasis on the disaster risk reduction measures that are aimed at preventing and reducing the impact of disasters. The DMA comprises four key performance areas and three enablers. The performance areas include integrated institutional capacity for disaster risk management, disaster risk assessment, disaster risk reduction and integrated disaster response and recovery.

2.11 National Disaster Risk Management Policy Framework of 2005

As Zuma et al. (2012) say, the Disaster Management Act No. 57 of 2002 constitutes the institutional capacity at all levels of government. National Disaster Risk Management Policy Framework of 2005 was published in 2005 in response to a DMA. The Constitution of South Africa, Act 108 of 1996 clearly clarifies the roles and functions of each sphere of government. This policy recognises a wide range of risks and disasters that happen in the country. Its focus is on the disaster risk reduction measures of vulnerable communities. The National disaster risk management framework calls for the coherent and collaborative approach to disaster risk management.

2.12 City of Tshwane Flood response plan

CoT developed a flood response plan in 2015 to guide flood risk management in its area of jurisdiction. The plan was developed to ensure a coordinated approach in managing flooding incidents and disasters in the city . This plan was a result of flooding incidents which occurred in March 2014 where it was identified that a coordinated response to flooding is required.

According to Section 152 (1) (d) of the Constitution of the Republic of South Africa, municipalities are mandated to promote safe and healthy environments. Based on this mandate, the City of Tshwane has a legal obligation to promote and encourage disaster risk management planning with special emphasis on disaster risk reduction. This plan encourages a multidisciplinary approach to disaster risk management in the city. The strong emphasis is on disaster risk reduction measures that are aimed at reducing vulnerabilities, particularly of communities at risk.

2.13 Chapter summary

City of Tshwane has experienced floods in the past few years. This has resulted in the loss of lives, property destruction, road infrastructure damage, and disruption of daily activities. It is for this reason that this study investigated the social and economic impact of floods at Kudube informal settlement in the City of Tshwane. In order to do this, it is important to understand the progression of vulnerability of the community, and to conduct community analysis to establish the social, economic, human and other capitals. This chapter presented and discussed the conceptual frameworks, namely, CCF and PAR. The PAR model focused on the progression of vulnerability which encompasses root causes, dynamic pressure and unsafe conditions. It turns out that pressure develops when flooding disaster occurs. This chapter offers a conceptual PAR model for the progression of vulnerability, which encompasses root causes, dynamic pressures and unsafe conditions. These components of the PAR model are critical to reduce the vulnerability of the society to floods.

In addition, the researcher discussed the legislative framework relating to disaster management. Several pieces of legislations that guide flooding were explored. The researcher discussed the international, national and local pieces of legislations relating to disaster management and floods. The legislations that were discussed focused on disaster risk reduction, which is a proactive approach to disaster risk management and flood management.

CHAPTER 3: LITERATURE REVIEW

3.1 Introduction

This chapter critically analysed the available literature pertaining to the socio-economic impacts of flooding on communities, particularly communities that are at risk of floods worldwide. The researcher solicited views and perceptions of various scholars and authors in relation to the socio-economic impacts of flooding on communities. This topic that has attracted attention, especially in academia. It was against this background that this study investigated the socio-economic impacts of flooding in Kudube informal settlement, City of Tshwane, South Africa to add to the existing body of literature, most importantly to add to the gap in literature on the socio-economic effects of floods in capital cities around the world.

Globally, there is trend of flood occurrences as the most common type of disaster accountable for almost half of all victims of disasters (Alderman, Turner and Tong, 2012). Flooding disasters are increasing in frequency around the world due to a variety of environmental and human factors (Musyoki, Thifulufhelwi and Murungweni, 2016). Flood is an overflow of water over land that is usually not submerged (Oyinloye, Olamiju and Adekemi, 2013). Natural disasters and floods have become more frequent and destructive in nature (Musyoki et al., 2016). Furthermore, Talbot, Bennett, Cassell et al. (2018) reported that flooding disrupted public services and caused diseases, loss of life, and damage to property and infrastructure. As compared to all disasters in the world, floods are the most frequent and widespread disaster (Salami, von Meding and Giggins, 2017). Moreover, Southon and Van der Merwe (2018) argued that floods are a growing global problem. There is evidence of increases in terms of the frequency of occurrences of floods, damage to properties, economic losses, environmental destruction, and loss of life.

A study by Doocy, Daniels, Murray et al. (2013) also reported floods as the most damaging of natural hazards. Svetlana et al. (2015) argued that countries do face a variety of flood problems. Changes in land use induced changes of hydrological systems and increased flood risks (Svetlana et al., 2015). Communities residing near wetlands, riverbanks and on the flood lines are more at risk for flood disasters (Douglas, Alam, Maghenda, et al., 2008). Deforestation, urbanisation, and reduction of wetlands caused a decrease in water accumulation in the basin and increased the possibility of flooding (Douglas et al., 2008). Floods could be more frequent, relevant, and damaging in future because of the effects of increases in population, which leads to rapid urbanisation (Miller and Hutchins, 2017).

Nguimalet (2018) reported that rising temperatures as a result of climate change caused heavy rains that might result in flooding. Nguimalet (2018) also reported that floods have to date caused major concern through harmful water abundance that destroyed harvest, houses or and loss of life. This study focused on socio-economic issues brought about by floods, particularly pluvial and fluvial flood types that are a constant in the community of Kudube in the City of Tshwane.

3.2 Types of Floods

Patra, Kumar and Mani (2016) reported that flooding had many sources such as fluvial or river flooding, pluvial or flash flooding, coastal flooding, surface water flooding, groundwater flooding, drain and sewer flooding. The paper focused on the pluvial and fluvial flood types.

3.2.1 Coastal flood/ storm surge

Barnard, Erikson, foxgrover et al. (2019) reported that more than 600 million people worldwide are residing in the coastal zone. Coastal flooding occurred when seawater submerged the dry and low-lying land. Though coastal flooding was largely a natural event, there was evidence of human influence on the coastal environment that exacerbated the flooding. Xie, Zou, Mignone et al. (2019) reported that the rise in sea level results in critical infrastructure vulnerability due to coastal flooding risks.

3.2.2 Pluvial or surface water floods

Khajehei, Ahmadalipour, Shao et al. (2020) argued that the pluvial floods imposed extensive damage and disruption to societies, and they are among the deadliest natural hazards worldwide. Rubinato, Nichols, Peng et al. (2019) emphasised that pluvial flooding occurred when the rate of water falling on an area exceeded the infiltration rate into the ground, while the piped sewer systems cannot cope with a higher amount of flows having reached their maximum capacity, causing overflows from the minor to the major drainage system or vice versa. This was indeed what happened in and around the City of Tshwane during floodings. Most sewer pipes are blocked due to illegal dumping caused mainly by rapid urbanisation that forced people to build anywhere and left no dumping space around their settlements.

Schanze (2018) reported that mostly pluvial floods affected both the land and communities. In line with this, Rubinato et al. (2019) argued that pluvial flooding had the ability to cause extensive damage to crops, properties, roads, infrastructure, railways and flood protection structures (dams, levies, etc.), and was observed to appear within couples of hours of receiving the rainfall (Schanze, 2018). Though Rubinato et al. (2019)

argued that the index for flash flood is maximum rainfall exceeding 300 mm in any given area, Khajehei et al. (2020) argued that it was very difficult to predict pluvial floods. Houston, Werritty, Bassett et al. (2011) argued that pluvial floodings are not manageable as they are unpredictable, making it difficult to send adequate warnings. Moreover, pluvial flooding hardly happens for more than a day (Patra et al., 2015). However, during the 2019 cyclone Idai, South Africa and in particular the City of Tshwane experienced this type of floods for a few days because of the intensity of the cyclone. This impacted most communities socially and economically.

3.2.3 Fluvial/river floods

Rubinato et al. (2019) described fluvial flooding as a natural process essential for the proper functioning of a river and floodplain ecosystem, indicating that river flooding events occurred due to increase in urbanisation as it caused increases in the frequency and magnitude. Patra et al. (2015) stated that fluvial flood events occurred for days or weeks with widespread damages in the river system. According to Rehman, Jingdong, Du, et al. (2016), residential areas and businesses located in river flood plains are often damaged by flooding events. This was evident in the City of Tshwane during the 2019 floods where most rivers flooded and caused extensive damage, especially in the Centurion area, where the flooded Hennops river swept away most expensive cars around the National Disaster Management centre building, as this building is in front of the river (Kahla, 2019). Economically and socially, the 2019 flood affected a lot of people throughout most of the Southern African Development Community (SADC) Regions and South Africa in general.

3.2.4 Flash flooding

Modrick and Georgakakos (2015) argued that flash floods are amongst the world's destructive natural hazards. Bryndal, Franczak, Krocak, et al. (2017) reported that flash floods are the most destructive phenomena as compared to other natural disasters with regards to total numbers of people affected. Modrick and Georgakakos (2015) reported that flash floods accounted for above 5 000 deaths globally every year. Furthermore, Modrick and Georgakakos (2015) argued that flash floods accounted for 50% of flood-related damage to property, infrastructure and industry. Yao, Xie, Guo, et al. (2016) reported that in China, flash flood disasters are triggered by sudden local heavy precipitation. Khajehei et al. (2020) reported that flash floods are amongst the deadliest natural hazards around the world. Zhou, Su, Leng et al. (2019) reported that flash flood is usually caused by heavy rainfall in a short space of time, and mostly rain not more than six (6) hours. South Africa as a country is also not immune to flash floods and will also be the focus of this study.

3.3 Historic floods occurrences and their impacts

Flooding is a widespread disaster that affected a lot of people worldwide (Gautam and Van der Hoek, 2003). An average of 66 million people per year suffered flood damages between 1972 and 1998 (Gautam and Van der Hoek, 2003). Gautam and Van der Hoek (2003) reported that about 3000 people were killed in more than 80 countries and 17 million people were affected by floods across the world since 2002. The World Meteorological Organisation (WMO) reported that more than 30 billion US dollars was the total estimated property damages due to floods in 2002 (Gautam and van der Hoek, 2003). According to Shrestha (2008), floods affected over 1.4 billion people, and accounted for 100 000 deaths worldwide in the last decade of the 20th century. Furthermore, an estimated annual cost to the world economy as a result of flooding was about 50-60 billion US dollars (Shrestha, 2008).

Ismail and Mustaquim (2013) reported that the total number of people affected by rains and floods in Southern Africa was above 194 103 people in 2007, of which 60 995 were in Malawi, 94 760 people in Mozambique, more than 16 680 in Zambia with 1 890 displaced people and 15 168 in Zimbabwe. In Swaziland and Lesotho, an estimated 4000 and 2 500 people were affected respectively (Ismail and Mustaquim, 2013).

Kundzewicz, Kanae, Seneviratne, et al. (2013) reported that in the summer of 2010, Pakistan, India and China experienced heavy floods. Colombia also experienced heavy floods from October to December 2010, while in Australia heavy rains were experienced in the austral summer period 2010/2011 (Kundzewicz et al., 2013). In 2010, China was the country with maximum annual damage as a result of river floods with a total loss estimated at US\$51 billion. Pakistan recorded almost 2000 immediate fatalities from monsoonal flooding in 2010 (Kundzewicz et al., 2013).

In 2011, flood disaster occurred around the world, and countries that were affected included Thailand, Cambodia, China, India, Korea, Pakistan and the Philippines in Asia. Furthermore, the 2011 floods affected Brazil, Mexico, Columbia and the United States in the Americas (Kundzewicz et al., 2013). African regions that experienced flooding again in 2012 were Madagascar, Uganda Niger and Nigeria. In the SADC region, countries that were affected included Mozambique, Namibia and South Africa. In the same year in Asia, flood occurred in Bangladesh, China, India, North and South Korea, the Philippines and Russia and in America floods affected Argentina, the United States and Haiti.

In South Africa, Smith (2011) reported that floods killed more than 100 people, displaced 8 400 people and 33 areas within seven provinces were declared flood disasters area in 2010. Flood damaged costs to infrastructure was estimated at R160 billion rand in the affected seven provinces. Hill (2014) reported that floods hit four provinces in the country, namely,

Gauteng, North West, Limpopo and Mpumalanga. At least 32 people were reported dead and 2 535 people were displaced in all affected areas, causing damage to roads infrastructure in North West Province and closed businesses in Mpumalanga Province (Hill, 2014). Earlier, Khandlhela and May (2006) reported that severe floods hit Limpopo Province in February 2000, claiming 84 lives, caused damage to roads infrastructure and led to school closure. Furthermore, about 300 000 people were displaced and 45 000 houses damaged by these floods (Khandlhela and May, 2006).

Recently in South Africa during the 2019 floods, the KwaZulu Natal Province reported 70 fatalities as well as damage to properties (Singh, 2019). In Gauteng Province, floods claimed two lives in the City of Tshwane and displaced 500 people (Ndlazi, 2019). Mahlokwane (2019) reported that heavy rains flooded the low-lying bridges and some roads in the City of Tshwane. In addition, more than 700 shacks were swept away in the informal settlements across the country (Mahlokwane, 2019). Pijoos (2020) reported one fatality and one injured child in Limpopo Province after heavy rainfalls that resulted in flooding and misplaced numerous residents in the Mopani district area during those 2019 floods. Other provinces that were affected by these heavy floods in the country included the Free State, the North West, some parts of the Eastern Cape and the Western Cape Provinces.

3.4 Causes of floods

According to Mohamed, Ebenehi, Adaji, et al. (2017), floods are caused by either natural processes or by human error. Furthermore, Kundzewicz et al. (2013) reported that floods may be caused by either natural events, or by human activities, or by a combination of both. However, Tripathi (2015) was of the view that floods are caused by the intense rainfall when a river is full. This viewpoint was substantiated by Erena and Worku (2019), who emphasised that floods are caused by various factors such as heavy rainfall, topography, effect of climate change, encroaching to riverbanks, poor housing infrastructure, insufficient early warning information, dam breaking, blocked drainage systems and land use change.

Sakijege, Lupala and Sheuya (2012) reported that floods are due to the unavailability of stormwater drainage systems/channels in the settlement. Furthermore, flooding problems was aggravated by lack of maintenance in the existing stormwater drainage systems and poor waste management practices. Regardless of their cause, floods have a profound effect on people and the economy. In particular, the economy of most underdeveloped countries such as South Africa (Sakijege et al., 2012). Miranda and Ferreira (2019) reported that they have observed increases in flood frequency in the last decades across the world as a result of climate change, extended urbanisation, land use, etc. This study was supported by Tabari (2020) as argued that the expected increases in intensity and frequency of extreme rainfall

was due to climate change. Nazeer and Bork (2019) reported that flood caused high damage in a flat area as water stayed for longer period. With all the above definition of floods by different scholars, one important issue remain, that flood disasters caused the affected people extensively socially and economically. This issue cannot be ignored, hence this study.

3.5 Vulnerability to floods

Efobi and Anierobi (2013) reported that flood vulnerability is a measure of exposure of either individual, households, groups, communities or a risk area in a flooding situation. Vulnerability was defined as the degree to which an individual, a household, a community or an area may be adversely affected by a hazardous event or a disaster (Proag, 2014). For example, for a flood event to be considered a natural hazard, there must be a threat to property and human life (Ismail and Mustaquim, 2013). Vulnerability is the extent to which the physical, social, economic and environmental wellbeing of the society is exposed to a certain hazard (Proag, 2014). Khandhela and May (200) argued that the needy communities are the most vulnerable to disasters compared to rich communities, and that some are unable to recover from disasters. Nazeer and Bork (2019) argued that human populations are vulnerable to both natural disasters and environmental changes worldwide. As compared to men, women were identified as the most vulnerable group to natural hazards, especially to floods. For example, most women and children cannot outrun flood water (Nazeer and Bork, 2019). Owing to women's vulnerability to flood disasters, the severe 2000 Mozambiquan floods saw a woman giving birth on a tree due to the fact that she was unable to outrun the flood water to the hospital (Clifton, 2019). Mohamed et al. (2017) reported that children are an exposed group, followed by women, the elderly and people living with disabilities. During the 2019 floods caused by cyclone Idai, there were reports of child fatalities due to drowning (Chatiza, 2019).

Hossain, Uddin, Rokanuzzaman et al. (2013) explained that flooding cannot be prevented. However, flood damages can be mitigated through the implementation of flood control measures. According to Nazeer and Bork (2019), floodings are aggravated by socioeconomic issues such as high population, high illiteracy rate, lack of proper health facilities, widespread poverty and the encroachment in waterways. Du, Ottens and Sliuzas (2010) reported that the nature and extent of flood is determined by the location, topography and built environment. Floods have significant impact on the physical and mental health of people regardless of their magnitudes. Ismail and Mustaquim (2013) argued that population growth led to increase in exposure of both people and property to flood hazards.

Communities are urged to adopt a risk management approach as flooding cannot be eliminated entirely (Ismail and Mustaquim, 2013).

Ismail and Mustaquim (2013) reported that floods have led to loss of life, destruction in social and economic infrastructure and ecosystems degradation. In line with this, Du et al. (2010) reported to have observed a huge increase in illnesses on people affected by floods compared to those that are not affected. While Ramakrishna, Gaddam and Daisy (2014) argued that the most vulnerable to flooding disasters are internally displaced people (IDP) because they reside in hazardous areas. Although people live in vulnerable conditions, when affected by a flooding event, they find it difficult to reconstruct their livelihoods after a disaster (Ismail and Mustaquim, 2013). Tandi and Mawere (2018) argued that people living in poor conditions are more vulnerable to disasters as they lack required resources, leading them to be locked in a cycle of vulnerability. The recurrent of flood disasters increased the vulnerability of the poor (Tandi and Mawere, 2018).

3.6 Floods impact

Kundzewicz et al. (2013) asserted that flooding has impacted on both the less developed and industrialised countries. Hossain et al. (2013) reported that the impact of floods on both the society and the environment are enormous. In line with this, Jonkman and Vrijling (2008) reported that flood impacts are enormous on a global scale. Sieg, Schinko, Vogel et al. (2019) emphasised the need to comprehensively understand the impacts of flood on communities as this will assist with identifying relevant risk mitigation measures. Erena and Worku (2019) reported that there was a notable increase in the flood risk and flood impacts. However, Gautam and van der Hoek (2013) reported that most studies gave attention to direct losses as compared to indirect losses that are equally or even more important than direct losses. Both direct and indirect losses are categorised into tangible and intangible losses, which are also divided into primary losses (loss from the event) and secondary losses (one casual step removed from flood) categories. Ramakrishna et al. (2014) argued that floods not only caused destruction on the environment and economy, but it also timeously led to loss of life.

The below diagram showed the general impact of floods as reported by Gautam and Van der Hoek (2013).

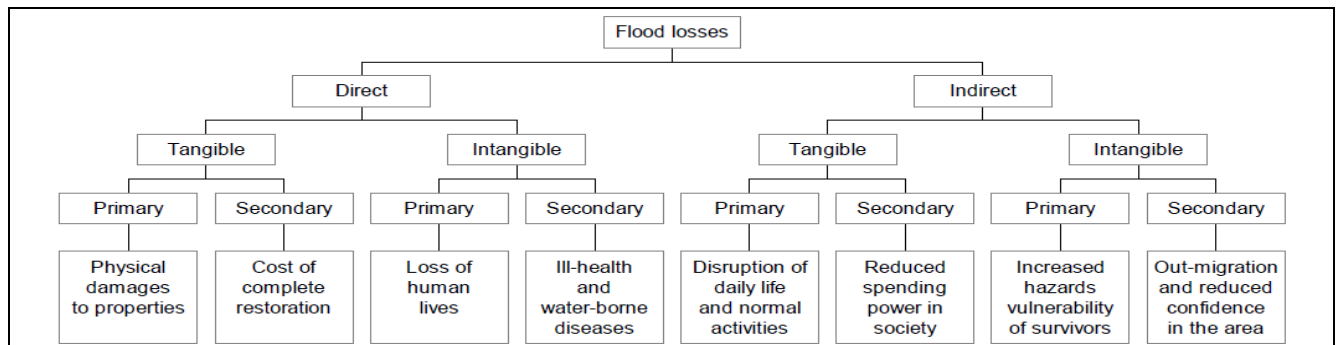


Figure 3. 1: General impacts of floods, showing the direct and indirect losses

Source: (Gautam and van der Hoek, 2013)

A lot of studies reported the social, economic and psychological impacts of floods. Ramakrishna et al. (2014) reported that the impacts of floods on communities and individuals had social, economic and environmental results. However, this study focused more on the socio-economic impacts of floods to the Kudube community without neglecting other impacts of floods because these impacts are interlinked.

3.6.1 Social impacts of floods

This section discussed the adverse social impacts of flooding on communities. Subsequent to flooding, it was pivotal to assess the social impacts of floods on the affected individuals and families. It was of utmost importance to begin by defining what social impact was. Social impact, as described by Twigger-Ross (2005), is a disruption in the social activities or interactions that exist amongst individuals, households and communities. For the purpose of this study, the researcher explained the social impact of floods on individuals and communities. Tandi and Mawere (2018) argued that floods always resulted in loss of life, damage to property, crops and livestock and disrupted communication channels in Southern Africa. Poor people are at higher risk because of exposure, vulnerability and lack of adaptive capacity.

Mwape (2009) explained that “different population segments can be exposed to greater relative risks because of their socioeconomic conditions of vulnerability”. Bubeck, Otto and Weichselgartner (2017) stated that impacts of floods are not distributed equally across various societal groups. For example, the poor, elderly, and marginalised societal groups were more vulnerable to flooding effects.

It appeared that the magnitude of adverse social impacts were dependent on the vulnerability and capacity of the community exposed to the flooding incident or disaster and vary in terms of the geographical location. For example, communities settling in flood-prone areas would experience the social consequences of flooding. In addition, a

community that has less capacity or less resources will be severely affected by the aftermath of flooding.

A study conducted by Mwape (2009) showed that the social impacts of floods are generally disruption of the people's way of life, culture, community, political systems, environment, health and wellbeing, their personal and property rights and their fears and aspirations. It was understood that communities living in rural areas showed social cohesion and kept on helping one another (Ashraf, Iftikhar, Shahbaz et al., 2013). A study conducted by Ashraf et al. (2013) on the Pakistan community discovered that this type of social cohesion and family connection got lost when the transport and systems are damaged by floods. Furthermore, Ashraf et al. (2013) added that criminality was a major threat during flooding as some of the belongings and commodities of the communities were stolen when individuals and families were evacuated to a safe area. Research conducted by Ashraf et al. (2013) indicated that cultural practices are integral in the unity of rural communities, but this unity was disrupted due to lack of transportation means and infrastructure. In this community, floods destroyed the livelihoods of the Pakistan rural communities and led to poverty and food insecurity, particularly in the flood-prone area (Ashraf et al., 2013).

The aftermath of flooding disrupted the social functioning and setup of the affected community. In this regard, Andrea, Juarez and Kelly (2016) stated that individuals and communities are affected in various ways such as:

- Communities' lifestyle which depicts how individuals and families live, work and interact every day.
- Cultural aspects such as habits, obligations, values, language, religious beliefs, customs, aesthetics and cultural heritage, feelings of belonging, security and livability, and aspirations for the future are disrupted.
- Social cohesion such as social interactions, character, stability, services and others within the community are disturbed.
- Political system gets disrupted which limits or prevents communities' participation in decision-making and the way in which resources are shared and distributed in order to promote democratisation.
- The environment, air and water quality, availability and quality of food, the disaster risk level, health quality, as well as access to and control over natural resources.

- Health: including physical, mental, social and spiritual well-being, is not only considered as the absence of disease.
- Personal and property rights guaranteed to ensure that people are not economically affected or disadvantaged in terms of civil and political liberties.
- Fears and aspirations: their perception of security, their fears about the community's future, as well as their own aspirations for the future and for future generations.

Communities settling on the flood-prone areas would experience social consequences such as loss of lives, damage to property, destruction of crops, loss of livestock and exposure to flood-related diseases. It is important to explain how flooding affects the communities from a social point of view.

3.6.2 Economic impact

Substantial evidence showed that floods have adverse impact on both the local and national economy (Svetlana et al., 2015). Amarasinghe, Amarnath, Alahacoon, et al. (2020) argued that natural hazards, including floods are responsible for severe economic loss around the world. Furthermore, it is believed that flooding accounts for 69% of financial damages (Amarasinghe et al., 2020). Moreover, economic development is hindered by water-related disasters from either floods or drought in most countries. Grothmann and Reusswig (2006) reported that the financial cost of flood damages can be reduced by 80% should residents in flood-prone areas adapt to self-protective behaviour.

The funds that were meant for economic development may be shifted to flood response and recovery efforts. Considering this, the economic development opportunities may be adversely affected. Flood disrupted the livelihoods of local people because some businesses would have been destroyed such as farming land which could be unusable in the aftermath of flooding (Armah, Yawson, Yengoh, et al. 2010). Floods have a negative effect on the economy and stability of a society. If floods hit an area and the businesses are destroyed, it leaves the community devastated. It also affects the economy negatively. In this case, workers were not able to generate their income as their businesses would have been destroyed (Svetlana, et al. 2015). As Svetlana et al. (2015) reported, the companies within the vicinity of the area which are flooded would have to shut down. This meant that these companies would no longer contribute towards paying taxes. Furthermore, Svetlana, et al. (2015) added that "it will be necessary to evacuate more buildings, provide emergency accommodation for more people, more workers will not be able to make money, because they would have to rescue and look after their property".

3.6.3 Environmental impact

Walker-Springett, Butler and Adger (2017) argued that many countries worldwide experienced environmental risk as a result of flooding. Oyinloye et al. (2013) reported that the most common environmental hazard was flooding. In addition, Gautam and Van Der Hoek (2003) reported that the impacts of flooding on the environment range from dispersion of household wastes into the river systems, thereby contaminating water resources for both communities and wildlife habitats. Talbot et al. (2018) argued that global environmental change was the reason why there was increase in impacts related to floods. The higher the magnitude of the flood, the greater the damage to the environment (Talbot et al., 2018).

Though they have negative impacts, Talbot et al. (2018) argued that floods created unique habitat and supported both biodiversity and biological productivity in the rivers. Floods made land unsuitable for agricultural production until water recede (Tandi and Mawere, 2018). Floods had negative impacts on the environment by causing loss of fertile soil.

3.6.4 Psychological impacts of floods

This section discussed the psychological impact owing to the aftermath of flooding. Many studies have been conducted in relation to the psychological impact of floods. A substantial body of knowledge showed that flooding poses detrimental psychological consequences on the affected people (Walker-Springett et al., 2017; Stanke, Murray, Amlot, et al., 2012). Following flooding, individuals and communities experienced post-traumatic stress disorder (PTSD), depression as well as anxiety. Stanke et al. (2012) are of the view that flooding presented immense social and mental health consequences that may last over a long period of time. It appeared that there was growing interest in the studies related to psychological effects of natural disasters (Jerg-Bretzke, Walter, Limbrecht-Ecklundt, et al., 2013). According to Jerg-Bretzke et al. (2013), symptoms of PTSD included re-experiencing, emotional numbing and avoidance and heightened arousal. A study conducted by Jerg-Bretzke et al (2013) also indicated that the psychosocial impacts of floods can have dire consequences on the affected individuals or communities' wellbeing, relationships and mental health. Furthermore, the psychological effects of flooding can manifest itself in various ways. For example, economic problems for families; behavioural problems in children; increased substance use; increased domestic violence; as well as exacerbating, precipitating or provoking people's existing problems with their mental health. It is believed that anxiety and depression can continue

for many months and sometimes years following a flood event (Hajat et al., 2005). In some cases, affected people become traumatised after they have lost their loved ones.

Paranjothy, Gallanches, Rubin, et al. (2011) reported that flooding is associated with a wide range of psychological and mental health impacts. Examples of psychological and mental health impacts included psychological distress, anxiety, depression, somatisation and post-traumatic stress disorder (PTSD). Tapsell, Penning-Rowse, Tunstall, et al. (2002) argued that floods had negative impacts on human health such as stress and trauma, which are mostly experienced whenever floods occur. This was supported by a study conducted by Mason, Andrews and Upton (2010), that a range of symptoms as a result of exposure to flood disasters included anxiety, depression and post-traumatic stress disorder. French, Waite, Armstrong, et al. (2019) reported that people's physical and psychological health can be compromised by effects of flooding.

There was a need to thoroughly understand the health impacts of flooding as this will assist public health officials with mitigation strategies for future flooding victims. The main focus during flooding was generally on the tangible or physical effects based on the previous research. Little attention was paid to the psychological consequences (Otto and Weichselgartner, 2017).

3.7 Chapter summary

This chapter provided a comprehensive literature review related to the socioeconomic impacts of flooding. It discussed different types of flooding, causes of floods and looked at the historical flood occurrences and impacts around the world. The study also investigated the impacts of floods on social, economic, environment and psychological lives of people. Literature was reviewed, argued and contrasted to come to conclusions in order to put the objectives of this study into perspective.

CHAPTER 4: RESEARCH METHODOLOGY

4.1 Introduction

This chapter outlines the research design and methodology adopted in this study. The research design and methodology outline the approach that will solve the research problems or questions (Sileyew, 2019). In addition, this chapter outlines the philosophical paradigm, research design, sampling, data collection tool, data collection procedure, data analysis, reliability and validity, limitations and delimitation, ethical considerations, and conclude by summarising the chapter content.

4.1 Philosophical paradigm

Žukauskas, Vveinhardt and Andriukaitienė (2018) define scientific research philosophy as a system of the researcher's plan to obtain research objectives. Furthermore, it outlines the research strategy, problem statement, data collection, processing and analysis employed by the researcher. According to Kaushik and Walsh (2019), a philosophical paradigm is divided into four types, namely, postpositivist, constructivism, transformative and pragmatism. Each of these philosophical paradigms will be briefly explained below before the study reports on the paradigm it has adopted.

4.1.1 Postpositivist research philosophy

This philosophy advocates for the utilisation of quantitative research methods to ensure that the researcher can generalise what could be expected in other areas apart from the study area (Kivunja and Kuyini, 2017). This philosophy will not work in this study as already it is set out for the mixed method approach. Meanwhile Žukauskas et al. (2018) emphasise that this philosophy argues that the researcher is an objective specialist who eliminates personal views and works independently to achieve the research objectives. Disaster management is not a specialised field, it is multisectoral. This approach will not work in this study because it (the approach) needs objective specialists which the research is not.

4.1.2 Constructivism research philosophy

Kaushik and Walsh (2019) report that this philosophy is linked with the qualitative research methods, and informal writing in a way that the researcher solely relies on the opinion of participants to draw subjective conclusions of findings. Furthermore, this philosophy is designed bottom up even though the study is designed bottom up by virtue of the data collection methods whereby opinions and perceptions of the community (bottom) will be collected and analysed. This philosophy will not be adopted by this study

because of its limiting factor to qualitative research only as the study is already set to adopt a mixed method research approach.

4.1.3 Transformative research philosophy

This research philosophy provides a framework for dealing with injustice and inequality in any society with the application of culturally competent (Mertens, 2007). Furthermore, Antunes (2009) argues that this approach is appropriate for integrating action and reflection and connecting management consulting and research. This study is limited in most of what this philosophy needs. Therefore, the study did not adopt this philosophy. Instead, this study will recommend similar studies focusing on the socioeconomic impacts of floods to look at integrating action and reflection and connecting management consulting.

4.1.4 Pragmatism research philosophy

According to Žukauskas et al. (2018), this philosophy addresses the facts, that the researcher has the freedom of choice as this philosophy is flexible. This philosophy recommends the research to choose methods, techniques and procedures most suitable for research aims (Žukauskas et al., 2018). Moreover, this research philosophy is associated with mixed methods in research. Taking the above definitions of different paradigms into considerations, the pragmatist research philosophy is the one most suited for this study as it allows the researcher to select suitable methods, techniques and procedures that are deemed to address the research objectives and research questions. According to Morgan (2014), pragmatism dislocates the notions of older approaches based on the philosophy of knowledge. This philosophy provides a new direction for knowledge in the social research environment. This is what the study was set out to do.

4.2 Research methodology

The research design and methodology outline the approach that will solve the research problems or questions (Sileyew, 2019). Most studies that showed interest in mixed method research utilise the case study method (Ebneyamini and Moghadam, 2018). A case study is an intensive study of a specific individual or specific context (Harrison et al., 2017). Furthermore, a case study has also been used across several disciplines to address a wide range of research questions (Harrison et al., 2017). Moreover, Harrison et al. (2017) state that case study research has grown in reputation as an effective methodology to investigate and understand complex issues in real world settings. Therefore, by virtue of this study adopting a mixed method research, this study also adopted case study research by quantifying the socio-economic impacts of floods as a case of Kudube informal settlement in

the CoT. Even though a mixed method approach was adopted in this study, the two approaches that make up this mixed method approach are described below.

4.3 Research approach

Research approaches are plans and procedures that a researcher set out for their research methodology on how data will be collected, analysed and interpreted (Sutton and Austin, 2015). There are three types of research approaches, namely, qualitative, quantitative and mixed methods (Parylo, 2012).

4.3.1 Qualitative research

According to Kabir (2016), qualitative data are non-quantifiable and usually descriptive in nature. In other words, the qualitative research method explores the social phenomenon under investigation by gathering feelings, perceptions and experiences of participants. The aim of this method is to determine “how” and “why” by using unstructured data collection methods. Even though this study will also use a questionnaire as another data collection tool, the study notes and acknowledges the disadvantages of using questionnaires because participants are likely to give wrong information due to feelings of embarrassment, lack of knowledge on the topic, or confusion (Oatey, 1999). However, the main objective of this study which includes to quantify the socio-economic impacts of floods can be collected through a questionnaire in a social study. Experiments that are mainly used in the hard science field to quantify variables do not work well with human sciences, especially now with the COVID-19 as people had to keep our distance from each other.

4.3.2 Quantitative research

Quantitative methods focus mainly on numeric data and require mathematical calculation to make an informed conclusion (Daniel, 2016). This method addresses the “what” of the programme. The advantage of using this method is that it is cheaper to implement (Kabir, 2016). Quantitative data collection methods generally make use of random sampling and structured data collection instruments which this study adopted. By contrast, qualitative research is based on the collection of verbal data; it is often presented in the form of narrative accounts of what people say and or do, while quantitative research is based on the collection and statistical analysis of numerical data. Quantitative research findings are often presented in the form of tables, charts and graphs (Angrosino, 2012). This is what the study will present in the following chapter and the perceptions of respondents, collected through the open-ended questions in the structured questionnaire used to collect data for this study to cater for the qualitative approach part of this study.

4.3.3 Mixed method

According to Johnson et al. (2007), mixed research method is recognised as the third major research approach that encompasses both quantitative and qualitative methods. Though mixed methods research is not new, there are many researchers in response to current quantitative research and qualitative research (Timans, Wouters and Heilbron, 2019). Mixed method research is a mixture of ideas from both quantitative and qualitative research (Schoonenboom and Johnson (2017).

The qualitative research case study methodology allows researchers to conduct an in-depth investigation of intricate phenomena within a specific context (Rashid et al., 2019). On the other hand, the quantitative research method enables the researcher to gain deep insights into the numerical data trends.

From the explanations provided above, a mixed research method, supported by the pragmatic philosophical approach, was found to be more appropriate in this study. In other words, the researcher utilised both quantitative and qualitative research methods in a single or same investigation. Furthermore, Johnson et al. (2007) assert that proponents of the mixed method approach argue that qualitative and quantitative viewpoints and methods addressed their research questions.

This study focused on the Kudube informal settlement only. For this reason, a case study research design was found to be more appropriate in order to investigate and understand complex issues and application of recent knowledge and skills within a specific context (Harrison et al., 2017).

4.4 Sampling/population selection

4.4.1 Population

Garg (2016) defines population as a group of people from which a sample is taken for measurement. The population in this study was the community members of Kudube informal settlement. According to StatSA (2011), the total population of Kudube informal settlement is 10 725 people, of which 5 041 are males and 5 684 are females. Therefore, the study sample was selected from this population. According to Taherdoost (2016), sampling is a technique that can be utilised to select a representative part of the population in order to determine characteristics of the entire population. Francis et al. (2010) justified sample size as conducting interviews until data saturation is achieved, that is for qualitative research. Furthermore, Teddlie and Yu (2007) discuss different sampling procedures that are used in social and behavioural sciences. The probability

sampling technique is primarily used in quantitative research and involves the selection of several units from either specific sub-groups or population.

4.4.2 Sample selection and size

There are two sampling techniques, namely, probability and non-probability sampling. These are discussed in detail below.

4.4.2.1 Probability sampling

This selection was done in a random manner where the probability of including every member of the selected population is determinable. The purpose of probability sampling is to select a representative sample of the selected population. There are different types of probability sampling, namely, simple random sample, stratified random sampling, cluster sample and systematic sample (Sharma, 2017).

Simple Random Sample: this technique affords every population member an equal opportunity of being selected. Acharya, Prakash, Saxena et al. (2013) report that this technique is costly, requires a sampling frame and is less precise compared to stratified samples of the same size.

Stratified Random Sample: in this method, the population is divided into sub-groups, such as male and female, and within these sub-groups, a simple random sample is performed. This enables a random sample that is representative of a larger population. Furthermore, Acharya et al. (2013) argue that this technique requires exact information proportions of each sub-groups and is expensive to prepare.

Cluster Sample: this technique is a two-step process whereby population is divided into groups/clusters. This sampling can be used in large national surveys as it requires a larger sample size. Acharya et al. (2013) emphasise that this sampling technique is useful where the population is widely scattered.

Systematic Sample: This technique utilises fixed interval to choose participants. The first subject selected is probability as subsequent selections are subjects that will have zero probabilities to be selected (Sharma, 2017).

4.4.2.2 Non-probability sampling

Non-probability sampling is a type of sampling that does not choose members of the population randomly. This selection is done non-randomly and is a process whereby the researcher can stop people in the street. Furthermore, non-probability sampling can include a targeted group of participants. This technique is mostly utilised during the

exploratory stage of a research project, and in qualitative research. There are different types of non-probability sampling, namely, convenience sample, snowball sample, quota sample and purposive/judgmental sample.

Convenience Sample: This technique utilises people available to participate in the study. Participants are mostly chosen because of their availability at the right place and time. The disadvantage of this technique is that regardless of it being easy and quick, it will not yield results that can be generalised to the larger population (Sharma, 2017).

Snowball Sample: in this technique, the first participants are selected by probability or non-probability methods. Additional participants are recruited by initial participants (Etikan, Alkassim and Abubakar, 2016). In other words, few participants are chosen and are also asked to recruit potential participants who meet the requirements to be included in the sample.

Quota Sample: This sampling makes sure that particular population groups are represented. Researchers that utilise this sampling technique are unable to determine any sampling error as sampling is not selected using random selection (Sharma, 2017). Furthermore, selected sample groups cannot be generalised as a population representative.

Purposive or Judgmental Sample: This sampling technique is defined as selecting units based on a specific purpose associated with answering research questions (Etika et al., 2016). Purposive sampling is defined as a type of sampling in which “particular settings, persons, or events are deliberately selected for the important information they can provide that cannot be deduced from other techniques” (Teddlie and Yu, 2007).

Therefore, this study adopted the non-probability sampling technique as the researcher cannot collect data from the entire residents of Kudube informal settlement. To be more specific, this study adopted purposive sampling, which is a category of non-probability sampling, to sample the population of Kudube non-randomly. Data was collected from 100 participants.

4.5 Data collection

Kabir (2016) defines data collection as the process of gathering and measuring information in an established systematic manner that will allow one to address the research questions. Furthermore, data is collected to capture quality evidence that seeks to answer every research question (Kabir, 2016). McLaughlin (2016) argues that accurate data collection is important and assists to maintain the integrity of the study and helps to

make informed decisions while promoting quality assurance. Moreover, the collection of data helps in improving the quality of information and assists researchers to make some informed decisions about the study (Schildkamp, 2019).

Therefore, this study used the following tools to collect data, observing all the COVID-19 regulations during data collection that includes social distancing, wearing of masks and frequent sanitising of hands. Data collection methods adopted by this study are briefly discussed below.

4.5.1 Focus group interview

Kairuz, Crump and O'Brien (2007) defined focus group as group discussions that are utilised to identify and explore thoughts regarding a research topic by a selected group of participants. Data is collected through interaction and communication amongst participants. Kairuz et al. (2007) argue that focus group is a useful research tool that can be used within a specific population to get relevant information. Dasgupta, Da Costa, Pillay et al. (2013) and Nyumba, Wilson, Derrick et al. (2018) highlight that this method of data collection allows the researcher to gather preliminary information about the topic. According to Oatey (1999), focus group interviews are cheaper and easier to conduct and the response is more complete and less inhibited.

Focus groups using face-to-face interview was utilised to gather information of this study. The total people in the group was kept at 10 to obey the Covid-19 regulations. Dilshad and Latif (2013) suggested that discussions should be between one to two hours. Like any type of interview, focus group has its disadvantages (Miller, 2020). One person can always undermine the other group members by dominating the conversation (Dasgupta et al., 2013) and other members might be influenced by the answer of an individual (Oatey, 1999). The researcher gave each member an equal opportunity to lessen the disadvantages, and the report on the results was based on the opinions of the majority in the group.

4.5.2 Questionnaires

A questionnaire is a research tool that can be used to gather information from participants (Kazi and Khalid, 2012). Adams and Cox (2008) emphasise that this tool takes into consideration two important concepts such as reliability and validity. Furthermore, Codo (2009) regarded questionnaires as tools that can be used to gather quantifiable information on communities. Due to people's short attention spans, questionnaires should not be long to ensure that they are completed accurately (Adams and Cox, 2008). They must be short and simple to increase the possibility of participants answering accurately

with understanding (Adams and Cox, 2008). The questionnaire developed for this study was kept short with few open-ended questions, but mostly it consisted of closed-ended questions that required yes and no answers and those with categories. The questionnaire was used as the main data collection tool of the study, and is attached as Appendix A.

4.5.3 Observation

Direct observation in research is regarded as one of the most important research methods of collecting data in social science fields even though it is one of the most complex (Ciesielska, Boström, and Öhlander, 2018). Jamshed (2014) associates observation with the qualitative research method that includes participants' observation and cover research field work. Ciesielska et al. (2018) reported that observation consists of various techniques and approaches that can be combined in a variety of ways. Direct observation can be either for participants or their surroundings such as type of material used in the household. This method was applied in this study to collect information on mitigation measures, exposures and vulnerabilities of respondents to the flood hazard by the researcher (See Photographs in the next Chapter).

4.6 Data analysis

According to Sargeant (2012), the purpose of data analysis includes interpretation of data, resulting themes and understanding what is being studied. There are various qualitative data analysis techniques. The same research questions can be analysed in multiple ways (Onwuegbuzie and Leech, 2006). Data analysis requires the study to be comfortable with developing categories and making comparisons and contrasts (Onwuegbuzie and Leech, 2006). The researcher used descriptive statistics and chi squared test of independence to gauge the relationship between responses. The chi squared test caters for the quantitative approach of the mixed method applied in this study. For chi squared test, the statistical significance was set at $p < 0.05$. Thematic analysis, which was used to analyse qualitative data, was also employed by this study for open-ended questions. Data for this study was analysed using the Statistical Package for the Social Sciences ((SPSS) software, and Microsoft Excel was used to draw tables.

4.6.1 SPSS software

The SPSS software, which can be described as a multipurpose package, makes provision for various types of data analyses, transformations, and forms of results (Arkkelin, 2014). The SPSS programme was used to analyse the quantitative data of this study. (Alvarez, 2003).

4.6.2 Thematic method

Maguire and Dundalk (2017) describe thematic analysis as a process that can identify patterns or themes within qualitative data. The identified themes or patterns can address the research concerns. Descriptive statistics was also used to describe the demographics of the community, and inferential statistics was used to find correlations between demographic variables and other variables in the questionnaires. Frequency tables, central tendency (mean, mode and median) and correlation coefficients were reported in my results.

The thematic instrument was used as a data analysis method for the qualitative data. In this method, the data was analysed and themes that were generated explained the phenomenon under investigation.

4.7 Reliability and validity

Reliability is regarded as the extent to which results are consistent over time and have accurate presentation of total population under study (Golafshani, 2003). Lueng (2015) reported that data validity determines whether research questions are valid for the desired outcomes. Therefore, data collection tools selected for this study were used as a measure to test the validity and reliability of data collected. Golafshani (2003) argues that validity determines whether the research truly measures what it is intended to measure or how truthful the outcome of research is.

4.8 Limitations and delimitations

Goes and Simon (2018) argue that every study has limitations that are beyond the researcher's control. In light of this argument, the language barrier might be the main limitation of this study because settlements are characterised by people from different backgrounds and ethnic groups, including foreign nationals (StatSA, 2011). To address this limitation, the researcher sought an appropriate translator who spoke all the native languages of the study area to fast-track the data collection process.

The current COVID-19 pandemic was another limitation to this study in the sense that potential participants were reluctant to talk to a stranger because of regulations and restrictions such as social distancing. However, the researcher assured the potential respondents that the study would adhere to the Disaster Management regulations for alert level 3. Proper arrangements were made with the identified participants to adhere to the regulations as stipulated in the National Disaster Management Website. Some

respondents asked the researcher to collect the questionnaire the following day as they wanted to be part of the study but were sceptical about the COVID-19 pandemic.

Delimitations are boundaries of the research set by the researcher (Simon, 2011). Although delimitation sets boundaries to ensure that both study aims and objectives are achievable, Theofanidis and Fountouki (2019) argue that delimitations are mainly concerned with the study's theoretical background, objectives, research questions and sample. This study was conducted within the context of the socio-economic impacts of flooding and was limited to the Kudube Unit 9 informal settlement known as Portion 9 of the CoT. Therefore, it must be noted that Kudube unit 3 and unit 8 will be excluded from this study.

4.9 Ethical considerations

Mouton (2006) emphasises that ethical considerations should not be ignored while conducting interviews. The researcher avoided plagiarism and ensured that all sources used are referenced in text and are listed in a list of references at the end of each chapter (Scazufca, Almeida, Vallada, Tasse and Menezes, 2008). In addition, the study sought ethical clearance from the Research Development Department of the University of the Free State before data collection (Protocol number (UFS-HSD2020/1736/2311) Attached as Appendix B in this study).

4.9.1 Permission from the university of FS ethical committee

The University of the Free State (UFS) ethical policy for research was adhered to throughout the study. Permission to collect data was granted by the UFS ethical committee.

4.9.2 Informed consent

Kadam (2017) argues that informed consent affords participants relevant information and allow them to make an informed decision regarding their participation in data collection. Informed consent is regarded as the ethic's cornerstone in research (Kadam, 2017). The researcher informed participants about their rights in taking part in the study, that their participation is voluntary, that they will not be offered any reward, and that they have the right to stop participating if they are not comfortable. Participants signed consent forms before participating in the study as per the UFS ethics guidelines (Scazufca et al., 2008) (See Information Sheet and Consent form attached as Appendix C).

4.9.3 Anonymity

Participants were assured of anonymity. The researcher will not share information from participants with a third party. Participants were informed that their answers will be used

for academic purposes only by the Researcher and the University (Mouton, 2006). To ensure anonymity, numbers were used instead of names during data analysis

4.9.4 Confidentiality

According to Allen (2017), confidentiality refers to the separation of personal information provided by participants. The collected data was password-protected for access control and the questionnaires are kept in a locked cupboard.

4.10 Chapter summary

This chapter discussed three types of research approaches, namely, quantitative, qualitative and mixed method research approaches. Furthermore, it explained four types of research paradigms, population, sampling, data gathering instruments, limitations and delimitations, ethical aspects, reliability and validity. This study adopted a mixed research approach, which encompasses both quantitative and qualitative research approaches. The qualitative approach was used to gain more understanding of perceptions, views and experiences of participants regarding socio-economic impacts of floods at Kudube informal settlement. On the other hand, the quantitative research approach was used in order to understand responses of participants in the form of numeric data. The research used questionnaires, focus group interviews and observations as primary data gathering collection of the study, but a semi-structured questionnaire was the main data collection tool of this study. Questionnaires were completed by participants and were used to generate tables and charts. This information was useful to quantify the socio-economic impacts of floods.

CHAPTER 5: DATA ANALYSIS AND PRESENTATION OF RESULTS

5.1 Introduction

This chapter provides an analysis of the collected data and presents the results. The analysis consists of data obtained from face-to-face interviews using semi-structured questionnaires, key focus group discussions and observations. This chapter also covers the socio-demographic profile, flood risk, socio-economic impacts of floods, and flood disaster management information in the Kudube informal settlement in the CoT.

The researcher distributed 100 questionnaires and received all questionnaires back. Some of the questionnaires were dropped and collected as per participants' request. This study used descriptive statistics to present the demographic variables of respondents and applied inferential statistics to assess the relationship between these demographics and the flood risk questions using chi-squared test of independence. The questions related to the socio-economic impacts of floods and the flood disaster of this study were also analysed descriptively using excel tables and graphs.

5.2 Demographic and socio-economic characteristics profile of the respondents

This section of the chapter outlines the demographic and socio-economic characteristics of respondents. In this study, female respondents accounted for 64% whereas male respondents for 36%. This could be attributed to the fact that more males are likely to be more employable in the area than their female counterparts as the questionnaires were administered in the mornings during business hours. Studies conducted by Hamidazada, Cruz and Yokomatsu (2019) show that women are the most vulnerable groups to flood disaster or any other disasters as they are always at home taking care of the households and the children (Hamidazada et al., 2019). This viewpoint is substantiated by Azad, Hossain and Nasreen (2013), who embolden that the most vulnerable to disasters are the poor and disadvantaged women. This is an indication that women have more social and family responsibilities than their male counterparts, which makes them more vulnerable to disasters. Neumayer and Plümper (2007) report that natural disasters kill more women as compared to men on average, which is directly linked to their vulnerable status. This is also reported in the Sphere project and its standards (Sphere project, 2011).

The most spoken language in Kudube informal settlement was Setswana by 36% of the respondents, followed by Sepedi 25%, Xitsonga 16%, Sesotho 6%, Tshivenda 5%, and

IsiZulu and IsiXhosa speakers made up 4% of the respondents apiece, and IsiNdebele 3%. Only 1% of the respondents was English-speaking and there were no Afrikaans and sign language representatives amongst the respondents.

Most respondents reported to be single (n=56), followed by married (n=37), widowed (n=5) and divorced (n=2). A study conducted by Cvetković (2017) uncovers that married people are normally less vulnerable to floods because of some financial securities.

The age of the respondents ranged from 18-33 followed by 42-49 years old; 50-57 years, 58 to 65 and above 65 years. However, young people between the age group of 18-33 comprised the majority of respondents (n=27). These results were not surprising because in South Africa, most young people are unemployed, and since the questionnaire was administered in the morning, this could explain the highest number of youth respondents in this study. This assertion is supported by StatsSA (2021), which explains that the unemployment rate of youth aged between 15-24 years stands at 63.2%, while those between the ages of 25 -34 years have an unemployment rate of 41.2%. Furthermore, StatsSA (2021) reports that black Africans have the most unemployment rate (36.5%) as compared to other population groups of the same age groups, followed by the age range between 42-49 (n=22); 50-57 years (n=20); 58-65 (n=17); above 65 (n=7) and 34-41 (n=6).

Of all the 100 questionnaires administered, 98 responded to the question of the level of education. Nevertheless, 44% of respondents, which is the highest percentage, reported that their level of education was secondary level. This was followed by 29% of respondents who indicated that they had no schooling, and 13% who reported that they had tertiary education, whereas 9% indicated that they had primary education and 3% reported to have Adult Basic Education and Training education (ABET). This implies that most of the respondents (57%) had some form of educational qualifications and could, therefore, read and write. According to Torani et al. (2019), education is important as it provides individuals with knowledge to minimise their level of vulnerability to disasters. NDMC (2005) encourages risk avoidance culture through the promotion of education and training. Literacy skills in most groups limit the community or individual with the ability to understand and make use of information that could save their lives (Brown, Haun and Peterson, 2014).

When respondents were asked about the number of dependants that they had, only a few (n=5) responded to not having any dependants, but the majority of respondents reported to be having dependants between 1-6 (n=82), followed by respondents who had 7-9 (n=9) and those who had above 9 (n=4) dependents.

Unemployed rate was reported at 70%, and out of this percentage, 32% of the respondents, which is an overwhelming majority, depend on social grants for survival, 16% on child support, whereas 11% of the respondents depend on temporary jobs while another 8% depend on other means (modes) of survival, and 3% did not indicate how they survive.

Of the 30% of the respondents that reported to be unemployed, 8% reported that they depend on social grants, 6% reported that they rely on child support, and another 6% did not specify their type of employment. Furthermore, 5% of the respondents reported to rely on temporary employment, and 3% on other modes of survival. 1% of the respondents reported that they rely on remittance and another 1% receive support from neighbours (See Figure 5.1 for comprehensive employment and survival statistics).

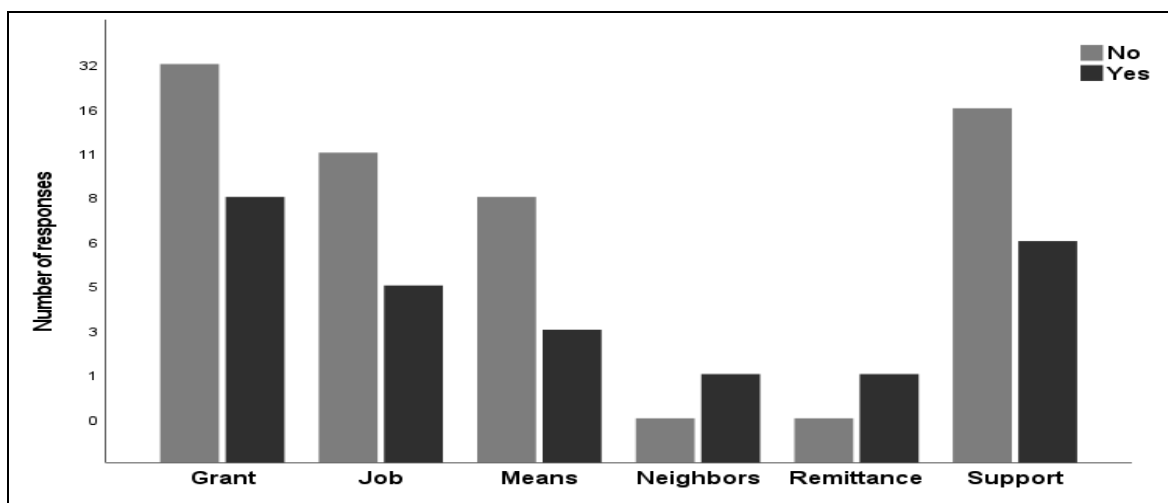


Figure 5.1: Employment status correlated with survival strategies
Source: Field survey (2021)

In terms of the analysis, most of the respondents receive an income below R500.00 (n=32). This was followed by those who receive an income of between R1001-R2000 (n=27). Respondents (n=16) receive an income between R500 – R1000; (n=4) receive an income of between R2001-R3000; (n=4) receive an income of between R3001-R4000 (n=3). The least number of respondents (n=2) receive an income of between R4001-R5000 and above R5000. There was a marginally significant difference ($\chi^2= 12.462$, $df = 6$, $P=0.052$) between respondents' responses to the question about the employment status and their survival mode, implying that there could still be some kind of real effect between the responses.

Table 5.1: Chi-Square tests output on the question regarding employment and how the respondents survive if they are not employed

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	12.462 ^a	6	.052
Likelihood Ratio	12.136	6	.059
N of Valid Cases	100		

Source: SPSS output by author

5.3 Flood risk

Respondents were asked about their personal flooding experience in their households or community. All respondents replied to this question (n=100). There were significant differences between the yes and no responses ($\chi^2 = 100.00$, df=3, $P < 0.001$).

The table shows a highly significant value.

Table 5.2: Chi-Square tests output on the question regarding the flooding experience in the respondent's community or household

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	100.000 ^a	3	<.001
Likelihood Ratio	128.207	3	<.001
N of Valid Cases	100		

Source: SPSS output by author

Out of the 100 respondents, most of the participants who responded to the question of experiencing flooding and the flood frequency in their households or community were those that experienced flooding every time it rains, which comprises 67% of the respondents. However, 32% of the respondents stated that they do not experience any flooding in the community/households. As a result, they were unable to indicate flood frequencies (Figure 5.2). Minority of the respondents, 1% said that they only experience flooding several times a year (Figure 5.2).

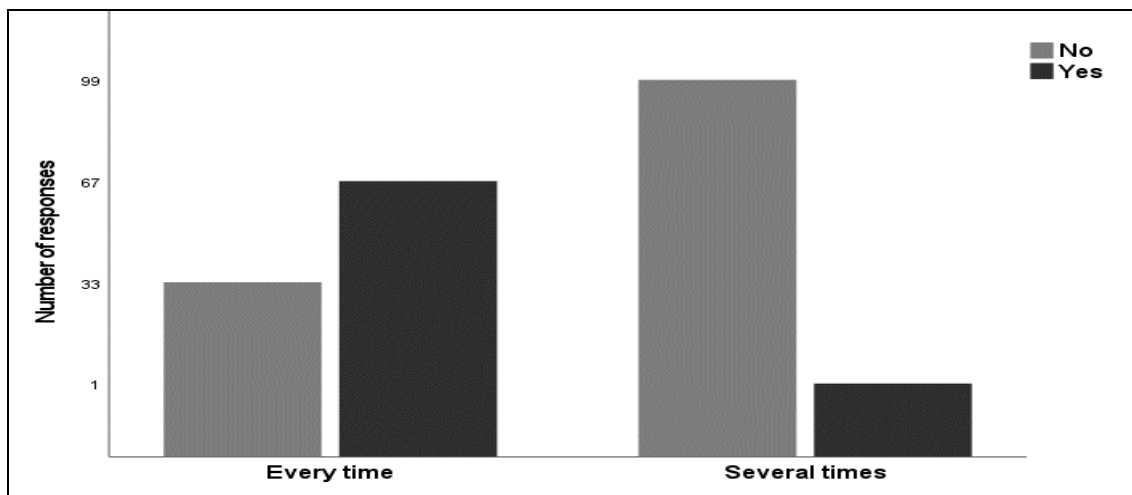


Figure 5.2: Flood frequency reported by respondents in Kudube informal settlement
Source: Field survey (2021)

The majority of respondents, 34% reported that flooding is not a problem in their community/households, and did not specify the flood intensity (figure 5.3). The other group of respondents reported that flooding is a problem in their area 66%. Furthermore, the majority of respondents rated the flooding intensity as being minor 23%, and others reported flooding as a moderate 22%. Some of the respondents stated that flooding intensity in their area is rated as a major problem (21%; Figure 5.3).

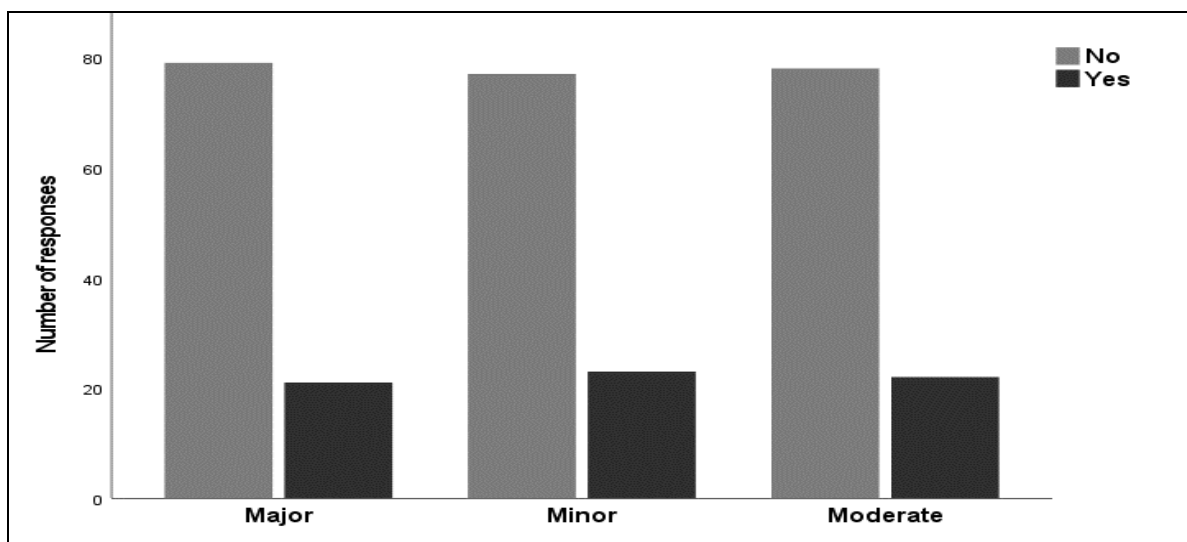


Figure 5.3: Flood intensity reported by respondents in Kudube informal settlement
Source: Field survey (2021)

Most of the respondents, 77%, reported that flooding is caused by heavy rainfall in their community. This is followed by those that reported flooding to be caused by a combination of heavy rains, unavailability of drainage systems, environmental degradation and steep slope,

8%. Few respondents reported flooding to be caused by the unavailability of a drainage system 7%, environmental degradation 5% and steep slope 1%. Two respondents chose not to answer this question (Figure 5.4).

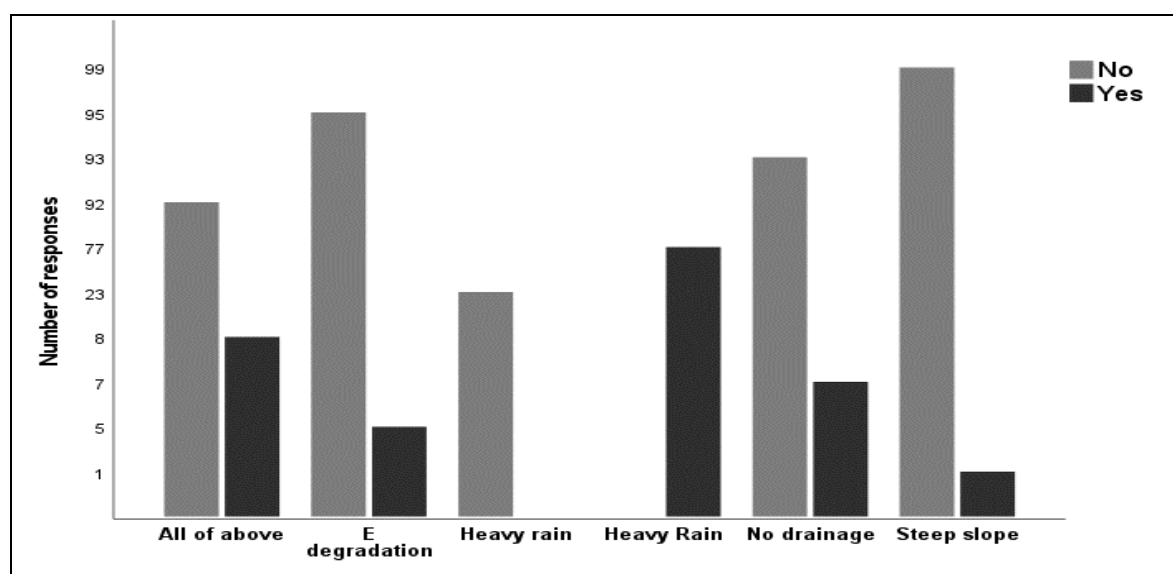


Figure 5.4: Major cause of flooding in Kudube informal settlement

Source: Field survey (2021)

In contrast with the majority of respondents, 51% reported that their homes are at risk of flooding, and 48% that their homes were not at risk of flooding. Furthermore, the majority, 34% of respondents that reported that their houses were at risk of flooding gave the following reasons. 18% reported that their houses are at risk of flooding due to heavy rains, followed by those that reported lack of drainage system, 6% and those that reported that road development in the area went wrong, another 6%. Some of the respondents explained that their houses are at risk of flooding because of the steep slope, 2% and wetland, 2%.

Of the total respondents to the question if there was ever an incident where household was evacuated to a new area due to flooding (n=100), 73% of the respondents, which represents the majority, pointed out that no household was relocated. This was followed by 21% of those that reported that there were incidents that households were temporarily relocated due to flooding. Only 6% of the respondents explained that they do not know of any incidents that lead to households being relocated. Furthermore, most respondents, 35% reported that most of the housing materials in the area are brick houses, followed by reports of mud houses, 20% and shack houses, 20%. 25% of the respondents chose not to answer this question (Figure 5.5).

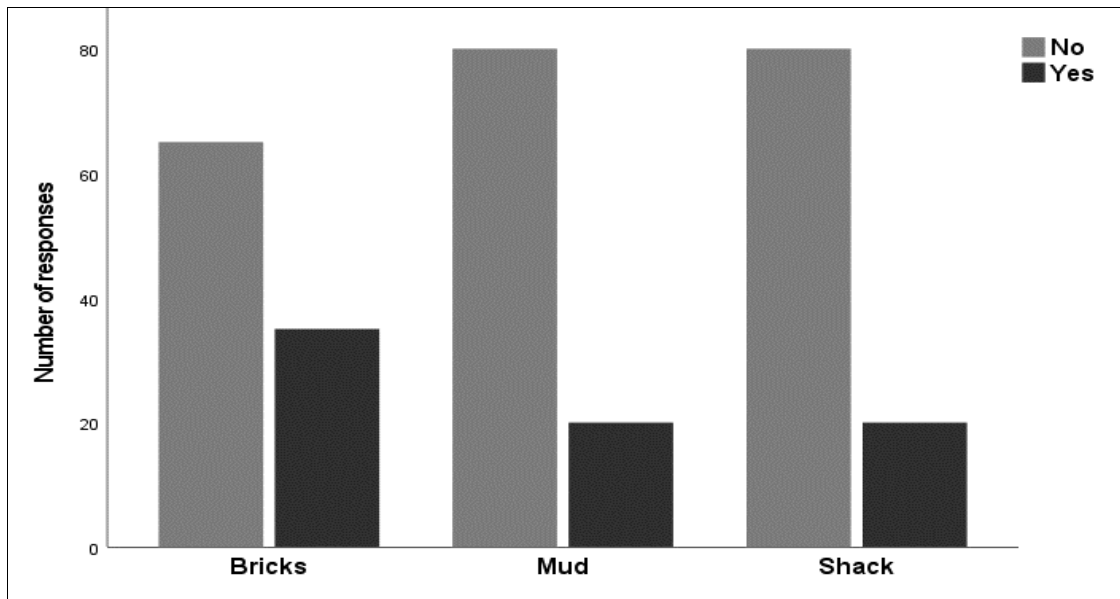


Figure 5.5: Types of housing infrastructure in Kudube informal settlement
Source: Field survey (2021)

Most of the respondents, 38% reported that they can access the health facilities, followed by 31% of those that reported that they cannot access the health facilities during floods, and 31% of the respondents decided not to participate in this question (figure 5.6).

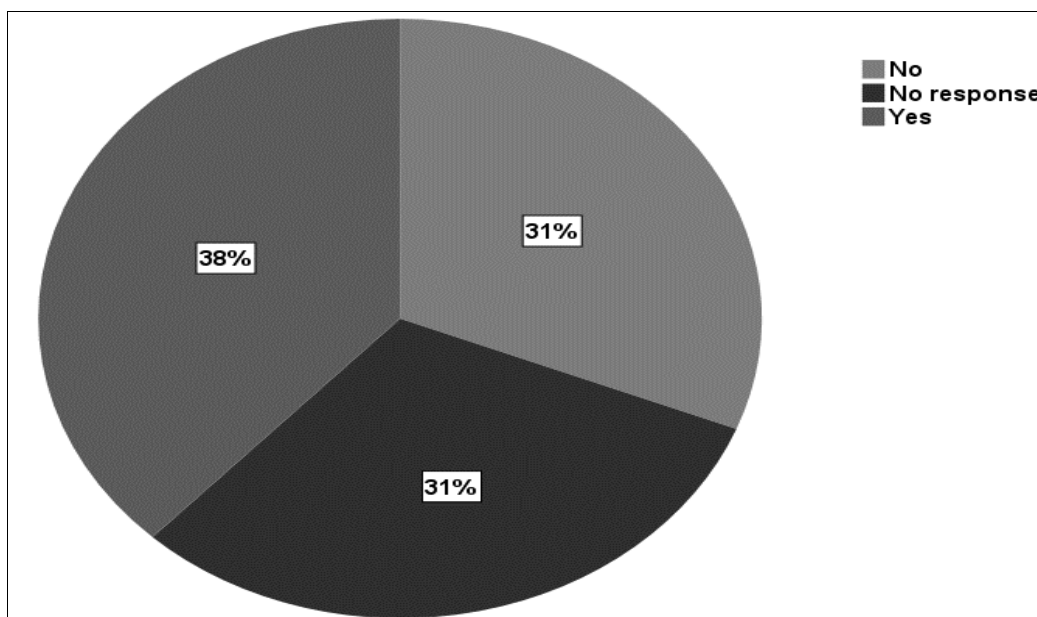


Figure 5.6: Respondents' responses in relation to access to health facilities during flooding at Kudube informal settlement
Source: Field survey (2021)

Most of the respondents (45%) reported that they can access educational facilities in their area during flooding. A concern 30% of respondents did not participate in the question. However, 25% of the respondents indicated that they cannot access educational facilities during flooding in their area.

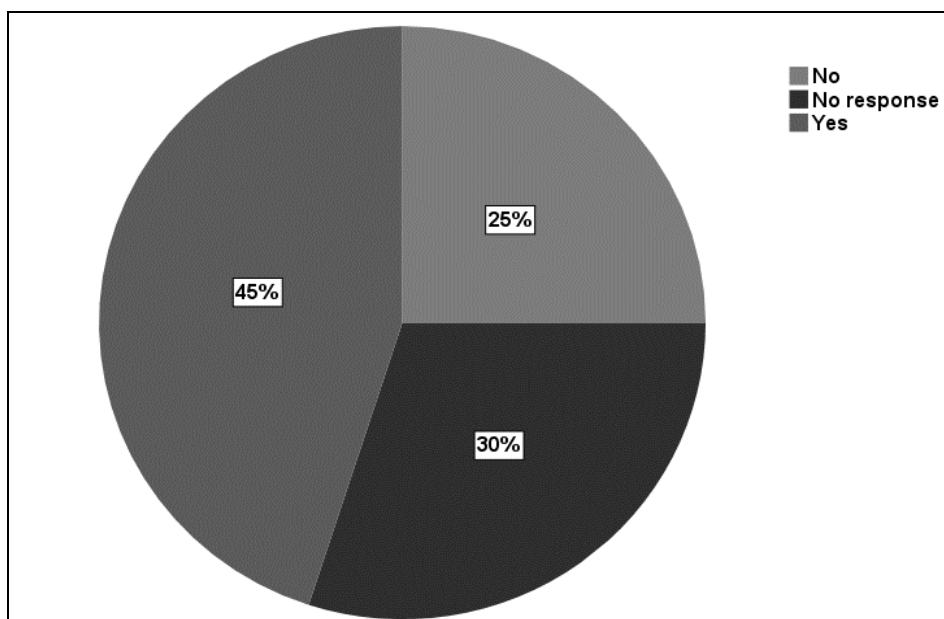


Figure 5.7: Access to educational facilities during flooding
Source: Field survey (2021)

In addition, most of the respondents, 39% reported that they can access places of worship during flooding. This was followed by 32% that reported that they cannot access the place of worship during flooding. The minority, 29% of the respondents did not respond to this question (Figure 5.8).

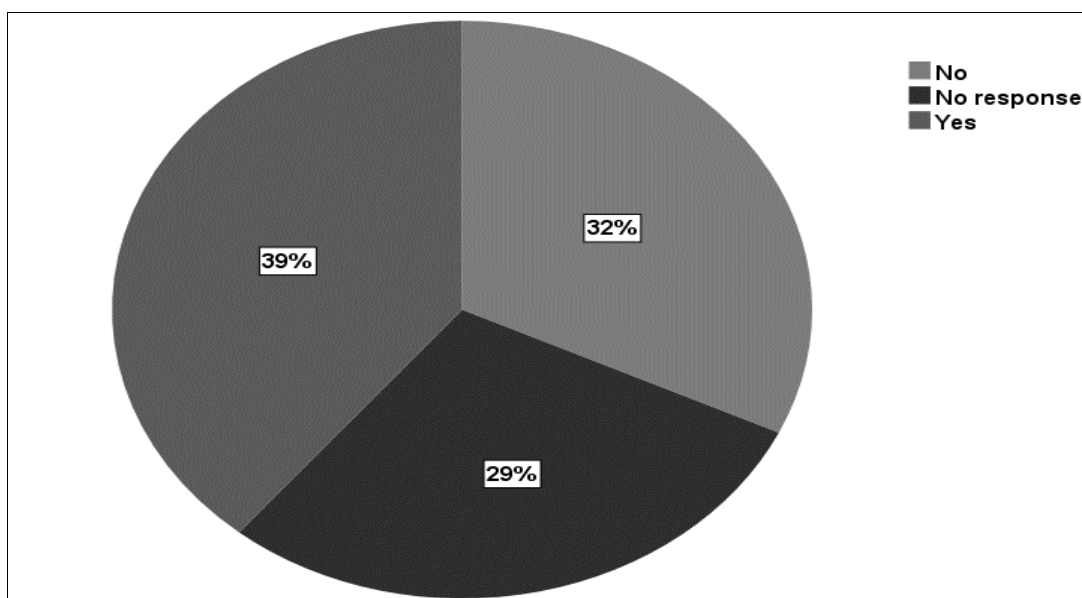


Figure 5.8: Access to their place of worship during flooding
Source: Field survey (2021)

When respondents were asked about the impact of flooding in their households/community, the majority, 30% of respondents chose not to respond to this question. However, most of the respondents, 29% out of those who responded to the questions reported electricity

disconnection as the major impact resulting from flooding in their households. This was followed by 12% of the respondents who reported to not be able to attend school during flooding. Furthermore, some respondents, 10% stated that food shortages are the major impact of flooding and other respondents, 9% reported water shortage/contamination as major impacts of flooding. Loss of life was also reported by 4% of respondents as one of the consequences of flooding. A negligible number of respondents, 2% equally reported severe injuries, disease outbreaks and other reasons (Figure 5.9).

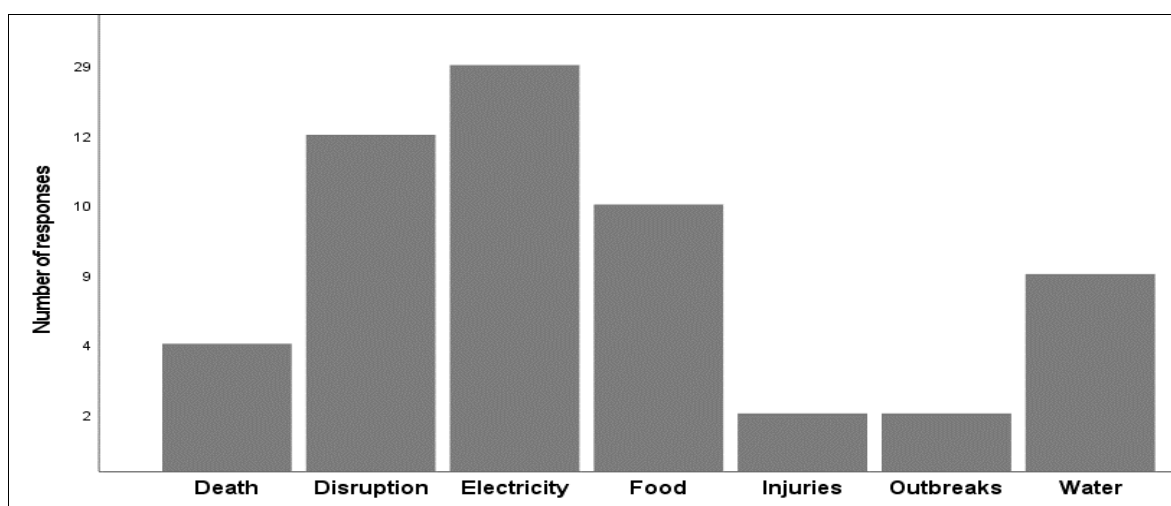


Figure 5.9: Impact household/community experience during and post flood disasters
Source: Field survey (2021)

The respondents were asked if they have repaired any damages caused by flooding in their property and to further indicate the estimated repair value. There were significant differences between the yes and no responses ($\chi^2 = 87.091$, $df = 8$, $P = 0.00$).

The table 5.3. shows a positive significant P-value of ≤ 0.00

Table 5.3: Chi-Square tests output on the question regarding repairs after flooding and estimated cost of repair

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	87.091 ^a	8	.000
Likelihood Ratio	115.720	8	.000
N of Valid Cases	100		

Source: output from SPSS

Most of the respondents, 57% reported that they have not repaired any damages caused by flooding in their households. However, 43% of the respondents reported that they have repaired damages caused by flooding in their households. Furthermore, of the 43%, 15% of the respondents reported that they have fixed the damages with the estimated amount of less than or equal to R1000.00, 13% reported that they have fixed the damages with estimated amount of less than or equal to R2000.00, and 11% reported that they have fixed the damages with estimated amount of above R1000.00. About 4% of the respondents did not specify the estimated amount they repaired the damage as represented by other-none in figure 5.10 below.

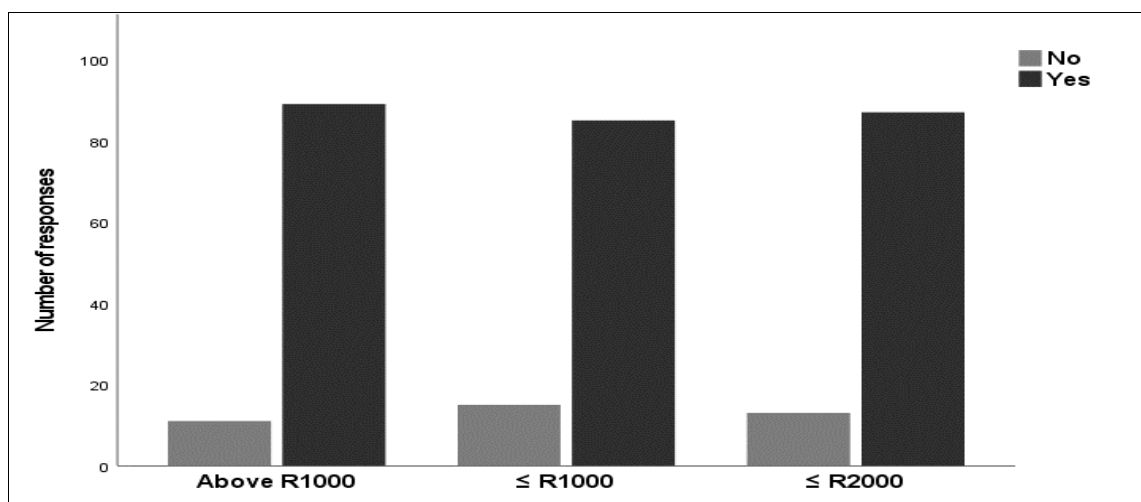


Figure 5.10: Shows the respondents that repaired flood-related damages and their estimated repaired cost and those that have not repaired any damages

Source: Field survey (2021)

Majority of respondents, 38% did not respond to the question of whether they asked municipality to reimburse them with money, they used to repair the flood damages. This was followed by 37% of the respondents that reported that they have not requested the municipality to reimburse them. However, there are those respondents, 25% that reported that they have asked the municipality for reimbursement (Figure 5.11).

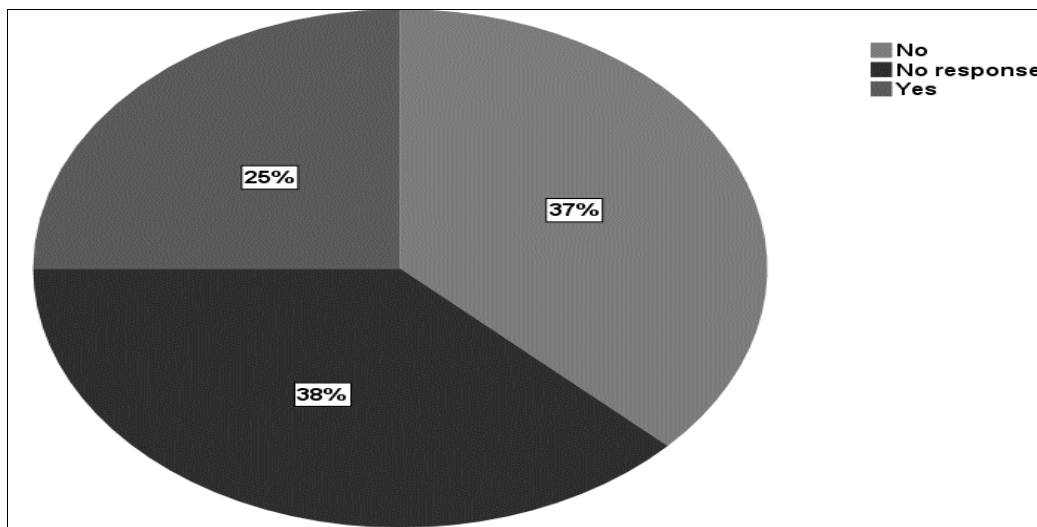


Figure 5.11: Number of respondents that requested the municipality to reimburse the money spent in repairing flood-related damages

Source: Field survey (2021)

Furthermore, most respondents, 73% did not respond to the question of whether they were reimbursed by the municipality for the flood damages. However, 14% of the respondents reported that they were not reimbursed whereas 13% of the respondents reported that they were reimbursed (Figure 5.12).

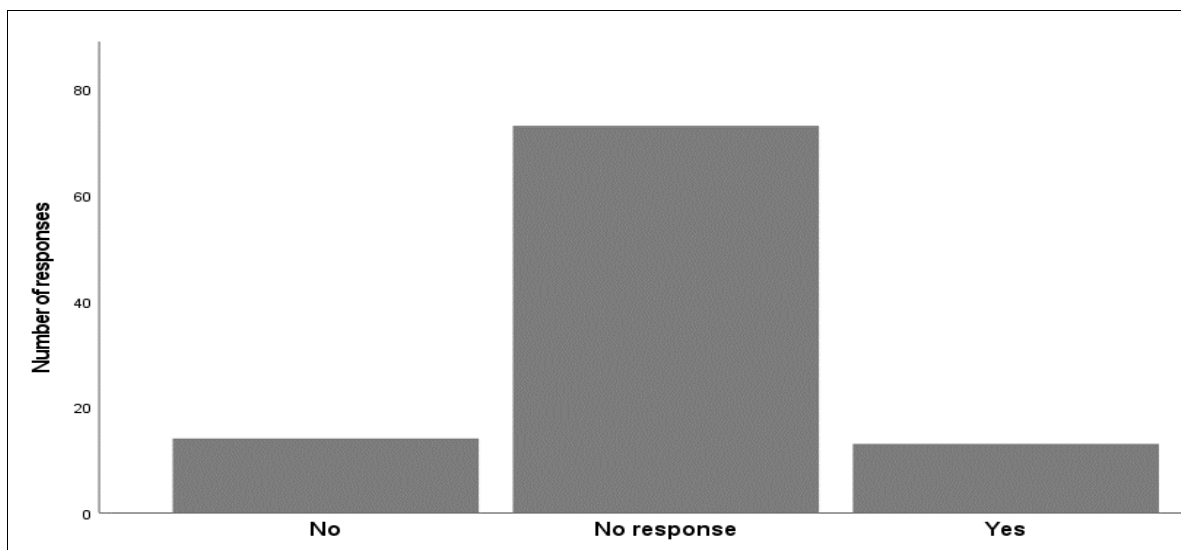


Figure 5.12: Shows the number of the respondents with regards to reimbursement by their municipality for the flood damage cost

Source: Field survey (2021)

The respondents were asked how flooding in the area affected them financially. 48% of the respondents chose not to respond to this question. However, 22% reported that they fixed the flood damages with the money intended for food. Moreover, 16% reported that they fixed

the flooding damages with the money intended for their children's school fees. About 14% reported that they lost money to fixing damaged electrical appliances (Figure 5.13).

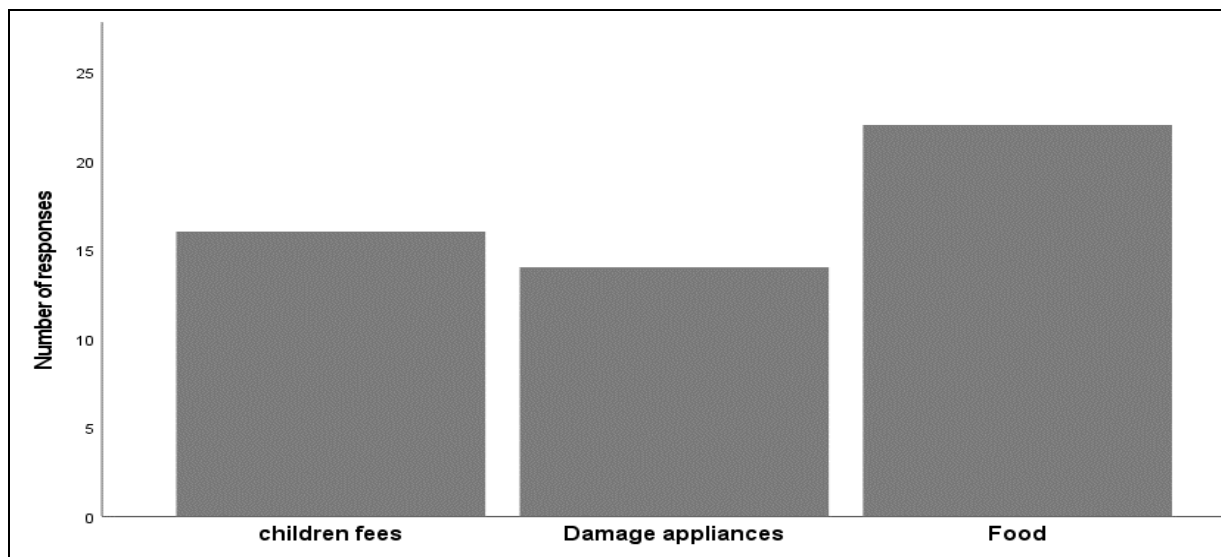


Figure 5.13: Shows how floods affected the community financially
Source: Field survey (2021)

5.4 Flood disaster management

Most of the respondents, 78% reported that they do receive flood early warnings in their area, whereas 22 % reported that they do not receive any flood warning (Figure 5.14).

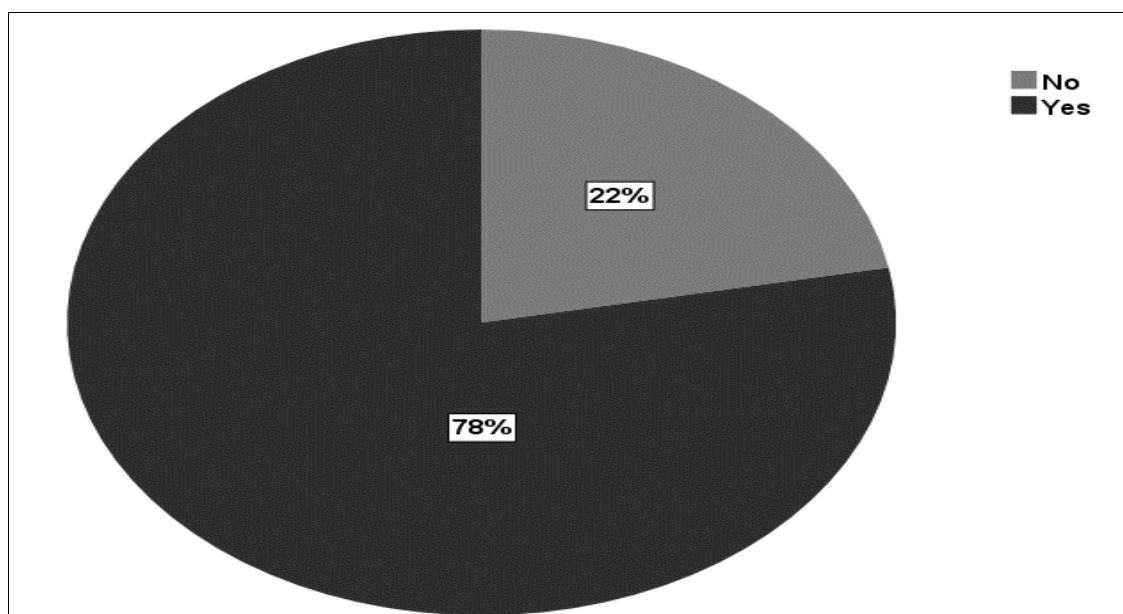


Figure 5.14: Shows the percentage of respondents receiving flood warning system
Source: Field survey (2021)

Most respondents, 32% reported that disabled groups are the most vulnerable in their community during flooding, followed by 28% of respondents who reported children as vulnerable to floodings. In addition, 17% of the respondents indicated that elderly people are more vulnerable than pregnant women reported by 15% of the respondents. A negligible number of respondents, 8% reported that people residing in the flood-prone area are the most vulnerable group in their community (Figure 5.15).

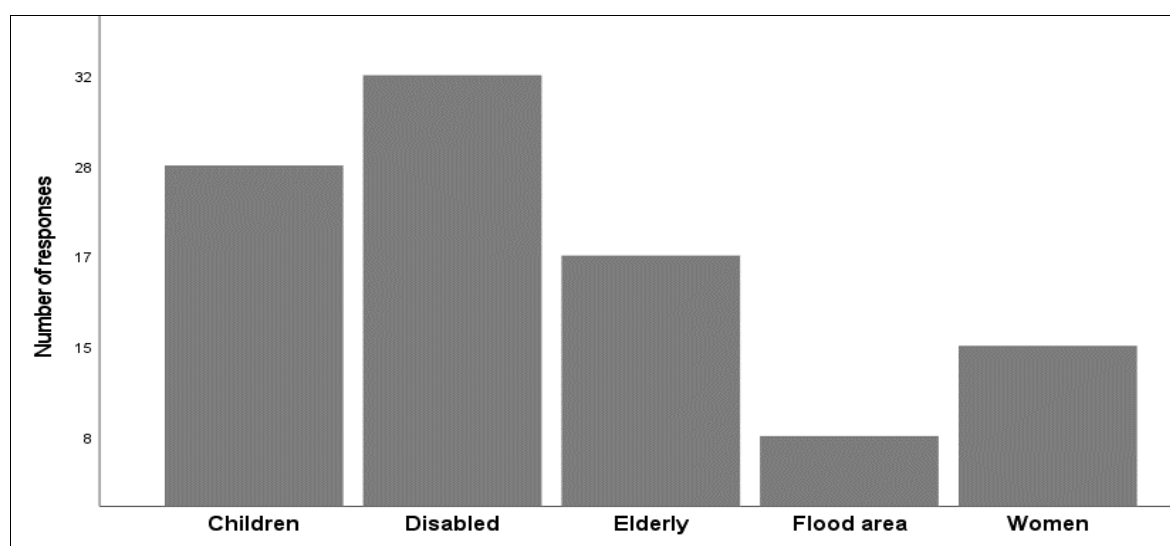


Figure 5.15: Shows the most vulnerable groups at Kudube informal settlement
Source: Field survey (2021)

In terms of gauging the community's preparedness, this study asked respondents their preparedness level should flood disaster occur in their community by asking six relevant questions in a Likert scale format. The responses are as follows:

The majority, 40% of the respondents reported that they plan to collect information about floods. In addition, majority of respondents, 45% reported that they plan to speak to CoT disaster management representative in their area regarding floods. Furthermore, most of the respondents, 57% reported that they plan to prepare a family flood plan. Moreover, the majority, 44% of the respondents reported that they have not taken special training such as first aid/rescue. Most of the respondents, 38% reported that they have not learnt how to swim in case floods forced them to swim their way out of danger. The majority of respondents, 42% reported that they have not signed up with entities that provide emergency news or alert (See Table 5.3).

Table 5.4: Respondents' response to gauge the community's preparedness to floods

Parameters	Do not want to do	Not able to do	Have not done	I plan to do	Total
I have collected the information about floods	7	31	22	40	100
I have spoken to disaster management representative in my area in regard to floods	9	20	26	45	100
I have prepared a family floods plan	1	14	28	57	100
I have taken special training such as first aid/rescue	10	16	44	30	100
I have learned how to swim	16	16	38	30	100
I have signed up with entities that provide emergency news or alert system	3	14	42	41	100

Source: Field survey (2021)

The respondents were asked if they have home content insurance and strategies that they implement to reduce the impacts of flooding. There were significant differences between the yes and no responses ($\chi^2 = 13.360$, $df = 5$, $P = 0.02$).

The table shows a positive significant P-value of $= 0.02$.

Table 5.5: Chi-Square tests output on the question regarding the home content insurance and flood mitigation strategies to flooding in the community

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	13.360 ^a	5	.020
Likelihood Ratio	13.310	5	.021
N of Valid Cases	100		

Source: output from SPSS

The majority, 86%, of the respondents reported that they do not have home content insurance, while 14% reported that they do have the insurance. Of the 86% of respondents without home content insurance, 35% reported that they use sandbags as their flood mitigation strategies. This was followed by 28% of those that use furrows as their mitigation strategies. 8% of respondents reported that they have constructed a protective wall to reduce the flood impacts, and 7% reported that they use tree logs. Another 7% of respondents also reported to utilise a combination of tree logs and sandbags to reduce the

flood impacts. Just 1% of the respondents stated that they have elevated their house foundations to reduce the flood impacts. Furthermore, of the 14% respondents that reported to have home content insurance, 5% reported that they use sandbags as flood reduction strategies in their households. This is followed by 4% that reported that they use tree logs as a flood mitigation strategy and another 4% that reported that they use a combination of sandbags and tree logs to reduce the flood impacts. However, 1% reported to use furrows as their mitigation strategies (figure, 5.16).

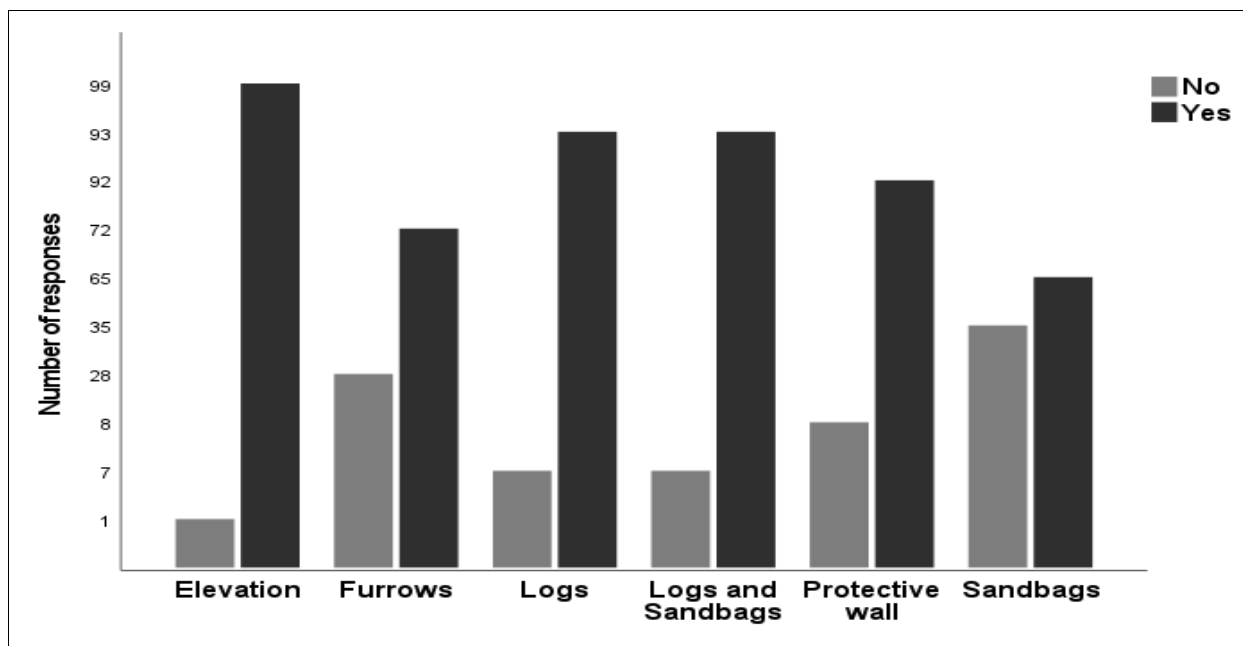


Figure 5.16: Shows households with home content insurance and strategies used by households to reduce the impacts of floods
Source: Field survey (2021)

The majority of respondents, 67% reported that municipal officials do not offer them any assistance during flooding, whereas 30% reported that they do receive assistance from the municipal officials during flooding. A very negligible 3% of the respondents did not respond to this question (figure 5.17).

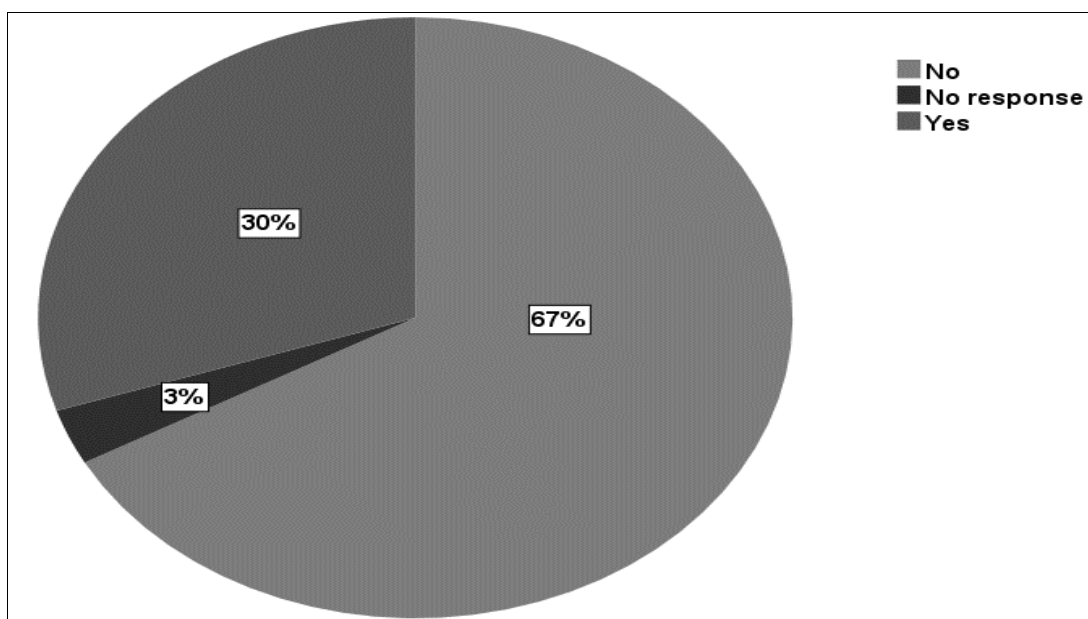


Figure 5.17: Responses regarding receiving assistance from municipal officials
Source: Field survey (2021)

The majority of respondents (70%) reported that they do receive warning during floods or any other severe weather hazards, whereas 30% stated that they do not receive those warnings. However, 95% of respondents reported various ways that they receive the warning when floods or any other severe weather is about to happen, leaving out 5% of those that chose not to answer this question. Even though only 70% reported receiving warning, 95% reported to receive their warnings as per the Table 5.5 below:

Table 5.6: Percentage of respondents that receive early warning for floods and other weather-related hazards

Source of early warning news	% Responses
Television	79
Newspaper	1
Community members/leader	1
Family or friends	4
Cellphones	7
Internet/social media	2
Other, specify	1
Total	95

Source: Field survey (2021)

Majority of respondents, 19% reported that they have received assistance in preparing for floods in their community from the national government. A comprehensive report of where respondents received their assistance in preparing for floods is shown in Table 5.6 below.

Table 5.7: Percentage of respondents that reported where they receive their early warning for floods and other weather-related hazards

Responses	% of responses
National government	19
Non-government organisation or voluntary organisation	6
United Nations agency	2
Voluntary groups	8
Local politician or a party	2
Disaster management officials	16
Other, specify	14
n/a	33
Total	100

Source: Field survey (2021)

Most of the respondents (78%) responded to the question of whether there was any member of their households who would have any challenge to evacuate during floods emergency. 22% of the respondents did not respond to the question, but the highest percentage of respondents, 21% equally reported that people living with disabilities will have a challenge during evacuation, and that none of their family will have a challenge to evacuate. Furthermore, 18% of the respondents reported that elderly people will have a challenge to evacuate during the emergency flooding situation, and 7% of the respondents reported that they will have a challenge to evacuate because of lack of access to personal vehicles. This is followed by 6% of respondents that reported that pregnant women would have a challenge to evacuate during a flooding situation. Limited mobility or wheelchair bound was a concern to 3% of respondents, whereas 2% reported that people who have limited vision/blind would have a challenge in evacuating during a flooding emergency (Figure 5.18).

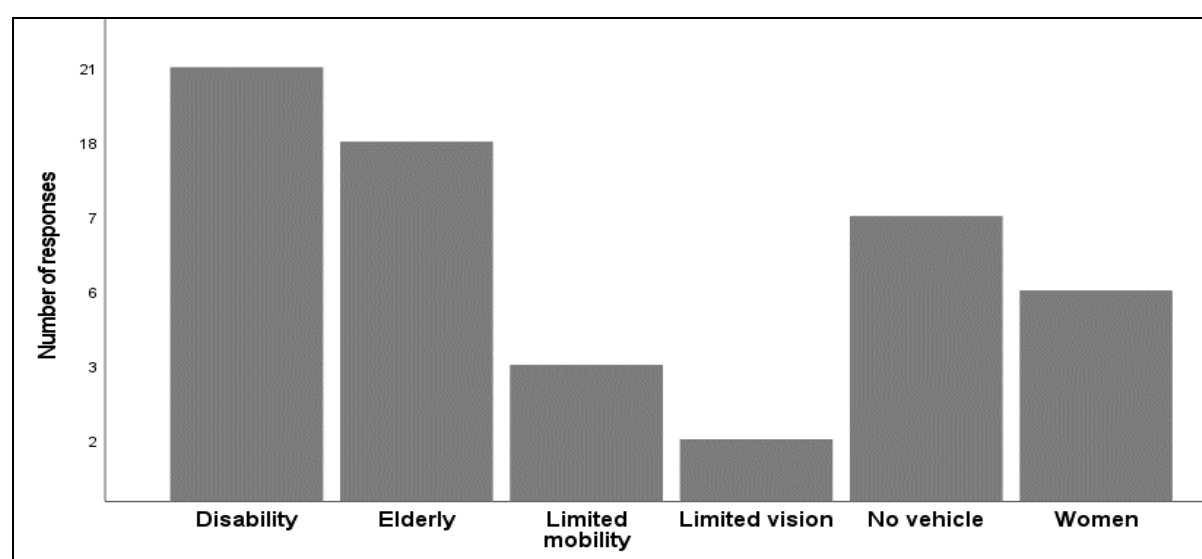


Figure 5.18: Various household members that will have a challenge to evacuate during floods emergency
Source: Field survey (2021)

When respondents were asked who assisted them during flooding, the majority of them, 30% reported that they were assisted by a disaster management team. Other agencies reported to assist the study community during flooding were reported as per table 5.7 below.

Table 5.8: List of various organisations that have assisted the community members during flooding situation

Responses	% of responses
Disaster Management team	30
Ward councilor	8
NGO's	4
Voluntary group	16
Local politician or a party	2
I do not know	26
n/a	14
Total	100

Source: Field survey (2021)

Of the 100 questionnaires distributed, the majority of respondents, 90 % did not participate in the question to explain in short, the kind of assistance they received. Of the 10% that responded to this question, the majority reported that they were assisted with temporary shelter, food and blankets, 6%. This was followed by 4% that reported that they received donations.

Most of the respondents, 70% reported that they were never evacuated during flooding, while the minority, 30% reported that they were evacuated during flooding (see figure 5.19). Furthermore, a follow-up question regarding why the respondents were evacuated was asked. Of the 30% that reported that they were evacuated, 16% reported that their yard was flooded, and they could not leave, and 14% reported that they were evacuated because their houses were flooded.

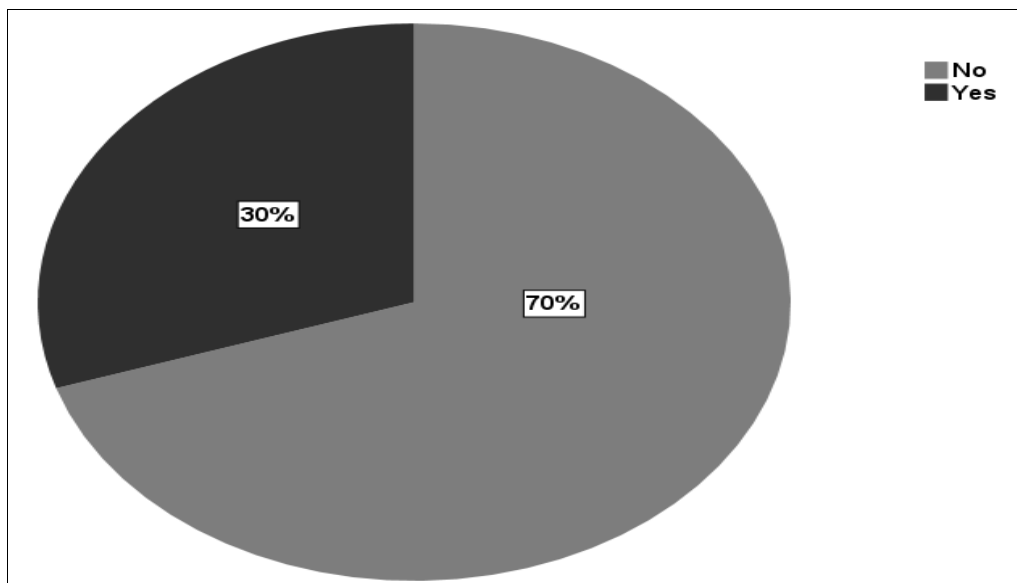


Figure 5.19: Percentage of the respondents that evacuated and did not evacuate during flooding
Source: Field survey (2021)

Most of the respondents, 48% reported that they managed to recover ever since they experienced flooding. This is followed by 21% that reported that they have not recovered from flooding, and 31 % of respondents decided not to respond to this question.

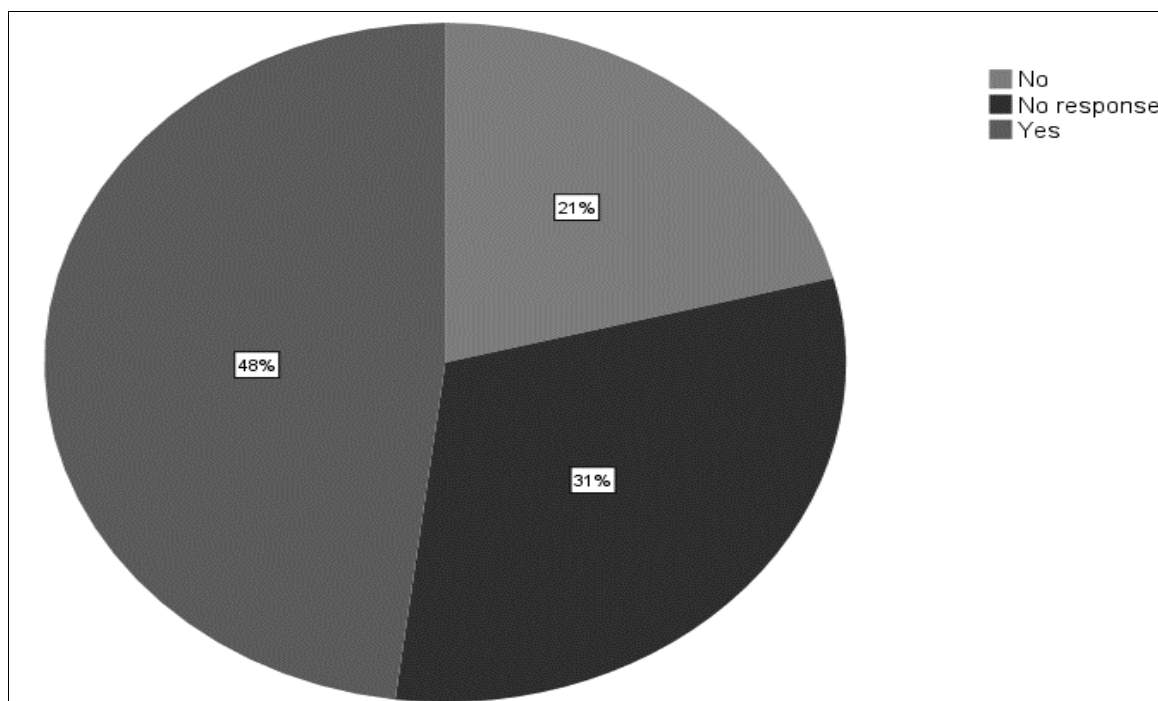


Figure 5.20: Percentage of respondents that recovered and did not recover post-floods experience
Source: Field survey (2021)

5.5 Observations

Ciesielska et al. (2018) explain that direct observation in research is the most important research method for data collection, but the most complex. This study also adopted direct onsite observation to gather information from the study area. According to this data collection method, the researcher observed the natural setting where the research was conducted. Onsite observation mainly focused on the infrastructure and environment at Kudube informal settlement. According to Mazele and Amoah (2021), the observation study in quantitative research involves non-living things such as weather patterns and black holes. This study mostly observed and quantified mitigation strategies employed by the study community to include the quantitative approach of the mixed method design adopted in the study.

This study particularly focused on mitigation measures employed by this community as structural mitigation was more visible in the study area. The researcher noticed the following structural mitigation measures while directly observing the study area:

The figures below show traditional and innovative flood mitigation practices employed by the study community.

The researcher observed that some of the residents used sandbags, furrows and stone lines as their flood mitigations measures. Sandbags are traditional and reliable mitigation measures as the water could not pass through them as shown in figure 5.21 below.



Figure 5.21: Shows sandbag flood mitigation measures implemented at Kudube informal settlement
Source: Researcher

Furrows as another identified mitigation strategy for flood impact reductions are also implemented in the study area by some of the community members to redirect the flooding water out of their yards and to prevent flooding water into their yards as indicated in figure 5.22 below.



Figure 5.22: Shows furrows as floods mitigation measures implemented at Kudube informal settlement
Source: Researcher

The other mitigation strategy used by some of the community members was hand-packed stone line strategies aimed at slowing the flooding in the area as depicted in figure 5.23. These stones form a wall that is effective in preventing flooding.



Figure 5.23: Shows stones used as flood mitigation measures implemented at Kudube informal settlement
Source: Researcher

5.5.1 Affected infrastructure

Some of the road infrastructures in the area are severely affected by flood. They are inaccessible and limit movement until the water subsides. Figure 5.24 indicates an adult female attempting to pass through at the edge of the road. The road below is damaged by floods, making it difficult for people and vehicles to pass through.



Figure 5.24: Shows the inaccessible road at Kudube informal settlement
Source: Researcher

The house types observed in the area include brick and zinc houses as indicated in figure 5.25 below. The researcher spotted some of the houses and protective walls with water marks from previous floodings. This would cause the infrastructure to collapse in a long run as flooding weakens the foundation.



Figure 5.25: Shows some of the housing structures at Kudube informal settlement
Source: Researcher

Some of the community members are residing in close proximity to the dam as shown in figure 5.26 below. These community members are some of the most vulnerable groups in the study area because a dam can pose a serious flood risk. Dam failure can result in the loss of lives, property damage and environmental degradation.



Figure 5.26: Shows overview of Tshwane dam at a close proximity to the community at Kudube informal settlement

Source: Researcher

5.6 Focus group discussion

The focus group consisted of 10 community members with majority of the participants being male. The findings from the group are as follow:

The group members agreed that they experienced flooding in their community whenever it rains. The participants reported that flooding was a major problem in the area, and they explained that the cause of flooding in their community was because of the development that went wrong as major flooding started after the upgrading of N1 north. The flood waters are from upstreaming as there are no adequate catchment systems.

The participants reported that although they experienced flooding that required temporary relocations, in the past, they were not relocated as they were scared of losing their belongings. According to the group, during floodings, the roads are inaccessible, which often results in their children missing school days and some parents being unable to go to work. Furthermore, the group members reported that some of the community members had severe injuries, and water shortages amongst other impacts of floods.

The unemployment rate in the area was reported as a contributing factor for delays in fixing flood damages. Some reported that they have fixed the damages with money meant for food, and others with money meant for clothes. Regarding the early warning system, participants stated that they receive early warnings on radios and television (TV), but most of the time they receive the warnings a day before which, according to them, is not sufficient time for them to plan. The group reported that the most vulnerable groups in their community

were children, pregnant women, the elderly, people living with disabilities and those residing in the flood-prone areas.

The participants stated that they would love to be equipped with flood mitigation information at the household level to ensure that they are well prepared should flooding occur. Some of the participants asserted that they once received flood awareness campaigns from the municipality that taught them about flood mitigation measures. Furthermore, participants reported that they have implemented the following flood mitigation strategies: furrows, sandbags, tree logs, and constructed protective walls to minimise the impacts of flooding in their area. Moreover, they reported that they sometimes receive assistance during/after flooding through the ward councillor, community leaders, and office of the regional head at the local municipal offices.

5.7 Summary of the findings

This study was set out:

5.7.1 To establish the social and economic effects of floods on the community of Kudube informal settlement

This study organised themes to summarise the findings

5.7.1.1 Temporary shelters for families affected by flooding

Most of the people are temporarily relocated from the flooding area to safer places. However, there are still some resistance in some of the areas. Ashraf et al. (2013) explain that during flooding evacuation, some of the belongings and commodities of community members are normally stolen. This finding might imply that a total of 38 respondents that refused to be evacuated irrespective of available resources from the municipality could have been scared of losing their belongings. Only 14 respondents agreed to be evacuated to temporary shelters. This is not surprising that the other 24 could not be evacuated regardless of available resources.

5.7.1.2 Effects of flooding on housing infrastructure

The housing infrastructure in Kudube includes brick houses, mud houses and shacks (made of corrugated iron sheets). Floods have the potential to damage properties (Tandi and Mawere, 2018). This is a concern as majority of respondents reported that they experienced flooding every time it rains in the area. Therefore, the foundations of their housing infrastructure of Kudube community are slowly weakening. In line with this, Njogu (2020) argues that there was evidence of risks to structural damage due to flood exposure to infrastructure. Furthermore, these damages lead to the wearing out of buildings, and the quick aging and weakening of foundations of infrastructure.

5.7.1.3 Economic impacts of flooding at household level

This study found that most of the respondents are unemployed and rely on either temporary jobs or some social grants for survival. It is also noted that most of the respondents reported that they do not have house content insurance. Amarasinghe et al. (2020) advance the view that flooding accounts for 69% of financial damages. Therefore, this study uncovered that flood damages in the area were fixed with either money meant for school fees or money meant for food. Floods contribute negatively to economic loss around the world (Amarasinghe et al., 2020). In line with this, a study by Kawasaki, Kawamura and Zin (2019) reported that poor people suffer the flood's effects thus making them more vulnerable to flood disaster. Furthermore, this study discovered that not all flood victims in Kudube recovered from the flooding disasters financially.

5.7.2 To assess the vulnerabilities of the Kudube community to flood disasters

5.7.2.1 Social, environmental, and economic impact of flooding

Most of the respondents mentioned that flooding in their community is a problem. Furthermore, they reported that they experienced flooding due to heavy rainfall, the unavailability of drainage system, steep slope and environmental degradation. The flood intensity in the study area was rated, minor, moderate, and major accordingly. Moreover, floods caused disruption in some of the respondents. It was reported by some of the respondents that they were not able to access educational facilities, health facilities and some could not access place of worship due to flooding. In line with this finding, Mwape (2009) reported that social impacts of floods disrupt people's lifestyles, community, culture, environment, health, and wellbeing. Walker-Springett et al. (2016) reported that floods carry direct health impacts such as death, injuries, and disease outbreaks. Furthermore, some of the impacts the respondents mentioned are electricity disconnection, children not being able to attend school, shortage of food, water shortage/contamination, loss of life, severe injuries, and disease outbreaks.

According to Tandi and Mawere (2018), floods always resulted in damage to property, loss of life, disruption in community channels, damage to crops and livestock. Bubeck et al. (2017) reported that impacts of floods are not distributed equally across various societal groups. This study found that the most vulnerable group to flooding disasters in Kudube were people living with disabilities, children, elderly, pregnant women, and people residing at the flood-prone area, respectively.

5.7.2.2 Identification of vulnerable groups to flooding

Vulnerability is defined as the degree to which an individual, a household, a community or an area may be adversely affected by a hazardous event or disaster (Proag, 2014). Certain

groups are more vulnerable to flooding than others. This study found that the most vulnerable group to flooding disasters were people living with disabilities, children, the elderly, pregnant women and people residing in flood-prone areas. According to Munyai, Musyoki and Nethengwe (2019), the level of vulnerability is determined by economic factors and the geographical location. Furthermore, the findings of this study discovered that the economic factors of the sampled group made them to be vulnerable to flooding disasters.

Respondents reported that they fixed the flood damages with money meant for children's school fees and money meant for food. They lost money to fix damaged electrical appliances. Some of them reported that they have not recovered from these impacts. Many of the respondents reported that they can access educational and health facilities, and places of worship as compared to those that could not access them during flooding. These findings are not surprising as studies by Munyai et al. (2019) reported that individuals and communities are differently affected and vulnerable to flooding. This is because of their different socio-economic factors. The impacts of flooding experienced by the community of Kudube included electricity disconnection, inability to access educational facilities, food shortages, water shortage/contamination, loss of life, severe injuries and disease outbreaks. In line with this, Walker-Springett et al. (2016) reported that floods carry direct health impacts such as death, injuries and disease outbreaks.

5.7.3 To assess available flood-related coping mechanisms within the community of Kudube informal settlements

5.7.3.1 Early warning system as a preparedness measure for flooding

This study found that most of the respondents receive floods early warning through various platforms such as TV, social media, community leaders, family members, radios, cell phones, and newspapers. Gwimbi (2007) reported that early warning systems are aimed at providing information regarding natural hazards to ensure a better preparedness by those residing in vulnerable areas and to minimise the impacts. However, the finding that TV was the most preferred source of early warning news was not surprising as traditionally, TV has always been relied on as opposed to social media, which is mostly used to circulate fake news.

5.7.3.2 Household insurance

The employment rate in Kudube could be a contributing factor why most of the respondents do not have house content insurance. The respondents reported that they fixed flood damages with their money except few that reported to have insurance.

5.7.4 To ascertain how the communities of Kudube mitigate the impacts of the flood disasters

5.7.4.1 Coping mechanisms

The respondents in Kudube have adapted various strategies that mitigate the impacts of flooding in their households. Sandbags, furrows, protective walls, tree logs, and elevation of house foundations are used as flood control measures in Kudube. A study by Hossain et al. (2013) emphasises the need to implement the flood mitigation measures as flooding cannot be prevented. Some of the respondents were evacuated to a safer area as part of their coping strategies during flooding.

5.7.4.2 Municipal support during flooding

The municipality offers support during flooding, according to most of the respondents. One can conclude that the group of respondents that reported that they do not know if the municipality offers assistance are those that might not have experienced flooding in the area. The other group of respondents that experienced flooding reported that they also received assistance from voluntary groups, ward councillors, NGOs, and local politicians or parties, apart from the municipality. A small group of respondents reported that they have not received any assistance from anyone.

5.8 Chapter summary

This chapter summarised the demographics, flood risks and socio-economic impacts of flooding in the study community by depicting the results narratively and in tables and figure forms. In addition, flood management in the study area was addressed, where mitigation measures employed by the community are shown by photographs in this study. To address flood management, this study also gauged the level of preparedness by the study community by asking Likert scale questions related to flood preparedness.

CHAPTER 6: CONCLUSIONS AND RECOMMENDATIONS

6.1 Introduction

This chapter presents the conclusion of the research findings discussed in the previous chapter. Furthermore, recommendations linked to the conclusions will be made in this chapter. In addition, the chapter will close by recommending future studies on the gaps identified by this study.

6.2 Conclusion

The purpose of the study was to assess the socio-economic impacts of floods on the community of Kudube informal settlement in the CoT. Furthermore, the main objective was divided into sub-objectives to unpack the aim of the study.

The conclusions of this study are based on the data analysis conducted in the previous chapter. The conclusions drawn from the objectives of the study are as follows:

6.2.1 Flood risk

The study sought to establish the social and economic effects of floods on the community of Kudube informal settlement. However, this study had to look at the flood risks before the socio-economic effects of floods were considered. Seven questions related to flood risks were asked. The findings indicated that the majority of respondents experience floods in their households every time it rains. This is in contrast with the photographs and focus group discussions. Heavy rains were reported by most of the respondents as a major cause of floods. The majority of respondents thought that their homes are at risk of floods because of heavy rains and lack of drainage systems.

Most of the respondents experience floods every time it rains. This could imply other risks such as water borne diseases that come with flooding in the community. Indeed, floods have been reported as a problem by the majority of respondents. This means that the flood disaster risk should be taken seriously in this community by the relevant authorities. Stormwater drainage is being reported by a lot of studies, especially in South Africa as a major problem that exacerbates flooding and put communities at risk. Based on the analysis above, this study concludes that the study community is at risk of floods and that flooding in the area negatively affected this community.

6.2.2 Socio-economic impact of floods

This study assessed the socio-economics impacts of flooding in Kudube. It was imperative that socio-economic impacts be investigated extensively. The majority of respondents reported that there was never an incident where households were relocated to a new area

due to flooding in the study area. Most of the respondents reported that housing infrastructure is made of bricks. Though flooding is a problem in the area, most of the respondents reported that they can access educational facilities, health facilities and places of worship. Electricity disconnection was the most impacts experienced by the respondents during and after flooding. The fact is that the poor of the poorest could not recover from the economic impacts of flooding in the area after they repaired flood-related damages with either school fees or money for food. Regarding these findings, people living in poor conditions mostly suffer the aftermath of disasters (Kawasakia et al., 2020). The only possible way for flood victims in this study to recover is through government interventions. The majority of respondents did not ask the municipality to reimburse them money used to fix flood damages. Although a minority requested the municipality to reimburse them, most were not.

These findings imply that the community is socially and economically vulnerable. People living with disabilities are amongst the vulnerable groups, and mostly require assistance during evacuation or temporary relocations. In addition, children in this community were also reported by the focus group as vulnerable. Findings by Lunga, Pathias, van Niekerk et al. (2019) are that disaster risk reduction measures excluded people living with disabilities just as much as it excluded children, which makes these groups more vulnerable to disasters. The geographical location is also a contributing factor in the constant impacts of flooding as the study area is located on a steep terrain (by observation) and receives most of the flooding water from neighbouring communities.

6.2.3 Flood disaster management

This section asked the respondents fifteen questions to evaluate the level of flood disaster management implemented in the study area. The majority of respondents reported that they receive flood early warnings and other severe weather hazard warnings. Most of the respondents reported to receive the information through television. The majority of respondents reported that they do not have household content insurance. Sandbags were reported as the most used mitigation strategies implemented by respondents. The majority of respondents reported that the municipality does not offer any assistance during flooding.

Most of the respondents reported that the national government assisted them to prepare for floods whereas the majority of respondents reported that people living with disabilities will have difficulties to evacuate during floodings. This is supported by a study that argues that people living with disabilities are amongst most of the flood victims worldwide (Ton, Gaillard, Adamson, et al., 2020). Furthermore, the majority of respondents reported that the disaster management team assisted their community during floodings with temporary shelter, food

and blankets. The majority of respondents were not evacuated during floodings. Most of the respondents reported that they recovered from flood impacts.

6.2.4 Preparedness level

The majority of respondents reported that they plan to be prepared in case floods strike their area again. Their preparedness level was evaluated through six questions that also tested the willingness of the respondents to be prepared for flooding. Most of the respondents plan to prepare family flood plans to ensure better preparedness. The respondents also indicated interest in reaching out to disaster management representatives in their area regarding floods. This will assist them to understand the dynamics of flooding and reduce possible flood impacts. Furthermore, the respondents plan to subscribe with entities that provide emergency news or alert systems. The respondents highlighted that they plan to collect flood information. Some of the respondents plan to learn how to swim and to be trained on first aid and or rescue. As the majority of the residents receive early warnings regarding heavy rains, they are in a position to prepare for the flooding. This study concludes that community members can be well prepared once they are equipped with information regarding flooding reduction measures.

6.2.5 Mitigation strategies

The available flood mitigation strategies within the community are noted as photographed in the results section. But this study concludes that the community needs more assistance in mitigating flood risks based on the analysed data. The data revealed that the community does not cope regardless of the available early warning issued on various platforms. The support that they received from the municipality, NGO's, ward councillors or community leaders and the emergency relief is a temporary relief.

This study also concludes that even though some community members have implemented various flood mitigation measures aimed at reducing the impacts of flooding at a household level, there is still the majority of community members that cannot afford these measures. For example, it is illegal to harvest sand in South Africa. This means that community members who cannot afford sand for sandbags will still be vulnerable. Therefore, this study concludes that community-based mitigation measures supported by the government are needed in the study community to reduce the impact of floods. Although these structural mitigation measures might work to some extent, they are clearly not enough as flooding is still reported as a problem in the study area.

6.3 Recommendations of this study

This study made recommendations to the City of Tshwane Disaster Management Centre, City of Tshwane Department of Roads and Stormwater and City of Tshwane Department of Housing and Human Settlements based on the research findings.

6.3.1 Disaster management centre (DMC)

The centre is obliged by the Disaster Management Act 57 of 2002 and the National Disaster Management Framework to develop disaster risk reductions for all hazards prominent in their jurisdictions. Therefore, this study recommends that community members should be trained on flood prevention and mitigation measures to be adequately capacitated. Furthermore, public awareness, education and training on floods should be conducted in the area, preferably on Saturday or Sunday afternoons when people are not at work. This study also recommends that the disaster management centre should develop community based early warning systems that could possibly be issued at least two days before flooding. Furthermore, community members must be encouraged to continue using the mitigation measures which, amongst others, include tree logs, sandbags, furrows, lifting structural foundations and others. Community Based-Disaster Risk Reduction measures should also be looked into by the City of Tshwane. The study concluded that people living with disabilities are the most vulnerable group to flood disaster. Therefore, the DMC is recommended to design disaster management projects that accommodate people living with disabilities.

6.3.2 Department of roads and stormwater

The insufficiency of the drainage system contributes to flash flooding in the area as rainwater runs off uncontrolled through communities/households (Chang, Tan, Lai, Liu and Tung, 2013). This study therefore recommends that the department should conduct a survey in Kudube aimed at installing additional drainage systems to reduce the impacts of flooding. According to Sakijege et al. (2012), lack of stormwater drainage systems or channels in a settlement causes flooding. There is a need for continuous maintenance of all existing drainage systems to ensure that they are not blocked. Flooding problems are aggravated by lack of maintenance in the existing stormwater drainage systems and poor waste management practices (Sakijege, et al., 2012). The temporary solution is that the department could dig furrows in areas without drainage systems to channel out the floods water away from the community. Furthermore, this study recommends the review of the flood management plan of the City of Tshwane.

6.3.3 Department of housing and human settlements

Before a settlement is established, there is a dire need to conduct an environmental impact assessment in the identified land. Flood line must be considered and demarcated appropriately to ensure that the community does not knowingly settle on flood zones. This study recommends that community members that are residing in the flood-prone area, especially those residing at a close proximity to the dam, be permanently relocated.

6.3.4 Tshwane Department of Water and Sanitation

This study recommends that the department of water and sanitation should monitor Tshwane dam, especially during the flooding season. There is a dire need to constantly monitor the water to mitigate the dam from flooding. Dams can mitigate flooding and they can pose a flooding risk (Lempérière, 2017).

6.3.5 Community members

Community members must take matters of disaster management seriously. They must be involved in all community projects and not limited to community participation for Integrated Development Plans (IDPs), Community workshops, training and awareness campaigns, amongst others. Encourage risk avoidance behaviour and minimise flood risks. Avoiding residing in the flood-prone area or just occupying any piece of land without proper risk assessment. Also, since the study found that the majority of respondents do not have home content insurance, this study recommends a saving account or stokvel for the community to tap into in times of flood damages.

6.4 Other recommendations

6.4.1 Ways to minimise people residing in the flood-prone areas

Informal settlements are a result of a community occupying an open space of land without considering any existing risks. As the department of housing and human settlement hold the mandate to formalise the settlements, Environmental Impact Assessment (EIA) and disaster risk assessment must be thoroughly considered to identify existing risks and to develop mitigation strategies.

6.4.2 Effective relief provision for floods victims

Flood victims are often assisted with an emergency social relief, which is a temporary relief. Government should investigate making provision for fixing flood damages over and above the issuing of emergency relief.

6.4.3 Community based early warning system

The municipality must invest in community-based flood early warning system on all the flood hot spots in their jurisdictions to ensure proper preparedness, especially during the flooding season.

6.4.4 Relocation by law

Government should develop a law that will force all residents in a flood hotspot to be relocated to a safer place prior to a major flooding and arrange safety and security of their resources. Even though there are such laws, there have been a lot of cases where government has lost in court because of loopholes in those laws. Communities win these cases in most cases due to technicalities, but also because of the loopholes. Therefore, relocation laws need to be extensively revised to close the loopholes

6.4.5 Training and capacity building of women

The majority of respondents in this study were women and are either unemployed or housewives. There is a possibility that when floods occur in the area, they will be the group to be found at home and mostly affected. By capacitating women on what to do before, during and after floods, it will assist in preserving lives and minimising injuries and the impacts of flooding.

6.5 Recommendations for further studies

This study assessed the socio-economic impacts of floods on the community of Kudube informal settlement in the CoT. There were some limitations to explore other avenues. Furthermore, it is upon this study that the following are recommended for further studies in order to seal the identified gaps. The following are recommended:

6.5.1 A comparative study

City of Tshwane municipality has approximately 210 informal settlements. This study assessed the socio-economic impacts of flooding in Kudube informal settlement within the City of Tshwane Municipality. A comparative study is recommended in various informal settlements within the municipality to compare if the findings in Kudube will be the same in other settlements.

6.5.2 Other impacts studies

This study only looked at the social and economic impact of flooding. There are a lot of impacts of floods, such as psychological and environmental impacts. Therefore, this study will recommend other studies to look at the following:

6.5.2.1 The psychological impacts of flooding

Most studies on hazard impact studies do not focus on the psychological impacts of flooding in the City of Tshwane. This includes providing counselling to flood victims, as some of the victims might have lost their loved ones. Traumatic events in the aftermath of flooding could have long lasting psychological impacts on the victims. In light of this, it is of great importance to conduct studies to determine a variety of symptoms subsequent to exposure in the aftermath of flooding. It is a known point that people may normally experience symptoms of post-traumatic stress disorder, depression, and anxiety amidst hazards such as floods.

6.5.2.2 Environmental impacts of flooding

This study recommends that other researchers should investigate the environmental impacts of flooding in Kudube to determine the extent of environmental damages due to flooding. Furthermore, subsistence farming must also be assessed.

6.5.3 Resilience and coping capacities of Kudube

The ability to bounce back in the aftermath of flooding is very important. This of course includes local resources that will be used to resist and recover from the aftermath of flooding. The researcher recommends that further studies be conducted on how Kudube informal settlement community can resist the impact of flood incidents/disaster.

6.5.4 Study in the middle of the hazard

This study was not conducted during flooding. Therefore, there is a need for other researchers to focus on the assessment of socio-economic impacts of flooding in Kudube informal settlement during flooding.

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APPENDICES

Appendix A: Information Sheet and Questionnaire



Disaster Management Training and Education Centre for
Africa (DiMTEC)

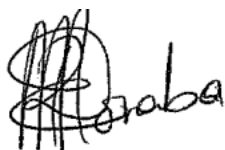
Dear Participant;

I, Moraba Raesetje Evelyn (Student number: 2007020635), am currently registered as a Master's degree student in the Disaster Management Training and Education Centre for Africa (DiMTEC) at the University of the Free State. I am in the process of completing a dissertation in partial fulfilment of the requirements of the degree: Masters in Disaster Management. My dissertation topic is entitled "The socio-economic impacts of flooding at Kudube Unit 9 settlement in the City of Tshwane, Gauteng Province". The main aim of this study is to assess how flooding affects the social and economic dimensions of the community of Kudube Unit 9 informal settlement.

The questionnaire is completed anonymously and will take approximately 30 minutes of your time. You have been selected to participate in the study based on the fact that you were confirmed to be a resident of Kudube Unit 9 for a minimum period of two (2) years and that you are above eighteen (18) years of age. The main purpose of this interview questionnaire is to acquire information that would inform the study on any social and economic impacts of floods, if there are any measures implemented to address the flood risks by the municipality.

For more information, do not hesitate to contact me on this number: 079 329 3237

Thank you for your cooperation.



Moraba Raesetje Evelyn

Questionnaire Number	
----------------------	--

SECTION A: DEMOGRAPHIC PROFILE

Please indicate your answer with an [X]

1. Please select your gender

Male	
Female	

2. Home language

Setswana		Afrikaans	
Northern Sotho		English	
IsiZulu		Sign language	
Xitsonga		IsiXhosa	
Venda		Sesotho	
IsiNdebele		SiSwati	

3. Marital status

Single	
Cohabiting	
Married	
Divorced	
Widowed	
Other, specify	

4. Age (Years)

18 – 25	
26 – 33	
34 – 41	
42 – 49	
50 – 57	
58 – 65	
above 65	

5. Highest level of education

No Schooling	
Primary School	
Secondary	
ABET Studies	
Tertiary	

6. Number of dependents

1-3	
4-6	
7-9	
Above 9	

7. Are you employed?

Yes	
No	

8. If not employed, how do you survive?

Social grant	
Child Support grant	
Temporary jobs	
Remittance	
Support from neighbours	
Other, specify	

9. If yes, what is your personal income per month?

Below R500	
R500-R1000	
R1001 – R2000	
R2001 – R3000	

R3001– R4000	
R4001– R5000	
above R 5000	

10. What is your employment type?

Permanent	
Self-employed	
Temporary contract	

SECTION B: FLOOD RISK

Please indicate your answer with an [X]

11. Do you experience flooding in your community/household?

Yes	
No	

12. If yes, how often do you experience flooding in your community/household?

Every time it rains	
Only once a year	
Several times a year	
Once every 2-4 years	

13. Do you believe that flooding is a problem in your community/household?

Yes	
No	

14. If yes, how would you rate the flooding problem

Minor	
Moderate	
Major	

15. What are the major cause of flooding in your area?

Heavy rain	
Unavailability of drainage system	
Broken dam	
Step slope	
Wetland	
Environmental degradation	
All of the above	

16. Do you think that your home is at risk of flooding?

Yes	
No	

17. If yes, what makes you think that, please elaborate here

.....

.....

.....

SECTION C: SOCIO-ECONOMIC IMPACTS OF FLOODS

Please indicate your answer with an [X]

18. Was there an incident where households have to be relocated to new area due to flooding?

Yes	
No	
Don't Know	

19. What are the types of housing infrastructure in the community?

Mud house	
Shack house	
Bricks house	

20. Are you able to access health facility in your area during flooding?

Yes	
No	

21. Can you access educational facility in your area during floods?

Yes	
No	

22. Are you able to access your place of worship during floods?

Yes	
No	

23. Which of the following impact did your household/community face during and after the occurrence of flood disaster?

Death/s		Severe injuries	
Food shortage		Water shortage or contamination	
Disease outbreaks		Electricity accessibility	
School/work attendance being disrupted		Other, specify	

24. Have you ever repaired the damage caused by flooding in your household at any time?

Yes	
No	

25. If yes, please estimate how much in South African Rand has it caused your household to fix the flood damages.

Less than or equals to R500.00		R600	
Less than or equals to R1000.00		Above R1000.00	
Other, specify			

26. Have you asked your municipality for reimbursement of the cost for the damage?

Yes	
-----	--

No	
----	--

27. If yes, have you received your total reimbursement?

Yes	
No	

28. Financially, how has the flooding in your community affected your household?

Money lost for food to fix the damage	
Money lost for children school fees to fixing the flooding damage	
Money lost to fixing damaged electrical appliances	
Money	

SECTION D: FLOOD DISASTER MANAGEMENT

Please indicate your answer with an [X]

29. Do you receive flood early warning?

Yes	
No	

30. In your knowledge, who are the most vulnerable groups in your community?

Elderly	
Pregnant women	
People residing in flood-prone area	
Disabled	

Children	
----------	--

31. To what level have you prepared yourself should flood strike again?

	Do not want to do	Not able to do	Have not done	I plan to do
I have collected the information about floods				
I have spoken to disaster management representative in my area in regards to floods				
I have prepared a family floods plan				
I have taken special training such as first aid/rescue				
I have learned how to swim				
I have signed up with entities that provide emergency news or alert system				

32. Do you have house or home content insurance?

Yes	
No	

33. What strategy have you implement to reduce flood's impact?

Sandbags	
Tree logs	
Raised pit latrines	
Elevation of house foundation	
Construction of protective wall	

Other, specify	
----------------	--

34. Do the municipal officials offer any assistant during flooding?

Yes	
No	

35. Do you normally receive warning when floods or any other severe weather hazards are about to happen?

Yes	
No	

36. How do you receive flood and other severe weather warning?

Television	
Newspaper	
Community members/leader	
Family or friends	
Cellphones	
Internet/social media	
Other, specify	

37. Has anyone from the following assisted you or your community in preparing for floods?

National government	
Non-government organisation or voluntary organisation	
United Nations agency	
Voluntary groups	
Local politician or a party	
Disaster management officials	

Other, specify	
----------------	--

38. Is there anybody in your home who would have trouble evacuating in case of floods emergency for any of the reasons below?

Limited mobility or wheelchair bound	
Limited vision/blind	
Lack of access to personal vehicle	
Limited hearing/deaf	
Elderly people	
People with disabilities	
Other, specify	

39. Has anyone from the following assisted you or your community during floods?

Disaster Management team	
Ward councilor	
Minister/s	
NGO's	
Voluntary group	
Local politician or a party	
I do not know	
Other, specify	

40. Please explain in a short sentence the kind of assistance you received from the **above-mentioned** persons

.....

.....

.....

41. Were you ever evacuated during the floods?

Yes	
No	

42. If yes, please select the possible reasons why you were evacuated.

My house flooded	
My yard was flooded , and I could not leave	
Other, specify	

43. Have you managed to recover ever since you have experienced floods?

Yes	
No	

Thanks for your time and inputs!!!!!!

Appendix B: Ethics certificate



GENERAL/HUMAN RESEARCH ETHICS COMMITTEE (GHREC)

24-Nov-2020

Dear Mrs Raesetje Moraba

Application Approved

Research Project Title:

**THE SOCIO-ECONOMIC IMPACTS OF FLOODING IN KUDUBE INFORMAL SETTLEMENT,
CITY OF TSHWANE METROPOLITAN MUNICIPALITY**

Ethical Clearance number:

UFS-HSD2020/1736/2311

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

Yours sincerely

Dr Adri Du Plessis

Chairperson: General/Human Research Ethics Committee

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Adri Du Plessis

Appendix C: Consent form



CONSENT TO PARTICIPATE IN THIS STUDY

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

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

I agree to the recording of the *questionnaire*.

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

Full Name of Participant: _____

Signature of Participant: _____ Date: _____

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

Signature of Researcher: _____ Date: _____



Appendix C: Plagiarism Report

Thesis

ORIGINALITY REPORT

12 %	11 %	5 %	6 %
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	Submitted to University of the Free State Student Paper	1 %
2	researchspace.ukzn.ac.za Internet Source	1 %
3	www.questionpro.com Internet Source	<1 %
4	repository.nwu.ac.za Internet Source	<1 %
5	Submitted to Stadio Holdings Student Paper	<1 %
6	www.apfm.info Internet Source	<1 %
7	natagri.ufs.ac.za Internet Source	<1 %
8	Scholar.ufs.ac.za Internet Source	<1 %
9	hdl.handle.net Internet Source	<1 %

Appendix C: Editors' Letter



University of Limpopo
Department of Linguistics, Translation and Interpreting
School of Languages and Communication Studies
Private Bag x1106, Sovenga, 0727, South Africa
Tel: (015) 268 3707, Fax: (015) 268 2868, email:kubayij@yahoo.com

26 November 2021

Dear Sir/Madam

SUBJECT: EDITING OF DISSERTATION

This is to certify that the dissertation entitled 'The socio-economic impacts of floods in Kudube informal settlement in the City of Tshwane, Gauteng Province of South Africa' by Moraba Raesetje Evelyn has been copy-edited, and that unless further tampered with, I am content with the quality of the dissertation in terms of its adherence to editorial principles of consistency, cohesion, clarity of thought and precision.

Kind regards

Prof. SJ Kubayi (DLitt et Phil - Linguistics)